INSTITUTE OF TECHNOLOGY
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Photo courtesy of Minneapolis Tribune

ITEMS

Volume 3, Number 2
Winter, 1977

In previous articles in ITEMS, I have discussed the need for more interaction between the Institute of Technology and industrial and government organizations. In this article I would like to place the subject in perspective in terms of the several roles of the Institute of Technology.

The principal business of the Institute of Technology is the education of students. These students fall into several categories. There are liberal arts majors who take courses in science and mathematics. There are I. T. undergraduates majoring in engineering, science and architecture. There are graduate students who are working for M.S., M.Eng. and Ph.D. degrees. Finally and importantly, there are full time professionals in industry and government who desire advanced courses in selected areas of science and engineering. Research activity plays an essential central role in this broad educational function. There are three main reasons for this.

First, most of the graduate students are engaged in research activity in order to fulfill their thesis requirements. Meaningful research in physical science and engineering is expensive and often requires specialized equipment and a sizeable supply budget. Only a small fraction of the funds for this graduate research and equipment is provided by legislative appropriation. Most of the funding is provided through competitively sought grants from federal agencies to the faculty in I.T. In order to obtain these grants our faculty must be leaders in their fields. They must prepare proposals which can withstand critical review by other experts outside the University. Virtually our entire graduate program is supported by outside funds, and most of this is in the form of several hundred grants from federal agencies. Without this support, and without a faculty which can successfully compete for support, our graduate program would collapse.

Second, active involvement in research programs enables the faculty to maintain technical leadership. This ensures that students thesis research work will contribute to knowledge and also tends to ensure that I.T. courses are kept up-to-date. Because of the rapid increase in knowledge over time, graduate and undergraduate courses in I.T. are in a continual state of change. Because of this rapid rate of change, today's graduate level courses become tomorrow's undergraduate courses. A program of instruction quickly becomes obsolete if the faculty do not occupy leadership positions in their fields. One becomes a leader by doing work at the frontier of knowledge. One cannot become a leader just by reading what others have done. Because of the educational focus of our programs, we have no research professors on the faculty. All faculty teach courses and are otherwise involved with students.

Richard A. Swalin - Dean

Third, the research results of all these programs are published in technical journals, thereby contributing to expansion of the frontiers of scientific and engineering knowledge.

Thus, in order to accomplish our principal mission, which is to provide educational opportunities of the highest quality for a wide variety of students, a very sizeable cadre of expert faculty and specialized research equipment has been developed. The programs in I.T. are more extensive in range and quality than most industrial or government laboratories can offer. The activities in I.T. cover the technological spectrum from research on advanced mathematical topics to development of energy conserving techniques for home construction. The tremendous variety of programs and equipment in the Institute is reflected by the work of our 400 faculty members and 1100 graduate students, and by the part-time involvement of numerous undergraduate in these programs.

The resources of the Institute of Technology would appear to be a potent force for stimulation of technological development in the region. For many years, of course, our graduates have taken employment in companies of the region and have helped these companies thrive. A new role is developing, however, which will become more important in the future. This role pertains to technological innovation. Over the past several years, there has been evidence that the United States is losing its so-called technological edge. By many signs, the rate of industrial innovation is slowing. There are several factors which contribute to this slowdown. One important factor relates to basic research. The amount of basic research supported in the United States has diminished over the past decade, and most of this decrease has occurred in industrial laboratories. Proportionately, therefore, universities are performing more basic scientific and engineering research than in the past. If one accepts a relation between technological innovation and basic research, high quality national colleges such as our Institute of Technology have a critical role to play.

Over the past several years, we have overtly taken several steps to integrate the Institute of Technology more closely into our community. This integration must be done wisely and with care in order to preserve our basic educational mission. In earlier columns in ITEMS, I have referred to some of these integrating mechanisms. Some of these policies are mentioned in an article by Harold Chucker of the Minneapolis Star which is reprinted in this issue.

We have not yet reached equilibrium in this interactive process and are thus in a state of flux. Several business leaders have indicated to me that I.T. has a potentially vital role in fostering regional development. Some direct spin-off in the form of new companies has occurred over the years from I.T. programs. We have some ideas; but we are also looking for suggestions from you. Perhaps some of these concepts can be developed in future columns.

Richard A. Swalin - Dean

Minnesota Trails in Components Race

By HAROLD CHUCKER
The Star's Associate Editor

Minnesota has grown fat on the computer industry. It ranks third in the nation, behind California and Massachusetts, in terms of sales of computing and office machines.

Sales of these products in 1973-the last year in which a Department of Commerce survey was made—totaled $1.2 billion, or 8 percent of total manufacturing sales in Minnesota. In terms of jobs, there were 20,700 employees in the industry in 1973, or 6.4 percent of total manufacturing employment.

Between 1964 and 1973, total employment in non-electrical machinery manufacturing companies in the state grew by 64 percent. In the computer-office machines industry, employment grew by 93 percent in that same period.

Cause for satisfaction? Of course. But cause for complacency? Not at all.

Rapid advances in technology, notably in microelectronics, could spell trouble for this employment-rich industry in Minnesota. Microelectronics is an umbrella term that includes a wide range of such solid-state electronic devices as transistors, integrated circuits, light-emitting diodes, etc.

There has been a technological explosion in recent years, leading to smaller and smaller electronic devices that carry more and more data at ever greater speeds. They have made possible, first, the transistor radio, then the feats of the space program, and now a wide range of products, from small calculators to digital watches to home computers.

At the same time, the price of these microelectronic devices has been plunging, from about $1.25 for a single-crystal silicon semi-conductor to just a few pennies.

These devices can be termed electronic components. The problem they pose for Minnesota can be stated simply: While their use is proliferating— a sizeable number of firms in the state are using them in their products—most are being manufactured elsewhere, and must be imported. James E. Moore, research director of Minnesota's Department of Economic Development, put the problem in terms of numbers at a seminar for alumni of the University of Minnesota's Institute of Technology. The state has 12 percent of the national computer business, he said, but only 1 percent of the component business.

In terms of employment, the relationship is almost the same. Minnesota has about 9 percent of national employment in manufacture of computers, but only 1 percent in components.

As more of the microelectronic devices are used in the electronic industry, the need for assemblers—a big part of the work force in computer firms—will shrink. Ray Warner, of the Department of Electrical Engineering at the Institute of Technology, stated the problem graphically at the seminar. "With every turn of the screw technologically," he said, "Minnesota exports jobs to California, Arizona,

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Everett Dale, President, I.T. Alumni Association

ALUMNI PROGRAMS

Everett H. Dale

Over 500 alumni, friends of the University and guests gathered at the Radisson South Hotel in Minneapolis on the evening of November 5th for the Annual Science and Technology Day. This was preceded by an excellent afternoon seminar at the University, entitled "Minnesota's Role in the Microelectronics Revolution," which was attended by 300 students, engineers and scientists.

Previous issues of ITEMS focused on these events and their importance to industry, the University and all I.T. alumni. Reflecting on the overall program, we believe the results were beneficial to I.T. and should yield results which will benefit the industrial community and the Alumni Association as well. A commentary on University President C. Peter Magrath's address on "The University, Technological Progress and Industrial Survival" will be published in next quarter's issue of ITEMS.

Your Board now embarks on a vigorous 1977 program which will include a much deeper involvement in "Career Development" activities for the I.T. students.

We will be working closely with the Institute's Student Board; the initial specific plans to be developed at the Alumni Association Board meeting in December.

The new Board members and officers appointed at the November 5th Annual Meeting are:

Aerospace—Robert Bateman, Rosemount, Inc.
Ag. Eng.—Philip W. Manson, Retired
Architecture—Alexander Ritter, Architects Alliance
Chem. Eng.—Leigh Nelson, 3M Company
Geology—Eugene A. Hickock, Eugene Hickock & Assoc.
Mechanical Eng.—Arnie Weimerskirch, Honeywell Inc.
Physics—Dr. Marius Cohn, Consultant and associated with Midwest Research Inst.
At Large—Norman C. Silver, Silver, Morken & Assoc.
Sec.-Treas.—Mark G. Mund, Donaldson Co.

OUTSTANDING ACHIEVEMENT AWARD WINNERS—John E. Naugle, William J. Bailey, Rudolph Pariser with Regent Robert Latz at left

Second V.P.—David Hagford, Fluidyne Eng. Corp.
First V.P.—Dr. Wayne Schmaedeke, Minnesota Gas Co.
President—Everett H. Dale, Fingerhut Corp.

A formal letter of appreciation was sent to all retiring Board members expressing my sincere thanks for their fine service to our alumni.

A Minnesota Alumni Association Program Evaluation Committee was established last October by Executive Director, Vince Bilotta. The Committee was designed to (a) evaluate present programs, (b) develop new programs, and (c) continue constant evaluation of all MAA activities. Your President was appointed as one of twelve people representing various constituent groups within the Association to serve. I will be reporting on plans and progress in upcoming issues of the Newsletter.

NEWS FROM ALUMNI

As mentioned in the Fall 1976 Newsletter, we would be devoting additional space in future issues to Alumni News. Recently, *J. Harry DuBois* of J. Harry DuBois Company sent an interesting letter to Dean Richard Swalin. He stated: "Our class comes up for it's fiftieth reunion and we are starting work to get all of the boys to come out. We've had a reunion every 10 years, so we have the 1967 list as a starter." Harry enclosed a brief resume of some of the high spots since graduation in 1927, and said he would surely be very active in business for another decade. "Life is too exciting and rewarding to sit on the sidelines and wait to expire." He was President of the Chicago Alumni Association in 1941 and Chairman of the New York Minnesota Engineer's Club from 1956-61. "We are looking forward to catching up on Minnesota's Engineering School in 1977." Mr. Vince Bilotta, Executive Director of the Minnesota Alumni Association, is sending Harry some guidelines for class reunions and other activities.

Mark Mund is the current Secretary-Treasurer of the I.T. Alumni Board of Directors. He received a BME from I.T. in 1953, a 5-year program at that time. He was in the first Mechanical Engineering Intern Program, interning with Donaldson Company, Inc. In 1955, Mark received a Master of Automotive Engineering degree from Chrysler Institute of Engineering Graduate School, Detroit, Michigan. Since then, he has been with Donaldson Company, starting as a Project Engineer in Product Engineering, moving to Chief Engineer in research and development in 1963. Mark is currently Vice President, Technical Development in the

International Division, Bloomington, MN. He is a Registered Professional Engineer in Minnesota.

The Board member representing chemistry is *Dr. Anthony F. Yapel, Jr.*, a native of the Minnesota Iron Range.

Dr. Anthony F. Yapel

Following completion of his studies at St. John's University, Collegeville, Minnesota, where he received a B.A. degree in chemistry, he entered the University of Minnesota from which he received a Ph. D. in physical chemistry in 1967. His thesis research involved fast reaction kinetics studies of enzymes and proteins.

Upon graduation, Dr. Yapel joined the 3M Company Central Research Laboratories as a Senior Chemist. Since that time, he has carried out research in a variety of areas, including chromatography, biological structure-activity correlations, microparticle research, membrane separations technology and drug delivery systems. He is currently a Senior Research Specialist in 3M's Central Research Laboratories.

He has been very active in 3M's 4,200-member Technical Forum organization. He has served as an officer of several of the Forum's twenty-seven committees and chapters, including the Academic Relations Committee, and in 1974-75 served as elected Chairman of the entire Technical Forum Organization. Professional memberships include the American Chemical Society and the American Association for the Advancement of Science.

Representing Electrical Engineering on the Alumni Board is *Meredith S. Ulstad*, who received an MSEE from the University in 1955. For the next four years, he worked on the design of UHF tropospheric scatter communication receivers at Collins Radio Company in Cedar Rapids, Iowa. In 1959, he began work on a Ph. D. degree at Iowa State University, Ames, Iowa, while teaching undergraduate course work in communications. This degree was granted in February 1962. Upon completion of this work, the Ulstad family was pleased to be able to return to their home state of Minnesota. Dr. Ulstad began working at Control Data Corporation early in the summer of 1962. A large part of his work since that time has been related to data communications in one form or another. For the past two years, his work has been primarily digital signal processing applied to radar, infrared and visible images. In keeping with his determination to pursue a technical, as opposed to administrative, career, he has found that continuing education is a relentless task. He feels very strongly that our current educational system will have to undergo substantial changes in the future in order to make an engineering career what it should be.

Earl Hoffman was appointed to the I. T. Board in November 1975, representing the graduates of the Mathematics Department. Earl received a B.A. degree in 1969 from The Johns Hopkins University, where he majored in mathematics, and an M. S. degree, also in mathematics, from the University of Minnesota, in 1972. While attending Minnesota, he also served as a teaching assistant for many of the freshman and sophomore algebra and calculus courses. Earl is currently an actuary for the St. Paul Companies, Inc., where he was worked since graduation. He is married and the father of one daughter.

Board member *Leonard Laskow* has been employed by Paper Calmenson & Company as a Metallurgist for the Steel Service Division for the past eight years. Prior to this, he held a position for several years with a steel castings and a forging concern. In addition, he has also taught night classes in Metallurgy at a Voc-Tech School. Len is a Registered Professional Engineer in the State of Minnesota, and is on the Executive Board of the American Society for Metals. Other professional society memberships include S.A.E. and A.S.T.M.

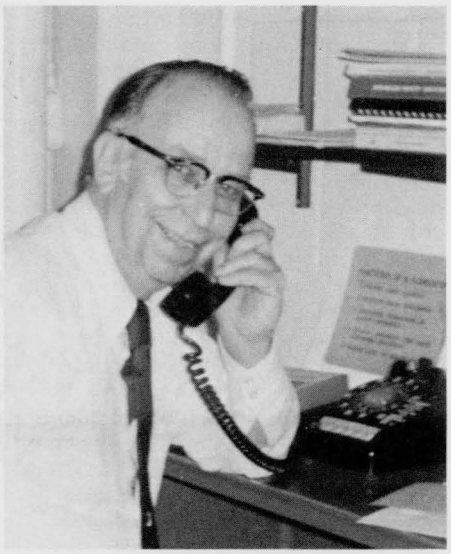
Representing Physics on the Board is *Dr. Marius Cohn*, who has used his education in physics and mathematics for a career in applied mathematics. After being among the initial group to receive a Bachelor of Physics degree from the University, he began his graduate studies at the University of Illinois. These were interrupted by World War II, during which he worked at Boeing Aircraft Company.

His initial work at Boeing was in experimental flight testing. While his assignment was the analysis of test results (in the pre-computer age) this required the planning and actual participation in the flight tests. He later helped form the Physical Research Unit at Boeing where he served as internal consultant in mathematics, physics, and aerodynamics. Here he did some of the original work in missile control systems, including the first proposal of the ABM.

After the war, he returned to the University of Illinois to complete the Ph. D., then joining the Control Systems Laboratory to apply the then new digital computers to large scale control problems. In 1955, he returned to Minnesota to join the now Univac Division of Sperry Rand. Here he carried out studies and research in various computer areas, especially in logic design. These included fault-tolerant designs, majority-decision logic, information theory, and novel arithmetic systems. For several years he headed the Mathematics and Logic Research Department. Dr. Cohn has published papers on the topics and holds a number of U.S. and foreign patents on specific designs. Currently, he is an independent consultant and associated with North Star Division of Midwest Research Institute.

Retiring Board member *Fred Bentz*, 1948 Bachelor of Architecture, is President of Frederick Bentz/Milo Thompson & Associates, Inc., Architects and Urban Planners. He is a past president of the Minnesota Society of Architects, and has served on the Commission on Architecture of the Lutheran Church Missouri Synod and the energy policy task force of the Environmental Quality Council of Minnesota. He has been active with the education committee of the Minneapolis Chamber of Commerce, the Minnesota School Facilities Council, and the Guild for Religious Architecture. In 1971, he was elected to the College of Fellows of the American Institute of Architects for notable contributions to the advancement of the profession of architecture.

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



Morris E. Nicholson

MANAGEMENT OF TECHNOLOGICAL INNOVATION VIDEOTAPE SERIES USED WIDELY

The videotape series Management of Technological Innovation has been used extensively by industries in Minnesota. Companies that have used the tapes have used them in a seminar setting where top management has led a discussion after each videotape has been shown, regarding the applicability of the concepts presented to that company. In one instance these tapes have been used as a part of a management retreat workshop.

The reaction to the tapes has been very enthusiastic at all levels of management.

The interest in particular tapes has varied from company to company and within companies from department to department depending on departmental R & D responsibilities. In order to provide for maximum cost effectiveness and to maximize the time involvement of employees, this series is now being offered on an individual tape basis.

To receive a brochure describing these tapes and rental fees, contact Dr. Morris Nicholson, 373-3132.

ELECTRICAL ENGINEERING ADVISORY COMMITTEE PLANS PROGRAM.

The Electrical Engineering Advisory Committee to the Director of Continuing Education in Engineering and Science has selected as its first program offering "Introduction to Solid State Power Electronics." This will be a two day conference offered during early April. The conference is jointly sponsored by the Minnesota Consulting Engineers Council and the Power Chapter of IEEE.

The course will include an introduction to electronic power converters and controls. The course will build a basic understanding of converters with natural or forced commutation from well known fundamentals. A large portion of the course will be devoted to power circuit analysis and the transient thermal analysis of solid state power devices. For further information, contact Dr. Nicholson's office 373-3132.

SCHEDULE OF CONFERENCES AND SHORT COURSES

TIMBER DESIGN FOR BUILDINGS. Tuesdays, March 1, 8, 15, 22. 6:00-8:30 p.m. Ellerbe Architects, Bloomington. Fee to be determined.

Instructors: Professor John G. Haygreen, Head, Department of Forest Products, University of Minnesota, and Mr. John O. Goehl, Structural Wood Corporation, St. Paul, Minnesota.

Topics:

—Highlights of mechanical and physical properties of wood important to structural design;
—Timber fastenings;
—Plywood diaphrams;
—Shear walls

MINI-COMPUTER SYSTEMS FOR WAREHOUSING/DISTRIBUTION OPERATIONS. March 21-23. Leamington Hotel. Fee. $395 per individual. $355 per individual if three or more people from the same company are registered.

This seminar will explain in simple, clear language what you must know about applying mini-computers to distribution/warehousing operations. Key subjects covered will be:

—Identifying warehouse functions with high rates of return on investment through mini-computer system implementation
—Evaluating trade-offs in centralized, on-site, and network systems
—Matching application systems with organizational policy and objectives
—Defining, measuring and improving productivity
—Controlling and minimizing pilferage through better records
—Developing and installing practical locator systems
—Interfacing the warehouseman with the computer

HAZARDS OF TAILINGS DUST OVERCOME BY CIVIL ENGINEERING GROUP

Airborne dust from taconite tailings—a health hazard and environmental concern, and a critical and major problem for the mining industries of Minnesota, may possibly be a thing of the past.

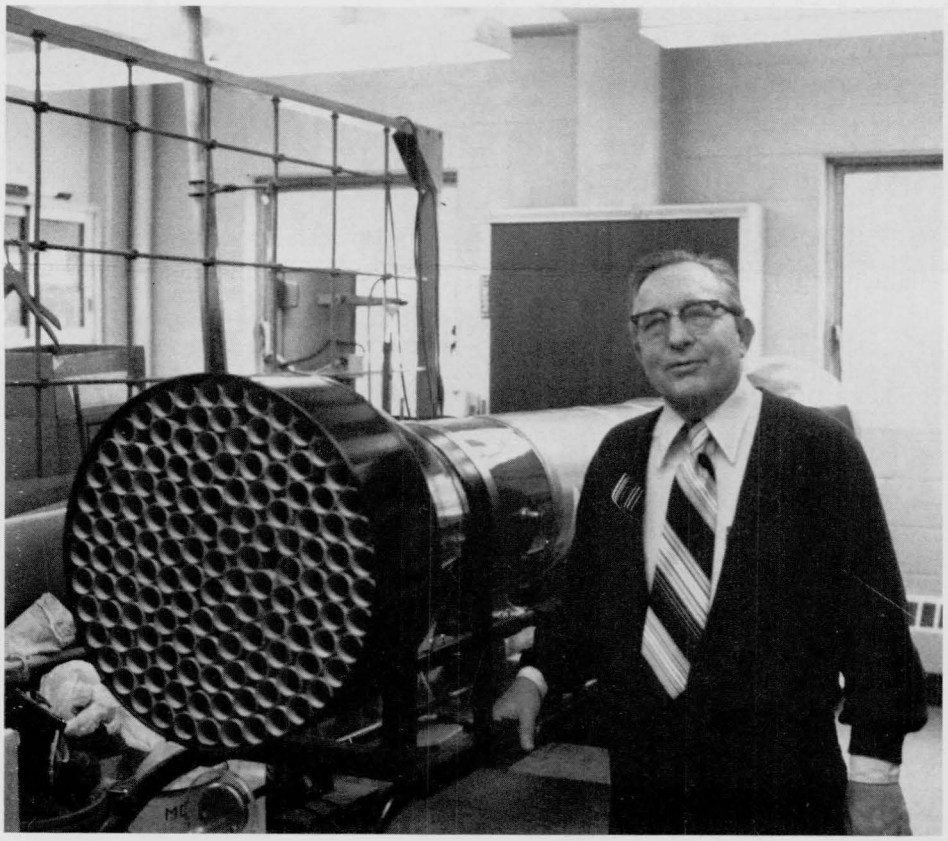
In a paper presented to the 38th Annual Mining Symposium held January 14 in Duluth, Minnesota, Donald H. Yardley, Associate Professor of Geological Engineering, disclosed the results of a year-long research project directed to suppressing this dust. Yardley, Assistant Professor Charles R. Nelson, and Associate Professor Emeritus W. D. Lacabanne, staff members of the department of Civil and Mineral Engineering, have been working under a grant from the U. S. Bureau of Mines. The object of their research has been to find ways of fixing tailings in place to prevent dusting. According to Yardley, they have been successful.

In September, 1975, a year before the grant from the USBM was awarded, Yardley and his associates had begun to study the problem, collecting the raw materials and conducting laboratory and on-site experiments with various chemicals which could be sprayed over the areas where the dust develops; in exposed "beach" areas adjacent to the settling pool, and along the retaining dikes and dams of the dumping sites. Research into ways of fixing the airborne tailings was based on a spray-grouting technique developed earlier by Yardley and Nelson to harden soft sandstone *in-situ*. The technique is being used on tunnel jobs in Minneapolis-St. Paul to provide a lining by forming an inner shell of hardened sandstone. Test patches of hardened St. Peter sandstone have existed for nearly three years in utility tunnels in St. Paul. Laboratory specimens have retained their hardness at ±72°F. Laboratory tests of these same hardening agents were carried out successfully on specimens of the taconite tailings for six months prior to applying for the grant from the Bureau of Mines.

The laboratory in 119 Mines Metallurgy, under the supervision of W. D. Lacabanne, now contains hundreds of shallow pans of tailings—treated, cataloged and tested. Since the award of the grant from USBM, Yardley has conducted wind tunnel tests on the treated pans of tailings, velocities and wind angles have been measured, and recently, with the help of the Whitby-Marple group from Mechanical Engineering, he has been able to count, photoelectronically, the number of individual tailings blown off by various wind velocities. Experimentation with various chemicals, all basically silicone solutions, has proved over a year's testing, that suppression of dust from treated tailings is more than 99% effective in the very fine tailings, and entirely effective in the coarser (more than 1 micrometer) tailings.

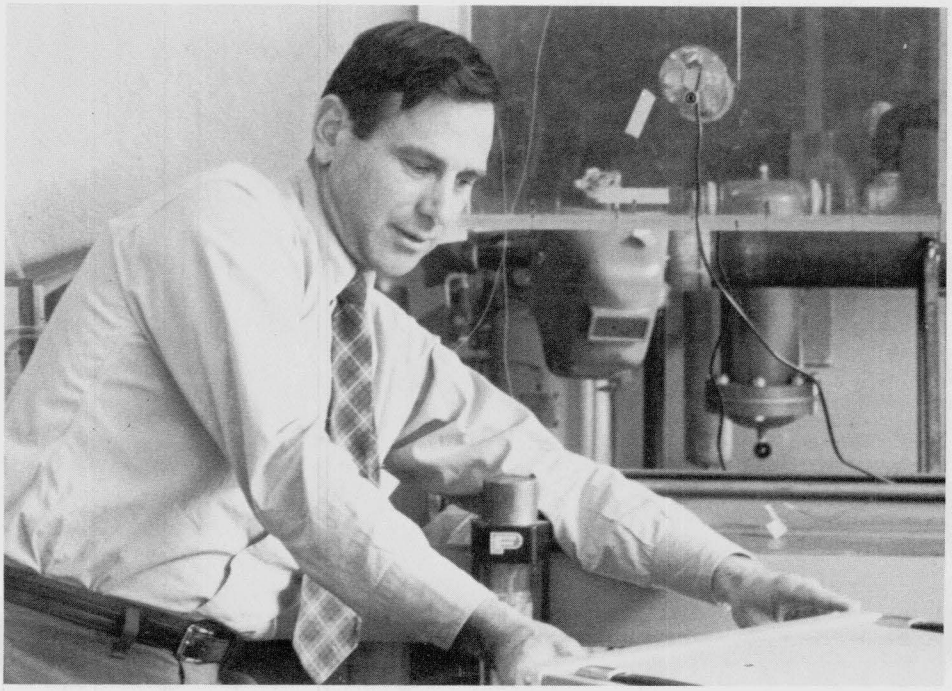
Other results of the tests have shown that hardening time is one hour or less, that the silicate hardener does not itself create pollution problems, that it can be applied quickly and cheaply by existing types of irrigation equipment, that the material is cheap and easy to obtain, and that it is safe to store. Perhaps just as important, the treated areas can be rehabilitated by planting, already proven at test sites along Lake Superior.

Professor Yardley, cautiously, but not very successfully underplaying his enthusiasm, believes that "the results justify optimism."



Professor Yardley and wind-tunnel in lab in 119 Mines Metallurgy

SPARROW NAMED ASME FELLOW



Professor E. M. Sparrow was installed as a Fellow of the American Society of Mechanical Engineers in a presentation made at the recent Annual Meeting of that society. He was cited for outstanding contributions to the heat transfer literature. In a twenty-year period from 1956 to 1976, which included a two-year leave of absence in Brazil, Sparrow published more than 325 papers. His impact on the literature is confirmed by his citations *in Science Citation Index*. In 1975, he led all mechanical engineering professors at all major universities in the United States, with the margin being almost a factor of two compared with the runner-up.

Sparrow received his professional education at MIT and Harvard. After completing his Ph.D., he was employed as a heat transfer specialist by the Raytheon Company and later at the Lewis Research Center of NASA. In 1959, he accepted a professorship at the University of Minnesota and has been on the faculty of the mechanical engineering department since that time, except for a two-year leave of absence in Brazil. During that leave, Sparrow was involved with the development of the first graduate program in engineering in Brazil. As a result of that service, he was awarded an honorary doctorate from the University of Brazil.

In addition to his teaching and research activities, Sparrow is senior editor of the Journal of Heat Transfer.

COMPONENTS RACE—from page 2

Texas, Florida and Colorado (states that are the leaders in microelectronic components)."

In the 1950s and 1960s, Minnesota gained a national reputation as a rapidly growing high technology center. The availability of risk capital, combined with the eagerness of engineers from existing companies, and graduate students and faculty members from the institute to launch new ventures, created a heady climate of growth in the electronics industry. For a number of reasons, including the growing conservatism of venture capital firms and the costs and risks of starting up a high technology business, the climate for entrepreneurs has cooled in Minnesota.

For the past decade or so, the climate for such ventures has been the warmest in Santa Clara County, Calif., south of San Francisco. There are almost 800 high technology companies in that area, all of which started from a small base, Richard Swalin, dean of the Institute of Technology, noted. Thanks to the availability of microelectronic devices, those firms are prospering and their numbers growing.

This growth feeds on itself, Swalin said. A community of interests develops around the companies, he explained, and there is a good deal of interaction among scientists and engineers. The exchange of problems and ideas provides fertile ground for the spawning of new companies. There is not much of that kind of interaction in Minnesota, he observed.

Can the erosion of jobs in Minnesota's electronics industry be halted? C. Peter Magrath, president of the university, told the institute alumni at their banquet that the answer is a greater commitment to research and innovation. Funding for research, he complained, "bounces between insufficient and inconsistent, and public understanding is often spotty."

Noting that the federal commitment to research, in terms of real dollars, is less now than it was a decade ago, Magrath said that "research, both basic and applied, is not a discretionary luxury, but a prerequisite to continued economic growth." He urged a closer relationship between the university and industry, and called for imaginative applied research by industry to go with the basic research of the academic side.

Ray Warner suggested that there should be an attempt to persuade established semiconductor firms elsewhere to expand into Minnesota. He said there is "a huge market" for these devices literally on the doorstep, simplifying vendor-customer communications. There is, in addition, a flow of specialists from the university who traditionally seek employment in Minnesota. But in too many cases, he said, students now educated in the university's microelectronics program have to go out of state to find the kind of work they want.

Swalin ticked off some of the things the institute is trying to do to help the growth of high technology companies. It is encouraging graduate students, as well as faculty members who can take leaves or work part-time outside the institute, to start up new ventures. It is making the faculty available for consulting work to high technology companies. Its facilities and equipment can be used by industry, and it is providing televised lectures on new technology to on-the-job engineers.

The problem, for Minnesota, has not yet reached the crisis stage, but it can be easily perceived. If there is a fading of technological innovation here, there will be a fading of jobs.

Arnold Cohen, assistant dean at the institute, noted that every engineering job creates and sustains from 10 to 100 other jobs. Engineers, he said, develop products that must be produced, marketed, shipped and maintained. If there is an erosion of engineering jobs to other "hot" innovation areas, there will be a far greater erosion in overall employment.

ITEMS

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University of Minnesota
107 Lind Hall
Minneapolis, Minnesota 55455

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