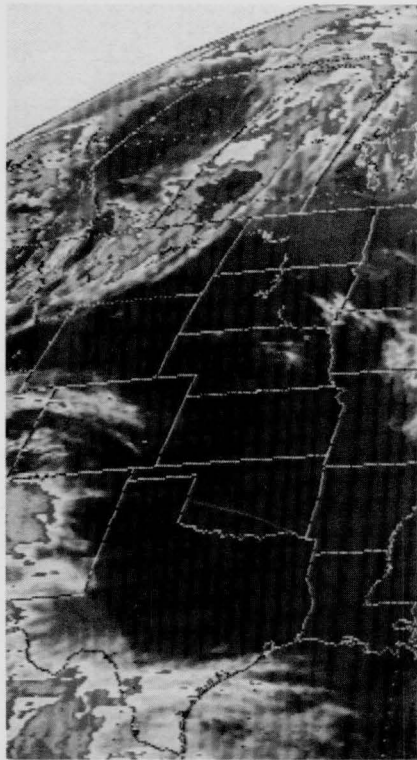


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Bias error is difference between ICBM hope and reality as defense system



A phenomenon called the bias error spells success or failure for an attack on U.S. intercontinental ballistic missiles (ICBM) or Minutemen silos—and raises important questions about the need for the multi-billion dollar MX missile system, according to Mechanical Engineering Professor J. Edward Anderson.

America's ICBM missile system includes 1,000 Minuteman and 54 Titan in silos spread throughout the country in North and South Dakota, Colorado, Arizona, Missouri, Arkansas, and Nebraska. To successfully incapacitate this system the Soviet Union would have to calculate and compensate for a bias error that appears impossible to predict or to allow for in adjusting missile flight.

"The Soviet high command would be crazy to assume they could strike with the necessary 300 feet to have a successful first strike," Anderson said.

That 300 feet refers to a Circular Error of Probability (CEP). To narrow the CEP and hit a target such as missile silos one must first make a pattern of hits at a target, then find the centroid of that pattern by drawing a circle around the portion which includes 50 percent of the hits. "And the centroid may not be the target," Anderson said. A first strike does not include target practice.

The United States currently fires test missiles from Vandenberg Air Force Base over the Pacific to ascertain CEP and correspondingly adjust missile guidance systems for on target hits. However, similar adjustments for bias error cannot be applied by the Soviets to missiles they would fire over the poles, said Anderson. A new set of factors affects missile trajectories—the earth's irregular gravitational field, varying atmospheric densities, and variable wind velocities.

Theoretical calculations of the error in such trajectories gives a bias error so great as to render a Soviet missile attack on the Minuteman system unsuccessful. Thus, the system is not vulnerable.

"Working formulae show that if you fire one missile at each Minuteman and Titan target that you would leave more than 50 percent of them intact," Anderson said. And that is not a successful first strike.

Anderson also pointed to other factors the Soviets would have to consider in an ICBM attack. "Striking the Minuteman fields is not a surgical strike," he said. "Radiation exposure downwind could kill anywhere from two

to twenty million Americans and the ground explosions which would be necessary to knock out U.S. missiles would create tremendous dust clouds that would circle the northern hemisphere and create a cooling effect that would result in crop damage for years to come.

"The ozone in the upper atmosphere would also be depleted by such an attack, increasing ultraviolet rays which in turn would increase the incidence of skin cancer as well as decrease crop growth.

"Such an attack could only be a serious and desperate one," he said.

If the Soviets would not initiate such an ICBM attack because of its disastrous proportions, then what?

It would make sense to phase out our land-based defense systems because of the subtleties involved in a successful attack, Anderson said. He noted that we seem to forget about our nuclear submarines and large bombers.

"And it is not technically feasible to build anti-ballistic missile systems, and arms reduction has not worked."

A mobile, land-based system has been rejected by the military because of its cost—in construction and in possible environmental and accident damages. Instead, they have proposed a multiple shelter system using MX missiles, he said.

The MX system is really a mobile shelter system that allows 23 shelters for each missile along a 19-mile track which is blocked off at each end. The missiles are moved in 750-ton transport vehicles and deposited horizontally in a hard bunker. Each missile is housed in a launcher-erector device that is 180 feet long and 15 feet in diameter and weighs 350 tons. This device is hinged in the middle and can be moved into a vertical position so the missile can be fired. The MX missile is a four stage rocket that has 10 warheads in each nose cone. Each warhead contains a 350 kiloton bomb that is 25 times as powerful as the one exploded at Hiroshima.

The system would utilize missile decoys so the Soviets could not detect which bunker holds the real thing; the track design allows more missiles to be added to each 23-bunker configuration.

The military sees the MX system as giving the U.S. over 3,000 missiles to attack the Soviet's 1,500 launchers—which is considered first strike capability.

But is such capability reality or hope in light of the bias factor?—*Mary Lou Aurell*



IT ALUMNI SOCIETY/In pursuit of "The Technology Goodness Quotient"

By Leigh E. Nelson '51ChemE
IT Alumni Society President

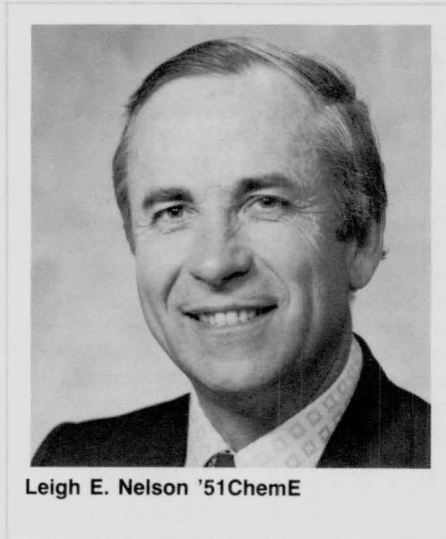
The Institute of Technology Alumni Society (ITAS) climaxed 1980 programming with a successful Science & Technology Day Banquet at the Radisson South Hotel on November 14. The evening activities emphasized "Innovation and Productivity" as the alumni society had in projects throughout the year. Nearly 1,000 individuals attended this event to hear Robert E. McDonald '40ChemE '40EE of Sperry Corporation describe the productivity challenges our nation must confront.

As 1981 unfolds, ITAS leadership is sobered by the social implications of technological development. Consequently, ITAS is focusing on morality and ethics in technological development or "The Technology Goodness Quotient" during all of its 1981 activities.

This timely issue involves our quality of life, even our survival, during the coming decades. To explore its ramifications as an organization, ITAS wants to discuss the following subjects:

- Technology and Public Policy
- Human Life Definition
- Limits to Growth
- Technology to Weapons to Use
- Ethics and Technology
- Legal Aspects of Engineering
- "Big Brother's Watching You" Technology
- Can We Over Communicate?
- Relationships in Traffic Jams
- Full Employment and Automation

IT students have already signaled their interest in ethics as concerns scientists and engineers through Tau Beta Pi's 1980 "Ethics and



Leigh E. Nelson '51ChemE

Technology" symposium. That program by the student honor society has since led to the formation of a course, "Ethics in Engineering," which is now part of IT's curriculum.

The IT Alumni Society hopes to stimulate similar course offerings in industry and other educational institutions. Continued discussions throughout the year should help ITAS define and better express the issue.

We are all faced with the dilemma of having created a technology that may be genie, monster, both genie and monster, or neither. Perhaps we all agree that technology is becoming a tower of Babel that is leading to confusion in all the world. (Genesis 11:6-9)

All of us have thought about the points I raise here. If you want to share your thoughts, write to the alumni office and we will try to consider your ideas in our planning. Or, if you want to participate in our activities, let the following committee chairpersons know:

1981 Science & Technology Day (an all-day program which includes seminars on selected topics of national importance addressed by international experts, an evening banquet featuring special awards and an outstanding speaker, and class reunions)—

Joseph R. Schumi '66Math '71PhDMath, St. Paul Fire & Marine Insurance Company, (612) 221-7718;

RITA (Reaching IT Alumni)

Seminars (a series of seminar lunches held throughout the Twin Cities area in industrial locales, designed to bring IT administrators, alumni leaders, and faculty and their latest research to the alumni and friends of the University)—

Jack S. Braun '56CivE '57MSCivE, Braun Engineering Testing Company, (612) 941-5600, and *Kris Black* '75Phys, Cardiac Pacemakers, (612) 631-3000;

Membership

Tony F. Yapel '67PhDChem, 3M Company, (612) 733-6125;

Student Liaison (work with various IT student groups to promote collegiate programs for students, such as a Technology Fair, career seminars, publications)—



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- Dean Roger W. Staehle
- Associate Dean Richard C. Jordan
- Associate Dean David A. Storvick
- Associate Dean Edwin F. Stueben
- Director, Continuing Education in Engineering & Science Morris E. Nicholson
- Associate to the Dean & Director of Special Programs ... Clarence A. Berg
- IT Alumni President ... Leigh E. Nelson
- Director of Development Catherine Day
- Director of Publications Martha A. Roth
- Director of Public Affairs Margaret A. Lulic
- Editor Mary Lou Aurell
- Assistant Editor George Lausch

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.

Editor's Note: ITems will appear more frequently this year on an every-other-month schedule except during the summer. It has grown in size to include wider news coverage and a special calendar of Institute of Technology and University events. Readership has also expanded to IT Advisory Council members, Partners Program participants, and other friends of the Institute.



Jack E. Meyer '47Civ E, Meyer, Borgman & Johnson, Inc., (612) 338-0713, and Gregg A. Vandesteeg '76PhDChem, 3M Company, (612) 736-0881;

IT Alumni Charter (an examination of the ITAS charter to insure its contemporary viability)—

Charles D. Christopherson '48CivE, Fluidyne Engineering Corporation, (612) 544-2721;

Regional Chapters—

Everett H. Dale '49EE, McQuay-Perfex, Inc., (612) 553-5316,

George A. Champine '56BS '57MS '75PhD, Vydec, Inc., (201) 822-2100 x2733, and Donald Sudor '53Math(CLA), IBM Corporation, (507) 286-2794;

Honors (work with the University Honors Committee to select deserving University alumni for awards recognition)—

Leigh E. Nelson '51ChemEng, 3M Company, (612) 733-8150.

Also as part of its 1981 programming, ITAS will begin to establish regional chapters. To be effective we must hear from and involve alumni outside of the midwest area, alumni living in the east, west, north, and south, as well as abroad. Our goal is to double our membership in one year.

ITAS welcomes the following individuals to its board:

Thomas Bastien '59Geo '63MSGeo, vice president, Ernest K. Lehmann & Associates, Inc., Minneapolis;

Kristine Black '75Phys, qualifications engineer, Cardiac Pacemakers, St. Paul;

Donald D. Carlson '48AeroE, president, Detection Sciences, Inc., a division of Digital Systems, Minneapolis;

Lemoine L. Johnson '56MechE, vice president for research and development, Donaldson Company, Inc., Minneapolis;

John Kugler '59ChemE '60Bus, senior product design engineer, Bemis Company, Minneapolis;

Robert L. Raymond '71PhDMath, program analyst, Control Data Corporation, Roseville;

James R. Sutherland '61AgE, consultant, Staples Irrigation Center, Minneapolis;

Wayne Winsor '54Arch, president, Winsor-Farcy Architects, St. Paul.

3M loans top executive to IT and CBA for 1981

James Tait Elder, former general manager of 3M's New Business Ventures division, is serving on the University's Minneapolis campus during 1981 as an adjunct professor of Mechanical Engineering and of Marketing in the Institute of Technology and College of Business Administration (CBA), respectively.

He is here to assist the two colleges in expanding and refining their participation in the industrial/community sectors which have a growing need for the varied capabilities of the University.

ITAS Presidential Profile/Leigh

Nelson '51ChemE joined the Shell Chemical Company as a process engineer following graduation from the University of Minnesota. Six years later he moved to Montreal to supervise process engineering for Shell Oil of Canada, then, in 1959, returned to Shell Chemical to be section leader for research and development in Houston.

In 1962 he came back to his native Minnesota to join the 3M Company where he is today. He has served successively as a process engineer, process engineering supervisor, and superintendent for 3M's Chemical division at Chemolite, as a laboratory manager and, since mid-1974, technical director of the 3M Central Research Pilot Development Laboratory.

Nelson is a member of the American Institute of Chemical Engineers and chairs the advisory board of the International Fine Particle Research Institute.

Active politically and in church and community, he currently directs Lutheran Youth Encounter and heads the Welch Village Ski Area board. He is married and has four children.

His presence as a loaned executive is supported by 3M.

More specifically, Elder is helping IT and CBA to develop curricula pertinent to the needs of Minnesota industry in the future.

"You might say that I'm a market research specialist working with two venture deans who are aggressively trying to chart new courses that meet the needs of industry," he says. The deans he is referring to are IT's Roger Staehle and CBA's David Lilly.

To achieve this goal Elder must learn as much as he can about those parts of the University which interact with the Twin Cities business/industrial communities, as well as try to understand what local business wants from the University and whether that means more of the same or something new.

The helpful relationships built between the educational and industrial sectors involves coordinating University people having similar goals, assisting in the cooperative development work of IT and CBA, and identifying activities that might involve further efforts from either sector.

Elder's experience as a business executive also brings a valuable viewpoint to classroom and seminar discussions. He is advising student projects for Mechanical Engineering Professor Darrell A. Frohrib's Design Engineering class and Marketing Professor Richard N. Cardozo's Product Policy class. He will also lecture on career options to an Industrial Engineering class and participate in seminars on marketing and technology offered through the CBA Executive Development Center.

Additionally, Elder consults with IT Associate Dean Edwin F. Stueben and Executive Development Center Director John Mauriel to better focus continuing education programs on the needs of Minnesota companies.

Elder, a Naval destroyer officer during WWII, received his Ph.D. in physics from Johns Hopkins University in 1952. He worked as a research physicist for seven years with the New Jersey Zinc Company before joining 3M in 1959. He was with the 3M Central Research Laboratories as a scientist and manager before moving to its New Business Ventures division in 1968. He was named head of that division in 1973.

Scholarship program fuels Civil Engineering careers

Civil engineering students who battle the financial rigors of a university education can find a wealth of encouragement in the Minnesota Surveyors and Engineers Society (MSES) scholarship program. The MSES, an organization of persons interested in transportation and its advancement in Minnesota, has awarded 334 scholarships—totalling over \$135,000—to Minnesota students since starting its scholarship work in 1953.

"The society's scholarship eliminated a severe financial hardship for me," says David H. Pederson, a civil engineering graduate who enrolled at the University after working several years as a technician. He supported his wife and five children while he worked toward his degree. "It enabled a family man to continue his education," he adds.

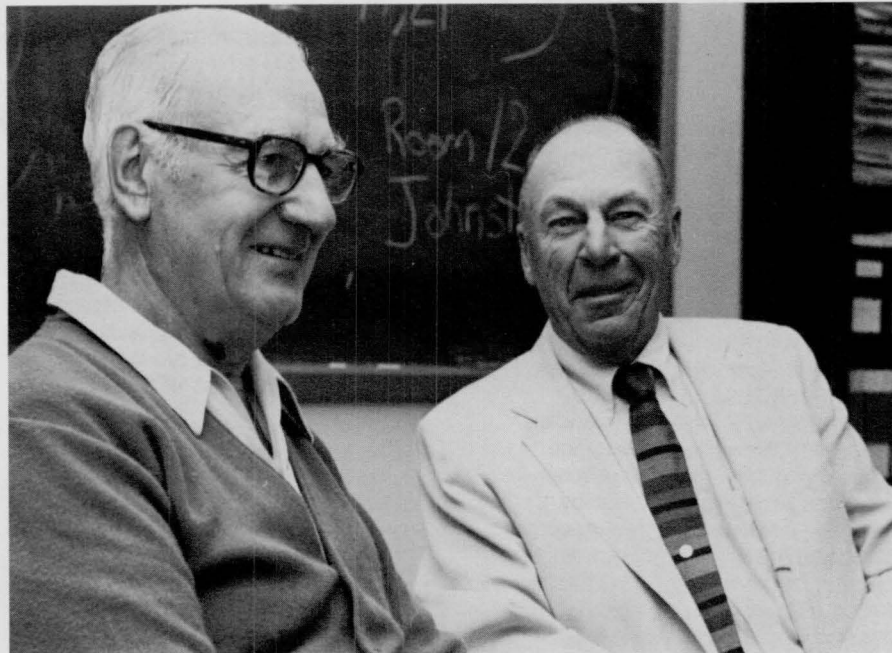
Pederson is now an assistant hydraulic engineer and water quality unit supervisor with the Minnesota Department of Transportation.

Job opportunities are part of the encouragement that comes with the awards. "Along with the scholarship money," says Miles Kersten '34CivE, a former MSES officer and professor emeritus of civil engineering, "the Minnesota Department of Transportation, primarily through the efforts of training officer Gunnar Pederson, places many of the recipients in summer work. We feel that this is an excellent way for the students to become acquainted with the transportation fields and earn some additional money as well."

The membership of the MSES numbers nearly 800 professionals—more than half University of Minnesota graduates—who are affiliated with the Minnesota Department of Transportation, city and county engineering offices, contracting firms, and equipment and materials suppliers.

According to current scholarship chairman Stan Watkins '31CivE, the MSES started the scholarship program to try to interest graduating civil engineers in careers in transportation engineering.

"At that time, many of the engineers working with groups like the State Highway Department did not have engineering degrees but had advanced through the ranks from jobs on survey crews or as technicians. The



Miles Kersten '34CivE, left, professor emeritus of Civil Engineering, and Stan Watkins '31CivE, scholarship chairperson, have helped to build a successful Minnesota Surveyors and Engineers Society scholarship program.

need then for men and women with academic backgrounds and training was great," Watkins explains. "And to some extent, it still is."

The entire scholarship program is run by MSES members, from publicity and fund raising to the selection of recipients from among the 30 to 40 students who apply annually. An MSES team interviews each applicant, and the 12 to 15 finalists are announced and honored at a special spring banquet held on the University campus.

David Janisch, one of 12 recipients for the 1980-81 academic year, says that in addition to the money and his summer research job, he appreciates the award because it was based on more than just academic achievement. "The MSES interviewers also evaluated my personal qualities and financial need, as well as my interest in transportation engineering," he explains.

Money for the scholarships comes exclusively from within the ranks of the MSES. A percentage of each member's annual dues, profits from internal fund-

raising campaigns and outings, and a trust fund for surplus monies all go to the scholarship effort. Kersten says that the society members "have really taken to the scholarship program with a lot of enthusiasm. It gives us a serious purpose to go along with our regular social activities, and it allows us to maintain contact and involvement with University students."

Some of the recipients stay in touch with society members as well. Stan Watkins tells of one student who received a \$250.00 scholarship in 1960. He graduated in civil engineering from the University of Minnesota, then went off to the West Coast where he eventually earned a law degree. He recently sent a letter to the scholarship committee that explained how much the scholarship had helped him, and that he is now in a position to help someone else. He included a check for \$1,000.

"It is a response like that," Watkins says, "that makes the work we do in our scholarship program worthwhile."—George Lausch

Aeronautical Engineering & Mechanics

Leif W. Ericksen '43AeroE '47MechE, Minneapolis, is president of Ericksen Ellison and Associates, Inc.
Art T. Sneen '70AeroE, New Hope, who also holds a certificate in industrial engineering, is manufacturing services manager with TESCO Corporation. He is married and has one son.

Architecture & Landscape Architecture

Kenneth A. LeDoux '69Arch, director of interiors for Hammel Green & Abrahamson, Inc., St. Paul, received a first place Institutional Design Award for the interior design of the Science Museum of Minnesota from the Minnesota chapter of the American Society of Interior Designers. The museum was one of several buildings also honored earlier this year by the Minnesota Society of the American Institute of Architects. LeDoux's work has been published in *Minneapolis-St. Paul* magazine, *Business Design and Construction*, and *Architecture Minnesota*.

Arthur E. Monthey '31Arch, Duluth, has retired. He was formerly with U.S. Steel Corporation.

Inez Allard Roach '33Arch, Stillwater, has retired from the Science Museum of Minnesota after 32 years of continuous service. During her last eight years there she was director of business and finance.

Chemical Engineering & Materials Science

Nancy Faville '79ChemE, Des Moines, IA, works for the American Can Company.

Gilbert B. Gehrenbeck '28ChemE, White Bear Lake, retired in 1971 from the 3M Company and is now self employed as a patent agent. He and his wife celebrated their Golden Wedding Anniversary in 1979. He has two sons, one an instructor in organ at Illinois Wesleyan, and the other an instructor in the History of Science at Rhode Island College.

Lyle W. Kirmis '71ChemE, Bismarck, ND, who graduated from the University of Minnesota Law School in 1974, is an attorney and partner with the firm of Zuger and Bucklin.

Civil & Mineral Engineering

James N. Boehlke '37CivE, Rochester, is a sales specialist with the Monsanto Company.



Kenneth A. LeDoux '69Arch

William J. Croke '61Geo(UMD) '68CivE, Duluth, is an assistant district engineer for maintenance with the Minnesota Department of Transportation. He and his wife, Kathleen Dinan '64Nur, have three children.

Robert A. Huber '73CivE, Edina, is an airports engineer with the Federal Aviation Administration.

Robert B. Rhode '37CivE, Duluth, though retired, works as a consultant to railroads and currently is a director on the national board of the American Society of Civil Engineers.

Donald R. Satrom '48CivE, Cinnaminson, NJ, executive vice president of Burlington County Trust Company, has a daughter who is a computer scientist, two sons who are engineers, a third who is a lawyer, and a fourth who is a dentist.

Donald Woodrow Scott '38Min&MetE, Hibbing, is president and owner of the Continental Sales & Equipment Company. He and his wife Rosemary have three sons, John J., an architectural engineer with Haskins, Scott, Taylor & Associates in Boston; James E., an orthopedic surgeon with the Billings Clinic in Billings, MT; Jerry, an attorney with the St. Paul Companies; and a daughter, Judy, who is a home economist teaching at Roosevelt Junior High School in Anoka. All their children graduated from the University of Minnesota except for Jerry. They have eight grandchildren.

Computer Science

John J. Feigal '75CompSci, Roseville, is a senior systems programmer with NCR Comten, Inc.

Russell C. Heinselmann '68Math '72CompSci, Sudbury, MA, is on the technical staff of the Sperry Research Center.

Leon P. Plantz '77CompSci, Duluth, a systems engineer with IBM, is married and has two children.

Electrical Engineering

John J. Davis '57EE, Winona, a corporate industrial engineer with G. Heileman Brewing Company, has four children—a son who is a senior at St. John's University, a daughter, a junior at the University of Minnesota, and two sons in high school.

Sam R. Hamilton '28EE, St. Paul, died November 16, 1978. His wife, a daughter, and two grandchildren survive him.

Anton A. Korba '29EE '40MSEE, St. Paul, retired, is currently a part time consultant. He worked earlier at Westinghouse Electric, Northern States Power Company, and Toltz, King, Duvall, Anderson, Engineers & Architects, and taught at the University of Minnesota. He is married and has two children and three grandchildren.

Geology & Geophysics

Michael R. Wigley '78Geo '78CivE, Columbia, OH, a project manager with Battelle Memorial Institute, received his master's in civil engineering from Stanford University in 1979. A member of the American Society of Civil Engineers standing committee on nuclear effects, he is married and is a tennis enthusiast.

Mathematics

Steven O. Link '77Math, Tempe, AZ, is a research associate at Arizona State University.

Mechanical Engineering

Lois A. Adamson '79MechE, Westminster, CA, a member of Technical Staff I at Rockwell, International, is presently working on the main propulsion system for the Space Shuttle.

Dwight O. Anderson '79MechE, Mosinee, WI, is a test coordinator with the Wisconsin Public Service Corporation, currently involved in the startup of a coal fired power plant.

T. Richard Andresen '64MechE, Brooklyn Park, president-elect of the Minnesota Society of Professional Engineers, is superintendent of plant engineering for Northern States Power.

Brian A. Beech '78MechE, Bloomington, is an engineer with Magnetic Peripherals, Inc.



Productivity challenges will make or break America, says S&T Day speaker MacDonald

Robert E. MacDonald '40EE '40Bus, a consultant to Sperry Corporation, keynoted the November 14 Science & Technology Day banquet. His remarks highlighted a full day's program focused on improving innovation and productivity in a resource limited world. An afternoon seminar featuring four nationally distinguished speakers preceded the evening banquet. Attendance records were set for all events.

"Our whole society is facing a productivity challenge that in many ways will determine whether this nation continues as a growing—or an ebbing—economic force in the years ahead," said corporate consultant Robert E. MacDonald.

In the 1960s, U.S. output per man hour grew at an annual rate of three percent. Then, in the early 70's, it started to fall until, in 1979, productivity was a negative two percent.

"Meanwhile, in most of the other major industrialized nations, the rate of productivity improvement grew," he said. "Though we have had, historically, a higher rate of output per man hour than other industrial nations, the gap is closing fast and, in the cases of Germany and Japan, may already have closed.

"In the simplest terms, if U.S. productivity continues to diminish relative to other major nations, our standard of living will erode."

MacDonald emphasized that today's economic events are the culmination of somebody's former good intentions, that a few years ago what might have looked like a quick solution to a problem or need, today is the problem.

"As one thinks about it, one realizes that more and more the long term health of American Society is being subverted—often with the best intentions—by short-term perceptions and pressures."

MacDonald went on to say that "one of the key productivity issues facing the American industrial establishment is the age and increasing obsolescence of our plants and equipment."

For nearly a decade the United States has invested in tools of production at the lowest rate of any industrialized nation in the world. That

means, he said, that our international competitors are modernizing their capabilities to produce goods and services much more rapidly than we are and, eventually, they will zip right by us in areas of commerce.

And, according to MacDonald, "one of the principal reasons that U.S. capital investment is so low can be traced to federal government tax, spending, and regulatory prices that were initiated years ago and continue today."

However, research and development (R&D) have suffered a kind of neglect, MacDonald said, except from the science-based industries, such as electronics, data processing, electro-optics, telecommunication, and others.

Funding for R&D multiplied 15 times between WWII and the Vietnam conflict. Many local, well-established companies increased their orientation to high-technology products, according to MacDonald. There was a dramatic emergence and growth of new companies in the Twin Cities area, particularly in electronics and in the computer and computer-related field.

Productivity grew rapidly, averaging 3.27 percent per year, MacDonald said. The gross national product tripled. Per capita and family income advanced sharply. Inflation was almost non-existent.

After the mid-1960s, national R&D spending began to wane, and has been flat for 10 years, MacDonald said. During this period our national growth, in output per man hour, diminished also.

The short-term viewpoint began to dominate in the 60's, he said. Both government and American industry shared this emphasis, with a major exception. "The high technology companies have consistently maintained very high R&D budgets even when under heavy economic pressure," MacDonald noted. "It is this group of companies that have accounted for almost all the real growth of industry-funded R&D.

"Other sectors of the American industry have not been committed to substantial support for R&D.

"Yet, study after study has shown there is a very strong correlation between R&D spending and growth in revenue and profit, which, in turn, reflect innovation and improvements in productivity."

The R&D commitment became a vital force in high technology companies, MacDonald said, because the industry quickly realized that to survive it would have to turn a profit on exciting new developments that made new systems obsolete before quantity shipments could be made. "That realization helped us to develop an appreciation for the vital need for long-term planning."

Though it is a continuing challenge even in high technology industry to make the case for future-oriented spending, "the dollar we spend today on R&D gives us our greatest leverage on the future in terms of products, employment, revenue, and profit," he said.

MacDonald continued, "The real challenge to American productivity and innovation is to free ourselves from economic time frames that are artificially short. They stifle ingenuity and creativity. They encroach on the future."

He proposed four ways to solve America's productivity problems. First, he feels, we should change our emphasis and that our corporations, financial institutions, and the government should give more consideration to the long-term.

Secondly, he suggests that we come up with new and more creative approaches to meet our challenges.

Thirdly, he says "we must transfer into national policy the kind of long-term strategic thinking that our science-based industries have demonstrated so effectively for so many years."

And, finally, he proposes the establishment of a "National Strategic Planning Institution" for the economy which would help set goals and provide the initiatives, policies, and guidance to reach those goals.

"The challenge is to convince our leaders of all political persuasions of the value and need in the realm of innovation and improved productivity," MacDonald concluded.



Regents honor mathematics scholar Markus

Lawrence Markus, who has advanced the application of mathematical principles to diverse scientific and engineering problems, was recently named Regents' Professor, the University of Minnesota's highest faculty honor.

This award, presented to only 35 University professors since the Board of Regents initiated the program in 1965, recognizes academic distinction and outstanding contributions to teaching, scholarship, and the public welfare. (To date seven IT faculty members have been so named.)

"I am very honored," says Professor Markus, "especially because the Regents' Professorship is conveyed by my peers. To have this degree of confidence placed in me is certainly a great satisfaction."

He also believes that his Regents' Professorship acknowledges the value of interdisciplinary collaboration. "In my work I interact with many branches of the Institute of Technology, and I feel this particular award recognizes the importance of such interactions."

Markus, a University professor of mathematics since 1957, became interested in the application of mathematics at a very early age. As an elementary school student, he tried to compute the size and number of eyes that fictitious inhabitants of other planets would need in order to see as well as we can on earth, based on the surface intensity of sunlight on their planets.

At the University of Chicago, he earned a B.S. degree in mathematics in 1942 and an M.S. in meteorology, interrupted by a tour of duty as a meteorological weather forecaster during World War II, in 1946. He received his Ph.D. in mathematics from Harvard in 1952.

After teaching at Harvard, Yale, Princeton, and Chicago, he accepted a position here in 1957. A Minnesota native, Markus was attracted to the University because "It had a very good administrative and intellectual structure interrelating mathematics, engineering, and the applied sciences, as well as having some very distinguished colleagues working in areas that interested me."

Markus believes his greatest intellectual strength is in "synthesizing, organizing, and restructuring bodies of

knowledge which are developing but still somewhat amorphous. I like to take a rather disorganized and organically developing branch of knowledge and bring it into focus so that it can be studied by very classical mathematical techniques," he explains.

He has concentrated on three fields: dynamical systems, astronomy and relativistic cosmology, and the mathematics of automation. Dynamical systems are moving objects or changing phenomena—such as the planets of the solar system, the interest rates in the national economy, or the growth pattern of biological organisms—studied according to certain known mathematical laws. Professor Markus and his colleague Leon Green, along with several investigators at Yale, prepared an influential monograph on "minimal sets," the elements from which all dynamical systems are constructed.

In his work on the mathematics of astronomy and relativistic cosmology, the study of the structure of the universe and its changes in space and time as derived from Einstein's theory of relativity, Markus determined that

certain geometrical limitations are deducible from the physical assumptions of Einstein's theory. This determination has led to current work by many investigators on the theory of black holes.

His greatest efforts have been in the mathematics theory of automation and its application to scientific and engineering problems. His book, *Foundations of Optimal Control Theory*, written in collaboration with Electrical Engineering Professor E. B. Lee, is considered a definitive work.

In the early 1960s Markus, Lee, and others established the Center for Control Sciences and Dynamical Systems (CSDS), which became a "nucleus of scholarly scientific and engineering investigations for the newly developing area of machine automation and control." CSDS involves faculty and students from Mathematics, Aerospace Engineering & Mechanics, Chemical Engineering & Materials Science, Mechanical Engineering, Electrical Engineering, Political Science, Economics, and Computer Science. Markus, who served as director from 1963 to 1973, accepted the position again last year.

In the 1960s most of the center's

Turn to page 10

Regents' Professor of Mathematics Lawrence Markus



FEBRUARY

- 19 **ASTRONOMY & ASTROPHYSICS**
Tom Murdock, Air Force Cambridge Research Laboratory
3:30 p.m., Physics 210
- ENVIRONMENTAL ENGINEERING**
"University of Minnesota Aquifer Thermal Energy Project"
Matthew Walton, Minnesota Geological Survey
1:15 p.m., Experimental Engineering 110
- GEOLOGY & GEOPHYSICS**
"Early Phanerozoic Cratonization of Northeast Africa"
John Rogers, University of North Carolina-Chapel Hill
3:15 p.m., Pillsbury 110
- 20 **AEROSPACE ENGINEERING & MECHANICS**
"Vector Processing with Application to Computational Mechanics"
Michael Kascic, Control Data Corporation
2:15 p.m., Aero 225
- 20-21 **EARTH SHELTER 3—HOUSING**
(Underground Space Center Series)
Faculty from the University's Underground Space Center will introduce, define, and describe all steps in planning, design, and construction of an earth sheltered house
Bemidji State University, Bemidji, MN
Registration information (612) 376-5341 (deadline 2/16/81)
- 20-3/8 **UNIVERSITY THEATER**
"No, No Nanette," by Frank Mandel and Otto Harbach
Ticket information at (612) 373-2337
- 21 **ALUMNI MEETING/Suncoast**
Tampa-St. Petersburg, FLA
For information contact chapter president Lewis Brown, (813) 796-8588
- 23 **INSTITUTE OF TECHNOLOGY ALUMNI SOCIETY (ITAS)**
Board Meeting
PHYSICAL CHEMISTRY
"Alkali Metal Vapors—Laser Spectroscopy and Applications"
William Stwalley, University of Iowa
4:30 p.m., Smith Hall 225
- 23-24 **CONTINUING EDUCATION**
Manufacturing Cost Estimating (a two-day seminar)
Holiday Inn-Downtown, Minneapolis
Registration information (612) 373-5361
- 24 **ANALYTICAL CHEMISTRY**
"HPLC Techniques in Plant Hormone Analysis"
Mark L. Brenner, University of Minnesota
8:00 p.m., Smith Hall 325

CHEMICAL ENGINEERING & MATERIALS SCIENCE

- "Theory of the Phase Change Behavior of Hydrogen in Metals and Alloys"
Carol K. Hall, Princeton University
1:15 p.m., Amundson 240
- 25 **PHYSICS & ASTRONOMY**
"The View for the Tropics: Aztec, Maya, and Inca Astronomy"
A.F. Aveni, Colgate University
4:00 p.m., Physics 131
- 26 **ASTRONOMY & ASTROPHYSICS**
Ralph Fiedler, University of Minnesota
3:30 p.m., Physics 210
- ENVIRONMENTAL ENGINEERING**
"Effects of Incineration Operation on Meeting Air Quality Standards"
Nadim Shamat, Metropolitan Waste Control Commission
1:15 p.m., Experimental Engineering 110
- GEOLOGY & GEOPHYSICS**
"Mars and the Northwest Channeled Scablands—A Similarity?"
Victor R. Baker, University of Texas-Austin
3:15 p.m., Pillsbury 110
- INORGANIC CHEMISTRY**
"Synthetic and Mechanistic Studies of Fluorinated Metallorganics"
Alan Seidel, 3M Company

Since January 7 and until March 6 approximately 250 companies will recruit IT students on the Minneapolis campus. Lists of those companies recruiting are available through Lee Ponto, IT Placement Office, 15 Experimental Engineering, 208 Union Street S.E., Minneapolis, MN 55455.

- 28 **PROJECT TECHNOLOGY POWER'S MATH BRIDGE**
Pre-College program for qualified minority eighth graders from Twin Cities area
Institute of Technology, Minneapolis
For information (612) 373-2673

MARCH

- 1 **ALUMNI MEETING/Naples, FLA**
Tailgate Party
3 p.m. to sunset, County Fairgrounds
For more information contact Nancy Devine, (612) 373-2466
- 2 **PHYSICAL CHEMISTRY**
"Synthesis, Structure, and Physics of One-Dimensional Platinum-Chain Metals: An Emerging Underlying Unity"
Jack Williams, Argonne National Laboratory
4:30 p.m., Smith Hall 225

- 3 **ANALYTICAL CHEMISTRY**
"Modern Atomic Emission Methods"
George Prohaska, University of Minnesota
8:00 p.m., Smith Hall 325
- CHEMICAL ENGINEERING & MATERIALS SCIENCE**
"Strategies in the Design of Flexible Chemical Plants"
Ignacio Grossman, Carnegie-Mellon University
1:15 p.m., Amundson Hall 240
- GEOLOGY & GEOPHYSICS**
"Apennine Magnetic Stratigraphy and the Cretaceous—Tertiary Extinctions"
Walter Alvarez, University of California-Berkeley
- INSTITUTE OF TECHNOLOGY ADVISORY COUNCIL MEETING**
- 4 **THE ART AND TECHNIQUES OF JAZZ IMPROVISATION**
Jeanne Arland Peterson, Piano, Vocals
2:15 p.m., Scott Hall Auditorium
- ORGANIC CHEMISTRY**
Free radical chemistry; photochemistry; polymer-supported reagents; tri-phase catalysis
Douglas Neckers, Bowling Green State University
7:30 p.m., Smith Hall 325
- PHYSICS & ASTRONOMY**
"High Angular Momentum State in Nuclei"
J.O. Newton, A.N.U. Canberra and Lawrence Berkeley Laboratory
4:00 p.m., Physics 131
- 5 **ASTRONOMY & ASTROPHYSICS**
Robert Gehrz, University of Wyoming
- BIOLOGICAL CHEMISTRY**
"Conformation, Design, and Synthesis of Analogs of Somatostatin"
Daniel Veber, Merck, Sharp & Dohme Research Laboratories-West Point, PA
4:00 p.m., Smith Hall 225
- ENVIRONMENTAL ENGINEERING**
"Passive Solar Energy Design"
Tim Darr, Architectural Alliance
1:15 p.m., Experimental Engineering 110
- GEOLOGY & GEOPHYSICS**
"Adirondack Geology"
Ingvar W. Isuksen, New York State Geologic Survey
3:15 p.m., Pillsbury 110
- INORGANIC CHEMISTRY**
Bruce Parkinson, Ames Laboratory
- 7 **PROJECT TECHNOLOGY POWER'S MATH BRIDGE**
Pre-college program for qualified minority eighth graders from Twin Cities area
For information (612) 373-2673

UNIVERSITY THEATER

Young People's University Theater
 "Toad of Toad Hall," by A.A. Milne
 For information (612) 373-2337

8 UNIVERSITY THEATER

"No, No Nanette," by Frank Mandel
 and Otto Harbach
 For information (612) 373-2337

9 ASTRONOMY PUBLIC EVENING

"Cosmic Weight-Watchers: Accreting
 Binaries"

Gary Schmidt, University of Minnesota
 7:30 p.m., Physics 170

PHYSICAL CHEMISTRY

"Polymer Chemistry"
 Guy Berry, Carnegie-Mellon University
 4:30 p.m., Smith Hall 225

9-4/11 EARTH SHELTER 3

(Underground Space Center Series)
 A Practical Introduction to Earth
 Sheltered Homebuilding
 Monday evenings, March 9, 16, 23,
 30, April 6, from 7:00-9:30 p.m.
 and Saturday, April 11, from 9:00
 a.m. to 4:00 p.m.
 Earle Brown Continuing Education
 Center, St. Paul Campus
 Registration information (612)
 376-5341

10 ANALYTICAL CHEMISTRY

"Effects of Nonlinear Detectors on
 Chromatographic Peak Shape"
 Peter W. Carr, University of
 Minnesota
 8:00 p.m., Smith Hall 325

**CHEMICAL ENGINEERING &
 MATERIALS SCIENCE**

"The Effect of Boundary Surfaces of
 Suspensions"
 Peter O. Brunn, Columbia University
 1:15 p.m., Amundson Hall 240

**INSTITUTE OF TECHNOLOGY ALUMNI
 SOCIETY (ITAS)**

Executive Board Meeting

11 PHYSICS & ASTRONOMY

"New Results in the Theory of
 Convection"
 P.C. Hohenberg, Bell Laboratories
 4:00 p.m., Physics 131

13-14 NORTHROP DANCE SEASON

Alvin Ailey American Dance Theater
 For information (612) 373-2345

**14 PROJECT TECHNOLOGY POWER'S
 MATH BRIDGE**

Pre-college program for qualified
 minority eighth graders from Twin
 Cities area
 Institute of Technology, Minneapolis
 For information (612) 373-2673

**17 MINNESOTA CHROMATOGRAPHY
 FORUM QUARTERLY MEETING**

**22 MACPHAIL CENTER FOR THE ARTS
 FACULTY ARTISTS SERIES**

Telemann: Trio Sonata in A Minor,
 Leonard Danek: Quintet (premiere),
 Brahms: Sextet in B^b Major, Opus
 18
 3:00 p.m., Walker Art Center,
 Minneapolis

APRIL

**3 AEROSPACE ENGINEERING &
 MECHANICS**

"Lubricated Extensional Flows"
 Chris Macosko, University of
 Minnesota
 2:15 p.m., Aero 225

**7 INSTITUTE OF TECHNOLOGY ALUMNI
 SOCIETY (ITAS)**

Executive Board Meeting

8 ORGANIC CHEMISTRY

Isolation and structural studies of
 physiologically active natural
 products; applications of
 spectroscopy to structure
 determination
 Koji Nakanishi, Columbia University
 7:30 p.m., Smith Hall 325

**10 AEROSPACE ENGINEERING &
 MECHANICS**

Ian N. Sneddon, University of
 Glasgow
 2:15 p.m., Aero 225

**12 MACPHAIL CENTER FOR THE ARTS
 FACULTY ARTISTS SERIES**

Giuliani: Grand Sonata, Opus 25,
 Britten: Phantasy Quartet, Respighi:
 Il Tramanto
 3:00 p.m., Walker Art Center,
 Minneapolis

13 ASTRONOMY PUBLIC EVENING

"Astrophysical Jets"
 R. L. Fiedler
 7:30 p.m., Physics 170

13-5/16 EARTH SHELTER 3

(Underground Space Center Series)
 Special Problems in Earth Sheltered
 Design and Construction
 Techniques
 Monday evenings, 7:00-9:00 p.m.,
 April 13, 20, 27, May 4, 11, and
 Saturday, 9 a.m.-4 p.m., May 16
 Earle Brown Continuing Education
 Center, St. Paul Campus
 Registration information (612)
 376-5341

**12 ASTRONOMY & ASTROPHYSICS
 SEMINAR
 GEOLOGY & GEOPHYSICS**

"A Paleobotanical Interpretation of
 Tertiary Climates in the Northern
 Hemisphere"
 Jack Wolfe, U.S. Geological Survey,
 Menlo Park
 3:15 p.m., Pillsbury 110

The Department of Astronomy presents its
 second series of Public Evenings through May
 11. These evenings feature a faculty member
 or guest lecturer speaking informally and non-
 technically on an astronomy topic of current
 interest. After each talk, weather permitting,
 the telescopes are open for viewing the moon
 and any planets then visible.

The department continues to provide
 Starwatch Tapes on Minnesota's night sky for
 interested callers to (612) 376-5587. The tapes
 are changed on the 1st and 15th of each
 month.

16 INORGANIC CHEMISTRY

Leonard Interrante, General Electric
 Corporation

**17 AEROSPACE ENGINEERING &
 MECHANICS**

"Cell Mapping and a Method of
 Global Analysis for Nonlinear
 Dynamical Systems"
 C.S. Hsu, University of California-
 Berkeley

22 ORGANIC CHEMISTRY

Theoretical organic chemistry;
 synthesis of molecules of
 theoretical interest; stereochemistry
 of organic reactions; reaction
 mechanisms
 Weston Borden, University of
 Washington
 7:30 p.m., Smith Hall 325

23 INORGANIC CHEMISTRY

George Hammond, Allied Chemical
 Company

**24 AEROSPACE ENGINEERING &
 MECHANICS**

"Turbulence"
 John Laufer, University of California-
 Los Angeles

24-5/10 UNIVERSITY THEATER

"Camino Real" by Tennessee Williams
 For information (612) 373-2337

**25 24TH ANNUAL UNDERGRADUATE
 SYMPOSIUM IN CHEMISTRY**

Sponsored by Minnesota Section of
 the American Chemical Society to
 stimulate interest in creative
 activities in chemistry and to
 further educate students in
 chemical research through the
 presentation of a scientific paper,
 as well as provide undergraduates
 an opportunity to participate in
 professional meetings.

*Paper titles and abstracts due March
 20*

St. Olaf College, Northfield, MN
 For further information (612) 373-2324

**28 INSTITUTE OF TECHNOLOGY ALUMNI
 SOCIETY (ITAS)**

Luncheon Seminar

Lawrence Markus, from page 7

work focused on the problems of aeronautics and space exploration technology. Since then the focus has broadened to include societal problems—such as the control of energy systems and pollution—that affect all of us. Center investigators will contribute to the work of the University's new Microelectronic and Information Sciences (MEIS) Center as well.

Markus has also taught at Columbia, the Technical Universities of Warsaw and Copenhagen, Imperial College of Technology in London, and the Universities of Florence, Tokyo, Paris, and California at Berkeley and Los Angeles. At the University of Warwick in England, where he teaches on a regular basis, he directed the Control Theory Centre.—*George Lausch*

The \$750,000 split

Each of the Institute's 11 departments shared in the equipment allocation and purchased the following:

- Aeronautical Engineering & Mechanics—Universal testing machine, electronic items;*
- Architecture & Landscape Architecture—Video and photo laboratory equipment;*
- Chemical Engineering & Materials Science—Chromatograph, photometer, microreactors, miscellaneous supplies;*
- Chemistry—Infra red spectrometers, nuclear magnetic resonance spectrometer, spectronics;*
- Civil & Mineral Engineering—Drop wind tunnel, drop or testing and hydraulics equipment;*
- Computer Science—Instructional equipment;*
- Electrical Engineering—Junior electronics laboratory equipment;*
- Geology & Geophysics—Microscope display systems, camera lucida;*
- Mathematics—Instructional equipment;*
- Mechanical Engineering—Equipment for heat transfer, design, thermal environment laboratories;*
- Physics & Astronomy—Lecture demonstration equipment, for lower division and advanced laboratories.*

Legislators listen to lobbying ITAC members

At the end of the 1979 Minnesota legislative session, the Institute of Technology received some heartening news. The Legislature had included in its budget request a special appropriation of \$750,000 for IT undergraduate equipment. This was the first equipment appropriation of this magnitude ever made to IT.

The efforts of the Institute of Technology Advisory Council (ITAC) were critical to the Legislature's action, according to Representative Bill Dean (IR).

"ITAC members helped bring about a more thorough investigation on the part of legislators who had not fully understood how badly such funds were needed," said Dean.

Such legislative contacts have been initiated since ITAC was formed in 1972. In addition, Council members advise IT on curriculum and other matters, and participate in a wide variety of activities. The insight gained from such involvement, coupled with the members' awareness of the impact IT has on their companies or organizations and the state, gives them a special perspective.

Representative Todd Otis (DFL)

notes that "ITAC provides an important link between the business community, academic community, and Legislature. It is impressive that they take time from their busy schedules to speak on behalf of IT."

This legislative session ITAC members will again be discussing important issues with members of the Legislature.

Top graduating Ph.D. students are receiving industrial salary offers averaging \$32,000 to \$35,000. IT offers its new faculty members with Ph.D.s approximately \$22,000 for nine months. The difference between academic salaries and industrial salaries continues to mushroom from there. The University is seeking a special budget increment from the state to reduce the severity of the situation before it loses more top-flight faculty to industry.

The University is again requesting \$750,000 for IT undergraduate equipment, which continues to be a severe need category. Students require hands-on experience for a good technical-scientific education. The equipment currently available in IT is totally inadequate to meet increasing student needs.



ITAC's WORK WITH THE MINNESOTA LEGISLATURE was well underway when 1981 brought a new session. An executive committee member, Herb Johnson, president of Electro/General Corporation, left, discussed IT concerns with State Representatives Todd Otis (DFL) and Bill Dean (IR).



Special funding is also being sought for the Minnesota Science & Technology Center, a new research and technology transfer center.

Finally, the University will ask for funds to continue remodeling Smith

and Kolthoff Halls, to start an IT-wide building program, to cover an inflation-related supplies increment, and to pay for research in the Mineral Resources Research Center and Minnesota Geology Survey.

IN THE INSTITUTE...

Matthew V. Tirrell III, assistant professor of Chemical Engineering, has received a **1980 Dreyfus Teacher-Scholar Grant** through a program funding young faculty members to allow them freedom to develop their potential and do innovative research. His \$40,000 grant supports a general, ongoing research program in the diffusion of polymers, especially concentrating on polymerizing or reacting mixtures. Though this research deals with fundamental principles, his team is looking for applications in practical engineering situations.

Edward Silberman, professor of Civil & Mineral Engineering, is chairing the American Society of Civil Engineers Water Resources Planning and Management divisions during 1980-81. He also attended a summer NATO conference on drought held in Lisbon.

EE's Polish Connection: E. Bruce Lee, professor and head of Electrical Engineering, visited Poland from November 20-December 5 where he presented seminars at the Technical University of Warsaw, Institute of Automatic Control, and participated in the Mathematical Theory of Optimal Control seminar at the Stefan Banach International Mathematical Center.

Rolf Schaumann, associate professor of Electrical Engineering, gave an invited paper at the European Conference of Circuit Theory and Design in Warsaw. He later spent two months in Germany and England working with scientists at the Universities of Stuttgart and Erlangen and the Imperial College.

James R. Johnson, IT director of Technology and Public Policy, shares the **1980 American Society of Metals Engineering Materials Achievement Award** with a research team from 3M's Technical Ceramic Products division. His award recognized the development and commercialization of monolithic catalyst technology for control of automotive emissions.

Turn to page 12

ITAC MEMBERS

Andrew E. Abramson
D. W. Angland
Eugene M. Booker
Thomas E. Brunelle
Jean M. Burhardt
Richard Congreve
John N. Dempsey
Elizabeth Close
Charles M. Denny, Jr.
Frank A. Donaldson
Willis K. Drake
Donald R. Dwight
Kent Eklund
Leroy M. Fingerson
Clarence Frame
Richard Green
Dan Gustafson
John E. Haaland
Roger L. Hale
Richard F. Hammel
J. William Haun
Vernon H. Heath
Donald J. Herman
Terry Hoffman
Gary Holland
Richard E. Horner
Herbert C. Johnson
Ansel Kleiman
Paul Kraemer
Frederick W. Lang
Robert D. Lund
Mark Mason
R. E. McDonald
John A. McHugh
Gerald G. Mueller
Miller F. Myers
Robert J. Odom
Eugene R. Olson
George T. Piercy
John Rollwagen
Jack Rowe
Robert Rynearson
James R. Spicola
Donald M. Sullivan
James E. Thornton
Richard A. Trachy
Thomas G. Valenty
Richard J. Vasatka
Roland E. Weber
Robert E. Wesslund
Frederick T. Weyerhaeuser
John A. Yngve
Robert Zicarelli
Joseph D. Zook

ORGANIZATION

Research, Inc.
Northern States Power Company
McQuay-Perflex, Inc.
Economics Laboratory, Inc.
Hennepin County
Potlatch Corporation
Bemis Company, Inc.
Close Associates, Inc.
Magnetic Controls Company
Donaldson Company, Inc.
Data Card Corporation
The Minneapolis Star and Tribune
Department of Economic Development
TSI, Incorporated
First National Bank of St. Paul
Minneapolis Public Schools
Minnesota AFL-CIO
The Pillsbury Company
Tennant Company
Hammel, Green & Abrahamson
General Mills, Inc.
Rosemount, Inc.
Comten, Inc.
Minnesota Pollution Control Agency
CPT Corporation
E. F. Johnson Company
Electro-General Corporation
Telex Communications, Inc.
Minnesota Gas Company
Analysts International Corporation
General Motors Corporation
State of Minnesota Energy Agency
Sperry Corporation
Northwestern National Bank
3M Company
Econo-Therm
H. B. Fuller Company
Deluxe Check Printers, Inc.
Exxon Corporation
Cray Research
Minnesota Power and Light
Honeywell, Inc.
Cargill, Inc.
MTS Systems Corporation
Network Systems Corporation
IBM Corporation
Onan Corporation
Setter, Leach & Lindstrom, Inc.
Perkin-Elmer
Control Data Corporation
Conwed Corporation
Nortronics Company, Inc.
Northwest Growth Fund
American Hoist & Derrick Company

IN THE INSTITUTE...

A top Chinese mathematician discussed popularizing mathematics in his country at a recent talk arranged by the **Mathematics department. Hua Luogeng**, who led the team that developed the computations for China's nuclear weapons program and who has taught commune people how to use mathematics to increase their production, directs China's Institutes of Mathematics and Applied Mathematics. He is also vice president of the Chinese Academy of Science. Hua led

a delegation of 10 visiting mathematicians who were here to discuss research and exchanges of students and faculty.

More on IT's China Connection: **Roger Arndt**, director of the **St. Anthony Falls Hydraulic Laboratory**, spent over a month in China presenting seminars on cavitation at the Water Conservancy and Hydropower Electric Institute in Beijing and the China Ship Scientific Research Center in Wuxi, on cavitation and hydroacoustics at the Jiao-Tong



Chinese Mathematician Hua Luogeng

Famed Finnish mathematician is first Visiting Ordway Lecturer

In 1936 the Fields Medal was established as the most prestigious international award for recognizing excellence in mathematics. For those in the discipline its esteem would rival that of the Nobel Prize. And, in 1936, the first Fields Medal recipient was Lars Valerian Ahlfors, a 29-year-old mathematician from Finland who was a pioneer in the area of complex analysis.

In 1980, at age 73, Ahlfors was at the University of Minnesota enjoying another first. During the fall quarter he joined the faculty of the School of Mathematics as the first visiting lecturer

sponsored through the Samuel G. Ordway Chair in mathematics. The Ordway Chair was established in November 1979 by a \$1 million bequest from the estate of the late Katherine Ordway. The position, to be permanently filled in September 1981, provides the School with visiting professors through the 1980-81 academic year.

Ahlfors' appointment reflects the prestige which University officials felt should be connected with the new chair. An emeritus professor at Harvard University, Ahlfors is a member of the National Academies of Science in the United States, Finland, Sweden, and Denmark, and received Finland's International Award in 1968. His peers have called him one of the greatest scholars in complex analysis in history; his vita lists nearly 100 published works, the most recent appearing last year in the *American Journal of Mathematics*.

Ahlfors, who came to the United States because "it is here that the opportunities for serious work are best," lectured weekly to faculty and graduate students while on the Minnesota campus. His presentations included new material and reviewed his recent work in the area of real analysis.

Ahlfors accepted the first Ordway Visiting Professorship on the invitation of his former student, Albert Marden, a professor in the School of Mathematics.

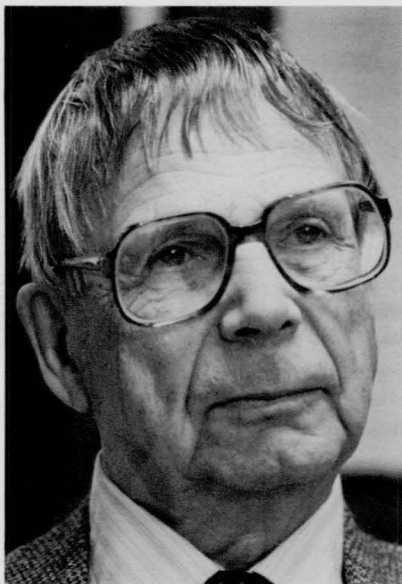
(Reprinted from the Winter 1980 Cornerstone of the University of Minnesota Foundation)

University in Shanghai, and on hydraulic engineering research at the Ministry of Water Conservancy and Hydroelectric Power in Hangchow. On the way home he visited several research institutes in Japan.

Morton Hamermesh, professor of Physics, will be in China during spring quarter. He will spend half of his time at Nankai University in Tianjin, and the other half at Jilin University in Changchun, teaching a full course in group theory at each. Author of the popular graduate textbook, *Group Theory & Its Application to Physics*, published in 1962, he held an autograph session with his Chinese edition during a China visit with Dean Roger Staehle and other University representatives over a year ago.

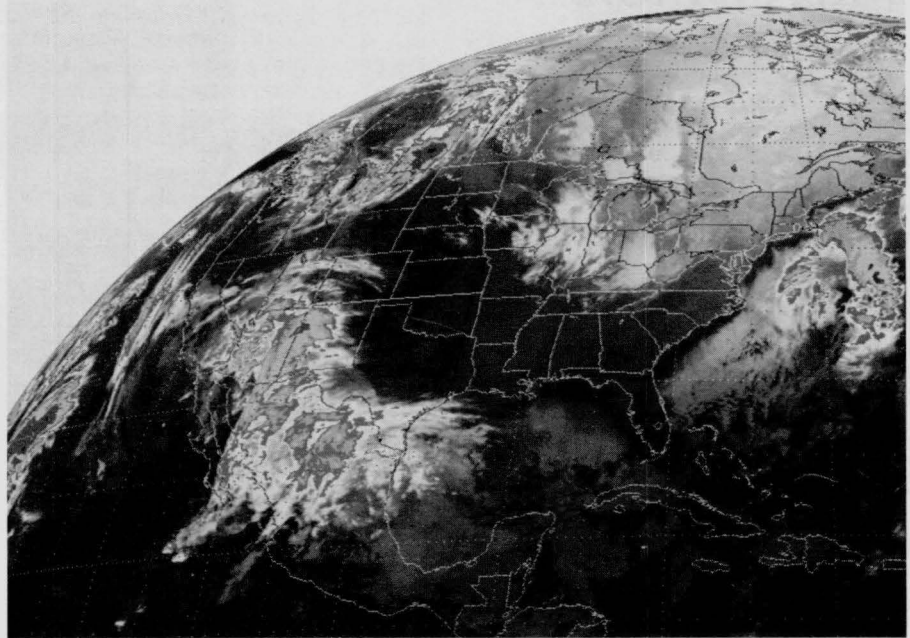
Ray Sterling, director of the **Underground Space Center**, will lead a delegation to China in mid-August to study underground space use there under the auspices of People-to-People International, the university's exchange program with China. Following the study, he will conduct a workshop at the Architectural Engineering Institute in Chongqing. This past November he lectured on earth-sheltered construction in Tokyo.

Y. Y. Huang from the People's Republic of China is a visiting scholar in the Civil & Mineral Engineering department during the current academic year. He is doing research in structures under **Dimitrious Beskos**.



Lars Valerian Ahlfors

If you're wondering what is rising from the roof of **Tate Laboratory of Physics**, wonder no more. They're weather satellite receivers. The system receives facsimile weather photographs and charts from the Geostationary Operational Environmental Satellites (GOES) stationed over the equator at 75, 105, and 135 degrees west longitude. During daylight hours the satellites provide visible and infrared photographs every three hours. This, a new service from National Oceanic and Atmospheric Administration, will be the primary means of facsimile transmission within a few years. The antennas atop the south wing of the Physics building point at two of the satellites, bringing pictures to Room 135 for public display and meteorology lectures. Under a National Aeronautics & Space Administration grant, the **Physics department** is developing a simple converter to put facsimile photographs directly on television screens throughout the building.



An infrared NOAA photo from Tate Lab satellite receivers.

Charles W. Landmesser, who recently earned his Ph.D. in Geology and Geophysics, was one of two University graduate students gaining honorable mention in a research awards competition sponsored by the National Sea Grant Association. Landmesser was recognized for his paper, "Interpretation of Seismic Reflection Data from Western Lake Superior Recessional Moraines and Their Relation to Regional Deglaciation." The awards program acknowledges outstanding student research directed toward wise use of the nation's marine resources.

The founder of the University's internationally celebrated center of heat transfer research, **Ernst R. Eckert**, received the gold **American Society of Mechanical Engineers Centennial Medallion** from its Heat Transfer Division at the November centennial celebration of the Department of Mechanical Engineering. Eckert's work brought him a Regents' Professorship of Mechanical Engineering from the University of Minnesota in 1966, the first U.S. Max Jakob Award and Medal, the Vincent Bendix Award, a gold medal from France, and honorary doctorates from the Technical University, Munich, the University of Manchester, England, and Polytechnic Institute in Iasi, Romania.

Sperry Univac gives MEIS Center \$1 million

The Center for Microelectronic and Information Sciences (MEIS) continues to grow, and the latest corporate participant is Sperry Univac. In late October, at groundbreaking ceremonies for its new semiconductor facility in Eagan, Product Division President Paul Spillane presented Dean Roger Staehle with Sperry Univac's check for \$1 million.

This brings the total support of MEIS to \$5 million, with the grants received in winter, 1979, and spring, 1980, from Control Data Corporation and Honeywell. A new member has joined the MEIS board of directors: John Pearson, vice president for development at 3M. Dean Staehle and acting MEIS co-directors William R. Franta and Richard Y. Kain are currently making further proposals for corporate participation.

According to Professors Franta, a computer scientist, and Kain, an electrical engineer, MEIS will act as an "umbrella organization" to develop collaborative research projects between the University and those local companies with an active interest in microelectronics and information science.

MEIS has attracted considerable attention and has been cited (see *Business Week*, Nov. 10, 1980) as an example of the kind of cooperation that

the United States needs to maintain—some say to regain—its economic vitality: cooperation between industries and between industry and universities. The Japanese economy, specifically its computer industry, which threatens to dominate the world market, is notable for the successful collaboration of universities, industries, and government. Under MEIS, companies will share their facilities, equipment, and personnel with University investigators, who will share their ideas and resources.

MEIS aims to sponsor work "at the cutting edge of the disciplines," according to its acting co-directors. Another aim of the center is the education of new generations of investigators and specialists.

The major MEIS educational programs are directed to undergraduate and graduate students and to practicing engineers, so they can better manipulate the techniques while understanding their operations, capabilities, and limitations.

Continuing education programs offered through MEIS will widen the opportunities for engineers and scientists to update their skills and information. Another educational direction will address the public's need to understand the potential of the new technologies.



IN THE INSTITUTE...

W. A. Kleinhenz, associate professor and associate head of Mechanical Engineering, has received the **American Society of Mechanical Engineers (ASME) National Service Award** for his contributions and service to society. Active in many professional organizations, he was elected vice president for ASME's Region VII in 1979 and, that year, received the IT Alumni Society's George Taylor Service Award.

MINNEAPOLIS TRIBUNE PHOTO



Kenneth J. Reid

"Direct reduction" is stirring economic hopes for Minnesota's Iron Range, according to a recent article by Patrick Marx in the *Minneapolis Tribune*. This method of refining iron, which has been studied for more than 20 years and used successfully in the U.S., Germany, and Japan, is currently touted by some state political and business leaders as an effective process that might return economic prosperity to the Range. **Kenneth Reid**, director of IT's **Mineral Resources Research Center**, received a \$94,000 grant from the Upper Great Lakes Regional Commission in July 1980 to conduct a one-year study of direct reduction. Reid sees it as a secondary process adding value to the state's current taconite product. The method further refines taconite pellets to increase their iron yield from the present 65 percent to a high of 90 percent, making it more competitive

with scrap iron. Unlike usual refining methods, direct reduction does not require melting to remove oxygen from the iron to make it pure enough to use. Instead, taconite pellets are heated and mixed with gases to produce a "sponge iron," a refined iron suitable for actual steelmaking. A smaller, more efficient electric arc furnace replaces the larger blast furnace in such refining.

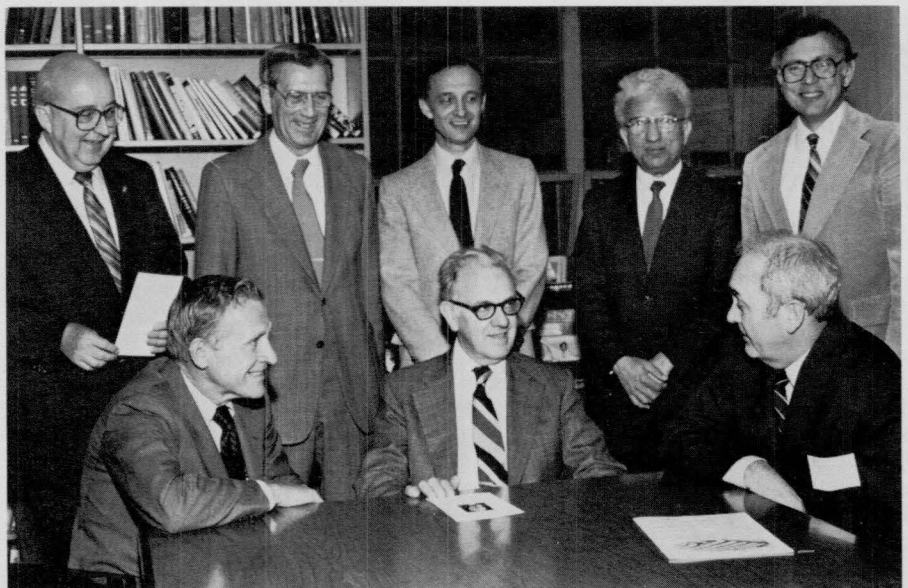
Arthur G. Erdman, associate professor of Mechanical Engineering, received the **Gustus L. Larson Memorial Award** for outstanding achievement from the American Society of Mechanical Engineers. Erdman, who joined the University faculty in 1971, teaches and does research in kinematics and dynamics of linkages and mechanisms, computer-aided design, and the biomechanics of body joints.

Patarasp R. Sethna, professor and head of the Department of Aeronautical Engineering & Mechanics since 1966, was recently honored by an American Academy of Mechanics election as Fellow. He was similarly honored a year ago by the American Society of Mechanical Engineers. Sethna has been especially cited for a series of 30

papers on the mathematical analysis of vibration which have been published internationally.

The first **Akerman Visiting Professor of Aircraft Design, J. Mack Eaton**, joined the Aerospace Engineering & Mechanics faculty during Fall Quarter 1980. The Lockheed-Georgia Aircraft Company, Marietta, arranged the presence of this senior research and development engineer through its LEND Program (Lending Employees for National Development). The Akerman Professorship has been established through funds raised by Aerospace Engineering & Mechanics alumni. While on campus, Eaton taught aircraft design for Aerospace Engineering seniors, exposing them to the compromises required in such design. His students worked in teams, each assigned to design a jet airplane for business use.

Dr. Charles Fairhurst, on sabbatical leave for six months since mid-December, is studying recent European developments in the philosophy of design of tunnel supports at the Institut de Physique du Globe in Paris. He will also participate in research on geothermal energy.



Aerospace Engineering & Mechanics Advisory Council members who attended the Akerman dedication included, from the left, seated, Gerald Busch, Lockheed Aircraft Co., Richard V. DeLeo, Rosemount, Inc., and J. Leonard Frame, FluidDyne Engineering Corp.; standing, Clarence A. Syvertson, NASA Ames Research Center, Leslie F. Kurrasch, retired from McDonnell Douglas Corporation, Gordon S. Beavers, associate head of Aerospace Engineering & Mechanics, Patarasp Sethna, department head; and Robert Foseld, Boeing Commercial Airplane Company.

Aerospace Engineering building named for John D. Akerman

A man who combined the talents of an educator, engineer, and entrepreneur to found and lead a Department of Aeronautical Engineering at the University was honored at a special ceremony on November 21. The building which housed the department he headed from 1930-1957 and now holds the Department of Aeronautical Engineering & Mechanics was renamed Akerman Hall for John D. Akerman who died in January 1972.

In bestowing this, one of its highest honors, the University is able to further associate itself with the luster of an important career, said David M. Lebedoff, University of Minnesota Regent. And, the University can recognize an individual who has contributed to its growth, according to Kenneth Keller, vice president for academic affairs.

Akerman, who was born in Latvia and attended the Royal Technical Institute in Moscow, was lauded for his courage, ability to bring ideas into reality, and innovation by IT Dean Roger W. Staehle. "We name our buildings after those we want our students and faculty to emulate," Staehle said.

As an educator, Akerman is remembered for the excitement and creativity he generated among his students and colleagues. He convinced the University administration and the Legislature to support a department of aeronautical engineering, attracted good faculty, and is credited with the creation of Rosemount Aeronautical Laboratory, the research facility which provided an invaluable training ground for students and was among the nation's outstanding aeronautical laboratories during postwar years.

Akerman was also an inventor and designer; his tailless airplane, called the missing link in the development of the delta wing design of today's supersonic planes, supported colleague Jean Piccard's ballooning experiments. Working with the Mayo Clinic staff, he developed one of the first high-altitude oxygen masks used during WWII and an early flight pressure suit.

"You can tell a lot about John Akerman from the alumni his department produced," said Leonard Frame '43AeroE, president of FluidDyne Engineering Corporation. Three of these alumni head major collegiate

aeronautical departments, the U.S. Manned Space Program was led by alumnus Robert Gilruth '35AeroE, and numerous other Minnesota graduates are in major corporate management positions.

The Twin Cities community gained economically through the efforts of Akerman's colleagues and students who founded such area companies as FluidDyne, Rosemount, Inc., which later spawned MTS Systems, and Research, Inc. These companies do more than \$54 million in business, employ thousands, and have paid more than \$4 million in taxes to Minnesota.

Akerman reached into the community in other ways. He served on the Minneapolis and St. Paul Air Transport Committee and on the first State Aeronautical Commission which

developed this area's air transportation network.

He is special to the members of the Latvian community, many of whom credit him for bringing them to this country, building their community, and insisting that they go to college and pursue professional careers.

The department he founded has enjoyed his legacy. Its number of students has doubled in the past three years and its educational philosophy has matured and was strengthened through the addition of the Mechanics department which is one of the most distinguished in the nation. "But many things have not changed," said Patarasp R. Sethna, professor and department head. "We have continued to graduate thousands of students who are major figures in today's industry."



Participants in the name changing ceremony for Akerman Hall included Kenneth Keller, left, vice president for Academic Affairs, David M. Lebedoff, University of Minnesota Regent, Roger W. Staehle, dean of the Institute of Technology, Patarasp R. Sethna, professor and head of the Department of Aerospace Engineering & Mechanics, and Leonard Frame '43AeroE, president of FluidDyne Engineering Corporation.

Partners Program provides vital dollar support for IT growth

Legislatures can build sound public universities, but only private financial support can build great ones. Nowhere is such support more vital than in today's management and technological educational sectors.

The State of Minnesota provides approximately 37 percent of the University of Minnesota's operating income. Student fees account for an additional 25 percent. The balance—those funds that provide the critical margin of excellence so necessary to develop outstanding and highly responsive academic programs—must come from other sources, according to the University's merit and in competition with other institutions.

The University's Business & Technology Partners Program was initiated in 1979 by Deans Roger W. Staehle of the Institute of Technology and David M. Lilly of the College of Business Administration to establish a

vehicle for obtaining additional revenues for their colleges, revenues which would enable them to broaden their services and programs to students and the community.

The Partners Program includes business corporations, financial institutions, professional firms, and other management and technology related organizations that value the Institute of Technology and the College of Business Administration and thus make an annual unrestricted contribution to them. With this financial assistance, the colleges continue to build, update, and improve the quality and effectiveness of programs in management and technological education, and provide fellowships to top quality students, research funding to outstanding faculty, and continue to improve services to professional managers and technicians in the business and technological communities.

To date, the 24 companies that have joined the Partners Program have committed a total of \$1,191,000 to the two colleges—an outstanding beginning for the program. By year's end, the number of companies involved is expected to double.

An essential aspect of the Partners Program is the development of a strong working relationship between its members and the two colleges. This newsletter (*ITems*) represents one link to member institutions. In addition, staff members are assigned from each participating company and from the two colleges to work in liaison to provide information and resources.

For more information on the Partners Program, contact Catherine Day, Director of Development, Institute of Technology, 107 Lind Hall, 207 Church Street SE, Minneapolis, Minnesota 55455, telephone (612) 376-4608.

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