



IN THIS ISSUE

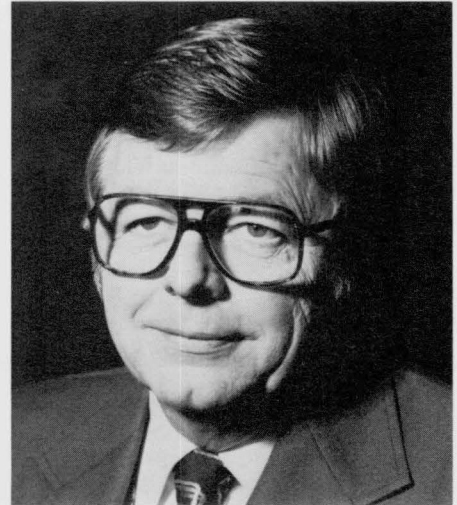
- Computer Science department implements Plan for the '80s, p. 3
- Student intern saves dollars for area company, p. 4
- Minnesota Wellspring forms coalition between business, government, labor, and academic leaders, p. 5
- Solar research furnace is most advanced in U.S., p. 6
- Advanced computer technology builds better robots, p. 10

Minnesota Governor Quie keynotes annual ITAS banquet

1981 Science & Technology Day speakers to explore technology's impact on ethics and civilization

Prominent scholars and public officials will discuss technology's impact on society during the Institute of Technology Alumni Society's (ITAS) 1981 Science & Technology Day seminar and banquet program on Friday, November 6.

RICHARD MOLLISON '41BMinE (left), president of Texasgulf, Inc., and **Earl Bakken '48BEE**, board chairman of Medtronic, Inc., will receive Outstanding Achievement Awards at the Science & Technology Day banquet on November 6.



The afternoon seminar program in Coffman Memorial Union's Theater begins at 1 p.m. and is open to the public. It features four major addresses:

Dr. James R. Johnson, University of Minnesota director of Technology & Public Policy, on "**Violence in a Raindrop**,"

Dr. John S. Najarian, chairman of the University of Minnesota Medical School's Department of Surgery, on "**The Impact of Technology on Surgery**,"

Dr. Myron Tribus, director of the Massachusetts Institute of Technology's Center of Advanced Engineering Study, on "**The Impact of Society on Engineering**," and

Dr. Arthur Harkins, University of Minnesota associate professor of Education and Sociology, on "**Cultural Futures**."

Outstanding Achievement Awards, the highest honor the University can confer on graduates who have distinguished themselves and thus, the University, in their careers, will be presented to IT alumni Richard D. Mollison '41BMinE, Greenwich, CT, and Earl E. Bakken '48BEE, Minneapolis, MN, during the Science & Technology Day Banquet. The program will begin at 6:30 p.m. at the Radisson South Hotel in Bloomington, MN. Reservations can be made through the Minnesota Alumni Association by calling (612) 373-2466.

(Turn to page 2)

IT gets \$400,000 grant from Exxon

The Exxon Education Foundation has awarded a \$400,000 grant to the Institute of Technology to help attract engineering students to study for advanced degrees and retain junior faculty in teaching careers.

The grant is part of a \$15 million grant program announced by the foundation and believed to be the largest of its kind ever undertaken by a corporate foundation.

A six-month intensive study by the Exxon Education Foundation showed that undergraduate engineering enrollments are the highest they have ever been but that there are serious shortages of faculty in certain key fields of engineering. The faculty shortage stems in part from the fact that industry is hiring engineers immediately after they receive their bachelor's degrees at starting salaries that make graduate study and junior faculty positions financially unattractive by comparison.

Half of the grant to IT will support teaching fellowships for doctoral candidates in chemical engineering, mechanical engineering, mining engineering, and earth sciences/geology. Four candidates, one from each field, will receive an average of \$50,000 over three years for tuition,

fees, and living expenses.

Advanced students often need an incentive to remain at the University because the demand for graduating engineers is so great, said Roger W. Staehle, dean of IT. Students with bachelor's degrees are now being offered between \$22,000 and \$28,000 a year to take jobs in industry, he said.

The other half of the \$400,000 will be used to augment the salaries of junior professors in the chemical engineering and mechanical engineering departments for five years. This is designed to keep faculty in the university. Currently, faculty members can increase their salaries 20 to 100 percent by taking jobs in industry, Staehle said.

"I think business realizes that unless a university has the teaching staff, it can't graduate the students who will move into industry in coming years. Industry can't eat up the seed corn," Staehle said. The grant will begin in the 1982-83 school year.

The special one-time grant program to recognize the 100th Anniversary of the founding of Exxon will be in addition to the foundation's regular programs which have made appropriations of more than \$20 million for 1981.

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Chemist Bryce Crawford Wins 1982 Priestley Medal

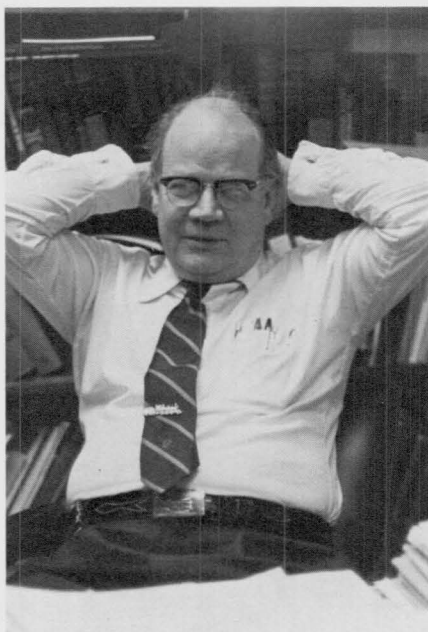
The most prestigious award an American chemist can receive—the American Chemical Society's Priestley Medal—will be awarded to Institute of Technology Chemistry Professor Bryce Crawford in 1982. The medal will be presented at a spring meeting in Las Vegas.

Crawford is known for his many accomplishments as a molecular spectroscopist, as a teacher, as an editor, and as a servant of the American Chemical Society (ACS). A colleague described Crawford as a scientist who is highly regarded by his peers and as a renowned statesman for chemistry.

Crawford, who came to Minnesota in 1940 as an assistant professor, received a B.A. in 1934, an M.A. in 1935, and a Ph.D. in chemistry in 1937 from Stanford University. He was at Harvard as a National Research Fellow and at Yale as an instructor in chemistry before joining the Institute of Technology faculty.

Minnesota made him a full professor in 1946. He chaired the Chemistry department here from 1955 to 1960 and was dean of the Graduate School from 1960 to 1972 when he returned to full time teaching and research. While dean, he helped to found the Council of Graduate Schools.

During and after World War II



Crawford did research in rocket propellants and pioneered an understanding of the properties of double-based propellants—significantly affecting WWII rocketry and the development of solid propellants used in the larger rockets that have since evolved.

Yet Crawford prefers to work in molecular spectroscopy, particularly in

understanding molecular vibration. He added to the theoretical knowledge of normal coordinates and helped develop the best ways to define force constants and to determine their values for a large number of molecules. He and his coworkers went on to advance reliable methodologies for calculating force constants, pioneering first principle calculation, by molecular orbit techniques, of the twisting frequencies of ethylene and benzene.

Crawford also tackled problems of infrared intensity measurement and achieved results that led to dependable measurement methods.

Throughout his career Crawford has remained active in ACS affairs, making notable contributions to the construction of a second ACS Chemical Abstract Service (CAS) building in Columbus, Ohio, to the computerization of service operations, and to increased attention to the needs of user chemists.

He is proudest of the role he played in forging cooperative agreements between CAS and its counterparts in the United Kingdoms, West Germany, France, and Japan, making the overall operations of the service more effective.

Crawford was elected to the National Academy of Sciences in 1956 and has served since 1979 as home secretary.

University will honor two graduates...

(From page 1)

Minnesota Governor Al Quie will keynote the evening program, discussing the impact technology has on the State of Minnesota and the need for technology to join with business, government, and education to improve Minnesota's economy. Institute of Technology Dean Roger W. Staehle will update the Institute's progress and discuss its future.

Awardee Richard Mollison is president of Texasgulf, Inc., a diversified natural resources company. He joined the company as a mining engineer in 1947 and was named manager of exploration, vice president and manager of exploration, and vice president and senior vice president of the Metals Division, before becoming president in late 1973. He also heads and is a director of Texasgulf's subsidiary,

Texasgulf Canada Ltd. which owns and operates Kidd Creek mine and a metallurgical complex in Timmins, Ontario.

Timmins residents praise Mollison's community work to improve care and activities for the handicapped, health service, and museums and sports facilities for all citizens.

Mollison's mining experiences date back to college days when he spent vacations in mines in Ontario, California, and Montana. After graduation he worked for Penn Iron Mines in Norway, MI, for Cerro de Pasco Copper Corporation in Peru, and for Newmont Mining Corporation. He was with Phelps Dodge Corporation in Arizona before joining Texasgulf.

A director and vice president of The Silver Institute and The Zinc Institute, he also is director of the Phosphate Chemical Export Corporation.

Earl Bakken founded Medtronic, Inc., manufacturer of cardiac pacemakers, in 1949. He presently is

chairman of the board of the Twin Cities corporation.

Bakken has lectured in several colleges of the University of Minnesota, delivered numerous talks in medical and technical arenas around the world, and published alone and with bioengineers and physicians prominent in implantable pacemaker fields.

He founded the Bakken Museum of Electricity in Life in 1970 and gathered the finest collection of its kind in the world, displaying hundreds of original devices and publications outlining and documenting the history of electricity in medicine and biology.

Bakken is chairman of the board of the Minneapolis Medical Center, Inc., a member of the business advisory committee of The Science Museum of Minnesota and of the executive committee of Abbott-Northwestern Hospital, on the board of the Children's Heart Fund, and a member of the Minnesota Business Hall of Fame.

Bell Laboratories joins graduate program

Computer Science rebuilds

The Institute of Technology's Computer Science department is growing into one of this country's outstanding departments due to the combined efforts of industry and the University.

A Long Range Planning Committee, composed of IT and University of Minnesota professors and major industry representatives and chaired by Computer Science Professor Marvin Stein, has put together a "Plan for the '80s" to implement this growth.

"There is a strong consensus among local industrial leaders that IT's Computer Science department is important to our region and that adequate support is needed for the department in the coming decade," Acting Computer Science Department Chairman Kurt Maly said. "During the last few years we have not kept pace with industry.

"We have been growing in service without actual growth in resources. And the demand for our services is increasing tremendously," Maly added.

Those from area industry serving on the Long Range Planning Committee include:

Gary R. Holland, President, CPT Corporation

Donald M. Sudor, Director of Information Systems, IBM Corporation

Carl A. Kuhrmeyer, Vice President-Administration, Minnesota Mining & Manufacturing

John W. Lacey, President, Systems Company, Control Data Corporation

James R. Berrett, Vice President-Corporate Development, Honeywell Inc.

John A. Rollwagen, President & Chief Executive Officer, Cray Research Inc.

George F. Marette, Director of Computer Engineering, Sperry Univac

Despite the severe financial crunch faced by the fastest growing department in IT, Computer Science has maintained significant strengths which were recognized by Bell Laboratories in recent months.

Following a site visit, Bell's Educa-

tion Center accepted the department's proposal to join the Bell Laboratories Graduate Study Program. To begin officially in 1982, this program could bring anywhere from 10 to 30 new graduate students to the campus for one year of study that will "profit both the department and Bell Laboratories," Maly said.

Participation in the program places the Institute of Technology among distinguished company. The other universities sharing in this portion of the Bell Laboratories program include California-Berkeley, Carnegie-Mellon, Cornell, Illinois, Michigan, Purdue, Southern California, Stanford, and Wisconsin.

Located in one of the nation's five top centers of computer technology, IT's Computer Science department has built strong department-industry ties through an industrial advisory committee, adjunct professorships, and continuing education programs. Additionally, the department is a center for University computer activities and has an undergraduate program that currently teaches almost 23,000 student credit hours per year and offers a Computer Science degree in the College of Liberal Arts as well as IT. Its associations with the Micro-electronic & Information Sciences Center (MEIS), the Charles Babbage Institute, and the NSF National Institute for Mathematics offer added benefits and opportunity.

As the department plays an increasingly important role in the state's computer industry which today accounts for 15 percent of the gross sales in Minnesota, it must expand its resources.

"We really reached a crisis point last year when the financial crunch became unbearable," Maly said.

The department operated then with 14 faculty members, a student/faculty ratio over 37, and a little more than \$7,000 of equipment per faculty member. Its peer departments average 28.5 faculty members, student/faculty ratios under 20, and on the order of \$20,000 in equipment per faculty member.

It must recruit new faculty while the production of Ph.D.s in Computer Science is declining nationwide. Many new Ph.D.s are attracted to major industrial laboratories and other geographic centers of high technology.

As Minnesota continues to develop as a center for computer science its industries will turn more and more to the Institute of Technology for its employees, particularly those specializing in software engineering, VLSI design, distributed systems, database systems, industrial automation, and applications of numerical methods.

Effective computer education requires extensive hands-on experience. The Computer Science department must make a substantial investment in equipment in order to meet the demands of computer science research and education and to keep pace with technological change.

The strategy of the Long Range Planning Committee builds on the strengths of the department. The committee wants to find a strong permanent department head by 1982 and hire new faculty in critical areas. Specifically, the strategy is to:

- Reduce student/faculty ratio to 24.13 by 1986, while handling 38,000 student credit hours (*Current ratio is about 31.24, with 23,900 credit hours*).
- Increase space for the department from the current 8,555 square feet to 41,000 square feet by 1986, which means a new building that also would house Electrical Engineering and the Computer Center.
- Allow equipment capitalization of \$20,000 per new faculty member and \$3,000 per year per faculty member for equipment depreciation, while bringing necessary equipment to the department.
- Increase the number of full time faculty from the current 17 to 35 by 1986.
- Double the number of teaching assistants from the present level of 12.5 to 25.5 by 1986.
- Increase community ties and interdisciplinary activities through programs of faculty exchange, internships and research fellowships, adjunct courses, and cooperative industrial research grants.

"If we can implement the strategies this major technical task force has put together, we should be able to produce the numbers of qualified students needed in today's economy," Maly said. "And we will have established ourselves as the computer science center of the Midwest."

Internship program benefits companies and students

Many Minnesota companies realize the value of Institute of Technology students even before they graduate. For more than 30 years IT's student internship program has placed students during alternate quarters in industry as employees—and helped many students pay for an education they otherwise might not afford.

The internship program has involved more than 135 area companies and more than 2,000 students through those 30 years. Total earnings of the Mechanical Engineering student interns alone are estimated to be more than \$10 million in salaries and about 11,000 credit hours in work/study assignments. Aeronautical, Civil, and Electrical Engineering departments recently have started internship programs similar to the original program initiated by the Mechanical Engineering department.

Rein Teder, in his third quarter as an intern at Telex Communications, Inc., is a senior in Electrical Engineering. By the end of next spring he will have alternated four quarters of work with four quarters of school during his junior and senior years in IT. He estimates he will need an extra year to graduate because many of the courses he needs are not available during the summer months.

"Admittedly, I'm not in a hurry to graduate. I like the academic life and suspect I might go for my master's degree," Teder said. "I like the fact that the University gives you a lot of flexibility—if you want to take longer to graduate and take other courses that interest you, you can."

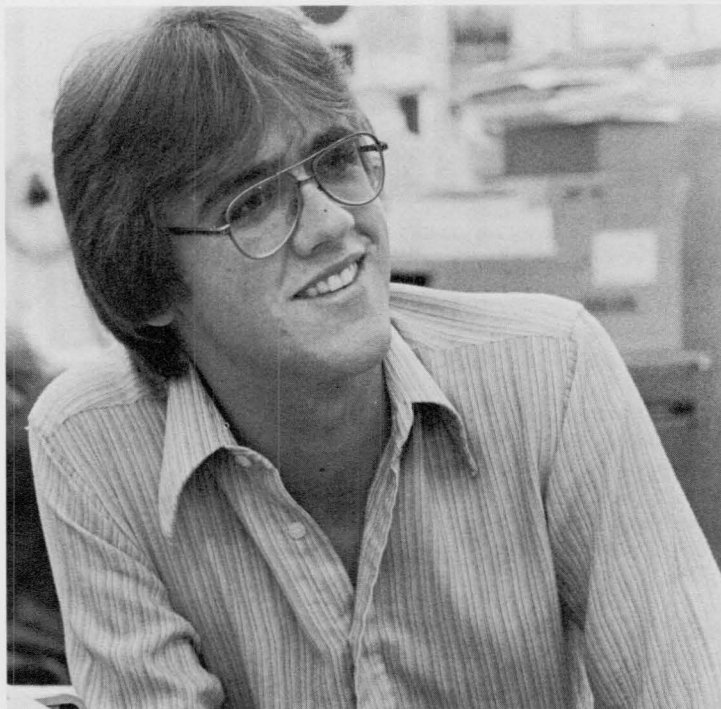
"I think the cost of education at the University is cheap for what I'm getting and I use my internship to help pay for my education," he said.

Teder spent his first two quarters at Telex under the supervision of engineer David Lindvall, working on simple computer programs to analyze the drive circuit required for the erase head in a tape recorder as well as designing a tone detector.

"We try to give our interns work in general purpose engineering, in jobs that need to be done," Lindvall said.

"Telex wants these to be jobs that interest an intern, that apply to an intern's program of study, and that are a benefit to Telex," added Paul D'Amico, Telex's chief engineer of advanced development.

Teder finds it gratifying to learn something in the classroom and the next quarter be out in the field where



Rein Teder

that knowledge can be put to use. He also appreciates the feedback he gets from professional engineers.

"Some of the interns I've talked to work on technical 'gopher' projects—work that someone who knows electronics has to get done," Teder said. "It's all 'real world' stuff and technical help is scarce now."

However, no other intern Teder knows has been given such important projects as Teder nor has his independence. Yet Teder feels that engineers are expensive now that there are so few and there is much work to be done. "If the company thinks I can do a project, they let me do it," he said. "It's very satisfying."

"I like working a 40-hour week, too. It's nice to get home at day's end and not have a pile of homework saying, 'Do me, do me.' I have more time for myself, which I appreciate."

And Telex appreciates Teder and feels he has been good for the company. "In essence, he's already a peer to the engineers who work here," Deminico said. "He has the potential of a Renaissance man, he has the intelligence, the interest, and the curiosity."

Teder is excited when he talks about the work he did on the design of a new professional quality record/play amplifier for a reel to reel tape recorder. He helped to design the playback EQ and the record EQ.

"I used a computer and plotter to write a whole software package explicitly for designing record EQs," Teder said. "It's too early to say how much it will benefit Telex, but I really think I helped them come up with a better product."

Telex's executives are even more excited about Teder's work; they feel he found a major error in earlier mathematical computations that when corrected will mean less time spent on a manufacturing process, saving significant amounts of money for the company over the long run.

Rein's work in the internship program helped him decide what he wants to do in his professional career.

"I want to work in professional audio—that's why I chose to come to Telex. Out of the 14 companies with which I interviewed, it was the only one involved with professional audio," Rein said.

Following graduation from Minneapolis' Washburn High School he enrolled in the Institute of Technology because of an interest in electronic music. "When I was in 9th or 10th grade I heard musician Wendy (Walter) Carlos play *Switched on Bach* and realized immediately what I wanted to do.

"I've always had too many interests and could never follow through on any of them until electronics and

music—now they have both become obsessions," Teder said.

He has a synthesizer and electric piano in his south Minneapolis duplex, and though he prefers to play alone on his acoustic piano and play whatever comes into his head, he does appear at parties with a small band, "until they unplug us," he says, and was part of the Electrical Engineering band that appeared last spring at Campus Carry.

Teder used to take a lot of music classes. When he was a freshman, he and another student were the only two nonmusic majors in freshman music theory. "And we stuck it out for the whole year, too," he said.

If you've guessed that music will continue to play a major part in Rein's future, you're right.

"Once I graduate I'm not sure if I want to go directly into engineering," he says. "I'd rather get a good rock and roll band together and travel around for awhile."



ITeMS, a newsletter of the Institute of Technology at the University of Minnesota, is published every other month with special support from the IT Alumni Association, IT Advisory Council, and the Partners Program. Material from this publication may be reproduced without cost, but credit to ITeMS will be appreciated. Gifts or inquiries concerning them should be sent to the Director of Development, Institute of Technology, 107 Lind Hall, 207 Church St. S.E., University of Minnesota, Minneapolis, MN 55455, telephone (612) 376-4608. Changes of address or requests to be put on the mailing list should be sent to the editor at the same address, or telephone (612) 376-2447.

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The University of Minnesota adheres to the principle that all persons shall have equal access to its facilities, activities, and employment without regard to race, creed, color, sex, national origin, or handicap.

Minnesota Wellspring formed

New collaborative venture with business, government, labor stresses technology growth

An unusual coalition of business, government, labor, and academic leaders has been formed to speed development of Minnesota's high technology industries.

Called Minnesota Wellspring, the collaborative venture will be led by Raymond Plank, chief executive officer of Apache Corporation and by David Roe, Minnesota AFL-CIO president. Honorary chairman will be Governor Al Quie. A 24-member executive committee has been established to organize the program.

One of Minnesota Wellspring's first activities is the Technology Options Project (T.O.P.) housed in the Minnesota Department of Energy, Planning & Development. T.O.P. provides research to explore how public policy can best be shaped to support technology-powered job development and economic growth.

Other Wellspring projects will be designed and conducted by special task forces and committees now being formed.

In a letter to leaders of the four participating sectors, the governor characterized the program as "potentially the most significant new initiative undertaken in this decade."

He said, "Minnesota is blessed with an industrious population which constitutes a superior pool of entrepreneurial talent and skilled labor. We have an outstanding education system to support broad-scale development, application, and integration of advanced technologies. Minnesota has a government dedicated to ensuring our quality of life.

"The Minnesota Wellspring is based on the belief that the creative collaboration of labor, business, education, and government can help ensure our vitality as a state and foster the wellbeing of our citizens."

The executive committee includes:

Wendell Anderson Larkin, Hoffman, Daly & Lindgren	Jack Jorgensen, Sr. Teamsters Join Council #32
Richard Caldecott College of Biological Sciences (U of M)	Phyllis Kahn House of Representatives
Harlan Cleveland Hubert Humphrey Institute of Public Affairs (U of M)	Eugene Kotz College of St. Thomas
Willis Drake Data Card Corporation	George Latimer City of St. Paul
Phil Duff <i>Republican Eagle</i>	Richard McFarland Dain Bosworth, Inc.
Kent Eklund Department of Energy, Planning & Development	Roger Moe Senate
Gleason Glover Minneapolis Urban League	Lloyd Nielsen Roseville School District #623
John Himle Minnesota Agri-Growth Council	Hazel Reinhardt Star & Tribune Corporation
William Hueg Institute of Agriculture, Forestry, & Home Economics (U of M)	John Rollwagen Cray Research, Inc.
Walter Johnson Conn-Co.	Richard Shepley First National Bank of Saint Paul
	Roger Staehle Institute of Technology (U of M)

Solar research furnace that melts steel could split water

Two Mechanical Engineering scientists have developed a high temperature solar research furnace that has melted through quarter inch steel plates to split water and produce hydrogen and oxygen through solar energy.

The water splitting research is a major experiment that occurs as a one step thermochemical process where the researcher thermally dissociates water and then separates it at a high temperature—2,000 Kelvin or 3,000 F—in a simple process to produce hydrogen and oxygen. Such hydrogen could be used as fuel or in fertilizer.

The researchers are working with one of this nation's most advanced high temperature solar furnaces that employs a relatively simple system of focused mirrors, developed by Mechanical Engineering Research Associate Richard Diver and Professor Edward Fletcher.

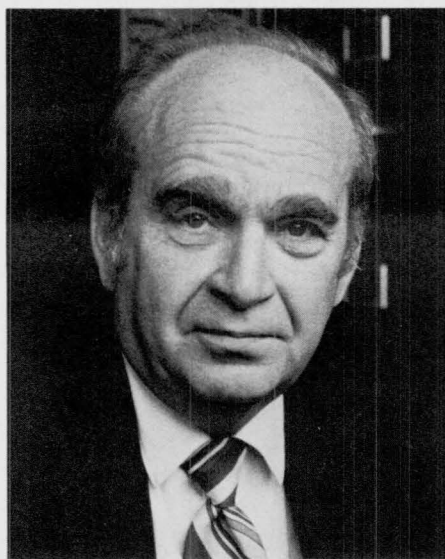
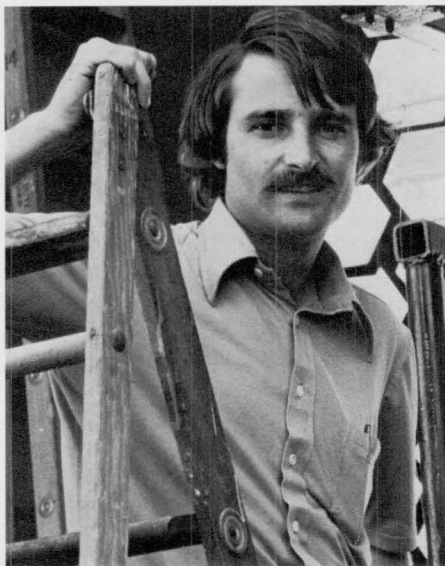
Housed on the roof of Ackerman Hall, the test furnace's large reflecting heliostat directs sunlight to several hundred hexagonal mirrors that then focus and direct the sunlight to a smaller spot about three inches wide at the same point where the temperature is the equivalent of 8,000 suns or hotter than 5,000 degrees Fahrenheit.

"This intense sunlight beams into a cavity receiver that is an insulated ceramic chamber with a window in it," says Ed Fletcher. "The light goes through that window, strikes the inside walls, and heats them, making the chamber a test bed—or an oven, or a chemical reactor, or whatever you want it to be as a high temperature research facility."

All the research at the facility is done in a closed system inside cavity receivers which can be anywhere from a few inches deep to several feet deep, depending on the experiments.

The light which the mirrors reflect has a hot center core that decreases outward in intensity. It moves within a controlled horizontal system that is more than 9 feet above the ground, minimizing the possibility of someone walking through it. However, anyone walking through the beam would only feel a warm sensation. "It's not any more dangerous than the windows in the IDS Center," Richard Diver says. "It's just reflected sunlight."

The furnace, patterned after facilities in France that have been in existence for several years, will be used



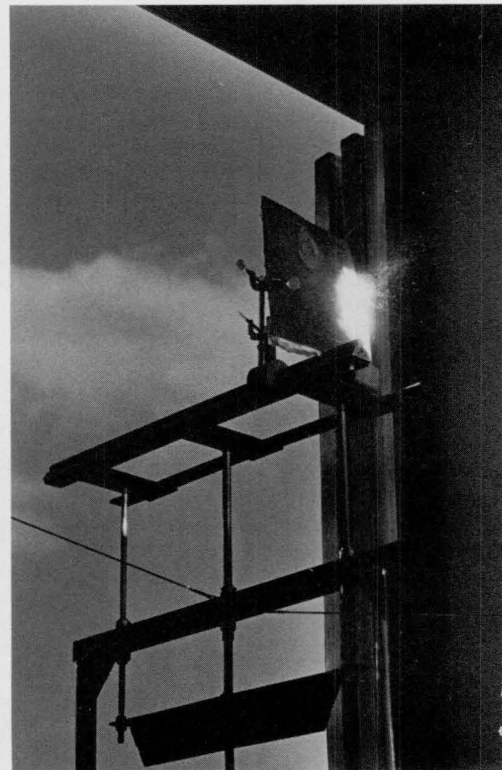
ABOVE, MECHANICAL ENGINEERING Research Scientist Rich Diver. Below, Mechanical Engineering Professor Edward Fletcher.

to study many new kinds of reactions that have never been researched before.

"First, we want to study the behavior of materials at very high temperatures, like corrosion and deterioration, because we anticipate that future technology will develop fruitfully through experimentation at higher and higher temperatures," Fletcher said.

"Secondly, we want to study very high temperature thermal chemical processes that can be made to occur more efficiently at higher temperatures than they can at lower ones," he added.

"Generally we are interested in



SMALL DROPS OF liquid steel spray from a steel plate exposed to the heat of 8,000 suns by the solar research furnace atop Ackerman Hall.

what we call thermochemical processes, where we take sunlight, thermalize it at high temperatures, and make fuels directly."

Fletcher would like to use hydrogen bromide as a working fluid in a closed system, producing hydrogen and using that in a fuel cell to produce electricity on demand. Such a system would have a constant fuel source and eliminate the problems of storing solar energy.

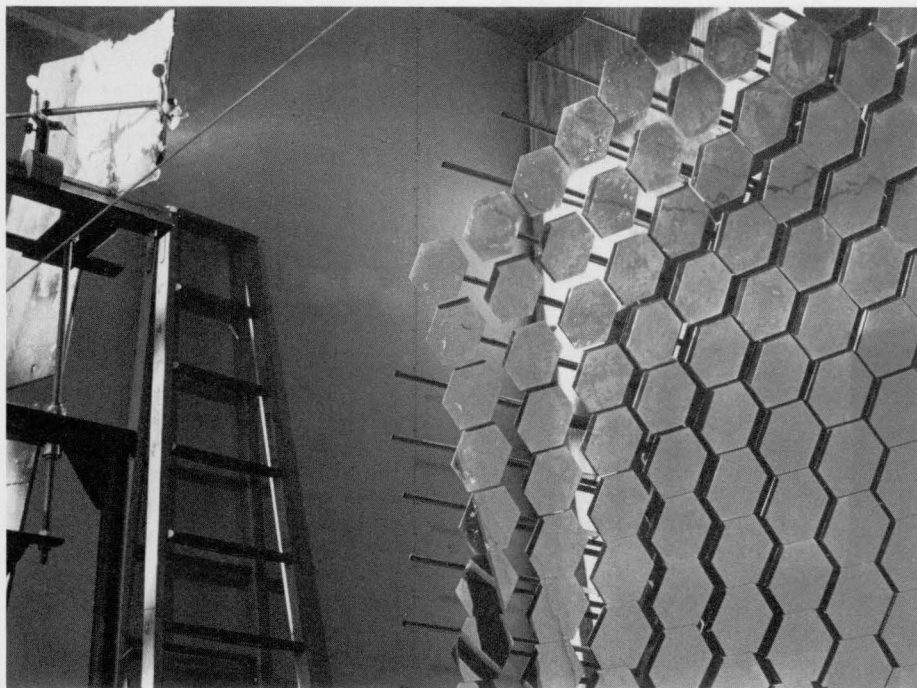
Hydrogen-bromine fuel cells already exist and are very efficient, according to Diver.

Graduate student Dave Carlson, who works with Fletcher and Diver, is looking at the batch catalysis of biomass relating to trees, cornstalks, and cattails to produce gasoline precursors like ethylene while maximizing yields.

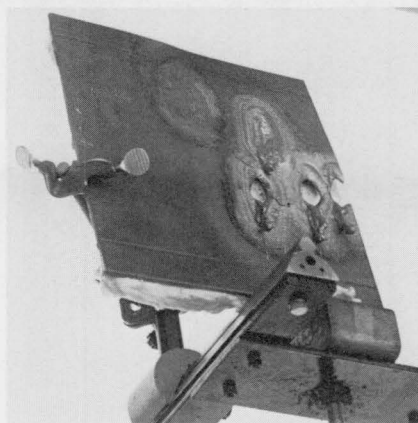
Other researchers hope to produce a variety of thermochemical products, including synthetic fuel from abundant hydrogen sulfide, as well as zinc and other metals from their oxides.

A \$48,000 Northern States Power grant is helping to finance such research for making synthetic fuels and reducing metals from their oxides.

"We really wanted one of these



ABOVE, FRENCH-BUILT mirrors focus and direct sunlight into a cavity receiver and the test bed for the high temperature research. Right, a steel plate shows burns from the furnace's concentrated sunlight.



facilities about 1975 when we first thought of making hydrogen and oxygen from water," Fletcher said. Jerry Shepherd '33BEE '37PhDPhys, former head of the Space Science Center and a University of Minnesota vice president for academic administration, became interested in Fletcher's theoretical solar research and was influential in getting a grant from the University Patent Office for an analytical study on the process and its patent.

"The paper on our patented idea appeared in the September 9, 1977, issue of *Science* and drew funds from the Department of Energy (DOE) to finance us for another few years," Fletcher said. Rich Diver joined Fletcher shortly thereafter. Diver received his PhD in Mechanical Engineering, specializing in thermodynamics.

The researchers began to build the solar furnace about a year ago. They were funded partly by DOE through IT's Corrosion Center, partly by a grant from the Solar Energy Research Institute, and partly from their own pockets.

"Students played a very important role in the construction of this facility, as paid employees and as volunteers in a design program," Fletcher said. "Much of the preliminary design was done by undergraduates in a regular

Institute of Technology design course.

"Student volunteers helped us build the equipment cover for the facility, constructing it to withstand virtually any wind. We hired other undergraduates to continue construction, actually starting to nail things together in the summer of 1980," Fletcher said.

Associate Professor of Mechanical Engineering Dick Springer also pitched in, checking the safety of the structure and saving hundreds of dollars in consultant fees.

As a permanent facility the solar furnace will be operated by graduate research associates and is not limited to the kinds of research that interests the Fletcher/Diver research group.

"A solar furnace like this one offers many possibilities for using very high temperatures in a very controlled environment," Diver said. "And you can avoid dealing with combustion products or with electrodes—both of which can be very difficult."

Scientist's work featured nationally

Many Americans now know IT alumna Ruth Reck '64PhDPhysChem and her work as a staff research scientist in the Physics Department at General Motors Research Laboratories through a special two-page advertisement run in the popular and professional media.

According to General Motors, Reck's investigations have revealed new knowledge about the influence of airborne particles in our atmosphere on the earth's thermal balance. She has integrated, for the first time, this complex factor of particles into radiative-convective atmospheric models. Reck's findings help determine under what conditions particles have a cooling influence and under what conditions they have a heating influence, says General Motors (GM).

Earlier models for calculating vertical temperature profiles included layers of clouds and significant gases but excluded the particle factor. Reck added this factor to a one-dimensional model developed at the Geophysical Fluid Dynamics Laboratory at Princeton University.

She discovered that whether particles have a heating or cooling influence depends on the surface albedo or reflective power of the earth directly beneath them, GM wrote. When surface albedo is small, the particles "shield" the earth from incoming solar radiation, thus cooling it. When surface albedo is large, a trapping effect prevails. The solar radiation which reaches the earth's surface is "trapped" between the surface and the particles, heating the earth. The competition between shielding and trapping determines the overall thermal influence of particles, Reck found.

"Previous models did not adequately take into account the role played by particles in the earth's thermal balance," Reck says. "The geosystem is continually changing. It is important for us to understand the elements that affect this evolution so that we may know how man's activities influence the atmosphere."

Reck was a research associate in the Applied Mathematics Department of Brown University before joining General Motors. Besides global climate studies, she also has researched solid state physics and magnetic materials at GM. During the past seven years she participated in several international exchange programs on climate-related subjects.

CALENDAR...

NOVEMBER

- 3 DIGITAL SYSTEMS SEMINAR**
(Broadcast on UNITE as EE 8390)
Systolic Processors
Professor Kung, Carnegie-Mellon University
2:15 p.m., Mechanical Engineering 102
- 4 LECTURERS IN ORGANIC CHEMISTRY**
Reactive intermediates, small ring compounds, carbenes, chemically induced dynamic nuclear polarization, model system for photosynthesis
Gerhard L. Closs, Argonne National Laboratories and University of Chicago
8 p.m., Smith Hall 325
- PHYSICS & ASTRONOMY COLLOQUIUM**
The Physics and Metaphysics of Sir William Rowan Hamilton
Thomas Harkins, University of Washington
- 5 CONTROL SCIENCE & DYNAMICAL SYSTEMS CENTER SEMINARS: Multivariable Control System Design**
(Broadcast on UNITE)
"Dynamics and Symmetry: Predictions for Modulated Waves in Rotating Fluids"
David Rand, University of Warwick
3:15 p.m., Mechanical Engineering 102
- ELECTRICAL ENGINEERING COLLOQUIA (Broadcast on UNITE)**
A CCD-based Parallel Image Processor
David Lamb, Honeywell Systems & Research Center, Minneapolis
4:15 p.m., Mechanical Engineering 102
- 6 ALUMNI SOCIETY: Science & Technology Day: "The Impact of Technology on Society"**
Sponsored by the Institute of Technology Alumni Society Seminar beginning at 1 p.m. in Coffman Memorial Union, featuring James R. Johnson, Institute of Technology director of Technology & Public Policy; John R. Najarian, chairman of Medical School's Department

of Surgery; Myron Tribus, director of MIT's Center for Advanced Engineering Study; Arthur Harkins, University of Minnesota associate professor of Education and Sociology

Banquet beginning at 6:30 p.m., Radisson South, Bloomington, MN
Banquet speaker: Minnesota Governor Al Quie

AEROSPACE ENGINEERING & MECHANICS COLLOQUIA

Mechanics of Granular Materials
S. Nemat-Nasser, Northwestern University
2:15 p.m., Ackerman 225

11

PHYSICS & ASTRONOMY COLLOQUIUM

Double Beta Decay
S. Peter Rosen, Purdue and NSF



12

CONTROL SCIENCE & DYNAMICAL SYSTEMS CENTER SEMINARS: Multivariable Control System Design
(Broadcast on UNITE)

"New Approaches to Multivariable Design"

G. Zames, McGill University
3:15 p.m., Mechanical Engineering 102

GEOLOGY & GEOPHYSICS SEMINAR

Low Angle Stereo Photography: Applications to Geology
William B. Hall, Idaho University
3:15 p.m., Pillsbury Hall 110

12-13

CONTINUING EDUCATION: Management of Quality Control

Faculty: William A. Spurgeon, program director for production, research, and

technology, National Science Foundation

Earle Brown Continuing Education Center, St. Paul campus, 9 a.m. to 4:30 p.m.
Registration information: (612) 373-5361

13

AEROSPACE ENGINEERING & MECHANICS COLLOQUIA

Density-Difference Singularities at Interfaces
Daniel D. Joseph, University of Minnesota
2:15 p.m., Ackerman 225

16-19

MECHANICAL ENGINEERING SHORT COURSE: Computation of Heat Transfer and Fluid Flow

Faculty: Suhas V. Patankar, B. Rabi Baliga
Regency Plaza Hotel, Minneapolis
Registration information: (612) 373-5325

17

DIGITAL SYSTEMS SEMINAR
(Broadcast on UNITE as EE 8390)

A Class of FFT-based Algorithms in Linear Estimation
A. Jain, University of California, Davis
2:15 p.m., Mechanical Engineering 102

17-18

CONTINUING EDUCATION: Minnesota Power Systems Conference

(Co-sponsored with Institute of Electrical & Electronics Engineers)

Earle Brown Continuing Education Center, St. Paul campus, Tuesday 8 a.m. to 5 p.m., IEEE Banquet at 6 p.m.; Wednesday 9 a.m. to 3:30 p.m.

Registration information: (612) 373-3173

18

LECTURERS IN ORGANIC CHEMISTRY

Radicals and radical ions; electrochemistry, ESR; photoelectron spectroscopy; hydrazine oxidation mechanisms; molecular rearrangements

Stephen F. Nelsen, University of Wisconsin
8 p.m., Smith Hall 325

PHYSICS & ASTRONOMY COLLOQUIUM

Colliding Beams at Fermilab
Lee Pondrom, University of Michigan

19

ELECTRICAL ENGINEERING COLLOQUIA (Broadcast on UNITE)

Application of Microprocessor Control to Electric Power

Systems
Arun Phadke, American Electrical Power, New York
4:15 p.m., Mechanical Engineering 102

GEOLOGY & GEOPHYSICS SEMINAR

Evolution of Carbonate Porosity during Burial—Bahamas, Florida, and Gulf Coast, Jurassic to Holocene
Robert B. Halley, AAPG Distinguished Lecturer
3:15 p.m., Pillsbury Hall 110

J. C. Doyle, Honeywell, Inc.
3:15 p.m., Mechanical Engineering 102

ELECTRICAL ENGINEERING COLLOQUIA (Broadcast on UNITE)

Complementary MOS for Custom VLSI
W.N. Grant, Sperry Univac Semiconductor Division, Eagan, MN

4:15 p.m., Mechanical Engineering 102

GEOLOGY & GEOPHYSICS SEMINAR

Metasomatism of the Earth's Mantle
V. Rama Murthy, Minnesota

Faculty: Tarald O. Kvalseth, Minnesota
Earle Brown Continuing Education Center, St. Paul Campus, 8 a.m. to 5 p.m., ending 12 noon Friday
Registration Information: (612) 373-3887

14-16

CONTINUING EDUCATION: Human Factors/Ergonomics

Faculty: Tarald O. Kvalseth, Minnesota
Earle Brown Continuing Education Center, St. Paul Campus, 8 a.m. to 5 p.m., ending 12 noon on Wednesday
Registration Information: (612) 373-3887.

DECEMBER

1 DIGITAL SYSTEMS SEMINAR (Broadcast on UNITE as EE 8390)

Lattice Structures for Estimation and Signal Processing
B. Dickinson, Princeton University

9-11 CONTINUING EDUCATION: Methods Engineering and Work Measurement



2:15 p.m., Mechanical Engineering 102

2 LECTURERS IN ORGANIC CHEMISTRY

New synthetic compounds; asymmetric synthesis; heterocyclic compounds
Sivaraman Raghu, American Cyanamid Company
8 p.m., Smith Hall 325

PHYSICS & ASTRONOMY COLLOQUIUM

High Resolution Imaging Using Speckle Interferometry
P. Strittmatter, University of Arizona

3 CONTROL SCIENCE & DYNAMICAL SYSTEMS CENTER SEMINARS: Multivariable Control System Design (Broadcast on UNITE)

"Limitations on Achievable Performance of Multivariable Feedback Systems"

Institute of Technology Advisory Council announces 1981-1982 agenda

The Institute of Technology Advisory Council (ITAC) announced plans for 1981-82 at their October 8 meeting at the Minneapolis Club.

Richard E. Horner, president of E.F. Johnson Company and the new ITAC chair, announced the formation of a 12-member executive committee which will lead the 60-member council composed of business, labor, governmental, and education leaders in its activities this year.

This fall the council will compile statistics on the demand for science and engineering graduates by Minnesota employers. The preliminary study conducted last year will be augmented with further statistics based on state-wide information.

The study will then be shared with IT departments and Dean's staff who will coordinate the information with long range plans for the Institute.

The ITAC executive committee includes:

Charles M. Denny, Jr.
President
Magnetic Controls

Willis K. Drake
Chairman & CEO
Data Card Corporation

Richard E. Horner
President
E.F. Johnson Company

Herbert D. Johnson
President
Electro/General Corporation

John A. McHugh
Vice Chairman of the Board
Northwestern National Bank

Robert J. Odom
Senior Vice President
H.B. Fuller Company

John A. Rollwagen
President & CEO
Cray Research

Robert L. Rynearson
Vice President
ADG, Honeywell, Inc.

James R. Spicola
Executive Vice President
Cargill, Inc.

Richard A. Trachy
Director
Plans & Controls, IBM Corporation

Roland E. Weber
Vice President & General Manager
Perkin Elmer

Frederick T. Weyerhaeuser
President
CONWED Corporation

Early bioengineering interests aid new work

Professor explains keys to better robotics

While many of us envy Japan's productivity statistics and that nation's use of robots to increase its industrial effectiveness, Mechanical Engineering Professor Max Donath scoffs. "The Japanese robots typically are no more sophisticated than what we have in the United States," he says. "And, if you compare their published research in manipulators (robots) to ours, it's hard to tell who's ahead of whom."

In fact, Donath believes we may have quite a lead over the Japanese. "I think we're way ahead of them in computer technology and if we can integrate that technology with our manipulators or robots we can continue to demonstrate leadership in robotics."

One key to advancing computer technology—and robotics—is high speed computation. Another equally important one is sensory capability—in particular vision. A vision sensing system has many ramifications, according to Donath, an assistant professor. "It can tell us where objects are in space, how a robot hand is manipulating them, and provides feedback for control."

However, a vision sensor requires a lot of number crunching that must be done very quickly. "When we put an image into the computer, it must be broken down into thousands of little pictorial elements, each indicating a light intensity level and possibly a color. For good resolution, it doesn't take long before you are manipulating millions of pieces of information. We ask the computer to make decisions based on these picture elements, to recognize an edge so we can tell where an object is.

"We use our two eyes to give us depth perception. We can do the same with two cameras viewing an image which typically involves matching every point in both camera images," he said.

"We've found faster and faster ways to do these calculations through parallel processing and are close to developing the hardware to handle such a vision system."

Honeywell Corporation recently won a major U.S. Defense Department contract to build very high speed parallel computers. "They've been able to integrate a 16 by 16 processor array all on one chip," Donath said. "If they can do it for 256 processors, how far away are we from 256 by 256 computer arrays?"



Donath has been talking to Honeywell about the use of such parallel processors for controlling multi-joint manipulators. These so-called robots could do many of the jobs that people find difficult or boring.

"Manipulators don't get tired and languid so they can lift heavy or hot loads, do precise spot welding, align, tighten, screw things together, and move objects from place to place again and again and again," Donath said.

More than half the work in any industrial concern seems to be moving things from place to place, he pointed out. The use of manipulators is cost effective and improves quality control in many manufacturing environments.

Though Minnesota does not have a lot of heavy industry, there are numerous large manufacturers and smaller companies here that do assembly and processing work. Robotics

MECHANICAL ENGINEERING Professor Max Donath works with Staff Scientist Keith Detz in Honeywell's Production Technology Laboratory on the system control performance of a robotic manipulator. The Unimation Puma pictured here also is used by Donath and Detz to explore its application in the Honeywell manufacturing environment. Projects planned for the immediate future involve the integration of a number of sensors with the manipulator control system.

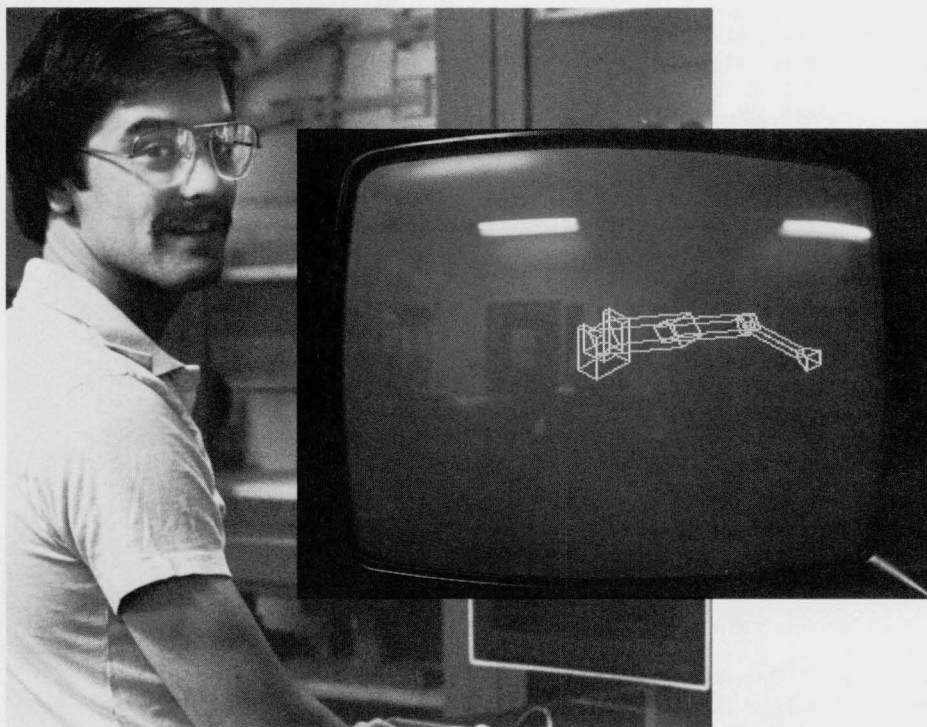
could be applied in all of these companies, as well as in Minnesota's food industry, Donath said.

CAD/CAM group works with robotic arm

A Computer Aided Design/Computer Aided Manufacture (CAD/CAM) research group in the Institute of Technology recently purchased a small robotic arm in order to experiment with high performance capabilities, in theoretical as well as applied work.

Donath is investigating the problems of sensory capability and feedback in manipulators, such as how to incorporate the sense of touch of the human hand into a mechanical hand and how to improve robot coordination and motion.

Two of Donath's students, Tim Walsh and Randy Nelson, have been



3-D SOFTWARE GRAPHICS PACKAGE IS DESIGN CENTER BREAKTHROUGH / As a senior, Mechanical Engineering student Brad Sauer designed a graphics package that can be used to study and eventually improve the industrial robots that are considered one of the keys to automation and productivity success in the U.S. As the first step in robotic arm studies began two years ago by Mechanical Engineering Professor Art Erdman and a student team, Sauer's package for generating links is the front end of CDC Cyber configuration for 3-D work. The graphics pictured here show a mechanical arm with four links that can pick up, rotate, and set down an object. The package utilizes complex mathematical calculations. However, Erdman's student analysis package they obtained from Dr. Bob Williams, formerly of Penn State University and now with Control Data Corporation. They cleaned up and modified it and then created each of the four links in the arm before Sauer put them together for the simulation study. Sauer, who may be better known for his efforts with a hockey stick than with a computer, now works at 3M's Computer Aided Design Center. The work of Erdman and his colleagues in linkages has important implications for IT activities in robotics.

working on the design of a multi-digit robotic hand utilizing a pressure sensor which can detect gripping force. "We should be able to control that force and control the hand's position—but it will be crude compared to what the human hand can do. But then again, so are most manipulators that are on the market today," he said.

Unimation, Inc., one of the nation's largest manufacturers of manipulators, has found it necessary to design a different hand for most every task to be performed; the company keeps track of thousands of hand designs, each with a singular ability.

Donath and Mechanical Engineering Professor Arthur Erdman of the CAD/CAM group seek the capability to design a more generic hand, one that can perform many different tasks in varied environments.

Many robots pictured in the popular press are fictional machines. They really can't walk, but roll along on wheels. "Walking is a very difficult problem," according to Donath. "It is incredibly complicated to maintain balance or posture—for man or machine."

He demonstrated the variables involved in controlling posture to an undergraduate class in control science by constructing a balancing machine. This one-legged device, mounted on a toy truck body, is hooked to a small computer that tells it when to move on a track in order to balance the weight on its high end. The result is that it maintains its stability much

as you or I might if we tried to balance a broom handle in the palm of our hand. The machine's response is so fast that it appears to stand still. Its properties might be applied to balancing the tall ladders fire fighters use where there is nothing to lean against, Donath said.

Donath established himself early in his career in an area of robotics called locomotion or walking. He was among those graduate students who initially worked on a Massachusetts Institute of Technology project that involved the use of signals from an amputee's remaining nerves and muscles to control his artificial limb during walking.

He has transferred this bioengineering concern to paralyzed individuals to help them to walk again. "It's been demonstrated that electrically you can stimulate a muscle and elicit a contraction. It also can be demonstrated that you can control the force of a given muscle. If that's possible, why can't we stimulate the appropriate muscles in the leg and allow people to walk or stand again? We have to figure out which muscles we must stimulate at which time and at what amplitude and frequency, and then synchronize everything."

To these ends Donath has established a gait laboratory in the Mechanical Engineering department—one of the few in the U.S. With initial support from the University as well as outside grants from the Engineering Foundation and private benefactors, Donath has spent more than three

years acquiring the funding and instrumentation he needs. "We have a computer, a walkway, and a platform to monitor forces applied to the floor. Jane MacFarlane, a graduate student, is developing laser-based instrumentation in order to monitor people as they walk.

"We hope to be able to track their limb segments, to essentially know what their arms and torsos are doing as well as what their legs are doing when they walk. Sabri Eken, another graduate student, has been able to produce computer-simulated walking figures on a screen," he said.

Recently Donath's interest in walking took him into an unusual project—one relating to degenerative joint disease in pigs. With Dr. Harvey Hilley in the Large Animal Clinical Sciences division of the University's College of Veterinary Medicine, he has been exploring methods of early prediction of walking problems in the animals. Their ability to walk affects feeding and breeding activities—no small matter when the sale of pigs brings \$9 billion yearly in the U.S. and Minnesota is the nation's third largest pig producer.

"Minnesota is a good place to be right now to begin some important things in robotics. And, if we have the right resources we will find ways to leverage these resources to build our programs—and our future," Donath concluded.

ALUMNI NOTES

AERONAUTICAL ENGINEERING

'81 **Peter O. Dille** '81BAeroE, New Brighton, MN, serves in the Air Force at the Edwards Flight Test Center in California.

ARCHITECTURE

'69 **Ken LeDoux** '69BArch, Minneapolis, MN, is an associate in Hammel Green and Abrahamson, Inc. where he is director of interiors. He joined the firm in 1974. LeDoux received the 1980 Institute of Business Designers award for the interior design of the Science Museum of Minnesota in St. Paul, MN.

'72 **Daniel Avchen** '72BArch, Minneapolis, MN, is Hammel Green and Abrahamson's youngest partner. He currently heads design efforts on plans for the renovation of the St. Paul Hotel, for the reuse of the Limestone and Upton buildings at historic St. Anthony Main, and for a proposed 430-room resort hotel in Florida.

CHEMICAL ENGINEERING & MATERIALS SCIENCE

'61 **John Rosandich** '61BChE is a senior engineering associate, EE-Petroleum department, at Exxon Research & Engineering Company in Florham Park, NJ.

CHEMISTRY

'41 **Harold E. Zaugg** '41PhD, Lake Forest, IL, retired from organic-medical research at Abbott Laboratories in February 1981 after 40 years in the only job he's held since leaving the University.

'42 **J. Keith Lawson** '42PhD, Raleigh, NC, with Monsanto Company's Research Triangle Park in North Carolina since 1961, has served as local American Chemical Society section secretary-treasurer, chairman, and councilor.

'45 **D.J. Lehmicke** '45PhD, Akron, OH, teaches at the University of Akron's Community College.

'48 **Vaughn A. Engelhardt** '48PhD, Wilmington, DE, as associate director of research is responsible for two research sections in the duPont Company's Agrichemicals Research division of the Biochemicals Department at its Experimental Station.

'49 **Wesley J. Dale** '49PhD, Kansas City, MO, returned to teaching and research after 19 years in a variety of University of Missouri administrative posts, including department chair and assistant to the dean of the College

of Arts & Sciences at the Columbia campus; and head of the evaluation group of the National Science Foundation's "Centers for Excellence" program, graduate dean, provost, and acting chancellor at the Kansas City campus.

Howard L. Dinsmore '49PhD, Lakeland, FL, is a professor of chemistry at Florida Southern College.

'51 **Lewis Katz** '51PhD, Storrs, CT, a professor of chemistry at the University of Connecticut, is researching the structure of mixed metal oxides and teaching physical chemistry and x-ray crystallography. He chaired the University Senate executive committee and the Storrs campus Presidential Search Advisory committee.

'52 **Leo Topol** '52PhD, Canoga Park, CA, works for Rockwell International's Environmental Monitoring & Services Center in Newbury Park as program manager of acid precipitation studies.

'54 **Lowell E. Peterson** '54PhD, Minneapolis, MN, is director of basic development at the Henkel Corporation.

Paul Toren '54PhD, Mahtomedi, MN, is a senior research specialist at the 3M Company in St. Paul.

'55 **John E. Franz** '55PhD, a Distinguished Fellow at Monsanto, works with bioorganic synthesis of herbicides and plant growth regulators. He discovered Roundup® herbicide and nitrile sulfides, publishing several papers concerning this latter 1, 3-dipole.

Harry E. Reiff '55PhD, Philadel-

phia, PA, is director of technical planning, research and development with Smith Kline and French Laboratories.

'56 **Charles D. Wright** '56PhD, White Bear Lake, MN, a researcher in rocket fuels and polymers as a senior research specialist in 3M Company's Adhesives division, holds 13 patents, including those for the discovery of four new organic functional groups which contain nitrogen-fluorine bonds. He contributed to the development of an encapsulated adhesive for threaded bolts and nuts and to a new low density cabin sealer for commercial and military jet aircraft.

'59 **Laurance A. Knecht** '59PhD, Marietta, OH, teaches analytical and general chemistry at Marietta College.

'62 **Russell N. Grimes** '62PhD, Charlottesville, VA, chairs the Department of Chemistry at the University of Virginia. Also, he is secretary-treasurer of the Inorganic division of the American Chemical Society.

'63 **Ray Farm** '63MS, White Bear Lake, MN, is a senior research specialist at Analytical Research Laboratories, responsible for commercial products and functional group analysis.

Wilfred Nelson '63PhD, Kingston, RI, is a professor of chemistry at the University of Rhode Island.

'66 **Michael L. Gross** '66PhD, Lincoln, NE, teaches chemistry and directs the National Science Foundation Center for Mass Spectrometry at the University of Nebraska-Lincoln.

'69 **Dennis Konasewich** '69PhD, North Vancouver, British Columbia,

'31 Civil & Mineral Engineers contribute to new underground building

The Civil & Mineral Engineering Class of '31 gave over \$7,000 to equip the new Civil & Mineral Engineering building during their summer 50th Anniversary celebration. The underground facility is currently under construction on the Minneapolis campus.

Alumni W. McGregor Beadie, Willard Fryhofer, and Stanley Watkins headed the fund drive in cooperation with the IT Development Office and the University Foundation.

Joining them in contributing to the new building were:

D.N. Anderson
Gordon Anderson
Lester Anderson
Harlo Beschenbossell

Harvey Dart
W.S. Ekern
F.M. Fahy
N.W. Hella
Wendell Johnson
Otto Knutson
Frank Kuhfeld
Giles Larkin
Carl Larson
Godfrey McMillan
Einar Odland
Roy Olson
Robert C. Ramsdell
Seth Shephard
Leonard Snell
Charles Sonnen
Paul Staffeld
John Swanson
Chuck Swenson
Roy Warner

Canada, who owns his own consulting firm and works with EVS Consultants Ltd., recently completed a six-year assignment with the International Joint Commission dealing with water pollution problems along the U.S.-Canadian border.

'70 **Norval C. Kenten** '70PhD, Fort Worth, TX, directs pre-professional and graduate studies at Texas Wesleyan College in Fort Worth.

'74 **John Maurus** '74PhD, Northbrook, IL, heads Probe, Inc., organized in 1980 to determine the cause and origin of fires. His clients include insurance companies, attorneys, and law enforcement agencies. Additionally, he is an air pollution consultant with Process Design Associates, Inc., Chicago.

'80 **Indulis (Indy) Rutks** '80BChem, St. Paul, MN, is a senior laboratory attendant in the University of Minnesota Institute of Technology's general chemistry undergraduate laboratories.

CIVIL & MINERAL ENGINEERING

'41 **Norman E. Henning** '41BCivE, St. Paul, MN, president of Twin City Testing & Engineering Laboratory, Inc., was elected president of the Iowa/Minnesota chapter of the American Concrete Institute.

'81 **James L. Wenzel** '81BCivE, St. Paul, MN, a member of the Air Force, works in the Civil & Environmental Engineering Office at Tyndall Air Force Base, FL.

MECHANICAL ENGINEERING

'68 **Thomas C. House** '68BME, Shorewood, IL, is Liquids Production manager for the Economics Laboratory, Inc. manufacturing plant in Joliet. He previously was manager of project engineering in the company's St. Paul manufacturing department.

'69 **Richard L. Sivula** '69BME, Maple Grove, MN, has been named vice president-engineering by Conkey & Associates, Inc., international engineering consultants.

'71 **Grant Quam** '71BME, Owatonna, MN, is a senior mechanical engineer in the Component Engineering department of E.F. Johnson Company, Waseca, MN. Earlier he worked for the Owatonna Manufacturing Company.

'80 **Jerry W. Jensen** '80BME, Minneapolis, MN, with the U.S. Air Force, works in the Ballistic Missile division of Norton Air Force Base, CA.

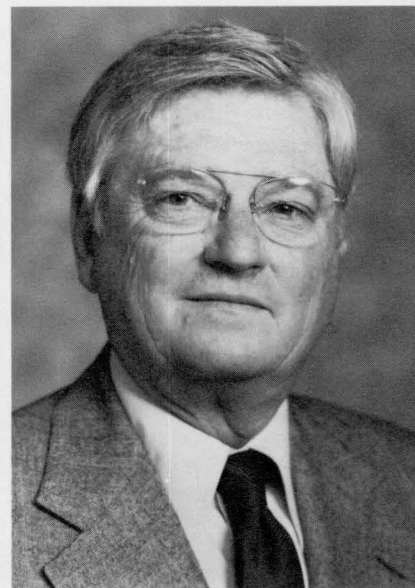
John Pitblado retires from 3M

John M. Pitblado '46BChemE, president of U.S. operations for 3M Company, will retire January 1 after 36 years with the St. Paul-based manufacturer. The 63-year-old Pitblado announced his retirement at a board of directors meeting in mid-August. He assumed his current position in 1979 and will complete his term on the company's board of directors.

Pitblado tried to retire once before, but 3M chairman Lewis Lehr persuaded him to stay on until 3M's recent organizational changes and new market programs were complete. He "played a major role in evolving the business sector organization which was announced earlier this year," Lehr said.

One of five executives reporting directly to Lehr since the restructuring, Pitblado oversees 3M's industrial and consumer products, life sciences, electronic and information technologies, and graphic technologies sectors.

A graduate of Minneapolis Central High School, he worked as a chemical engineer in U.S. Steel's Chicago South Works and Mobil Oil Company in Milwaukee prior to serving in the



U.S. Navy. He joined 3M in 1946 as a methods engineer in its Abrasives Division.

Pitblado sits on the boards of the St. Paul Chamber of Commerce, the United Way, and Jostens, Inc., and is a trustee of the Science Museum of Minnesota.

'31 Electrical Engineers celebrate 50th on campus

Thirty-eight members of Electrical Engineering's Class of 1931 returned to the University of Minnesota campus on June 2 to celebrate their 50th reunion. Those attending from the Twin Cities area included Albert W. Aune, Everett W. Christoferson, Bruce J. Evans, Earl J. Evans, Stanley Furber, Albert A. Goffstein, Charleen Klarquist, Paul A. Markson, Henry J. Marqfsky, Alfred O.C. Nier, Robert E. Rice, Solomon M. Rivkin, Leon Rovelsky, Joseph W. Skovholt, and Basil G. Walker. Among other Minnesotans were Leland Bauck of Perham; Roy I. Bemis, Browerville; Francis J. Biltz, Welch; Dorrance H. Johnston, Warroad; Richard E. Jones, Rochester; Donald W. Kanne, Waterville; Harold O. Moe, Rochester; and Frank J. Vouk, St. Cloud.

Other midwesterners included Edward H. Finch of Lake Bluff, IL; Carl C. Lorentzen, Weidman, MI; Hugh F. Mangskau, Bismarck, ND; and Webster F. Soules, Buchanan, MI.

Evert M. Ostlund, Randolph, VT came from the east coast and Harland Harmer, Memphis, TN from the

south.

Californians attending were C. Julian Ackerman of Coronado; Arthur D. Dittman and William L. Kinsell, Los Angeles; Meade J. Maynard, Glendora; Irvin L. McNally, Sun City; and Lyman G. Swendson, Studio City.

And from the west were Helmuth A. Hedke, Santa Fe, NM; R. Eugene Reinbold, Phoenix, AZ; and Wesley D. Taylor, Houston, TX.

Alumni at UOP receive patents

Peter R. Pujado '72PhDChem, Pallatine, IL, and Gary Kwong '67BChem '68MScChem '75PhDChem, Arlington Heights, IL, recently were awarded patents for their work at UOP, Inc.

Pujado's patents covered the expansion of the dense phase of a fluidized catalyst in an ammoxidation reactor which controls temperature and increases catalyst life. Kwong received two patents, one for using polyoxyalkylenlamines as additives for gasoline, lubricants, or fuel oils, and another with Joseph Levy for the condensation product of monoalkoxyalkylamines with epihalohydrin of dihaloalkane in the presence of a vase.

IN THE INSTITUTE...

PEOPLE

Professor of Architecture & Landscape Architecture Roger B. Martin is a Fellow of the American Society of Landscape Architects and received the CELA Award of Special Recognition this summer for his contributions to the profession and to his university.

Rutherford Aris, Regents' Professor of Chemical Engineering, will receive the Warren K. Lewis Award—the top national award in chemical engineering education—at the November annual meeting of the American Institute of Chemical Engineers. He is known for his analysis of chemical reactors and has written three textbooks and numerous scientific articles on the subject. Currently he is working on the mathematical characterization of the simultaneous separation and reaction of chemicals.

Professor Hans Levy of the University of California-Berkeley is the **Visiting Ordway Professor** in the Mathematics department for fall quarter 1981. He is a world renowned expert in the field of partial differential equations.

New **Department of Mathematics** faculty and their areas of interest include Full Professor **William Messing** (algebraic geometry) and Assistant Professors **William Lang** (algebraic geometry), **Mitchell Luskin** (numerical analysis), **Richard Moeckel** (dynamical systems, ordinary differential equations, celestial mechanics), **Wei-Ming Ni** (non-linear partial differential equations), and **Georgia Triantafillou** (algebraic topology). Also, **Mary Rees** (dynamical systems), who was appointed last year but has been on leave, joined the Mathematics faculty this fall.

Professor of Astronomy Thomas W. Jones is acting chairman of the Astronomy department for 1981-82 while a search is conducted for a new chair.

Department of Civil & Mineral Engineering head Charles Fairhurst is the first recipient of the Pergamon Medal for Outstanding Contributions to the Advancement of Underground Space Use. The award was estab-

lished by Pergamon Press Ltd., a leading international publishing firm specializing in scientific and educational fields. The recipient of the medal is selected by an awards panel formed by the board of directors of the American Underground Space Association. Fairhurst played a leading



Charles Fairhurst

role in establishing this association, an open membership non-profit organization dedicated to the promotion of the wise use of underground space. He served as its first president and is senior editor of its bi-monthly journal, *Underground Space*.

Professor of Electrical Engineering Robert Collins is on assignment for one year as director of electronics for the U.S. Office of Naval Research in Washington, D.C. His appointment came through a contract with the University of Minnesota and the Federal Government under the Intergovernmental Personnel Act.

Theodore V. Galambos joined the **Department of Civil & Mineral Engineering** in September as James L. Record Professor of Civil Engineering. He received his Ph.D. from Lehigh University in 1959 and remained there until 1964 as a research associate and associate professor. He then served as a professor of civil engineering at Washington University, St. Louis, and as chairman of that department until 1978. He held the Harold D. Jolley Chair of Civil Engineering at Washington University from 1968 to 1981 and was elected to the National Academy of Engineering in 1979. He has received several awards recognizing his contributions

to structural engineering, including the 1964 Walter L. Huber Research Prize, the 1968 Moisseieff Award, and a 1979 symposium held in his honor at Washington University.

Department of Agricultural Engineering head Arnold M. Flikke has been elected a Fellow of the American Society of Agricultural Engineers.

Chemistry Professor Emeritus I.M. Koltzoff will receive the 1981 Olin-Palladium Medal at the October meeting of the Electrochemical Society in Denver, CO.

Professor of Chemistry Donald G. Truhler, currently vice chairman of the American Theoretical Chemistry Conference, will chair the conference in 1987. The University of Minnesota has provided four chairs: Minnesota alumni R.G. Parr and W. Kern and Chemistry Professor Albert J. Moscowitz also have headed conferences.

Mechanical Engineering Regents' Professor Emeritus Ernst R.G. Eckert received the Senior U.S. Scientist Award of the Alexander von Humboldt-Stiftung, recognizing "an outstanding U.S. scientist's past accomplishments in research and teaching, and thereby promoting scientific cooperation between institutions in the Federal Republic of Germany and in the United States." Eckert spent five months at the University of Stuttgart doing research in energy conservation and solar energy and presenting papers and lectures to various German engineering audiences. He also visited the Norwegian Institute of Technology.

Mechanical Engineering Professor David Kittleson spent spring quarter at the University of Vienna's Institute of Experimental Physics as a visiting professor.

PROGRAMS

The international board of governors of the new National Science Foundation **Minnesota Institute for Mathematics and Its Applications** planned a two-year program in September. **Regents' Professor of Mathematics James Serrin** is one of the coordinators of the first year's program devoted to statistical and continuum approaches to phase transition. The second year's program emphasizes economics, with University of Minnesota Economics Professor Leonid Hurwicz as coordinator.

MINNESOTA GEOLOGICAL SURVEY LEGISLATIVE APPROPRIATION

Legislative funding for the Minnesota Geological Survey was erroneously reported in the 1981 Summer Items. The Survey received a State Special of \$1.2 million for the biennium and two grants from the Legislative Commission on Minnesota Resources of \$818,000 for aeromagnetic mapping and \$60,000 for Southeast Minnesota groundwater. A request of \$478,844 to continue a geological test drilling program and the collection and computerization of water well drillers' logs was not funded. The geologic mapping of Minnesota is fundamental to the basic mission of the Survey.

The University of Minnesota Talented Youth Project, administered by the Department of Mathematics, continues this year with 140 students. The project brings seventh and eighth graders to the University one day a week for special courses in algebra and geometry, as well as high school students for courses in first- and second-year calculus. Three former project participants are now enrolled in IT, two entering under the early admission program and one with advanced standing.

A new system for **Hazardous Chemical Waste Management** is being implemented throughout the University. The system reduces the volume of hazardous chemical waste generated and provides a computer-based labeling procedure. Skyrocketing costs of hazardous chemical waste disposal and increasingly restrictive regulations from the Environmental Protection Agency and Department of Transportation prompted these changes. The system was successfully piloted in the Chemistry department over the summer. All teaching, research, and clinical laboratories generating hazardous waste are affected. Guidebooks are available which provide instructions for labelling and volume reduction procedures.

The **Department of Astronomy's Starwatch** has been purchased by Synsat Communication, Inc. for national syndication except in Minnesota.

The **Mathematics department** has a new course in **Topics in Differential**

Geometry available during 1981-82. The fall quarter 8380 class deals with differential systems; winter quarter 8381 with Morse Theory; and spring quarter 8382 with either integral geometry or tight submanifolds.

A degree program in **Industrial Engineering**, specifically for a **Bachelor in Industrial Engineering (BIE)**, is being considered by curriculum committees. The program would follow the same requirements as the Mechanical Engineering program relative to lower division pre-engineering, upper division technical core, all-University liberal education, and coherent elective program. However, it differs from the ME program in that IEOR 1001, "Introduction to Industrial Engineering and Operations Research" is required. The basic engineering core is 48 credits and includes 12 credits of ME courses and 36 credits of IEOR courses. A 24-credit coherent elective program also is required and may involve manufacturing engineering, computer applications, organization theory, areas of mechanical engineering, public health and environmental control, and pre-master of business administration choices or other combinations of electives.

RESEARCH

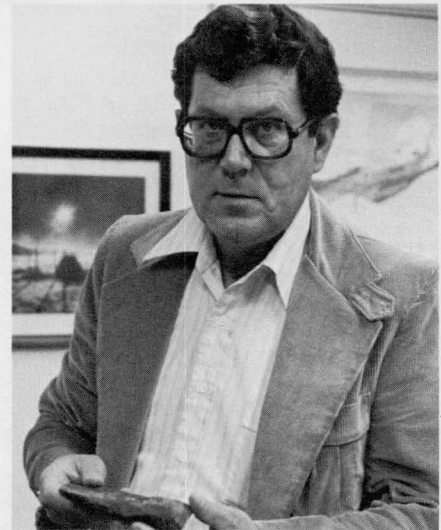
Associate Professor of Astronomy Roberta M. Humphreys has received a number of research grants within the past year, including two from the National Science Foundation, for studies of luminous stars in nearby galaxies, \$78,000 for 11/81-5/82 with possible future commitment of \$47,800 for 1982-83; and for the redevelopment of the automated plate scanner at the University, \$229,600 for 5/81-11/82 with a future commitment of \$140,000 for 82-83. Earlier NSF had given \$110,400 to the latter project. Humphreys also received a National Aeronautics & Space Administration grant of \$10,503 for ultraviolet spectroscopy of the brightest supergiants in M31 and M33.

The **Agricultural Engineering department** got a three-year grant from the U.S. Department of Agriculture-SEA-AR to research the "Effects of Surface Sealing and Consolidation on Infiltration and Runoff for Disturbed Soils." The project involves field experiments on infiltration, laboratory studies on seal formation, and mathematical modeling of the infiltration

process. **Professor of Agricultural Engineering Curtis L. Larson** is project leader. He is assisted by **Professor of Soil Science George Blake**, **Associate Professor of Agricultural Engineering Donald C. Slack**, and **Morris Agricultural Engineer Charles A. Onstad**.

Electrical Engineering Professor B.A. Sheno received a grant from the Gould Foundation in Rolling Meadows, IL, supporting his research and teaching activities in digital signal processing.

The National Science Foundation has funded a two-year cooperative scientific program developed by **Associate Professor Cesar Farell** of the **St. Anthony Falls Hydraulic Laboratory** with the University of Rio Grande do Sul, Brazil, to study fluctuating loads on and the modeling of flow around rounded structures, including the effects of their surface roughness. Farell was in Brazil this summer working on instrumentation, models, and data collection techniques. Additionally, he is chairman of the Fluids committee of the Engineering Mechanics division of the American Society of Civil Engineers.



JOHN SPLETTSTOESSER, program manager and senior scientist for the Minnesota Geological Survey, discussed a ventifact—or wind-eroded rock—central to recent participation in an International Conference on Aridic Soils held in Jerusalem. His discussions on polar soils convinced some Israeli geologists that the rocks in their country's deserts are eroded mainly by the wind's sand-blasting and aerodynamic effects rather than by water activity. His work also relates to imagery NASA has received from Martian flights. "Wind activity on Mars is producing some of the same features, but on a different scale, as the rock has that I hold," Spletstoesser said.

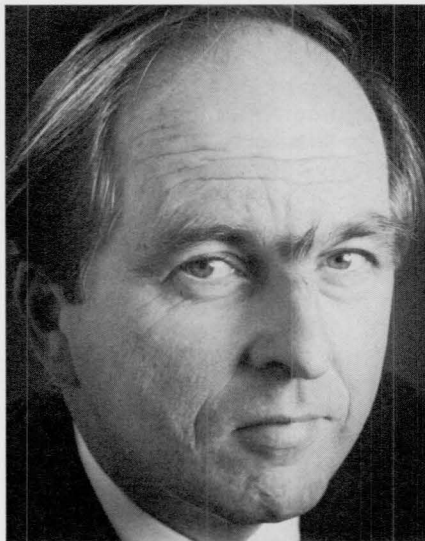
Babbage Institute head predicts far-reaching involvement

"The Charles Babbage Institute, first of its kind organized on a university campus, concerns itself both with the historical issues related to the development of computers and information sciences and with contemporary issues associated with the institutionalization of information processing," says its new director, Arthur L. Norberg. "The Charles Babbage Institute (CBI) gives us a chance to make positive statements about handling the negative aspects of computers and information sciences."

Norberg says that the strength of the University of Minnesota, recent important activities of the Institute of Technology in the information sciences, and the interweaving of the physical sciences and strong History of Science and Technology program, management information systems, and computer science and technology programs on the Minnesota campus assist the practical and historical sides of CBI's work.

"CBI can be involved in the resolution of contemporary questions through cooperation with the Hubert H. Humphrey Institute, the Law School, and the Library School, among others," Norberg says.

The University of Minnesota was chosen as the permanent home for the Charles Babbage Institute for the History of Information Processing in late June 1980. Named for a 19th-century English mathematician known for his pioneering work in computer logic and technology, CBI was



Arthur Norberg

founded by IT alumnus Erwin Tomash, a computer executive, in 1977.

The institute documents and studies the development of information processing—both its technical and its socioeconomic aspects—and promotes increased awareness of the impact that development has had on society.

Arthur Norberg became director of the institute on September 1. He has an outstanding background in the administration of projects in the history of science and technology, previously serving as manager of the National Science Foundation's program in Ethics and Values in Science in Technology, headquartered in Washington,

D.C., and as an analyst at NSF studying science and technology policy.

From 1973 to 1979 Norberg was research historian in the Bancroft Library at the University of California, Berkeley, heading its history of science and technology project and building it into a recognized leader in the country. He conducted original research into the development of the electronics industry, emphasizing the local high technology community's technical and business developments, and established an acquisitions program for rare books and archival materials that gained the attention of the research community.

He also has taught courses in the history of science, physics, and astronomy, and worked as a research scientist in industry. He holds a tenured appointment in IT's Department of Computer Science and will teach in its Program in the History of Science and Technology as well as direct CBI.

Norberg received his Ph.D. in the history of science from the University of Wisconsin in 1974. His M.S. and B.S. degrees are in physics and mathematics.

CBI is housed in Walter Library on the Minneapolis campus where its manuscripts, materials, and index are available to visiting scholars and students of computer and information sciences history. The institute will publish a national catalog of history of computers source materials.

ITEMS

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