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ABSTRACT

To draft a proposal for cooperative use of computing resources among state university system units, community colleges and private colleges in Montana, a task force examined present resources and proposed strategies for the future. Recommendations are given in areas of management, hardware, software, staff, funding, training, and communications interfaces. A three-phase implementation plan is proposed, covering organizational structure, extension of the network and provision for continuing funding. An inventory of current hardward by institution is appended. (SK)

MONTANA UNIVERSITY SYSTEM

AND POST SECONDARY EDUCATION

OFFICE OF THE COMMISSIONER OF HIGHER EDUCATION

Helena, Montana

Units of the Montana University System

University of Montana, Missoula
Montana State University, Bozeman
Eastern Montana College, Billings
Northern Montana College, Havre
Western Montana College, Dillon
Mont. College of Mineral Science & Technology, Butte

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UNIVERSITY SYSTEM
COMMITTEE ON COMPUTER USE

TASK FORCE REPORT

FINAL
NOVEMBER 2, 1973

INTRODUCTION

As a result of the May 18, 1973 meeting of the University System Committee on Computer Use, a Task Force assembled in Helena on July 23 - 25 to draft a proposal for the cooperative use of computing resources among the University System units, the Community Colleges, and the private colleges associated with higher education in Montana. The members of this Task Force are:

Bayliss Cummings - Flathead Valley Community College

Frank Greenwood - University of Montana

Jack Hall - Eastern Montana College

Lou Lucke - Montana State University

Jim Lucke - Data Processing Bureau, Department of Administration

Russ Roy - Communications Bureau, Department of Administration

Bill Lannan was host and coordinator for the meetings at the Office of the Commissioner of Higher Education.

A second meeting of the Task Force was held on August 28 - 30 to complete the proposal for presentation to the whole committee on October 12, 1973. The final proposal was approved in this form.

COMPUTING RESOURCES

The term "computing resources," as used by the committee in this report, has a broad connotation. It includes computing hardware of all sizes except noncommunicating calculators and bookkeeping machines and computing software of all kinds (operating systems, general languages, instructional and data processing programs). The computer expertise furnished by analysts, programmers, faculty, technical specialists, and computer professionals is also an important computing resource. Given the communications problem caused by the widespread location of the units for higher education, whatever facilities are utilized for sharing computer resources should be recognized as part of the resources. These would include communication hardware, control units, newsletters, manuals and the people who transfer computing power from one unit to another. Computing resources referred to in this report, then, encompass hardware, software, expertise, and people.

GOALS

The University System Committee on Computer Use proposes the following basic goals:

1. Computing in higher education must support the goals established for the various units of higher education.
2. Computing must contribute to the solution of the increasingly complex problems which face students, faculty, and administrators in the modern colleges of today and the future.
3. Computing resources must be managed effectively, efficiently, and economically.
4. Up to date, reliable computing resources should be provided at optimum cost through cooperation among users.

STRATEGY

It is not economically feasible for each unit of higher education to support a computing center capable of meeting all the unit's needs. However, nearly all computing needs can be met economically through the sharing of resources. Colleges which have computing facilities and those without all stand to gain from a cooperative approach. For a small cost, computer resources can be available to those colleges without them; and colleges which already have facilities can benefit from economies of scale as their systems grow to meet the needs of a wider range of users. The Committee realizes that this concept imposes some constraints upon individual units, but the benefits outweigh the disadvantages. To make such cooperation possible, agreement must be reached on the following points:

1. General purpose computing hardware should be shareable. This means that both in the upgrading of present equipment and in the acquisition of new facilities, consideration must be given to the communication of information between machines, machines and people, and among people. Exceptions to this generalization may occur if a specialized type of equipment is to be used only for a specific job.
2. All non-proprietary software should be equally available to all users, though data files would not necessarily be available to all. This is one of the big advantages of a cooperative system. Ideally, a student should have access to any program in the system, even if his college has only a small computer, or just a terminal. Unnecessary duplication of the creation or use of programs would be avoided, yet students and administrators could have some or all of the software they need.

3. Computing expertise should be available to all users. Currently, there is a wide disparity in use of computers among the units of higher education in Montana. This is due not only to the lack of facilities at some units, but also to the lack of know-how. This gap can be narrowed by providing ways for those who know how to use computers to help those who don't.

4. Management of the shared portion of computing resources should reside in the Office of the Commissioner of Higher Education. The Committee hopes to minimize the impact on present computer center management procedures, yet for the best use of computing in higher education, some coordination at the state level is necessary. Management duties pertaining to the sharing of resources should be handled by a state-wide centralized agency, while matters pertaining to local affairs should be handled by the local unit.

5. Success of this cooperative activity is dependent upon the understanding and support of all those concerned with higher education in Montana. This means that the concept and the plan that is developed will need the active support and commitment of the participating units, faculties, their presidents, the governing boards, the Commissioner of Higher Education, the legislature, the Governor, and finally the public to whom we are all ultimately responsible.

6. A detailed set of recommendations and an implementation plan must be developed and accepted by the appropriate levels of government mentioned above.

PRESENT FACILITIES

Before a detailed plan can be developed, we must take a close look at the computing resources now available, and state some basic assumptions about the present and future of computing in higher education. The tables on the following pages give some indication of the hardware and personnel resources currently available and utilized by higher education in Montana.

Hardware Inventory*

Unit	Equipment: Medium	Small	Mini	Digital Communication	Other Services
University System					
UM	Digital Equipment Corporation System 10			On line	Batch processing
UM			Digital Equipment Corporation PDP 11		Batch processing and "hands on" training
UM**			Digital Equipment Corporation PDP 11		Batch processing and "hands on" training
MSU	Xerox Sigma 7			On line	Batch processing
MSU			Hewlett Packard 2115A		Data acquisition and control
MSU			Hewlett Packard 2116A		Data acquisition and control; "hands on" training
MSU			Hewlett Packard 2116B	Terminal capacity	Batch processing; data acquisition and control; "hands on" training
EMC				On line terminal to MSU	
EMC		IBM 360/20			

* See Appendix A for detailed specifications

** On order and to be located at Malstrom Air Force Base in Great Falls, Montana for the off-campus Master of Business Administration program.

	Equipment				
Unit	Medium	Small	Mini	Digital Communication	Other Services
NMC			Hewlett Packard 2114B	On line terminals	Used for electronics training
NMC				On line terminals to MSU	
NMC					Use IBM System 3 at Vita Rich Dairy for administrative use only
Montana Tech		IBM 1620 Model 2			
Montana Tech		IBM 1620 Model 2			
WMC					Uses Montana Tech by mail
Private Colleges					
Rocky Mountain College					
College of Great Falls					Uses Acro Service Bureau
Carroll College				On line terminal to MSU	
Carroll College					Uses Montana Physicians Service for batch material
Carroll College			Digital Equipment Corporation PDP 8/e		"Hands on" training

Hardware Inventory
(continued)

Unit	Equipment: Medium	Small	Mini	Digital Communication	Other Services
Community Colleges					
Flathead Valley Community College		IBM 1130		Communication Adapter	
Dawson College					
Miles Community College					

Personnel Inventory

College	Operator	Data Entry	Systems	Applications	Instruction Faculty	Students Involved
UM Center	6	6	1	5	3 in Comp. center 15%	15-20%
MSU Center	8	2½	4	3	60%	40%
MSU Admin.		4		8		
EMC	1	1	1	1	7%	10%
NMC	1½	2		½	10%	5%
Tech	1	½		1	10%	5%
WMC					1 Faculty	1%
FVCC	½	1½	½	½	10%	10%
Dawson						
MCC					1 Faculty	
CGF					1 Faculty	
Carroll		1		2	2 Faculty	5%
Rocky					1 Faculty	

Basic Assumptions

Higher education is currently under study and may face extensive realignment in the future. But whatever form higher education takes, there are some basic assumptions about computing resources which can be generally agreed upon. The following assumptions form the rationale for this development plan:

1. <u>There is a valid and growing demand for computing in higher education</u>. Increasingly, students in college need access to computers as part of their instructional programs. Business, industry and the professions are demanding more computer skill and understanding. In almost every field, the student who is not familiar with computers and their uses is seriously handicapped.

   To meet the growing needs for accountability, centralization, detailed reporting, and to provide the basis for modern management practices, college administrators must have the necessary tools. Data processing equipment and techniques can help solve the problems of student record management, budget control, payroll, housing, food, library, bookstore, physical plant allocation and maintenance, and many other problems associated with the operation of today's complex college enterprises. If individual administrators desire to use them, computing resources should be available.

   The current level of research in almost every area is being cut back for lack of funding, but it is nevertheless true that most research projects require computing activity in the gathering and analysis of data, as well as in the preparation of progress reports. Only those institutions which can demonstrate their ability to meet these demands will be eligible for the limited amount of available funds.

The colleges and universities in the state are increasingly being called upon to supplement and extend the facilities of the secondary schools, and other state and local agencies. By making the computing power of higher education available to other areas of government activity, the public interest can be better served.

2. Standardized reporting, summarizing of information, and centralized accounting required by state and federal government will increase the need for computing resources in higher education.

3. Enrollment trends vary, but total demand for computing will continue to increase. Enrollments at the University System units have leveled off, while increases have occurred at the community colleges in recent years. Even if a decline in total students enrolled occurs, a growing proportion of students require computing resources as part of their academic instruction. Present computing facilities are inadequate for current and future needs of higher education.

4. Additional computing resources must be justified on the basis of statewide higher education needs, as well as local institutional requirements. This will necessitate that alternatives regarding acquisition, use, and disposal of resources must be studied carefully to determine the most cost-effective way to provide maximum usage to all participants.

5. Existing installations have a responsibility to provide computing service to other units of higher education without harming service to their present users.

6. All students, faculty, and administrators in higher education should have equal access to the basic computing resources without regard to geographic location. (This assumption forms the basis for much of the plan which follows.)

Recommendations

The Committee on Computer Use has analyzed the computing resources currently available and tried to project the needs for computing in higher education. In an attempt to provide these needs, the Committee has formulated some recommendations to be considered by all agencies responsible for higher education in Montana. From these recommendations a state-wide network of computing resources can be built to serve the University units, community colleges, and those private colleges who wish to participate. Among the areas which need to be considered are management, hardware, software, staff, funding, training, and communications interfaces.

1. Management recommendations. A Committee on Computing Coordination should be formed to establish network policy and to formulate long range plans. This Committee should be composed of one representative from each participating institution, a representative from the Office of the Commissioner of Higher Education, and a representative from the Department of Administration. (Initially, an ad hoc Committee would be formed from potential participants. This Committee would draft a set of by-laws, propose basic policies, and compose representative contracts. These would then be submitted to the potential participants for approval and those approving it would form the permanent Committee.) Membership in the network would be indicated by contracting to use or supply a specified amount of network computing service.

   Coordination and implementation of policy will ultimately require some staff. The Committee will assume the responsibility of selecting a full-time coordinator when such a position seems justified, but until that time, it is recommended that the Office of Commissioner of Higher Education furnish the secretarial and coordinating help required to start the project.

As a state-wide network becomes a reality, the Committee should consider the possibilities of enlarging the scope of its resources. It may become desirable to affiliate with other agencies of state and local governments, or become part of some larger network.

2. Hardware recommendations. The concept of a network of computer resources is based on the fact that information can be moved from one place in a network to another. This requires that code translation and signal sychronization between network nodes must be practical. The design of the necessary hardware and communication gear to perform this function should guarantee an individual user reliable computing power from any location on the network.

   An orderly growth of network resources can be accomplished only by considering each acquisition, modification, or removal of equipment in terms of its contribution to the entire network. Such things as code structures, transmission rates, usage accountability programs, and general computer architecture need to be considered at each stage of network development. For this reason, the Department of Administration should request that network computer hardware acquisitions at units of higher education be recommended by the Committee. The Committee will maintain an inventory of all computing hardware in higher education in Montana.

3. Software recommendations. One of the most valuable resources which can be made available to participants is a complete software library. The Committee should be responsible for establishing a software inventory, documentation standards, methods of acquisition, certification and maintenance of programs, and for disseminating information about available software to users.

4. Staff recommendations. A full-time coordinator and possibly some part-time clerical staff will probably be necessary to implement the plans of the Committee. The expenses incurred by this staff and by the Committee should be paid by the participating institutions as part of the usage fees charged by the network.

5. Funding and billing recommendations. The Committee on Computer Coordination should be responsible for acquiring the funds to implement the network. The Board of Regents should authorize the Committee to seek funds for start-up costs from legislative appropriations, gifts, foundation grants, or any other possible sources. Continuing operating expenses will be paid by the participating institutions in usage fees. For effective administration, each participating institution should be asked to contract for a specified amount of service each year. These contracts should include computing costs, communication costs, and administrative costs associated with the network.

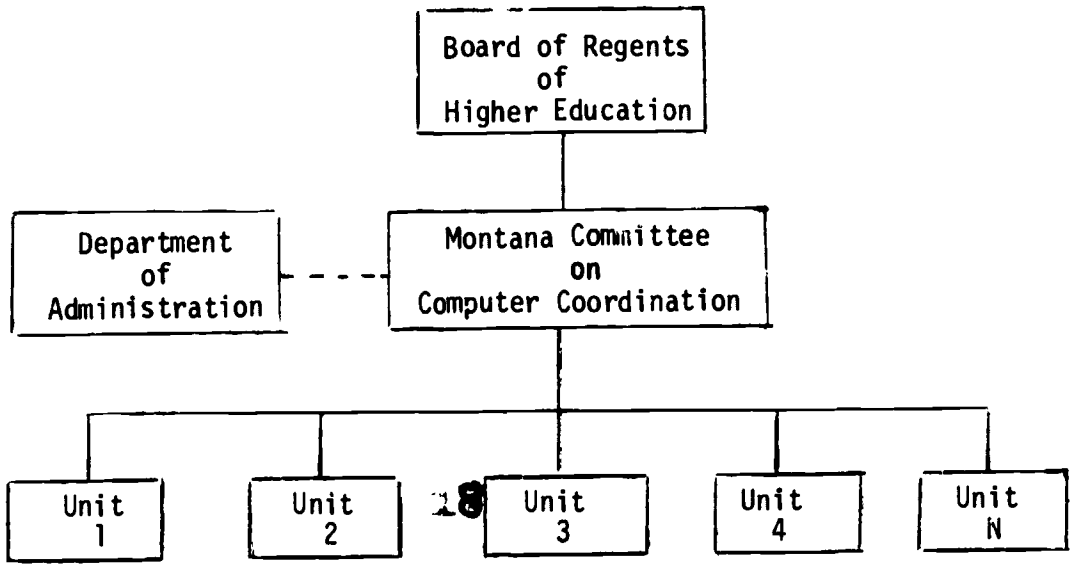
   The Committee should be responsible for establishing and adjusting rates for the users of the network. In cases where individual units have acquired computer resources on their own which are subsequently shared, the Committee will negotiate an equitable distribution of costs among those who use the resources. It will be necessary to work out a scheme for collecting and analyzing usage information on a unit cost basis, billing colleges each month, and providing for the collection and arbitration of the accounts.

6. Training recommendations. The Committee should train users as necessary to insure easy access to the computing resources. This may take the form of orientation classes for individual users, preparation of manuals, exchange of personnel, a traveling trouble shooter, or any other method

of training which the Committee and the participants may deem desirable.

7. Communications interfaces recommendations. At the heart of the network concept is the problem of providing communications for both machines and people. Good equipment and good planning are required to provide reliable voice and data communications. It is highly desirable to provide for concurrent voice and data communication from any participant to any other participant. In planning for the communications requirements, considerable flexibility should be built into the system to provide for subsequent growth. The Committee will work with the Bureau of Communications to determine how best to meet the needs of the network, and to provide for recovering the cost of the communications from users of the facilities.

In addition to the physical apparatus required for a successful network, there needs to be close articulation between various groups which are affected by such a cooperative venture. Outlined below in block diagram form is a recommended organizational interface plan which shows the relationship between elements of the network and various other agencies. (Solid lines reflect direct network control while dashed lines reflect network liaison and information exchange.)



Ultimately, other governmental agencies and commercial enterprises may wish to utilize the computing network of the units for higher education in Montana. The Committee should establish policy recommendations to the Department of Administration regarding these possibilities.

Implementation Plan

Implementing a plan for the cooperative use of computing resources in higher education may be slow, since funds for this purpose are severely restricted. With this constraint in mind, the Committee on Computer Use proposes a three-step timetable to establish a fully operational computer network by the beginning of 1975.

Phase I - Set up the organizational structure for the network and secure the necessary approval to proceed.

Phase II - Extend the present network on an experimental basis.

Phase III - Provide for proper funding on a continuing basis.

Phase I: To July 1, 1974

Each member of the Computer Use Committee will be responsible for acquainting his administrators, faculty, and in some cases, his governing board, with the network plans. Any Committee member may call on members of the Task Force for assistance in presenting the plan to his institutional representative. Th. can be done by contacting William Lannan in the Office of the Commissioner of Higher Education who will make the necessary arrangements.

A final presentation of the plan will take place at the January or February meeting of the Board of Regents. Two members of the Task Force, Lou Lucke, Montana State University, and Bayliss Cummings, Flathead Valley Community College, will deliver this presentation.

Early in 1974, it should be possible for each prospective user institution to appoint a person to serve on the ad hoc Committee on Computer Coordination referred to in part one of the Recommendations. This person may or may not be the same one who is now serving as a member of the Committee on Computer Use. This ad hoc Committee on Computer Coordination will draft a set of by-laws, propose basic policies, and compose representative contracts. Those institutions which indicate their willingness to participate in the network on at least an experimental basis will name a representative to the permanent Committee by May 1, 1974. Individual units will need to make budget provisions for terminals, communications costs, computer time, etc., for the fiscal year beginning July 1, 1974.

Phase II: July 1, 1974 - January 15, 1975

The beginning of a computer network in higher education already exists, since there are remote terminal connections to the major computing centers at the University of Montana and Montana State University. Institutions with no computer capability will need remote terminals (possibly borrowed) during this experimental phase. Ideally, each unit should utilize a terminal for most of a school year to develop an awareness among students, faculty, and administration; but, if necessary, a portable terminal could be circulated among those schools which need this kind of help.

During this experimental phase, it would be desirable to provide for inter-communication between the computers at Missoula and Bozeman. Code translation between these two machines can be handled on a limited basis by programmed software, but if the need to continue this link becomes evident, a separate mini-computer at Bozeman, Missoula, or Helena would be required for code translation and switching.

Data communications pose a serious problem for the developing network. However, some units are using available facilities at very little incremental cost. Where state "hot lines" are available, it may be possible to use these circuits after regular business hours. The Bureau of Communications is anxious to be of service in providing adequate communications at reasonable cost. Ultimately, it would be desirable to provide for station to station capability, but during this second phase of development, each college will have access to a computer through a terminal. Eventually the University of Montana and Montana State University computers will be able to communicate.

Phase III: December 15, 1974 - June 30, 1975

A statewide computer network for higher education in Montana will need the careful planning and enthusiastic support outlined in Phase I; it will need the evolutionary development described in Phase II; but its long range success will be determined by how well it meets the needs of its users. During the first two phases of this plan, suppliers of computer resources should make every effort to encourage the participation of all colleges in Montana. Once the feasibility of the plan is demonstrated, the system will have to be self-supporting.

The experimental Phase II will provide some guidelines regarding amounts of usage, peak periods, types of usage, etc. Some figures will be available regarding costs of communications, software, hardware, and additional people required to service the network. It is the intention of the Committee that these costs be covered as part of the rate structure, and that payment for network computer service be made as simple as possible. An example of the type of billing system that could be used is presently in operation between Northern Montana College and Montana State University. Currently, MSU sends a monthly bill to Northern for the amount of time the computer was used. The rate presently charged is calculated to cover the cost of providing the service.

Under the network plan, a small surcharge would be added to the basic rate, and this amount would be sent to the Committee by the unit to cover network overhead. Both the basic rate and the surcharge should be kept as low as possible to encourage network usage. However, there will be a need to make some fairly sizeable commitments by early 1975 if the network is to be a viable organization. Development of a firm budget will be dependent upon the outcome of the first two phases of this plan, but even now we can forecast some typical annual expenditures which will need to be

made beginning in 1975.

Coordinator salary	$13,500
Clerical - librarian	5,000
Travel expense	4,000
Software development	1,000
Communications	300
Supplies - equipment	1,500
	$25,300

There are essentially two ways to fund the network overhead:

1. Direct appropriations to the Office of the Commissioner of Higher Education for use by the Committee on Computer Coordination.
2. Adequate funds at the unit level to provide for increased usage fees.

If the direct appropriations route is taken then the Office of the Commissioner of Higher Education would be responsible for providing the coordination needed by the network. Funding at the unit level would require a realignment of priorities to provide computer usage money where there may have been little or none before. At this point, it seems reasonable to employ a combination of these two methods, with emphasis on direct appropriations for the first few years, then gradually shifting the financial responsibility to the users in the form of increased rates.

Conclusion

The University System Committee on Computer Use has devoted a great many hours to the development of a long range plan which is designed to provide computer resources for students, faculty, and administrators in higher education in Montana. The concept of sharing resources through a network is working in other states, and in fact is already working in Montana. In our opinion, it offers the most computing power to the most people at the least cost. It is our purpose to design a workable organization, develop a usable network by extending the present system, and to provide for a growing program by assuring adequate funding. Many of the technical people and managerial people are already available within the state and by utilizing these skills, it will be possible to bring computing resources to all elements of higher education in Montana.

APPENDIX A - - HARDWARE INVENTORY

UNIT University of Montana

MACHINE	INTERNAL STORAGE	CARD PUNCH	CARD READER	LINE PRINTER	PAPER TAPE READER PUNCH	MAG-NETIC TAPE UNITS	DISK		PLOTTER	TERMINAL PORTS	OTHER
							perma-nent	remov-able			
Digital Equipment Corp. Mod 10	96K words	1	1	1	1	3		3	1	24	
Digital Equipment Corp. PDP Mod 11	16K words				1					2	
Digital* Equipment Corp. PDP Mod 11-e10	16K words				1	1		1		2	

* On order, to be located at Malstrom Air Force Base, Great Falls, Montana, for the off-campus Master of Business Administration Program.

APPENDIX A - - HARDWARE INVENTORY

UNIT: Montana State University

MACHINE	INTERNAL STORAGE	CARD PUNCH	CARD READER	LINE PRINTER	PAPER TAPE READER PUNCH	MAG-NETIC TAPE UNITS	DISK		PLOTTER	TERMINAL PORTS	OTHER
							per.a-nent	remov-able			
Xerox Sigma 7	96K words	1	2	2		3	3	4	1	32	
Hewlett Packard 2115A	8K words				1						Portable Real Time Data Acquisition and Control
Hewlett Packard 2116A	8K words				1					1	Real Time Data Acquisition and Control
Hewlett Packard 2116B	16K words	1	1	1	1	1		1	1		Real Time Data Acquisition and Control

APPENDIX A - - HARDWARE INVENTORY

UNIT _ Western Montana College

MACHINE	INTERNAL STORAGE	CARD PUNCH	CARD READER	LINE PRINTER	PAPER TAPE READER PUNCH	MAG-NETIC TAPE UNITS	DISK		PLOTTER	TERMINAL PORTS	OTHER
							perma-nent	remov-able			
IBM Model 29											Key Punch

APPENDIX A - - HARDWARE INVENTORY

UNIT Eastern Montana College

MACHINE	INTERNAL STORAGE	CARD PUNCH	CARD READER	LINE PRINTER	PAPER TAPE READER PUNCH	MAG-NETIC TAPE UNITS	DISK		PLOTTER	TERMINAL PORTS	OTHER
							perma-nent	remov-able			
IBM 360/20	4K words	1	1	1				2			

APPENDIX A - - HARDWARE INVENTORY

UNIT Northern Montana College

MACHINE	INTERNAL STORAGE	CARD PUNCH	CARD READER	LINE PRINTER	PAPER TAPE READER PUNCH	MAG-NETIC TAPE UNITS	DISK		PLOTTER	TERMINAL PORTS	OTHER
							perma-nent	remov-able			
Hewlett Packard HP2114B	8192 words		1		1					1	

APPENDIX A - - HARDWARE INVENTORY

UNIT Montana College of Mineral Science & Technology

MACHINE	INTERNAL STORAGE	CARD PUNCH	CARD READER	LINE PRINTER	PAPER TAPE READER PUNCH	MAG-NETIC TAPE UNITS	DISK		PLOTTER	TERMINAL PORTS	OTHER
							perma-nent	remov-able			
IBM 1620 Model 2	60K units	1	1					2			
IBM 1620 Model 1	40K units	1	1						1		

APPENDIX A - - HARDWARE INVENTORY

UNIT Flathead Valley Community College

MACHINE	INTERNAL STORAGE	CARD PUNCH	CARD READER	LINE PRINTER	PAPER TAPE READER PUNCH	MAG-NETIC TAPE UNITS	DISK		PLOTTER	TERMINAL PORTS	OTHER
							perma-nent	remov-able			
IBM 1130	8K words	1	1	1				1			1-085 Sorter, 2 Key Punch Machines

APPENDIX A - - HARDWARE INVENTORY

UNIT _ Carroll College

MACHINE	INTERNAL STORAGE	CARD PUNCH	CARD READER	LINE PRINTER	PAPER TAPE READER PUNCH	MAG-NETIC TAPE UNITS	DISK		PLOTTER	TERMINAL PORTS	OTHER
							perma-nent	remov-able			
Digital Equipment Corp. Mod 8/e	8K words				1					1	
IBM Mod 026											Key Punch
IBM Mod 029											Key Punch
IBM Unit Records System											Collator and IBM 407 Printer

APPENDIX A - - HARDWARE INVENTORY

UNIT College of Great Falls

MACHINE	INTERNAL STORAGE	CARD PUNCH	CARD READER	LINE PRINTER	PAPER TAPE READER PUNCH	MAG-NETIC TAPE UNITS	DISK		PLOTTER	TERMINAL PORTS	OTHER
							perma-nent	remov-able			
IBM Mod 29											Key Punch