A Proposal To Establish
A Natural Resources Research Institute
at the
University of Minnesota, Duluth

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TABLE OF CONTENTS

APPENDICES

PROPOSAL TO ESTABLISH A NATURAL RESOURCES RESEARCH INSTITUTE

Introduction

On a national level, the economy continues to experience a recession due to federal monetary policies, high interest rates and lack of expansion in all sectors. International competition in the auto industry affects the iron mining industry in northeastern Minnesota. Consequently, there were extended lay-offs on the Iron Range this past year. The housing industry has also been in trouble, affecting the forestry/timber industry (although considerable progress has been made toward diversification of hardwoods via the growth of flakeboard and pressboard manufacturing) in the northern part of Minnesota. Expansion of industry, manufacturing and small business has suffered from high interest rates and a lack of investment capital. Naturally, northeast Minnesota felt the effects along with other areas in the State.

It is important to note that our part of the nation experienced greater distress as a result of these national events than did other parts of the country. As a matter of fact, the entire midwestern region of the country has continued to decline since the late 1960's with the increased out-migration of people, business and industry to the "sunbelt" states in the South and West.

In a report entitled "The State of the Region 1981," data indicates that the Northeast and Midwest Regions have suffered an economic decline during the past decade that poses a serious threat to the "physical and economic well being" of the nation. This report prepared by the Northeast-Midwest Congressional Coalition analyzes major economic trends such as income, employment and economic development to show which state economies are growing or declining.

According to the report, the South and West experienced twice the investment in new capital equipment between 1970 and 1977, as well as twice the investment in non-residential structures between 1970 and 1979, of that of the Northeastern and Midwestern states.

Migration patterns show that 3.4 million northern residents moved to other regions and 90 percent of all population growth in the United States between 1970 and 1980 occurred in the South and West where the growth rate was nearly double the national average. In addition, the report points out that federal programs tend to favor the sunbelt. The federal balance of payments statistics show that the 18 states comprising the "frostbelt" paid $165 billion more in federal taxes than they received in federal spending. These patterns, when coupled with a sagging national economy put extraordinary economic pressure on our state and district. Because Minnesota is one of the 18 states included in the report, it is affected by most of the trends discussed; although, not to such an extreme. From 1970 to 1980, our population growth was less than the nation's, we have lost many businesses (but we have attracted new ones) and we have missed our share of federal funding.

Within the state, some regions have suffered more than others. The Arrowhead Region is one of those. For example, our share of the state's total population has dropped from 10.1 percent in 1960 to about 8.2 percent in 1980. Our population shows no growth in the 0-4 age group which may mean that we are not keeping or attracting young families. We do have, however, the largest growth in the 65 and over group which should be used to our advantage. This shows signs of a mixture of natural age and retirement activities, and therefore presents a more stable population. Finally, our region is not expected to grow more than 2 percent in population by the turn of the century. This is based upon

past trends which could be subject to change if the area's economy expands or continues to decline.*

The Economic Development Committee, made up of Minnesota business, labor, and government leaders, identified the region's under-utilization of natural resources as the primary problem which must be addressed if the region's economy is to be improved. These resources include minerals, forest products, farmland, commercial/industrial land, tourism/recreational potential, education quality and labor.

The work force in northeastern Minnesota experienced lengthy lay-offs in the past year due, in part, to a reduced demand for iron ore throughout the nation. This happened just as the iron mining industry was recovering from the strike of 1977 which had cut production to its lowest level since 1970.

The region is continually looking for ways to improve its competitive edge in the iron mining industry. This was evidenced this past year by successful attempts on the part of key individuals in the region and state to obtain funds for determining the feasibility of establishing a direct reduction iron ore processing plant in northeastern Minnesota. If the process proves worthwhile, the region's economic base could be expanded, employment could increase and we would expand the use of this mineral resource.

The rock formations of northeastern Minnesota also have considerable deposits of copper/nickel, titanium, aluminum and uranium. Companies interested in these minerals have encountered problems, however, in finding suitable areas to explore and, where they have explored, they have not yet found deposits in concentrations high enough to justify large-scale developments. Hopefully, economics of scale regarding the cost of

* Minnesota: A Good Place to do Business, U of M, Continuing Education and Extension, 1981.

mining these minerals as compared to the market prices will prove more favorable in the months and years to come.

While the forestry industry has expanded in parts of the region (Grand Rapids and Cook), the State has not realized the full potential of those resources when it comes to utilizing the vast reserves of hardwoods (birch and aspen) which are found in every county.

The major problems encountered in developing this resource are the condition and accessibility of the wood supply that is considered economically suitable for commercial use. Many of the stands are becoming overly mature and, therefore, indicate inadequate reproduction of timber to supply future demands. What is needed is a management intensification program designed to improve genetic tree quality, timber harvesting techniques, reforestation potential, forest road access and transportation, research and development activities and communications requirements.

Finally, the other major resource which could be mined or harvested is peat. Northern Minnesota possesses thousands of acres of this resource (50 percent of the continental U.S. peat supply is located in 7 million acres in northeastern Minnesota); but, problems exist in the areas of land use, harvesting technology and environmental issues. All of these must be dealt with before the State can take full advantage of horticultural, energy and other uses of this abundant raw material.

To fully utilize the natural resources the State is blessed with, a significant increase in natural resources research will have to take place. The Natural Resources Research Institute proposed in this document would be a major step in achieving full and wise use of Minnesota's natural resources!

THE UNIVERSITY OF MINNESOTA, DULUTH: AN OVERVIEW

General Information

By most standards, the University of Minnesota, Duluth would be considered a medium-sized university. It has a physical plant consisting of 36 major buildings located on 250 acres, a student body of over 10,000 counting extension students, a faculty numbering more than 500, and a staff of approximately 600.

Physically, UMD is a young (founded in 1947), medium-sized university, but because of its affiliation with the University of Minnesota and its emphasis on quality it has taken on the characteristics of a much larger, older university.

As an integral part of the University of Minnesota system, the Duluth campus has the broad teaching, research, and service responsibilities of a land grant institution. In fulfilling these responsibilities, the primary role of the Duluth campus is to provide a broad and comprehensive selection of high quality undergraduate instructional programs. Its secondary responsibilities are to provide graduate, professional and continuing education programs as well as promote significant research and service activities.

The Duluth campus is organized into three broad functional areas, academic administration, business affairs, and student affairs. Each area is headed by a vice provost who reports directly to the provost.

The academic units of the campus are organized into six colleges and schools, each headed by a dean who reports to the vice provost for academic administration. These collegiate units are the School of Business and Economics, College

of Education, School of Fine Arts, College of Letters and Science, School of Medicine, and School of Social Development.

Academic support units, including the library, are under the jurisdiction of the vice provost for academic administration.

The business affairs office is responsible for financial records, collection of tuition and fees, disbursement of funds, hospitalization, insurance, parking and transportation, the transportation pool, real estate, inventory, payroll, and loan collections. The vice provost for business affairs supervises operation of the campus bookstore and plant, food, vending, printing, and police services.

The areas of admissions, records, testing and counseling, orientation and advisement programs, student financial aid, career planning and student placement, student activities and operation of the Kirby Student Center, student housing, and student behavior are areas under the administrative jurisdiction of the vice provost for student affairs.

Academic Programs

The University of Minnesota, Duluth, offers the following academic programs:

- Preprofessional programs of 1 or more years duration in most of the professions, including engineering.
- Two-year associate degree programs in liberal arts, dental hygiene, and law enforcement.
- A 2-year basic sciences medical school program leading toward the M.D. degree through transfer to the University of Minnesota Medical School, or another medical school.

- Four-year baccalaureate degree programs in accounting and business administration, fine arts, liberal arts and sciences, applied arts and sciences, social work, and elementary and secondary school teaching.
- Master's degree programs in art, biology, business administration, chemistry, communicative disorders, counseling, education, educational administration, English, geology, history, industrial safety, physics, and social work.
- A sixth year program and a 2-year specialist certificate program in elementary, secondary, and general school administration.

As a campus of the University of Minnesota, UMD's programs are fully accredited by the North Central Association of Colleges and Schools. They are accredited additionally by the National Council for Accreditation of Teacher Education, American Chemical Society, National Association of Schools of Music, American Association of University Women, Council on Social Work Education, Liaison Committee of the American Association of Medical Colleges and the American Medical Association, and Council on Dental Education of the American Dental Association.

Faculty

The heart of any educational program is the faculty. All other matters are secondary to a competent, qualified and forward-looking faculty that can give an overall scholarly atmosphere to the operation.

The overall competence of the faculty may be judged by such factors as the level of academic training of its members; the diversity of their backgrounds; their professional experience; their experience in teaching; their level of scholarship as shown by scientific and professional publications; and their participation in professional, scientific and other learned societies.

The faculty of the University of Minnesota, Duluth, which includes many nationally and internationally-known individuals, is truly a competent faculty evaluated on the criteria identified in the previous paragraph. Sixty-five (65) percent of all UMD faculty members have doctoral degrees earned from a broad spectrum of universities in the United States, Canada and other countries of the world.

Most UMD faculty members are actively involved in research activities. As a result of this activity UMD receives approximately 3 million dollars a year in external grants for research and training. Additional details on the research efforts of the UMD faculty are provided in the section of this proposal entitled "UMD As a Research University."

More detailed information on faculty members who might be associated with the Natural Resources Research Institute is provided in Appendix A.

Facilities and Equipment

UMD's physical facilities, except for a few buildings, are modern and reasonably well equipped.

Several of the facilities are unique for a campus with a total enrollment of 10,000 students.

Facilities that would be especially useful in support of major research programs would be UMD's modern computer center and its well-equipped science laboratories. The computer center is described in detail in Appendix B.

The computing equipment in the center and the accessed equipment on the Minneapolis campus give the Duluth campus greater computer capability than that which many much larger universities have. UMD's computer equipment is described in Appendix B along with the computer center.

Other scientific equipment available on campus includes a scanning electron microscope, a nuclear magnetic resonance unit, a single crystal X-ray diffraction unit, spectrophotometers and many other sophisticated instruments.

Library

The UMD Library, through its own holdings and those of other University of Minnesota campuses, contains a vast resource of books, periodicals and microformats that would be invaluable to scientists and technologists working in a Natural Resources Research Institute.

UMD AS A RESEARCH UNIVERSITY

The most common categorization of colleges and universities in the United States is fourfold:

1. Two-year institutions.
2. Four-year colleges (mostly private).
3. "Comprehensive" universities (formerly state teachers colleges now offering graduate work at the masters level).
4. Research universities (both private and public).

Nearly all the sponsored research is done in the research universities, including those sometimes called institutes of technology. This research may be basic research or applied research. Research by faculty in the humanities and social sciences is not usually followed by "development." The common compound -- research and development -- refers typically to technological research. It is here that the scientific findings require technological development for practical application. It is in these research universities where nearly all of the engineering schools are located. Engineering education requires a major research component.

UMD has been a research university for some time. The data for the last three years would seem to be the most appropriate. These data are summarized on Page 11. It is imperative that a distinction be made between sponsored research grants and sponsored training grants. Sponsored training grants are vital to the educational quality of units in professional education, social work, the health sciences and the like. However, such grants are not directly related to basic or applied research. Many institutions do not distinguish between research and training grants when reporting

"research" expenditures.

UMD Sponsored Research and Sponsored Training Grant Expenditures

	1982	1981	1980
Research	$2,209,269	$2,245,917	$1,778,420
Training	$ 851,965	$ 765,588	$ 879,315

UMD Sponsored Research Grant Expenditures by Unit, 1982

Lake Superior Basin Studies Center	$ 290,219
CLS (Geology/Geochemistry)	415,871
Biology	87,598
Chemistry	357,830
Physics	184,936
Economics	19,928
Anatomy	70,824
Biochemistry	243,620
Microbiology	265,615
Pharmacology	105,444
Physiology	145,258
Other	22,126
	$2,209,269

UMD Sponsored Research Grant Expenditures by Source, 1982

Federal	$2,037,812
State/Local	-28,441
Private	199,898
	$2,209,269

Some Typical Research Grants, 1977-1982, CLS

(Those marked with single asterisk * have a major computer component, those with a double asterisk ** have a major mineral component and those with a triple asterisk *** have a major electronic component.)

Principal Investigator	Brief Title	Sponsor	Amount
Olson (Physics)	Atmos. Electricity ***	ONR	$ 46,667

Harriss/Magnuson (Chem)	Aquatic Toxicity *	EPA	$255,000
Carlson/Caple (Chem)	Environ. Impact	EPA	179,979
Rapp (CLS)	Acid Rain *	EPA	458,746
Holst (Geology)	Precambrian Rocks **	NSF	42,477
Sydor (Physics)	Satellite Data ***	NASA	223,808
Grant (Geology)	Phase Eq. in Rocks **	NSF	29,800
Marsden (Geology)	Iron Ore Reserves **	USBM	18,066
Thompson (Chem)	NMR Instrumentation	NSF	24,995
Hargis (Biology)	Aquatic Pollutants *	EPA	124,394
Johnson (Geology)	Sed. in Lake Superior	NSF	150,000

PROPOSED NATURAL RESOURCES RESEARCH INSTITUTE

Introduction

The University of Minnesota is proposing to the Minnesota State Legislature that a Natural Resources Research Institute be established as part of the University of Minnesota, Duluth. The Institute, as perceived, would conduct research and development activities relating to the natural resources that exist in northeastern Minnesota. Resources that would be studied and worked on include taconite, copper-nickel, zinc, gold, titanium, vanadium, aluminum, cobalt, peat, timber, and water.

The proposed Institute would concentrate its efforts on applied research and would not duplicate the work that the Mineral Resources Research Center and other University of Minnesota programs currently do. The research done at the Institute would supplement and complement that being done in other parts of the University.

Even with present growth rates, world supplies of high grade iron, copper, nickel, titanium and other ores will be depleted, or nearly depleted, in the foreseeable future. As depletion of these ores takes place, the price of energy to refine lower grade ores will increase significantly. It is important to the future of the United States and Minnesota, therefore, that extensive research on lower grade ores and alternative energy sources be carried out in the years ahead.

The proposed Natural Resources Research Institute would have as its major goal the search for better and more efficient ways to utilize Minnesota's abundant mineral, biomass and water resources.

Need for Institute

If the State of Minnesota -- coupled with labor, industry and the University --

were to embark on a new research endeavor, the economy of northeastern Minnesota and the State could significantly improve. If a new technology for the production of steel, such as direct reduction, were proven to be feasible, Minnesota could again become a steel producing state. This scenario assumes that the national steel industry continues to follow the liquidation scenario it is currently following, but with investment in a new technology in northeastern Minnesota. This investment couples this new technology with mini steel mills to make semi-finished steel billets and possibly finished steel products. These facilities would be built either in conjunction with existing taconite plants or a green field operation. The key ingredients in making the operation feasible are the availability of a quality labor force, ore, energy, transportation, and research. Northeastern Minnesota now has the necessary ingredients with one exception and that exception is adequate research to transform energy and ore into steel, using Minnesota labor.

If steel were produced in northeastern Minnesota, the industry is forecast to increase output from 0 to 6 million tons by the year 2000. The total sales of the steel industry could rise from $0 to $25 million in 1985 and to $1.5 billion by 2000. These direct sales will have a ripple effect on the regional economy, increasing GRP from $47 million in 1985 to $2.8 billion by 2000. By the year 2000, total mining and steel activity in the region would account for $4.8 billion and GRP would reach $7.6 billion, measured in 1977.

Unfortunately, this or any other growth scenario is unlikely to occur without considerable amounts of additional research. Research is the key ingredient and the state government can help. At the present time, neither the private nor public sectors appear willing or able to conduct the research necessary to establish a steel or other mineral and natural resources-related industry in northeastern Minnesota.

To illustrate the importance of research in the establishment of any new industry or technology, we can look at the development of the taconite industry as we know it today.

During the 45-year period from 1910 to 1955, investment in taconite research averaged $70,000 per year. In aggregate this research commitment amounted to $3.25 million. In 1982 dollars, accounting for inflation, this research represents an investment of $19.3 million.

Has there been a payoff? The research conducted by Professor Edward Davis and others eventually resulted in a whole new industry which up until very recently produced $1.3 billion annually in gross state output.

Each year the rate of return on this cooperative endeavor, based on the original research investment, is over 6,000 percent crudely estimated. Research is the single, most important, highest yielding activity on which the state spends! Nevertheless, by comparison, the steel industry, the State of Minnesota, and the University have spent less than $500,000 in investigating the potential of a steel industry in northeastern Minnesota. This is the one area where the State Legislature can effect a major impact. While the State of Minnesota may not be able to reduce inflation or change world grain prices or alter the value of the dollar, a few dollars wisely invested in mineral and economic research can pay enormous dividends.

Although research is not cheap, the research that led to the production of taconite (1910-1915) has yielded the citizens of the State of Minnesota an annual 6,000 percent return, crudely measured. The legislation proposed to establish a Natural Resources Research Institute at the University of Minnesota, Duluth campus

(UMD) offers the potential of providing such returns in the future.

If this research facility can unlock the current practical technological and economic blocks to the establishment of steel industry in Minnesota, the use of biomass as an alternative energy source, or the use of other mineral or natural resources, the payoff may be as large or greater than the taconite industry. For example, the establishment of a 6 million ton steel industry in northeastern Minnesota would result in an annual increase in gross regional and state product of $2.8 billion, measured in 1977 prices. Given the budget requested by this legislation, biomass research, for example, could result in a rate of return even higher than the taconite industry. In addition, current research in biomass showsthat there may be an energy industry which could have a direct sale of $2.6 billion per year if current technological, market, and economic problems can be solved. The proposed Natural Resources Research Institute will bridge the gap between basic research and industry development and more fully utilize the natural resources of the area. Applied research at a distance can easily generate solutions which are inappropriate to the area or which are unacceptable to the population which would be affected by the proposed solution.

The Natural Resources Research Institute will form a new unit within UMD. However, both personnel and functions of the Institute will receive support from a variety of programs currently within the University. For instance, the Lake Superior Basin Studies Center (LSBSC) of UMD has water chemistry and geo-chemistry laboratories which can provide technical assistance and support capabilities to the Institute. Similarly, the Bureau of Business and Economic Research (BBER) at UMD can provide support in areas such as evaluation of the economic viability of products developed at the Institute. Furthermore, it is plausible that many of the personnel hired at the

Institute will have capabilities which could foster an expansion of the teaching and research mission of the University.

The Institute staff is not expected to have any continuing instructional commitment at UMD, but the interaction between UMD faculty and students, and the Institute staff, shall provide strong enrichment to both populations. Both undergraduate and graduate students from UMD create a trained or readily trainable source of research assistants for the Institute. In addition, the student assistants will gain invaluable research experience which helps develop their capabilities and provides experience helpful in gaining employment. The professional level interactions with UMD research faculty consulting or even directly involved in projects and the corresponding resource support provided UMD by Institute staff will complement and enhance the effectiveness and productivity of both groups. In addition, the current UMD staff is available to develop research programs necessary to begin the Institute's research while Institute's staff is being recruited.

Although base funding is required to remodel the SAGE Building and to initiate the Institute, it is highly likely that a large proportion of funds can be secured from a variety of state and federal agencies as well as from private businesses, which traditionally support applied research activities. Potential sources of support for at least one of the resource divisions include the Iron Range Resources and Rehabilitation Board (IRRRB), the U.S. Environmental Protection Agency (EPA), Sea Grant, U.S. Department of Energy (DOE), U.S. Department of Agriculture (USDA), U.S. Economic Development Administration (EDA), the Bureau of Mines, and especially private industry. In the latter case, it would be especially encouraging and beneficial for private industries to cooperate in the development of the Institute and its functions because private industry

stands to benefit significantly from the activities of the Institute.

Program Organization and Objectives

The Institute would be divided into four major divisions: (1) minerals, (2) biomass, (3) water, and (4) energy. The Institute would be headed by a director who reports directly to the Provost of the University of Minnesota, Duluth (UMD). In addition, an advisory board will be established to provide input and consultation to the director regarding the plans of the Institute. The director will be responsible for administration, planning, fund raising, and overall efficient management of the Institute. Under the director will be one division chief for each of the four major divisions. Each will be responsible for administration, planning, grant writing, and overall management of their respective divisions.

It is anticipated that the director will be a full-time administrator who has considerable research and management experience in a wide variety of resource areas. In contrast, the division chiefs will have responsibilities both in program administration and also will be in research activities. Considerable flexibility should be allowed in activities for both the director and division chiefs in order to attract some of the best people in these fields, and also to enable a variety of viable possible research lines to be explored. The director and division chiefs in consultation with the UMD Administration and the Advisory Board will develop the structure and personnel composition of the respective units.

Description of Divisions

Minerals Division

This will be the largest unit within the Institute because it is associated with the resources that have greatest potential for economic benefit to northern Minnesota.

Although the technologies associated with taconite development are relatively advanced, it is anticipated that the Institute personnel will explore the possibilities for the use of low grade ores which are abundant and are developed economically feasible methods for processing such ores. Northeastern Minnesota is also known to have deposits of copper and nickel which are obvious possibilities for further development. In essence, the Minerals Division will be expected to work with private industry and University personnel to develop technology for extraction, reduction, production, and marketing of the most economically viable mineral products available in northeastern Minnesota. The scope of the research activities will be to expand or refine existing operations to whatever extent possible, but also shall explore and develop other potential resource possibilities.

Possible Projects for Minerals Division

Iron Ore

1. Investigate and develop innovative methods for taconite breakage.
   a. Crushing.
   b. Grinding studies to reduce wear of grinding media and reduce energy costs. Major energy use in mining is for grinding the ore.
2. Improve screening techniques. Development of screens for fine particle separation.
3. Research to improve pellet quality to meet foreign competition. Develop reliable testing methods to determine high temperature breakdown, low temperature breakdown and reducibility. Improve pellet quality.
4. Develop new and novel methods to utilize taconite tailings.
5. New processes for recovery of iron from oxidized taconites.
6. New processes for recovery of iron from lower grade crude ores than currently being mined.
7. Improve recovery of iron from taconites.

Other Minerals

1. Develop and investigate methods to recover copper, nickel and precious metals, such as symbiotic bacteria leaching, liquid ion exchange, base metal leaching for precious metals.
2. Investigate environmentally-safe smelting of copper and nickel ores.
3. Develop and investigate methods to recover manganese from the Cuyuna Range manganiferrous ores.

4. Investigate the Duluth gabbros for potential recovery of olivine, ilmenite and feldspar.

5. Examine potential of Cook County Clays as a partial replacement for bentonite.

6. Examine potential of developing uranium in Minnesota.

Biomass Division

Northeastern Minnesota has extensive deposits of decayed organic matter (peat) and extensive areas of standing crops in the form of trees, shrubs, cattails, and a variety of other vegetational life forms. Although Northeastern Minnesota has an active timber industry which produces lumber, construction materials, and paper products among other goods, the present forestry resources are under developed. In the National Forests, for instance, extensive stands are overmature because of a lack of more demand for these goods or because of access problems. A variety of potential uses for these biomass products have been identified, but the development of technology for the expanded use of these products in Northern Minnesota is limited. Among the most readily identifiable possibilities for exploration and expansion of the economic use of these resources are energy production such as in the gasification of peat, the use of wood chips, and the production of gasohol.

Research within the biomass division of the Institute could focus on the areas listed below. However, the specific priorities in direction of research will be determined on the basis of (1) recommendations of an advisory committee comprised of local, state, and national experts in representative fields; (2) consideration of the

economic feasibility and the environmental problems associated with the end-products of the research activities; (3) the technical expertise of the individuals subsequently employed in this division of the Institute; and (4) the availability of funds and extent of cooperation from private industries.

1. Energy production - the resources of northeastern Minnesota have the potential to produce energy from biomass like aspen, peat, and cattails
    a. Gasification and the production of methane, including anaerobic digestion
    b. Pelletization and briquetting
    c. Direct combustion - bulk handling machinery
    d. Production of liquid fuels such as methanol and ethanol
2. Wood products - expand the use of existing timber products and develop uses for under-utilized species
    a. Construction materials - fiberboard, particle board, veneers, and lumber
    b. Paper products
3. Feedstuffs
    a. Roughage food supplements
    b. Cattle feed - muka
    c. Steamed aspen
4. Horticultural and agricultural uses
    a. Soil conditioners, additives, sod, and fertilizers
    b. Landscape materials

5. Others - includes a wide variety of potential uses of the natural resources of northern Minnesota that could lead to the development of higher value products and multiple-product industries (e.g., from peat)

   a. Production of bitumens that are used to synthesize waxes, steroids, adhesives, paints, lubricants, and medicines

   b. Production of carbohydrates for yeast cultures

   c. Development of exudates from coniferous trees to produce petrochemicals and other by-products (e.g., turpentine and wood)

   d. Production of humic acids for use as root stimulants, pest controls, and fertilizer additives

   e. Production of peat coke for use as activated-carbons in steel manufacturing, peat tar, solvents, and grease

Water Division

One of Northeastern Minnesota's most visible and distinctive natural resources is water. The abundance of lakes and rivers provides innumerable opportunities and support for the recreation and tourism industry. Therefore, the pressures for the protection of this resource are substantial. In contrast, the potential for the economic development of the water resources of Northern Minnesota is substantial, but has not been explored to a significant degree. The potential areas to be considered with respect to this resource include the use of water for irrigation or for consumption not only locally but also regionally or nationally. Other possibilities include the areas of aquaculture, fisheries development, and energy production.

Research would focus on several regional issues simultaneously. Within each research area, specific projects will address priority subjects as determined by local, regional and state advisors:

1. Economic Development and Utilization
    a. Slurry pipeline utilization and western coal
    b. Water export feasibility
    c. Industrial reuse of waste water
    d. Industrial cooling and reuse
    e. Transshipment of bulk commodities through the Twin Ports
2. Energy Production
    a. Atmospheric and aquatic pollution from coal-fired electric generation plants
    b. Reclamation and reuse of heated waters from power generation
    c. Water user conflict resolution associated with siting, constructing and generating energy conversion facilities and mining operations
    d. Hydropower and pump-back feasibility
3. Water Quality
    a. Sediment Transport processes
    b. Acid rain, public health and the aquatic environment
    c. Disposal of municipal and industrial wastes
    d. Land use drainage effects
4. Recreation and Tourism

a. Development of public and private water-based recreational facilities in urban settings

b. Regional integration of water-oriented activities and services

c. Seasonal development of water and winter recreational activities

d. Planning and development of the Duluth waterfront

5. Fish and Wildlife

a. Functional and economic value of wetlands including ecological and hydrological mechanisms that influence their integrity

b. Instream flow necessary, both quality and quantity, to maintain an active and viable aquatic biota

c. Fishing habitat evaluations oriented toward increased fish production for streams, rivers and lakes

d. Potential for increased waterfowl production.

Energy Division

The Energy Division is a necessity for the Natural Resources Research Institute because of the significant impact that energy has on the development and processing of many natural resources. In addition, several new sources of energy, particularly biomass and possibly water, require new technologies to transform these materials into usable energy forms. In addition, the development of various minerals is energy intensive. The grinding and separation of the usable mineral from its tailings requires large amounts of cheap energy. The further processing of minerals into metals or chemicals requires more energy. Therefore, energy research is an integral part of the Natural Resources Research Institute.

Facilities

The Semi-Automatic Ground Environment (SAGE) building was constructed in 1955/56. Considering its age, the building and equipment are in very good condition. The basic building structure consists of reinforced concrete floor slabs, columns, beams, and exterior walls. Exterior walls are constructed of 10-inch thick reinforced concrete with one inch rigid insulation, faced with 4-inch concrete block on the interior. Interior partitions are generally demountable type units with concrete block walls enclosing mechanical equipment rooms, stairways, elevator, toilet rooms, and special areas.

The building and grounds compound is enclosed with security cyclone fencing and electronic gates. The entire area within the compound is paved providing ample parking and storage of materials. The building has a loading dock at the elevator as well as overhead doors providing access to the building for vehicles. The buildings elevator has a 16,000 pound capacity with a 10' x 16' cab which has the capability to transport fork-lifts and other motor vehicles. The Power House portion of the building, first floor, has a rolling crane which runs the full length of the building. The clear floor to structural ceiling heights in building are as follows:

22'-0" at the Power House Area, First Floor
17'-0" First Floor
13'-0" Second Floor
19'-0" Third Floor
16'-0" Fourth Floor

The existing electrical systems are in very good condition and consist of: 500 kVA transformer, three generator switchgear units, power supply system, two power panels on each floor, and associated circuits for lighting panels and convenience outlets as well as electrical system supplying the refrigeration and air handling.

The existing mechanical systems were also found to be in good condition. They consist of building ventilation, water chiller, air conditioning, air distribution system, two oil-fired low pressure steam boilers, automatic temperature control, underground fuel oil storage tanks, plumbing and heating piping systems.

Reuse Conclusions

In appraising the SAGE building and site as a reuse facility for the proposed Minnesota Natural Resources Research Institute, it is apparent that the building and site, including the electrical and mechanical systems, are very adaptable; and the implementation of this proposed reuse could be accomplished with minor renovations and modifications. The site is adjacent to a major trunk highway and routes to targeted resource areas as well as being in proximity to UMD, the airport, and other areas of the city.

The building would be renovated and modified, ready for implementation of laboratory equipment, pilot plants, and support facilities, as follows:

Building Exterior

Would be wrapped in an envelope of two-inch rigid insulation board faced with reinforced resin/portland cement and exposed aggregate finish.

Building Interior

Demolition of certain partition walls and related patching.
Patch and fill in existing duct openings in ceilings and floors.
New floor covering.
New suspended ceilings.
Minimal - new concrete walls, doors, frames, and hardware.
Painting and refinishing of interior surfaces.
(All existing entrances, stairways, toilet rooms, janitor's rooms, and certain mechanical equipment rooms are to remain as they exist.)
Modification of ventilating, air conditioning, heating and plumbing systems.
Modification of electrical systems.
New lighting, electrical panels, and convenience outlets as required.

Assignment of Areas Within the Complex

First Floor

42,548 gross square feet
33,000 net renovated square feet

Minerals and Biomass Handling Facilities

Bulk handling
Pilot plants
Energy conversion
Field laboratories
Storage
Heavy equipment
Power plant and electrical power source

Second Floor

23,256 gross square feet
21,000 net renovated square feet

Applied Research and Experimental Laboratories

Minerals
Timber
Peat
Water

Third Floor

23,256 gross square feet
6,000 net renovated square feet

Office and Clean Laboratories

Note: Most of the existing rooms and partitions on this floor will be used as they presently exist.

Fourth Floor

23,256 gross square feet
21,000 assignable square feet

This Floor is Unassigned

Available for future related uses.
No renovation will be done on this floor at this time.

Preliminary Renovation Cost Analysis

Exterior Building Wall Area		52,300 square feet
Interior Renovated Areas		60,000 square feet
First Floor	23,000 sq ft	
Second Floor	21,000 sq ft	
Third Floor	6,000 sq ft	

Estimated General, Mechancial and Electrical Conversion Cost	$ 1,914,000
Architectural and Engineering Fees	136,000
Contingencies	100,000
Acquisition Costs (Land and Buildings)	100,000
	$ 2,250,000

New Building Comparison

Note: The first, second, and third floors of the SAGE building contain 89,000 gross square feet.

A new building of comparative size is estimated to have a construction cost of . . . . . $ 6,500,000

This cost does not include the $2,750,000 laboratory equipment costs, architectural/engineering fees, contingencies, or land acquisition.

BUDGET

The proposed costs for converting the existing SAGE building on the former Air Force Base in Duluth into a Natural Resources Research Institute are estimated for the biennium. It is expected that costs will be highest during the first year when remodeling and laboratory development will occur. The progression of hiring personnel will first include the director who will then develop the Institute in conjunction with the Provost and the Advisory Board. It is especially critical that the director have flexibility and authority to develop the most efficient operation that he/she sees fit. Therefore, the director will need to be hired in conjunction or preferably before most remodeling and laboratory development plans are finalized. Hiring of additional personnel will then lag behind the construction phase and likely will be primarily completed during the second year.

FY 1983-84

I. Equipment

1.	Analytical Laboratory		
	a. Sample preparation equipment	6,000	
	b. Analytical instrumentation (Phase I)	270,000	
	c. Control minicomputer	50,000	
	d. Sample storage facility	4,000	330,000
2.	Biomass Research Laboratories		
	a. Biomass conversion equipment (Presses, grinders, gasifier)	150,000	
	b. Biomass sampling equipment	60,000	210,000
3.	Water Research Laboratories		
	a. Analog/Digital computer simulation	150,000	
	b. Waste water reuse laboratory (Phase I)	80,000	230,000

4.	Mineral Resources Laboratories		
	a. Mineralogy Laboratory (Phase I)	145,000	
	b. Comminution and sizing facility (including autogenous mill)	190,000	
	c. Concentration pilot plant	185,000	
	d. Pyrometallurgical mill	300,000	820,000
5.	Fume hoods, benches, related fixed laboratory library facilities		160,000
	TOTAL EQUIPMENT		$1,750,000

II. Operating Expenses

A.	Salaries (6 months)		
1.	Director	37,500	
2.	Associate Director, Water	32,500	
3.	Associate Director, Biomass	32,500	
4.	Associate Director, Mineral	32,500	
5.	Accountant	10,000	
6.	Secretary (2)	14,000	
7.	Custodian (2)	16,000	
8.	Librarian	12,000	
9.	Technician (3)	36,000	223,000
B.	Fringe Benefits		51,000
C.	Travel		20,000
D.	Phone, Postage and Communications		30,000
E.	Supplies		36,000
F.	Maintenance		240,000
	TOTAL OPERATING EXPENSES		$ 600,000

III. For acquisition and rehabilitation of the SAGE building at the former Duluth Air Base $2,250,000

FY 1984-85

I.	Equipment		
	1. Analytical instrumentation (Phase II)		450,000
	2. Mineralogy laboratory (Phase II)		85,000
	3. Waste water reuse laboratory (Phase II)		115,000
	4. Forklift, trucks and related vehicles		45,000
	5. Core drilling equipment		140,000
	6. Computer equipment		165,000
	TOTAL EQUIPMENT		$1,000,000
II.	Operating Expenses		
	A. Salaries (12 months)		
	1. Director	75,000	
	2. Associate Director (3)	195,000	
	3. Technician (6)	144,000	
	4. Secretary (4)	56,000	
	5. Accountant (1)	20,000	
	6. Analyst (3)	75,000	
	7. Computer Operator (2)	50,000	
	8. Custodian (3)	48,000	
	9. Librarian	24,000	
	10. Mechanic (2)	36,000	
	11. Other personnel (5)	100,000	823,000
	B. Fringe Benefits		189,000
	C. Travel		40,000
	D. Communications		50,000
	E. Expendable supplies and equipment		275,000
	F. Furniture		80,000
	G. Computer software		100,000
	H. Library acquisitions		250,000
	I. Maintenance		300,000
	J. Other start-up costs		293,000
	TOTAL OPERATING EXPENSES		$2,400,000

PUBLIC SUPPORT FOR A NATURAL RESOURCES RESEARCH INSTITUTE

Many individuals in northeastern Minnesota are acutely aware of the problem our nation faces in competing with other countries that have taken significant steps to more fully utilize their natural resources (e.g., Saudi Arabia, Brazil, Australia, etc.). Living in an area that has experienced first hand the erosion of America's foreign markets, these individuals decided to get involved and try to make America more competitive.

To determine the role they might play in improving the economy of the region and in improving technical education in northeastern Minnesota they formed the Duluth High Tech Task Force and the Duluth Futures Task Force to address the problem.

Both the Duluth High Tech Task Force and the Duluth Futures Task Force have worked with statewide groups such as Minnesota Wellspring, the Minnesota Business Partnership, the Governor's Task Force on High Technology, the Governor's Minerals Development Commission, and the University of Minnesota as they pursued their goals.

At a meeting of the Policy Committee of the Minnesota Business Partnership held on March 24, 1983, the Partnership approved a recommendation which in part says,

"The Minnesota Business Partnership believes restoring the long-term economic health of northeastern Minnesota requires new and different approaches to the use of that area's natural resources.

"The MBP believes actions are required which will make the State's iron ore and taconite competitive in a world market and that will identify, evaluate, and develop environmentally sound and economically beneficial uses of northeastern Minnesota's many other natural resources.

"The MBP, therefore, supports the establishment of a Natural Resources Research Institute as a division of the University of Minnesota at Duluth with its main emphasis on minerals research and development."

The two citizens committees are totally committed to, and supportive of, the effort to establish Natural Resources Research Institute at the University of Minnesota, Duluth.

Membership of the two citizens committees and the Minerals Development Commission is shown in Appendix C.

UNIVERSITY SUPPORT FOR A NATURAL RESOURCES RESEARCH INSTITUTE

In the Mission and Policy Statement for the University of Minnesota, adopted by the Board of Regents on July 11, 1980, the role of UMD is clearly defined. The University of Minnesota, Duluth, should continue to develop and strengthen its undergraduate programs, the mission statement reads. This, the statement continues, must be its primary goal, and it is essential that appropriate resources be provided for these activities.

When it became evident that Governor Perpich and some legislators wanted to see additional natural resources research performed at the University of Minnesota, Duluth, President Magrath offered support for the idea. Since that time, President Magrath, Vice President Kegler and others have informed Governor Perpich of their support for having a Natural Resources Research Institute established at UMD and the continuation of the Mineral Resources Research Center at the Twin Cities campus of the University.

Establishment of a Natural Resources Research Institute at UMD is in accordance with the Mission and Policy Statement for the University.

SUMMARY

Although some research is presently being performed on problems related to the natural resources of northeastern Minnesota, it is geographically dispersed, essentially uncoordinated, and often the emphasis is upon basic rather than on applied research and product development. This is not to deny the importance of basic research, but immediate problems normally are solved through application of existing research results. With regard to the current geographical dispersal of research efforts, it is critical that the necessary studies, those relevant to a particular region, be carried out as a centralized research and development effort in the affected region where the research staff are intimately acquainted with the problem and the implications of any possible solution to other factors in the environment surrounding this problem. Applied research at a distance can easily generate solutions which are inappropriate to the area or that are unacceptable to the population which would be affected by the proposed solution.

The main objective for the proposed Natural Resources Research Institute would be to develop the natural resources of northeastern Minnesota into economically viable products. Subsequently, the economic status of northeastern Minnesota would be revived through the development of these new products.

Although the mainstays of the northeastern Minnesota economy will likely continue to be taconite and timber products, the Institute is envisioned to be an innovative program to develop or expand the use of other resources such as the copper, nickel, peat, and water resources described in this proposal. The applied research shall be prioritized such that those projects most relevant to the current situation in northeastern Minnesota shall receive the highest priority with more futuristic projects

accorded lower priorities.

It can reasonably be expected that the proposed Institute , if funded,would have a major impact on the economy of northeastern Minnesota and the State. It is entirely conceivable that within 3-5 years of its formation, the Institute could be doing from $5 - $10 million in contract research and employ a staff of 100-150 people.

APPENDIX A

FACULTY VITA

NAME: Mark Luker
RANK: Associate Professor
DEPARTMENT: Mathematical Sciences
HIGHEST DEGREE: Ph.D. (Berkeley) 1975
RESEARCH AREA: Microcomputers, 11 publications
SPECIAL EXPERIENCE: Designed a number of computer language special systems

NAME: Keith Pierce
RANK: Associate Professor
DEPARTMENT: Mathematical Sciences
HIGHEST DEGREE: Ph.D. (Wisconsin) 1970
RESEARCH AREA: Algebra of Ordered Groups, 11 publications
SPECIAL EXPERIENCE: Application of computers to study of ordered groups; several consulting contracts

NAME: Max Benson
RANK: Assistant Professor
DEPARTMENT: Mathematical Sciences
HIGHEST DEGREE: Ph.D. (Harvard) 1981
RESEARCH AREA: Symbolic manipulation of polynomials using computers, 2 publications
SPECIAL EXPERIENCE: Use of VAX computer system for research calculations

NAME: Richard Green
RANK: Assistant Professor
DEPARTMENT: Mathematical Sciences
HIGHEST DEGREE: Ph.D. (Berkeley) 1973
RESEARCH AREA: Statistics applied to natural science data, 13 publications
SPECIAL EXPERIENCE: Use of stochastic models in biology and in population problems

NAME: Thomas Jordan
RANK: Professor
DEPARTMENT: Physics
HIGHEST DEGREE: Ph.D. (Rochester) 1962
RESEARCH AREA: Mathematical and theoretical physics, 50 publications
SPECIAL EXPERIENCE: Hydrodynamics

NAME: Michael Sydor
RANK: Professor
DEPARTMENT: Physics
HIGHEST DEGREE: Ph.D. (New Mexico) 1964
RESEARCH AREA: Environmental physics and thermodynamics, 30 publications, over $1,000,000 in research grants
SPECIAL EXPERIENCE: B.S. is in engineering physics; computer modeling of satellite data

NAME: Bo Casserberg
RANK: Associate Professor
DEPARTMENT: Physics
HIGHEST DEGREE: Ph.D. (Princeton) 1968
RESEARCH AREA: Paramagnetic resonance, 3 publications
SPECIAL EXPERIENCE: Member of engineering honor society

NAME: Howard Hanson
RANK: Professor
DEPARTMENT: Physics
HIGHEST DEGREE: Ph.D. (Wisconsin) 1948
RESEARCH AREA: Atomic fluorescence, random geometrics, 12 publications
SPECIAL EXPERIENCE:

NAME: John Kroening
RANK: Associate Professor
DEPARTMENT: Physics
HIGHEST DEGREE: Ph.D. (Minnesota) 1962
RESEARCH AREA: Atmospheric ionization, ballistic hydrodynamics, 8 publications
SPECIAL EXPERIENCE: Office of Naval Research work on atmospheric ionization

NAME: Joseph Likely
RANK: Assistant Professor
DEPARTMENT: Physics
HIGHEST DEGREE: M.A. (Toronto) 1949
RESEARCH AREA: Elastic scattering of protons, 4 publications
SPECIAL EXPERIENCE: B.Sc. is in engineering physics

NAME: Vincent Magnuson
RANK: Associate Professor
DEPARTMENT: Chemistry
HIGHEST DEGREE: Ph.D. (Illinois) 1968
RESEARCH AREA: Application of computers to chemical modeling, 10 publications
SPECIAL EXPERIENCE: Developer of large computer data bases

NAME: Robert Carlson
RANK: Professor
DEPARTMENT: Chemistry
HIGHEST DEGREE: Ph.D. (Princeton) 1965
RESEARCH AREA: Organic synthesis and organic pollutants, 46 publications
SPECIAL EXPERIENCE: Application of organic analysis to environmental problems

NAME: Ronald Caple
RANK: Professor
DEPARTMENT: Chemistry
HIGHEST DEGREE: Ph.D. (Michigan) 1964
RESEARCH AREA: Stereochemistry and complex derivatives, 35 publications
SPECIAL EXPERIENCE: Member of special research group, Zelinsky Institute of Organic Chemistry, Moscow USSR

NAME: Thomas Bydalek
RANK: Professor
DEPARTMENT: Chemistry
HIGHEST DEGREE: Ph.D. (Purdue) 1961
RESEARCH AREA: Analytical chemistry, 16 publications
SPECIAL EXPERIENCE: Use of computer techniques to problems in analytical chemistry

NAME: Bilin Tsai
RANK: Associate Professor
DEPARTMENT: Chemistry
HIGHEST DEGREE: Ph.D. (North Carolina) 1975
RESEARCH AREA: Doubly charged ions, laser ionization, 9 publications
SPECIAL EXPERIENCE: Instrumental analysis

NAME: Larry Thompson
RANK: Professor
DEPARTMENT: Chemistry
HIGHEST DEGREE: Ph.D. (Illinois) 1960
RESEARCH AREA: Complexes of the rare earths, 24 publications
SPECIAL EXPERIENCE: Emission spectral analysis

NAME: Thomas Johnson
RANK: Associate Professor
DEPARTMENT: Geology
HIGHEST DEGREE: Ph.D. (University of California, San Diego) 1975
RESEARCH AREA: Sedimentology, 25 publications
SPECIAL EXPERIENCE: Seismic reflection studies

NAME: Richard Ojakangas
RANK: Professor
DEPARTMENT: Geology
HIGHEST DEGREE: Ph.D. (Stanford) 1964
RESEARCH AREA: Sedimentary petrology, uranium deposits, 30 publications
SPECIAL EXPERIENCE: U.S. Geological Survey

NAME: Ronald Morton
RANK: Assistant Professor
DEPARTMENT: Geology
HIGHEST DEGREE: Ph.D. (Carleton) 1976
RESEARCH AREA: Economic mineral deposits, 8 publications
SPECIAL EXPERIENCE: Member, American Institute of Mining Engineers

NAME: Timothy Holst
RANK: Associate Professor
DEPARTMENT: Geology
HIGHEST DEGREE: Ph.D. (Minnesota) 1977
RESEARCH AREA: Analytical structural geology and rock mechanics, 6 publications
SPECIAL EXPERIENCE: Ph.D. minor in geoengineering

NAME: George Rapp, Jr.
RANK: Professor
DEPARTMENT: Geology
HIGHEST DEGREE: Ph.D. (Geochemistry, Pennsylvania State University) 1960
RESEARCH AREA: Environmental Geology, 50 publications, 7 books
SPECIAL EXPERIENCE: Eight years a professor of geological engineering, 23 years a member of the Society of Mining Engineers, over $1,000,000 in research grants

NAME: Charles Matsch
RANK: Professor
DEPARTMENT: Geology
HIGHEST DEGREE: Ph.D. (Wisconsin) 1971
RESEARCH AREA: Quaternary geology, 12 publications, 2 books
SPECIAL EXPERIENCE: Three years a full-time geologist with Standard Oil Company

NAME: David Darby
RANK: Professor
DEPARTMENT: Geology
HIGHEST DEGREE: Ph.D. (Michigan) 1964
RESEARCH AREA: Paleontology and sedimentation, 10 publications
SPECIAL EXPERIENCE: Four years a full-time geologist with Mobil Oil Company

NAME: John Green
RANK: Professor
DEPARTMENT: Geology
HIGHEST DEGREE: Ph.D. (Harvard) 1960
RESEARCH AREA: Igneous geology, environmental geology, 30 publications
SPECIAL EXPERIENCE:

NAME: James Grant
RANK: Professor
DEPARTMENT: Geology
HIGHEST DEGREE: Ph.D. (Cal Tech) 1964
RESEARCH AREA: Phase equilibria in high-grade metamorphism, 13 publications
SPECIAL EXPERIENCE:

NAME: Douglas Dunham
RANK: Assistant Professor
DEPARTMENT: Mathematical Sciences
HIGHEST DEGREE: Ph.D. (Berkeley) 1975
RESEARCH AREA: Computer graphics, 3 publications
SPECIAL EXPERIENCE: B.S. is in physics

NAME: John Skelton
RANK: Assistant Professor
DEPARTMENT: Mathematical Sciences
HIGHEST DEGREE: Ph.D. (Denver) 1971
RESEARCH AREA: Computer software, 3 publications
SPECIAL EXPERIENCE: Director, UMD Computer Center; Eight years with Burroughs Corporation in computer systems

NAME: Donald Harriss
RANK: Professor
DEPARTMENT: Chemistry
HIGHEST DEGREE: Ph.D. (Northwestern) 1963
RESEARCH AREA: Application of computer methods to chemical equilibria, 20 publications
SPECIAL EXPERIENCE: Development of large computer data bases for chemical applications

APPENDIX B

UMD COMPUTER CENTER

Computer Center

The mission of the UMD Computer Center is to provide quality computer services to support the UMD academic program -- instruction, research and public service. The Center houses and operates a Control Data Corporation Cyber 171-6 and provides additional access to the other University systems located in the Twin Cities. The local Cyber 171 is classed as a large-scale, high-speed general purpose computer system supporting batch, time-sharing and remote batch access. The system contains 96,000 words (60 bits) of central memory and in excess of 700,000,000 characters of on-line disk storage. Thirty time-sharing ports and two remote batch ports are supported. The central system also contains a 1,200 card per minute card reader, two 1,200 line per minute line printers, a card punch and magnetic tape drives. A four-color graphics plotter with an accuracy of 0.001 inch is supported by the system. The major programming languages FORTRAN, COBOL, BASIC and Pascal are available as are other more specialized software packages such as SPSS, SIR, BMDP, GPSS, and GIMMS.

UMD computer users have access not only to the above equipment but also access to the facilities on the Twin Cities Campus through a time-sharing multiplexor that provides twenty ports of simultaneous usage over a dedicated communications line and a remote batch station that operates over another dedicated communications line.

The UMD Computer Center operates seven All University Instructional Laboratories that house equipment to access the UMD computational facilities. The equipment in these laboratories is available for use by all UMD students and faculty on a first-come, first-served basis. These laboratories contain 36 time-sharing terminals, 14 keypunches and 15 microprocessor systems (IBM PC, Xerox 820, Apple II and Terak) which can also access

the main-frame systems. Several other complexes of terminals and microprocessors are housed on campus for support of research or other specialized projects but are not available for general use.

It is the opinion of the center that the UMD Computer Center provides access to more computer power per student than does any other institution of higher education in the state with the possible exception of the Twin Cities Campus. This opinion is shared by several other departments, the most significant being the Mathematical Sciences Department which houses the computer science degree program.

This last winter, bids to upgrade the Cyber 171 were requested with the successful bidder being the Control Data Corporation. As a result, a Cyber 170/815 with 262,000 words (64 bits each) of central memory will be installed on or about July 1, 1983. This system was benchmarked in December with the result that it should provide 20 percent more processor power and at least a 40 percent increase in throughput. With this change in the central processor, an additional seventeen time-sharing ports will be added and the on-line disk storage system will be increased to 1,000,000,000 characters.

At the present time, bids are out for a UNIX based system to provide initially eight, with the potential to expand to sixteen, ports of UNIX service. This system will be housed and operated by the UMD Computer Center as an expansion of the presently supported computational facilities and will be used to meet the growing non-numerical computational needs of the campus. Bids are expected back on April 1, 1983 with the expectation that the system will be installed in the summer of 1983.

The UMD Administration has developed a plan to greatly increase the number of microprocessors available for student use on campus. Present planning calls for from 40 to 50 such systems to be acquired. The financing of this program is now under consideration.

APPENDIX C

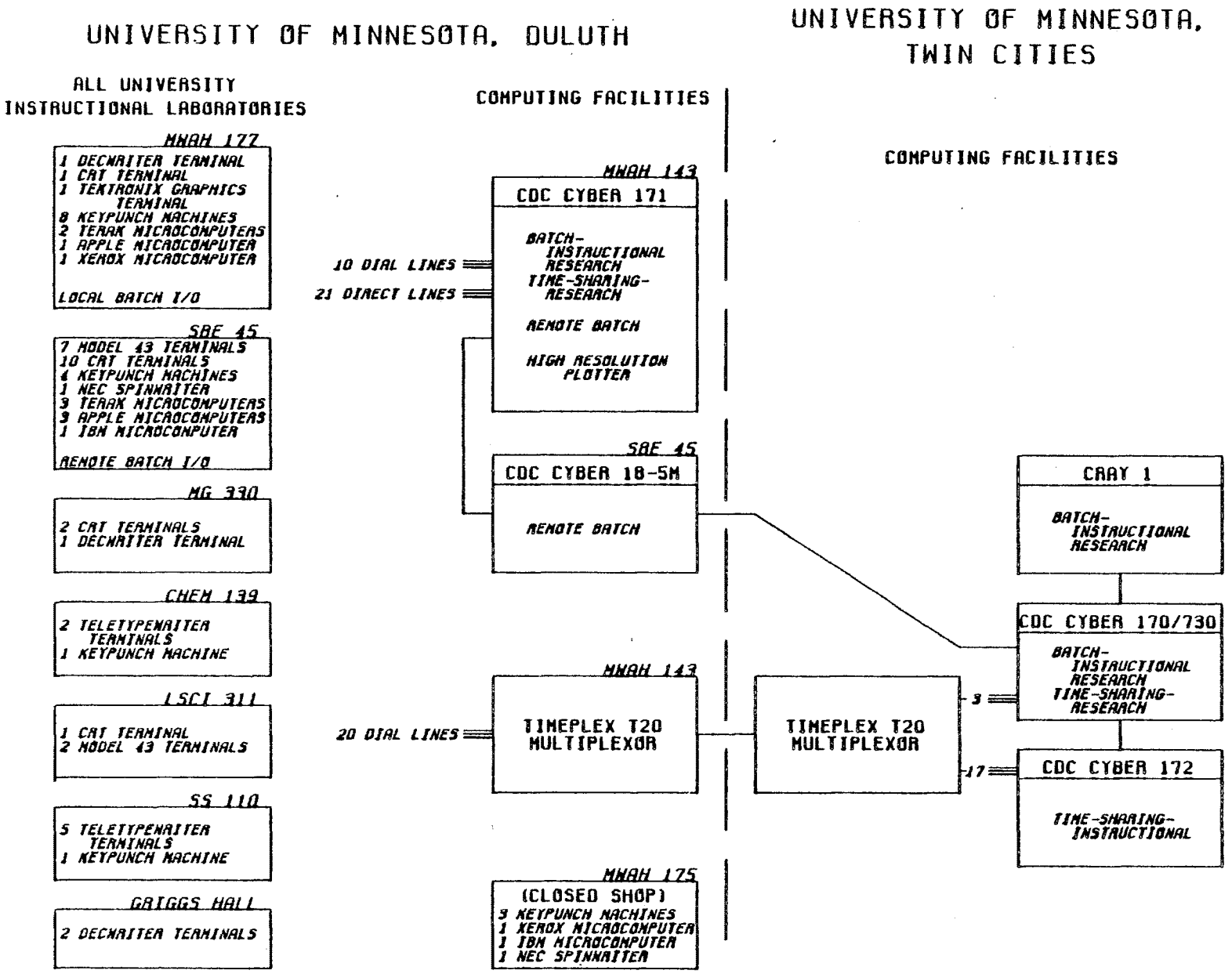
MEMBERSHIP LISTS

of

DULUTH HIGH TECH TASK FORCE

DULUTH FUTURES TASK FORCE

MINERALS DEVELOPMENT COMMISSION


UNIVERSITY OF MINNESOTA, DULUTH
UNIVERSITY OF MINNESOTA, TWIN CITIES
ALL UNIVERSITY INSTRUCTIONAL LABORATORIES
COMPUTING FACILITIES
COMPUTING FACILITIES
MWAH 177
1 DECWRITER TERMINAL
1 CRT TERMINAL
1 TEKTRONIX GRAPHICS TERMINAL
8 KEYPUNCH MACHINES
2 TERAK MICROCOMPUTERS
1 APPLE MICROCOMPUTER
1 XEROX MICROCOMPUTER
LOCAL BATCH I/O
SBE 45
7 MODEL 43 TERMINALS
10 CRT TERMINALS
4 KEYPUNCH MACHINES
1 NEC SPINWRITER
3 TERAK MICROCOMPUTERS
3 APPLE MICROCOMPUTERS
1 IBM MICROCOMPUTER
REMOTE BATCH I/O
MG 330
2 CRT TERMINALS
1 DECWRITER TERMINAL
CHEM 139
2 TELETYPEWRITER TERMINALS
1 KEYPUNCH MACHINE
LSCI 311
1 CRT TERMINAL
2 MODEL 43 TERMINALS
SS 110
5 TELETYPEWRITER TERMINALS
1 KEYPUNCH MACHINE
GRIGGS HALL
2 DECWRITER TERMINALS
MWAH 143
CDC CYBER 171
BATCH-INSTRUCTIONAL RESEARCH
TIME-SHARING-RESEARCH
REMOTE BATCH
HIGH RESOLUTION PLOTTER
10 DIAL LINES
21 DIRECT LINES
SBE 45
CDC CYBER 18-5M
REMOTE BATCH
MWAH 143
TIMEPLEX T20 MULTIPLEXOR
20 DIAL LINES
MWAH 175
(CLOSED SHOP)
3 KEYPUNCH MACHINES
1 XEROX MICROCOMPUTER
1 IBM MICROCOMPUTER
1 NEC SPINWRITER
TIMEPLEX T20 MULTIPLEXOR
CRAY 1
BATCH-INSTRUCTIONAL RESEARCH
CDC CYBER 170/730
BATCH-INSTRUCTIONAL RESEARCH
TIME-SHARING-RESEARCH
3
17
CDC CYBER 172
TIME-SHARING-INSTRUCTIONAL

COMPUTER CENTER

University of Minnesota, Duluth

The mission of the UMD Computer Center is to provide quality computer services to support the UMD academic program-instruction, research and public service. To fulfill this mission, the Center operates a local large-scale, high-speed general purpose computer system and also provides access to computer systems on the Twin Cities Campus of the University. These resources are available for use by units of government, nonprofit organizations and commercial enterprises in the Twin Ports area.

The locally installed Control Data Corporation Cyber 171 is capable of executing well over one million operations per second and can be accessed by batch, interactive and remote-batch facilities. The UMD Computer Center also provides remote-batch and interactive access to the Twin Cities computer systems--a Cyber 170/730, a Cyber 74 and a Cray Research Corporation CRAY 1B.

LANGUAGES:

FORTRAN, COBOL, PASCAL, BASIC

PACKAGES:

SPSS (Statistical Program for the Social Sciences)
SIR (Scientific Information Retrieval)
BMDP (Biomedical Computer Programs)
GPSS (General Purpose Simulation System)
GIMMS (Geographic Information Management and Mapping System)
Graphics support software
Technical text processing software

SPECIAL FACILITIES:

High resolution, high quality graphics plotter (30" x 120', four color, 0.001" resolution)
U. S. Census data and retrieval facilities
Consulting, programming and data entry services

FOR MORE INFORMATION:

John E. Skelton, Director, 726-7587
Thomas M. Nylen, Manager of User Services, 726-8845

DULUTH HIGH TECH TASK FORCE

Members

Sally Burns
Duluth School Board
1040 Missouri
Duluth, MN

Lars Fladmark, Exec. Vice President
Harcourt, Brace, Jovanovich Pub.
Duluth, MN

Phyllis France
Bush Foundation, Board of Directors
Duluth, MN

Robert Heller
Provost
University of Minnesota, Duluth
Duluth, MN

Mike Jaros
Governor's Minerals Development Comm.
Duluth, MN

Eleanora Johnson
City Council
Duluth, MN

Robert Marchetti, Sr. Vice President
Minnesota Power
Duluth, MN

Harry Munger
Attorney
Duluth, MN

Richard Palmer, Publisher
Duluth Budgeteer
Duluth, MN

Vlasie Solon, Manager
Dain, Bosworth Inc.
Duluth, MN

Maria Van Brunt
Education Consultant
Duluth, MN

MEMBERS OF DULUTH FUTURES TASK FORCE

Dennis Dunne, President
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Duluth, MN 55801

Alfred France, President
Lake Superior Industrial Bureau
828 First National Bank Building
Duluth, MN 55801

James H. Claypool, President
First Bank-Duluth
306 West Superior Street
Duluth, MN 55801

Clinton Ferner, General Manager
Duluth, Missabe & Iron Range Railway
500 Missabe Building
Duluth, MN 55802

Gerald Heaney, U.S. Circuit Judge
315 Federal Building
Duluth, MN 55802

Donald B. Shank, President
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A & E Supply Company
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Manley Investment Company
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KDLH - TV
425 West Superior Street
Duluth, MN 55802

John McMillion, Publisher
Duluth Herald & News Tribune
424 West First Street
Duluth, MN 55802

Robert S. Mars, Jr., President
W.P. & R.S. Mars Company
215 South 27th Avenue West
Duluth, MN 55806

Jeno Paulucci, Chairman of the Board
Jeno's Inc.
525 Lake Avenue South
Duluth, MN 55802

Jack Rowe, President
Minnesota Power
30 West Superior Street
Duluth, MN 55802

Robert L. Heller, Provost
University of Minnesota, Duluth
515 Darland Administration Building
Duluth, MN 55812

Vernon Harrington, Physician
Duluth Clinic, Ltd.
400 East 3rd Street
Duluth, MN 55805

Charles Westin, Exec. Vice President
Northeastern Minn. Development Assn.
800 Alworth Building
Duluth, MN 55802

Lars Fladmark, Executive Vice President
Harcourt, Brace, Jovanovich Publications
1 East First Street
Duluth, MN 55802

Dennis Leavitt, District Manager
Northwestern Bell Telephone Company
322 West First Street
Duluth, MN 55802

MINERALS DEVELOPMENT COMMISSION

Committee Members

J. H. DeLuca, President (Chairman)
Abe W. Mathews Engineering Co.
555 West 27th Street
Hibbing, MN 55746

Jack Rowe, President
Minnesota Power
30 West Superior Street
Duluth, MN 55802

Dick Maki, Business Agent
AFL-CIO, Local 1091
2002 London Road
Duluth, MN 55812

Art Samuel, Assistant to President
Reserve Mining Company
Silver Bay, MN 55614

Dennis Dunne, President
First National Bank of Duluth
230 West Superior Street
Duluth, MN 55801

Robert Frans, Director, Research Lab.
Hanna Mining Company
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Nashwauk, MN 55619

Thomas A. Vecchi, President
Thomas & Vecchi, Inc.
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Duluth, MN 55812

Tom Smrekar, Manager
Wood Products Division
Potlatch Corporation
Cloquet, MN 55720

Donald Grubich, Research Director
Iron Range Resources & Rehab. Board
P. O. Box 441
Eveleth, MN 55734

Clifford Niemi, Engineering Research Dir.
U. S. Steel
P. O. Box 417
Mountain Iron, MN 55768

John Basso, Research Director
Pickands Mather
P. O. Box 278
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Donald Harriss, Asst. V. Provost, Acad. Admin.
University of Minnesota, Duluth
413 Darland Administration Bldg.
Duluth, MN 55812

Douglas Johnson, Senator
205 Capitol Building
St. Paul, MN 55155

Sam Solon, Senator
303 Capitol Building
St. Paul, MN 55155

Gerald Heaney, U.S. Circuit Judge
315 Federal Building
Duluth, MN 55802

Robert L. Heller, Provost
University of Minnesota, Duluth
515 Darland Administration Building
Duluth, MN 55812

Charles Westin, Exec. Vice President
Northeastern Minn. Development Assn.
800 Alworth Building
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