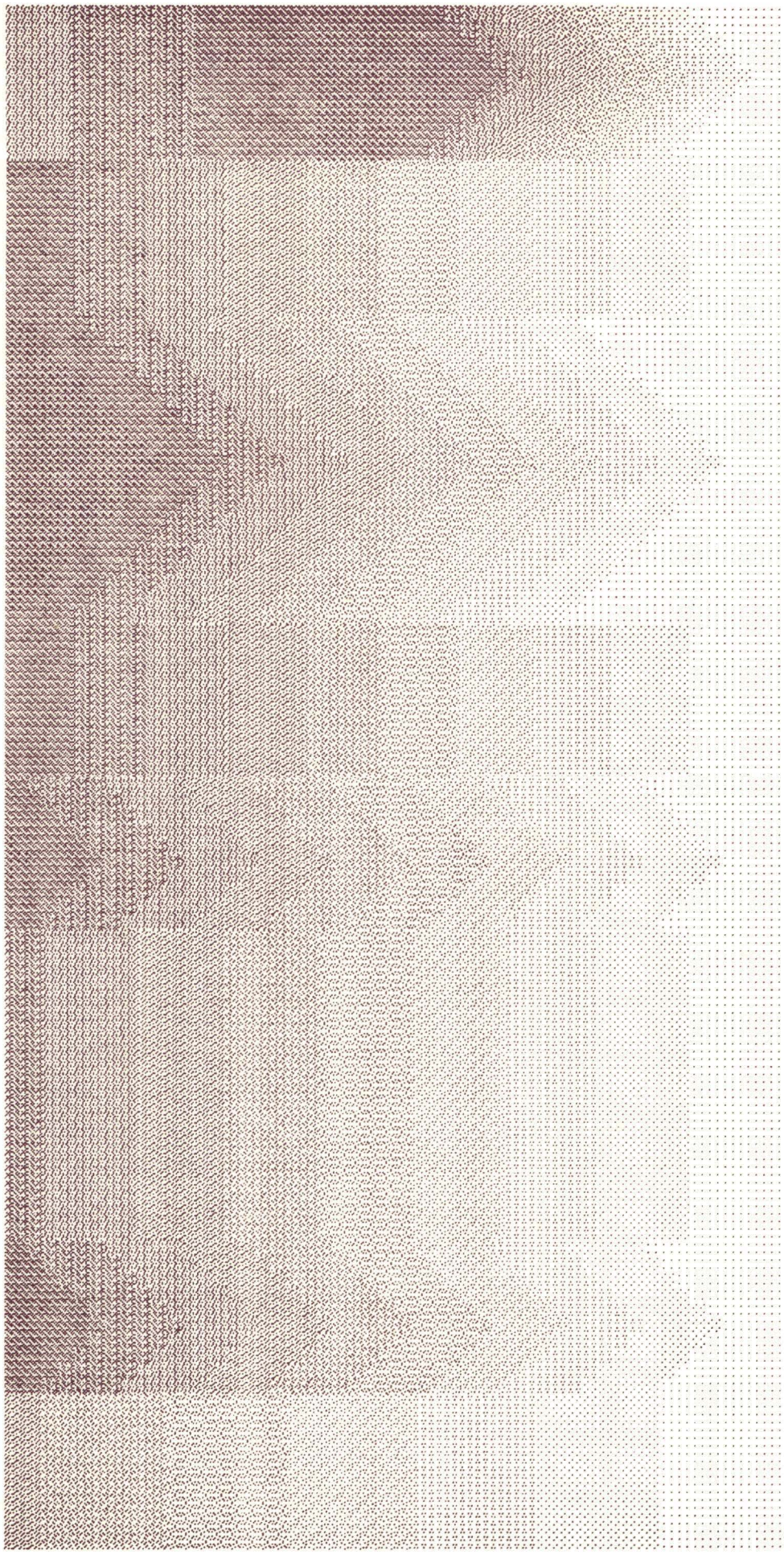


The Microelectronic and Information Sciences Center

MEIS
CENTER

operated by
The Institute of Technology
of the
University of Minnesota

August, 1980

CONFRONTING THE 80's

"Many believe that in the remainder of the century it will be the state of a nation's electronics industry that signifies whether it is a developed country or not. Integrated circuits are increasingly the heart of electronic equipment of all kinds, from computers to children's games. By the late 1980's integrated circuits will account for 10 percent of the value of products of a projected $400 billion electronics industry."
(*Science*, 9 May 1980)

The scientific race to create ultra-small circuits may be one of the most intensive in the world's history.

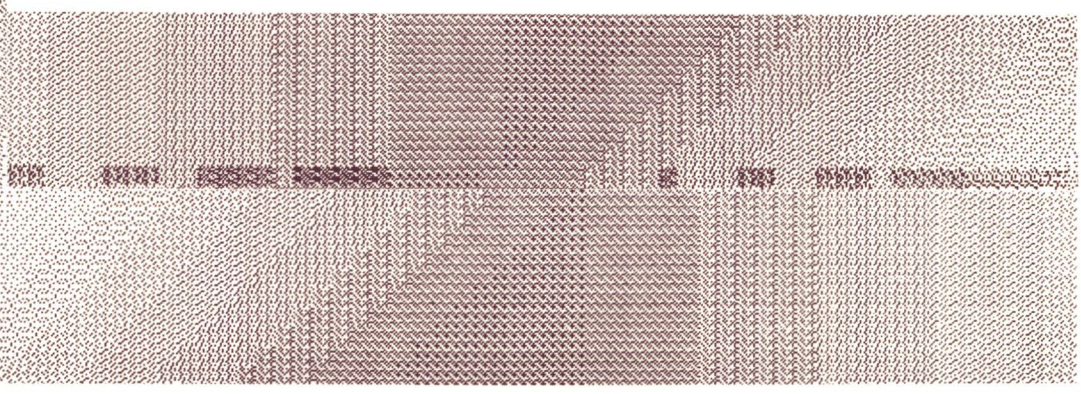
"The future economic, social, and military rewards are so promising, experts say, that it is worth the cost of one dollar's worth of development for every dollar's worth of product."
(*New York Times*, 29 June 1980)

Electronics systems contribute significantly to a healthy economy by . . .

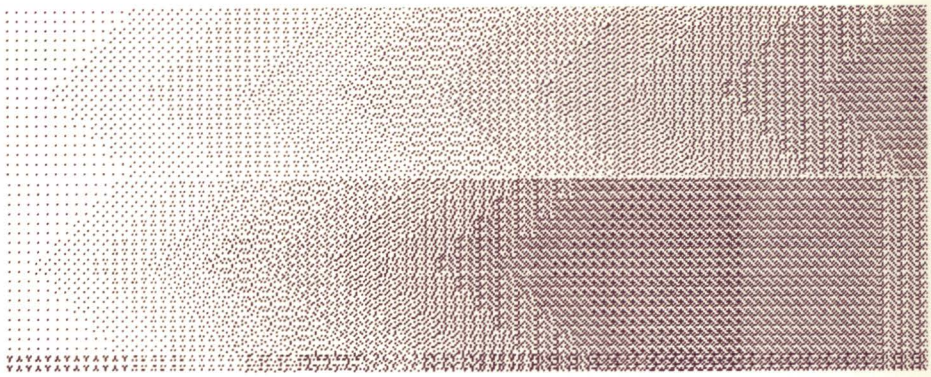
. . . leveraging human effort through improved automation,
. . . expanding the availability and exchange of information, and
. . . reducing energy consumption

Therefore, the Microelectronic and Information Sciences play a vital role in developing solutions to today's fundamental concerns by . . .

. . . quickening the pace of innovations,
. . . improving productivity, and
. . . revitalizing the economy.



AN ORGANIZATION FOR THE 80's



The University of Minnesota's Microelectronic & Information Sciences (MEIS) Center involves:

UNIVERSITY — INDUSTRY COOPERATION

"Beset by declining productivity, soaring energy costs, . . .U.S. corporations increasingly realized that they need outside talent to develop technological innovations. The largest untapped sector, businessmen say, is academia."
(*Wall Street Journal,* 24 June 1980)

Such university - industry cooperation allows for both sectors to be equal partners, yet maintain their integrity while responding to one another's needs.

RESEARCH

Integral to the synergistic cooperation between university and industry is research that is basic, focused, and seminal. The MEIS Center commitment to work on cutting-edge problems reaches into five broad areas:

Physical sciences supporting microelectronics
Microelectronic circuit design systems
Information system architecture
Software engineering
Information system applications

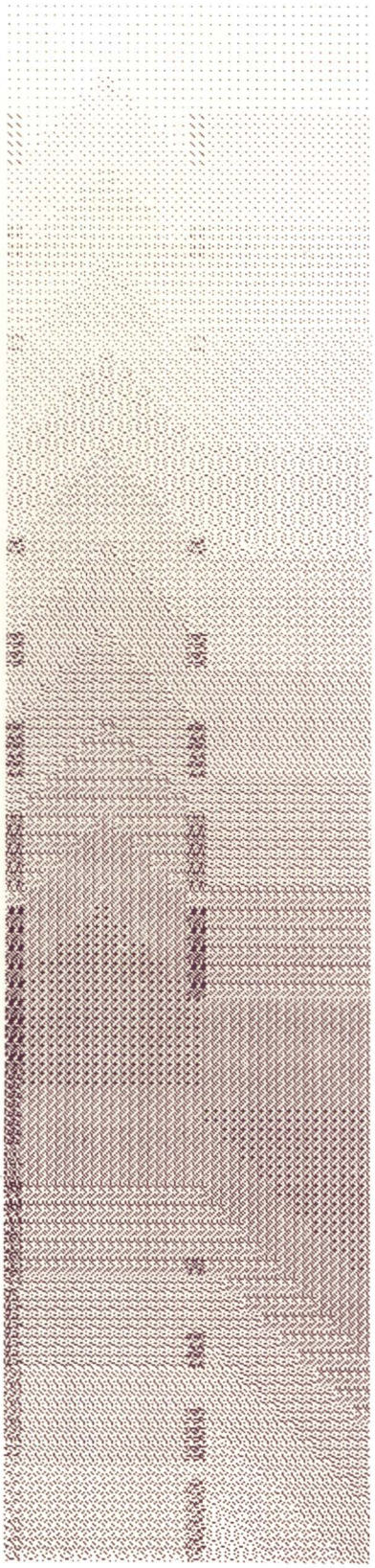
EDUCATION

The MEIS Center's collaborative focus strengthens the intellectual fabric of microelectronic and information sciences, and emphasizes an educational program designed to produce leaders. Major MEIS educational programs are directed toward undergraduate students, graduate students, and practicing engineers so they can better manipulate the technology, while understanding its basic capabilities and limitations. More engineers and scientists will be better educated and updated through degree-oriented and continuing education programs. Other MEIS programs will improve the public understanding of the basic capabilities and consequences of the new technologies.

In sum, the MEIS Center provides:

Synergistic collaboration among industry, university, and government
Full use of all intellectual resources in cooperating universities and industries
Effective interdisciplinary research programs
Optimum sharing of expensive facilities
Strong focus on cutting edge problems
Stimulating educational offerings in the state-of-the-art in microelectronic and information sciences
More and better educated employees
A diverse and flexible continuing education program
A better informed public

MINNESOTA'S SCIENCE & TECHNOLOGY AMBIENT



The University of Minnesota, as the major research institution in the state, contributes substantially to the Minnesota science and technology community.

The Institute of Technology combines in one college the basic sciences, engineering, and design, integrating 11 strong departments while providing a broad base for interdisciplinary activity.

More than 18 major interdisciplinary groups, such as Surface Analysis, Plasma Chemistry, Microelectronics, Control Sciences, CAD/CAM, and Digital Systems have their bases in the Institute of Technology.

The 350 members of the Institute of Technology's faculty, graduates of more than 90 universities located throughout the world, make important contributions to international science and technology.

The Institute of Technology graduates about 1,000 students each year from a student body of approximately 6,500.

40% of Minnesota's gross product is derived from science- and technology-related businesses.

Minnesota ranks second nationally in the number of people employed in the manufacture of computers and office machines, and fourth nationally in the manufacture of these products.

The Institute of Technology and Minnesota industry work productively together.

Industry supports the Institute of Technology through an Advisory Council consisting of top executives from over 40 major corporations and public agencies.

Numerous Corporate Affiliates Programs support interdisciplinary research in the Institute of Technology.

Over 40 Minnesota firms, including some major corporations, have been founded in the last 20 years by faculty or graduates of the Institute of Technology.

A dedicated alumni society actively supports programs of the Institute.

Concentrated in Minnesota is an impressive array of high-technology industries.

Control Data, headquartered in Bloomington, is a leading producer of large scale, high-speed computer systems.

Honeywell, headquartered in Minneapolis, is a major computer manufacturer with numerous engineering facilities in the Twin Cities area.

IBM designs and builds business computer systems at its Rochester plant.

Sperry Univac's Defense Systems Division, headquartered in St. Paul, is a major designer and producer of military computer-based systems; their Data Processing Division designs and manufactures a line of large scale computer systems in Roseville.

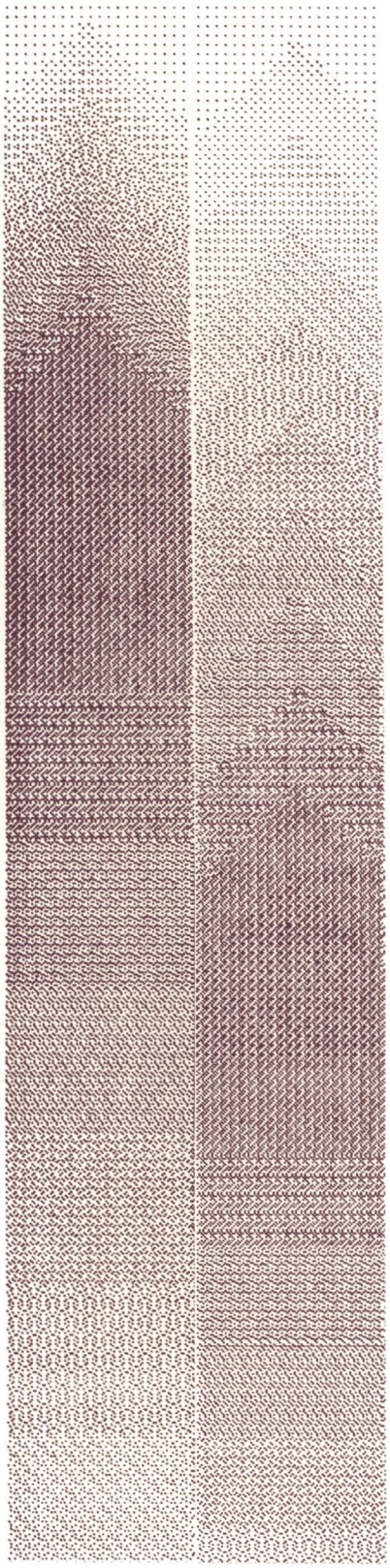
3M, headquartered in St. Paul, a major chemical manufacturer, producer of coated materials, and product lines which include photographic films, pressure-sensitive tapes, and health care products, uses computers for instrumentation and process control.

Other Minnesota high-technology firms with world-wide markets use digital techniques:

Analysts International Corporation — computer software
Cardiac Pacemakers, Inc. — biomedical devices
Comten, Inc. — computer communications processing systems
CPT Corporation — word processing systems
Cray Research — large-scale computer systems for scientific applications
Data Card Corporation — specialized business machines and related supplies
E. F. Johnson Company — two-way radio communications equipment and electronic components
Electro General Corporation — electronic data collection equipment
Magnetic Controls Company — magnetic and telecommunications access and test products
Medtronic, Inc. — pioneer in pacemaker designs
MTS Systems Corporation — hydraulic devices and electronic instrumentation
Network Systems Corporation — high speed digital communications networks
Nortronics, Inc. — advanced products for magnetic data storage
Physical Electronics — instrumentation for solid surface and thin film analysis
Research, Inc. — process control instruments, radiant heating devices, and telecommunication terminals
Rosemount Engineering — mechanical and electrical instrumentation
Telex Communications, Inc. — electronics for audio systems, ranging from audiotape recording to hearing aids
TSI Incorporated — environmental sensing and measurement devices

The Microelectronic

OBJECTIVES



The primary objective of the Center is to advance microelectronic and information sciences. To support this objective, the Center will:

Focus on the microelectronic and information sciences

Key technological developments shaping the 80's will be made in microelectronic sciences. The major impact of these developments will be felt in the information sciences. Active interplay between the scientists and those who apply their discoveries directs Center efforts towards projects of major impact.

Focusing the Center's activities in such directions maximizes effect; the Center will not diffuse its resources by attempting to be "all things to all people."

Optimize resource usage

Center resources include personnel, facilities, and money contributed by its partners. Careful allocation of these resources is necessary for effective progress. Personnel are teamed in interdisciplinary groups involving several partner organizations to enhance synergistic interactions. Industrial facilities made available to Center project teams reduce the need for expensive capital equipment purchases. Money from partners is pooled, thus leveraging individual contributions to support significant projects. Such projects will not include the construction of new buildings.

Build an effective organization for industry, university, government collaboration

An effective Center requires that dedicated individuals — educators, scientists, and professional engineers — be integrated into a sound management structure. This structure reflects the partnership inherent in the Center, connecting partners at both organizational and technical levels, while the commitment of each of the partners assures the integrity and success of Center programs. The management structure provides a framework in which to crystallize Center objectives, to direct technical activities, and to resolve patent, copyright, and proprietary information issues.

Direct research at pivotal issues

Cutting-edge research is the key to future development. Directing the Center's efforts toward focal areas identified by the partners maximizes the impact of Center projects on partners' growth and development activities; greater long-term benefits accrue if the Center's work complements partner's internal projects and long-range development programs. The Center's Technical Advisory Committee provides the forum for focus selection and tracking as technology matures.

Educate more people — better

Large teams of technically up-to-date scientists, engineers, and designers will be needed to produce the information handling systems required in the 80's. Existing educational programs are inadequate and cannot train and update a sufficient number of individuals. Center activities enlarge traditional opportunities at partner universities by attracting more faculty and increasing the expertise and facilities available. The innovative educational offerings, utilizing advanced delivery technology, developed under Center auspices, provide practicing scientists, engineers, and designers with relevant contemporary information.

Conduct programs at a significant level of effort

The effectiveness of individual research projects in the microelectronic and information sciences is dependent on the work of diverse project teams supported by expensive laboratory facilities. The project teams coordinated under the Center interact constructively, resulting in synergistic benefit to all partner organizations and individuals. Collecting an effective group of projects within a single organization to promote such synergistic interaction requires major commitments from all Center partners.

and Information Sc

MANAGEMENT

The members of the MEIS Center believe that the resources must be effectively managed to meet the Center's objectives.

Board of Directors

Board members are appointed by the president of the University of Minnesota and represent participating organizations. The primary goal of the Board of Directors is to assure that the objectives of the Center are implemented. In this regard, the board sets policy, approves fiscal matters, and stimulates vitality and growth. Board members are the organizational links between MEIS and participating organizations.

Technical Advisory Committee

Members of the Technical Advisory Committee are senior technical leaders appointed by participating organizations. The objectives of the Technical Advisory Committee are to:

Determine technical direction,

Assure the quality of Center-sponsored projects,

Represent the technical interests of participating organizations,

Encourage interorganizational project teams.

In this regard, the committee sets the Center's technical focus, evaluates proposals and projects, and makes sponsorship recommendations, which are acted upon by the director. The Technical Advisory Committee also monitors contemporary developments to keep the Center focused on cutting-edge research and education issues.

Members of the Technical Advisory Committee connect the Center to the technical programs of the participating organizations.

MEIS Center Director

The director implements the programs of the Center, recommends policy and budgets to the Board of Directors, allocates resources to projects, and oversees facilities of the Center.

BOARD OF DIRECTORS

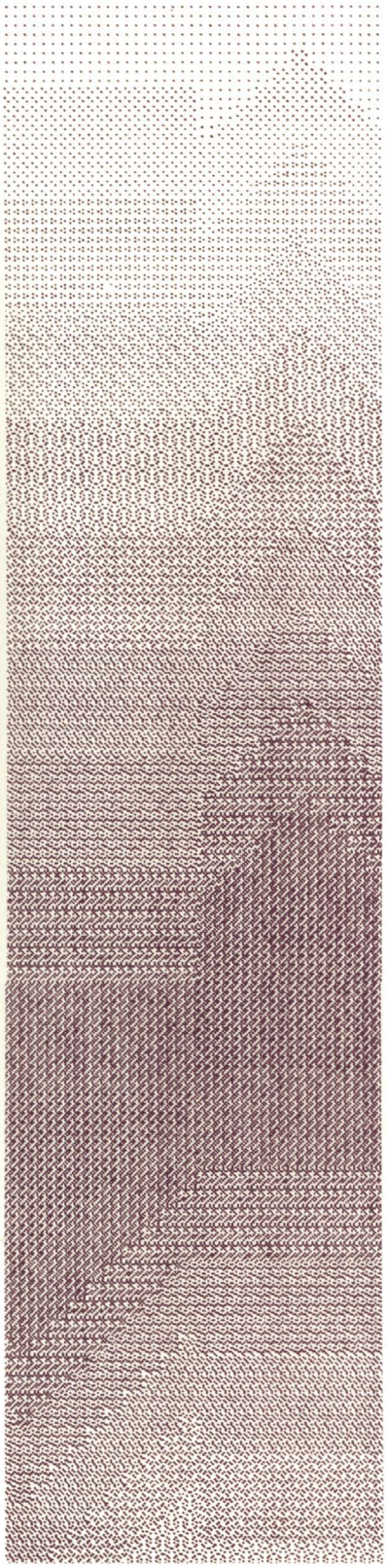
MEIS Center Board of Directors members pictured at a spring planning meeting included, from the left, **Prof. J. Ben Rosen,** head of Computer Science; **Prof. E. Bruce Lee,** head of Electrical Engineering;**Assoc. Prof. William R. Franta,** Computer Science (MEIS Center co-director); **Prof. Richard Y. Kain,** Electrical Engineering (MEIS Center co-director); **Dean Roger W. Staehle,** Institute of Technology; **James Berrett,** vice president for Corporate Development, Honeywell, Inc.; **William Malloy,** director, Plans & Communications, Sperry Univac; **Dr. Walter H. Bruning,** vice president, Consulting & Educational Services, Control Data Corporation; **Lloyd Thorndyke,** guest, Control Data Corporation.
Not pictured are **Dean Warren Ibele,** Graduate School, and **Prof. Robert M. Hexter,** Chemistry.

TECHNICAL ADVISORY COMMITTEE

Members of the MEIS Center Technical Advisory Committee who attended a recent meeting include, from the left, seated, **Prof. Lanny D. Schmidt,** Surface Science; **Prof. Allen M. Goldman,** Physics; **W. W. Lindemann,** vice president, Microcircuits/Printed Circuits Division, Control Data Corporation; **Dr. Dave Mueller,** director of Cardiovascular Instrumentation, Medtronics, Inc.; **Assoc. Prof. Arthur G. Erdman,** Mechanical Engineering; **Richard J. Petschauer,** Sperry Univac-Roseville Operations; **Assoc. Prof. William R., Franta,** Computer Science, MEIS Center co-director; **Prof. Richard Y. Kain,** Electrical Engineering, MEIS Center co-director; **Assoc. Prof. Sartaj Sahni,** Computer Science; **Dr. William T. Sackett,** vice president-Corporate Technology Center, Honeywell, Inc.; **G. M. Schumacher,** general manager, Arden Hills Programming Division, Control Data Corporation; **Dr. Ernest J. Dieterich,** vice president, Architecture & Technology, Honeywell, Inc.; **Asst. Prof. J. David Naumann** for **Prof. Gordon B. Davis,** Management Science & Accounting, director, Management Information Systems Research Center; **Prof. Raymond M. Warner,** Electrical Engineering; **Assoc. Prof. George Stephanopoulos,** Chemical Engineering & Materials Science.
From the left, standing are: **Prof. Larry L. Miller,** Chemistry; **Lawrence D. Walker,** director of Systems Design, Sperry Univac-Roseville Operations; **Bob Siegfried** for **Dr. Patrick L. Corbin,** Sperry Univac Defense System; **Assoc. Prof. Gary Robinson,** Electrical Engineering; and **Dr. K. C. (Carl) Nomura,** vice president and general manager, Solid State Electronic Center, Honeywell, Inc.
Not pictured are **Paul Citron,** director of Applied Concepts Research, Medtronics, Inc.; **Lincoln Hudson,** director of Engineering & Systems Development, Honeywell, Inc.; **Ralph Kerler,** director, Semiconductor Division, Sperry Univac; and **Prof. Lawrence Markus,** Mathematics

iences Center

PROGRAMS



All Center programs are focused on:

Microelectronics

Physical sciences — The bulk and surface properties of materials, new materials, the effects of submicron device dimensions, device modeling, new device technologies and fabrication techniques.

Design — Chip design systems, chip functionality, layout, logic and circuit simulation, chip testing.

Information Sciences

System architecture — System description languages, distributed architecture, communication technologies, system control algorithms, protocols and their performance evaluation.

Software engineering — Programming and specification languages, correctness proof techniques, software productivity aids, structured design, software testing.

Applications — Process control, automation, robotics, image processing, numerical methods, signal processing, CAD/CAM systems for mechanical design.

These areas are addressed through research and education enhancement projects that . . .

Address cutting-edge problems or provide sorely needed educational materials.

Organize professors, scientists, and engineers from the member organizations into collaborative teams.

Disseminate results through technical papers, conferences, symposia, special lectures, video tapes, computer tapes, and audio cassettes.

Address needs of the research community, undergraduate students, graduate students, practicing scientists, practicing engineers, and the public.

Advance the state-of-the-art in the microelectronic and information sciences.

Enhance the ability of participating universities to educate students or industrial personnel.

Ideas for Center projects may arise in various ways:

Interactions among personnel from participating organizations

Requests from industrial organizations

Requests from government agencies

Discussion among members of Center committees

Mechanisms

The MEIS Center solicits project proposals that address focal areas. Proposals are generated by project teams, or by Center response to requests for quotations or contract research initiatives from industry. Project principal investigators and team members may include University of Minnesota faculty, industrial members' staff, or affiliated university faculty.

Project procedure:

Project team formulates a project that responds to focal areas.

Project team submits a proposal to the Technical Advisory Committee (TAC).

TAC evaluates the proposal's technical merit, cost, and relevancy to research areas and technical focus of the MEIS Center.

TAC recommends proposal disposition to the Center director who suggests sponsorship.

Project team realizes project using joint facilities.

Facilities

MEIS Center project teams have access to chip design, analysis, and production facilities, special purpose computing equipment, and software packages at participating organizations.

The Microelectronic & Information Sciences Center addresses problems facing industries and universities by engaging in resource sharing and cooperative efforts.

Current Center partners are:

UNIVERSITY OF MINNESOTA

CONTROL DATA CORPORATION

Honeywell

Medtronic

SPERRY UNIVAC

3M

All participants benefit from leveraged, synergistic Center activities.

Industrial partners benefit from interactions with other partners, leading to a broad increase in the scientific and technological base within the microelectronic and information sciences. This base gives corporations the resilience and flexibility they need to meet their growth objectives. Additionally, the Center's educational activities supply more and better educated high-technology employees.

Universities obtain essential stimulation from the perspectives contributed by the industrial and governmental partners. Universities will attract new personnel. University students have increased opportunities for direct experience with new technology.

Government agencies obtain maximum results from Center projects, since Center funds from other sources will be used in support of Center projects. The Center's contributions will strengthen the national economic fabric by providing a strong scientific and technological base in the key areas crucial to solutions to the dilemmas of the 80's.

MEIS CENTER

143 Shepherd Laboratories
University of Minnesota
100 Union Street S.E.
Minneapolis, Minnesota 55455
612-376-9122

Art and Design by Sonja Hutchinson