2/19/71

THE EVERGREEN STATE COLLEGE COMPUTER SERVICES

IA. BACKGROUND

It is rather commonly asserted that the "information revolution" will produce changes in our culture even more profound than those wrought by the "industrial revolution". The augmented human intellect, it is widely held, can produce consequences far more profound than the augmented human arm and hand.

If we were to rank and weigh those attributes which give the computer its awesome potential, we would single out this one as foremost: The computer is a device for preserving many intellectual skills in a form in which they can be put to instant use--even by those who understand neither the intellectual skill, nor the processes providing its availability. For example, today even a five or six year old child can do arithmetic at the console of an interactive, conversational computer system of which he has not the least comprehension. In this context, the use of the computer must cause us to pause and reconsider what it is we must learn, and at what period in our life.

There is no intrinsic evil in the artifact we call a computer, but there is abundant evidence that the abuse of computers can lead to consequences to which very serious objection can be raised. For example, because computers can communicate with each other without human intervention, and because computers can share vast amounts of information, the uses of some information systems (e.g., credit systems) threaten large numbers of humans with the serious prospect

of a loss of privacy. Are we prepared to pay that price for rewards that may benefit only a few?

The examples of the previous two paragraphs suggest that every educated person must know what a computer is, and what can be done with it. Given this basis, it is not difficult to describe programs for the use of the computer in the academic activities--i.e., instruction and research--of TESC.

All of those to be benefited by Computer Services--students, faculty, staff, and off-campus clientele--need to know about computers, the uses to which they can be put and the implications of such usage. For example, if, as has been suggested, the uses of the computer auger a profound effect on society, every educated person must have more than a superficial knowledge of the computer in order to function as an effective and responsible citizen. In addition most students need to know how to use computers, particularly in the mathematically oriented disciplines, but not limited thereto. For instance, awareness of a problem-solving instrument affects the choice of problems one attempts to solve (and, in fact gives structure both to problems and the procedures for solving them); conversely, a knowledge of the problems that are to be solved affects one's choice of the tools appropriate to them (e.g., a digital computer, an analog computer, or a hybrid). All need to know how to obtain access to computer services through intermediaries; we have already noted that the computer is distinguished as

an instrument for preserving intellectual skills. All must learn how to make effective use of a computer-assisted service or a human technician.

The term computer services covers a wide variety of activities. For convenience, we may group these ventures at Evergreen in two classes of service: Instruction/Research and Administration. Indeed, the obvious requirements of these two classes appear to differ so markedly that many campuses have separated them into two unrelated departments. Upon closer examination of individual applications, it becomes clear that these areas have many important requirements in common; thus it is our conviction at TESC that the service rendered to all parties can be improved by centralizing all computer activities.

The following are some important areas for computer application:

1. The members of TESC community--students, faculty, staff, and others--must be provided with opportunities to learn about computers and the varieties of ways in which computer services are or can be made available.
2. In addition they should have the opportunity to invoke the power of a computer to aid in their academic, intellectual, and social activities that are not directly related to "learning about computers".
3. Although the research activities of Evergreen's faculty will be neither as intense nor as broad in scope as, say, the University of Washington's, Computer Services will be prepared to support student and faculty research.

4. The uses of the computer in the administrative service of the College are too well known to require repetition here. On the other hand, the uses of the computer by administrators as an "intelligent technician" to augment the human intellect in illuminating and dealing with the future, are just beginning to burgeon. Computer services must be made available to support a broad--and, probably, changing--demand from the administrators of TESC. Such demand includes the prosaic keeping of records to serve descriptive needs--Who is James Rogers' academic advisor?--and comparative purposes--has James Rogers satisfied the requirements for graduation? It also includes services that help administrators to illuminate and deal with aspects of the future: 1) prediction--e.g., What will be the intensity of classroom utilization if Plan A is adopted? and 2) optimization--e.g. Of all facilities plans, which allows the optimum use of the plant?

## IB. GOALS OF COMPUTER SERVICES

1. Provide opportunity and encouragement for each individual on campus to gain broader and more realistic views of the appropriate role of computers in modern society.
2. Increasingly bring the power of the computer to bear upon the problems faced by students (homework), faculty (computer-based instruction) and administration (record keeping and information necessary for college planning.)

3. Make available the opportunity to study computer sciences and information sciences, and to discuss them with other learners. Provide firsthand experience with computers in ways meaningful to the learner at his own stage of understanding.

4. Provide an increasingly broad variety of computer services in order to meet various needs most effectively. For example:

   Conversational mathematics

   Conversational data reduction and analysis

   Medium-scale, on-line, data-base-oriented information system

   Computer graphics/art/animation

   Simulations for the social and political sciences

   Large-memory computer service

5. Develop an effective set of administrative services.

   a) Readily accessible and easily updated data files as a substitute for volumes of paper reports.

   b) Emphasis on management by exception, i.e., providing specially tailored lists of action items, in addition to summary data. The action items will be chosen by criteria that may be changed from time to time as conditions change and campus problems are conceived along different lines.

   c) Different subsystems coordinated with one another through consistent coding schemes and output reporting--corresponding to WICHE's recommendations or other accepted standards.

   d) Development of a few comprehensive information systems to serve many different campus users instead of independent systems for each.

   e) Data file structure designed with a view to the kinds of large-scale bulk files under current development.

## IC. IMMEDIATE OBJECTIVES OF COMPUTER SERVICES

1. Provide a wide variety of computer services to support the academic program. These services, in moderate amount, should be available at no charge to all learners in the community including students, faculty, and staff. Furthermore, these services should also be made available to members of the Olympia community at times and in ways that will not interfere with their utilization by on-campus users.
2. Help gain access to the most appropriate computer services for those individuals and groups requiring a larger amount of computer time to support a special program. In such cases, it may be appropriate for the budgetary unit served to share in the cost of the services.
3. Provide the opportunity for members of the college community to use interactive computer terminals using a language specially developed for conversational usage, most likely the BASIC language developed at Dartmouth College. By this means, students, faculty and staff can enjoy hands-on experience without the substantial investment of time and effort usually required before one can work directly with a computer.

   We place special emphasis on reaching those not engaged in the mathematically oriented disciplines.
4. Maintain a listing of computer facilities and services available to TESC in order to use those best able to serve the College at the lowest cost.
5. Develop a courier system for delivering input and picking up output for computer runs at installations off campus. Provide as rapid service as possible within budgetary constraints.

6. Provide a facility on campus that will provide electronic access to major computers located off campus (e.g., UW's CDC 6400 or WSU's IBM 360/67) as soon as sufficient demand for this service warrants it. Page 21 has a further discussion of this topic.
7. Set up a series of skills workshops to help those on campus as well as those from the larger community learn a conversational computer language. The series should provide experience directly with a computer terminal. The series should be repeated throughout the school year to make it convenient for anyone to attend.
8. Make professional time available to help learners attack medium-scale problems through the use of the computer. The main purpose of this service is to help the learner gain direct access to the computer, as soon as he is able, without a programmer as intermediary.
9. Make professional skills of the Computer Services staff available to help design, code, and implement large-scale systems--both instructional and administrative. In addition to providing systems and programming services, this activity will help potential users (faculty and administrative staff) gain insight into the possibilities of using computers.

## IIA. ACADEMIC COMPUTING AT TESC

It is a primary mission of the College to help students to develop as intelligent and moral citizens in the local and

world community during the next half century. It is clear that the purposes and uses of computers in our academic program are different from a vocationally oriented institution. Every one of our students should be urged to take advantage of the opportunity to have some direct experience with a computer even if the total involvement amounts to only a few hours. The influence of computers is already so pervasive in the world of business and financial records (income tax, credit bureau) that every intelligent citizen should have some realistic understanding of the potential and the limitations of computers.

A great deal can be gained through the reading of some well chosen books concerning the application of computers, and through discussion with knowledgeable people about how a computer works, what the computer speed of calculation can mean, and what some of the state-of-the-art applications are. We believe the next step, that of working directly with a computer, is a necessary one in gaining a deeper appreciation for the capabilities of the computer.

What are the lessons to be learned from direct usage of the computer?

1. Anyone who intends to have the computer perform for him must express his intentions very fully and precisely. This contrasts strikingly with the large amount of ambiguity in most of the communication in which humans normally engage. The English language is a marvel of ambiguity and multi-meaning which can

be tolerated only because of its high degree of redundancy and the high tolerance the listener brings to his side of the conversation even when interaction is not possible, as in the case of a taped lecture.

2. There should be no magic or mystery surrounding a computer. A computer operation consists of a large number of elementary steps including the Add and the Test-and-Branch. Analyzing computer operations into these simple steps helps to dissolve the mystery and therefore the fear and the mistrust that often characterize attitudes toward the computer.

3. One is further led to realize that we cannot ask a question of a computer. Instead we provide a computer with a detailed program of instructions together with a data set on which to operate. During the course of executing the instructions, the computer is commanded to provide as output some of the results of the calculations it has made. The man who has sufficient confidence in the program and in the data set draws inferences based on the computer output; that man then answers the question, not the computer.

4. Computers and related data transfer and communications devices have so greatly increased the capabilities for gathering and storing data, and for manipulating, transmitting, and displaying information that few aspects of our lives will be

untouched by them. Major moral, social, political, and economic questions are raised that are far too important to be settled by a group of specialists. Two examples are concepts of copyright and personal privacy. Meeting these questions forthrightly, and discussing them intelligently and fruitfully will require an enlightened citizenry who have had enough contact with computers to understand their far-reaching potential.

5. A computerized process can be a degrading, dehumanizing process, or it can be a most humanizing influence and can serve to individualize services that were previously performed manually on a mass production basis. The basic difference lies in the attitude of the programmer and in the amount of time and thought he chooses (or is allowed) to invest in the program. One usually finds that writing the program steps necessary to the calculations for a computer application is usually the smallest part of the complete job. Writing an adequate input edit, and preparing the results for an understandable and unambiguous output display usually more than doubles the task. But the largest part of the job is associated with the intelligent, creative, and humane handling of the many unexpected conditions the program will meet as it processes data supplied by unpredictable, imaginative, and error-prone humans.

## IIB. ADMINISTRATIVE SYSTEMS

Computech Consulting, Inc. interviewed all key members of the Evergreen staff, and developed a comprehensive picture of our requirements for

administrative information systems. Their conclusions are documented in a report to Evergreen submitted in February, 1970. Of the 24 systems identified for early development, 16 were labeled as first priority: "Absolutely must be operational by opening day." These 16 systems, taken from their priority display on Page 76, are listed below.

1. Student Information

   Recruiting (students)
   Admissions
   Registration
   Financial Aids
   Student Accounting

2. Accounting

   Bookstore Accounting
   Cashiering
   General Accounting

3. Library

   Library Circulation Control
   Library Acquisitions

4. Facilities

   Facilities Inventory
   Job Cost Accounting
   Facilities Planning

5. Inventories

   Purchasing
   Inventory (Equipment)

6. Other

   Mailing and Public Information

On most campuses each major system has required many man years to develop. Computech estimated that over twelve effective man years

We can refine systems requirements based not on a theoretical a-priory view, but rather upon experimentation and utilization in actual practice.

3. We are designing and will use programs that are not endowed with the many data checks and reasonableness tests that make a program robust. In consequence, the programmer must continue to monitor the program during its usage for subtle problems. Such problems can continue undetected if the person using the program is not intimately acquainted with the program's features. Although not feasible on a long-term basis, this sort of arrangement has the short run benefit of giving the analyst/programmer a more significant involvement with the use of the programs; he can work with the user in deciding what features are important enough to be included in the next version of the program.

## IIC. SATISFYING THE REQUIREMENTS

It is clear that no one computer can satisfy all of our varied campus requirements.

1. The Washington State Data Processing Service Center is, and will probably continue to be, an important facility for our large administrative programs. At the same time, we are keeping informed about other business-oriented installations that might provide a part of our required processing at a lower rate, or with other significant bonuses.
2. We are exploring the usefulness of two different services that

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provide a combination of batch processing in the background, with on-line file inquiry. These services may enhance our information system significantly by making more current information available with much less total output.

3. We feel that an interactive computer facility will meet the educational needs of the broadest spectrum of users. Conversational computers immediately detect many errors and reinforce correct computer syntax, thereby encouraging rapid learning of the computer language. The interactive mode of operation keeps interest in its usage high even among students who would not otherwise persevere through the tedium of most data processing. Immediate response with a solution to some specific problem encourages more thorough and meaningful exploration of the various facets of the larger problem. The interactive computing is the best medium for many social science simulations, economics games, and other applications that benefit from man-machine interaction, such as drill-and-practice.

An interactive service can also meet a very broad spectrum of our overall campus needs. In order to increase the range of problems that can be handled and thereby decrease the number of applications that must be relagated to a larger computer off campus, the interactive computer facility must:

a) Have a fast computation speed

b) Appear to have a large memory to the terminal operator

c) Have a mass storage device for programs and data

interactive terminals placed conveniently on campus. In addition, we anticipate a fairly substantial memory for program and data storage, together with such peripherals as will be most useful. Among these other peripherals will be a device (probably magnetic tape) that will allow us to communicate with other computer systems.

A list of required and desired features is presented in Section IIIE. It should be viewed as a draft of the features necessary for the campus computer. When completed, it will form the nucleus of a Request for Bid to computer companies. In many respects the specifications are still quite vague. This is appropriate at this early stage in their development.

## IIIB. TERMINAL LOCATION

Whenever terminals are located on campus, their usage should be continuously monitored. Terminals will be moved to another location if it appears they would be more convenient to the users.

Discussions with those at Dartmouth and at other schools who have had large numbers of terminals on campus have shown that students seem to prefer the convenience of concentrations of terminals centrally located. As a result, we have decided to place the terminals in a few central places. A significant group of terminals will be located in the Library building, and another in the Science building. Normally, there should be official tutors or other help available to discuss programming

problems with students.

Other campuses have found that when terminals were dispersed widely at many "convenient" locations, the students were frequently frustrated in their attempt to find an unused terminal. Finding one terminal in use, they were faced with a prospect of walking to an alternative a quarter of a mile away. A rain soaked trudge, with no guarantee that the unit is free, hardly generates high morale or favorable attitudes toward computers.

## IIIC. SERVICE TO THE CAMPUS

The computer systems we have been exploring require little or no operating personnel. We expect that the computer will be available to students during large portions of the day, probably during the entire period that buildings are open, to permit access to the terminals. The terminals may be available from 7:00 a.m. to 11:00 p.m. or longer. One computer salesman has recommended that we leave the computer running unattended all night. On rare occasions, such a computer will have an unexpected crash and cease operations. If this occurred late at night, no attendant would be able to correct the error and bring the computer back into its operational state. There would be no permanent loss from this event, however.

The main emphasis of the campus computer will be to provide computer services to all learners on the campus, including

students, faculty, administrators and visitors. Administrative control should be kept at the level minimally necessary to make sure that members of the campus community are not prevented from using the computer by a group of off-campus visitors who have less reason to use the computer. Every reasonable attempt will be made to keep sufficient terminals on campus and sufficient computer power supporting the terminals that time on the campus computer will not become a dear commodity.

The campus computer will be dedicated to learners, including members of the administrative staff. Their purpose for using a computer terminal may range from simple curiosity or a desire to develop a computer game, to a very real concern with the possibilities for using computers for calculations central to their administrative responsibilities. This latter case can really be called learning or research into the potential of computers and should not be confused with the on-going operations of the campus, which will continue to require the use of a major business-oriented computer off campus.

## IIID. ADMINISTRATIVE USAGE OF THE CAMPUS COMPUTER

We may find that some data-based administrative functions can use the campus computer facility. As examples, we might consider a system to monitor periodical subscriptions, or an inquiry system for student accounts.

The campus computer will be utilized for administrative applications only so long as they do not interfere with academic uses. Many academic uses will require large amounts of computation and relatively small amounts of file access; these programs are dubbed "compute bound programs " By contrast many administrative computer applications will require more printout and file access with relatively little computation. Thus, it is possible that the campus computer could support some fairly substantial applications, if the file storage were adequate, without in any noticeable way affecting the response of the computer to student and academic usage. This could provide a very important service to the campus by providing on-line access to certain frequently used files.

## IIIE. DESIRED HARDWARE AND SOFTWARE FEATURES

We are currently evaluating computer hardware and software to support our goals and objectives. The following is a list of desirable characteristics of the Campus Interactive Computer Facility:

1. An interactive programming language (BASIC, APL, other) with the following features:

   *A. Mathematics and logic equivalent at least to Dartmouth BASIC.

   *B. String manipulation capability

   *C. Matrix manipulation capability — *First Priority

   *D. File processing capability — **Second Priority

   *E. Formatted output (Decimal alignment)

2. Support of the following terminal types:

   *A. ASR 33 teletype

   **B. Upper/lower case typewriter

   *C. Character oriented CRT

   *D. X-Y graphics CRT

   *E. Plotter (CALCOMP Type)

   **F. Cassette reader/writer

*3. Magnetic tape for backup and for interface with other computer systems

**4. Slow speed card reader (200-300 CPM)

**5. Slow speed on-line printer (200-300 LPM)

*6. High speed random access storage (1.0 million characters expandable to 20 million characters)

7. Disc Operating System with the following features:

   *A. Assembly language

   **B. Fortran

   **C. COBOL

   *D. Mathematical library

**8. Remote Job Entry to a larger computer (card reader/card punch/line printer)

*9. Capability for expansion to maintain a 100 to 1 student-terminal ratio.

## IVA. REMOTE JOB ENTRY

A Remote Job Entry (RJE) facility provides peripheral operations at distances of 3 miles to 3000 miles away from the main computer used for processing. Equipment such as a card reader/punch and a printer on campus will allow large volumes of card data to be input locally for processing at an off-campus computer. The output data may be printed on the line printer on campus, allowing the use of special forms and large volume print runs. The output listing from a computer run will start within a few minutes after the input is completed in most cases. Operational control can be provided using a CRT scope and keyboard for direct communication with the main computing system.

As soon as feasible we will acquire an RJE terminal for use by academic and administrative users on campus who require services of a remote computer. This facility will result in direct time savings and other benefits associated with having service available through a terminal on campus rather than forcing the user to travel personally, send a courier, or use the U. S. mail service. The benefits to the user will be real indeed, and the costs of

such a terminal are relatively modest. The timing of the acquisition of this device will require further study. There may be substantial benefits both in a lower cost and expanded capabilities to caution and delay before making our decision.

## IVB. DUAL PURPOSE OPERATION

Some of the minicomputers we have been considering for the campus computer could be modified at modest expense to run in a Remote Job Entry mode as well as interactive mode. However, the systems we have explored so far will not support time sharing and Remote Job Entry simultaneously. Thus, if we were to depend on the campus computer for dual-purpose operation, it would be necessary to shut down time sharing during certain periods of the day in order to make the terminal available for Remote Job Entry operation.

The complication associated with scheduling a computer between two modes of operation may not compensate the campus for potential savings. Separate RJE devices are not expensive and their cost is coming down. Before many years the cost may be so low that there would be no savings in this mode of operation but we risk a large amount of frustration on the part of students who would be denied interactive terminal service at a crucial time in their program.

## VA. ANTICIPATED PARTICIPATION

1. Students

   a. During each year at least 90% of the students studying problems in the physical and natural sciences will have learned how to use the computer.

   b. During each year, at least 50% of the students studying quantitatively oriented social probelms will have learned how to use the computer.

   c. During the first year of operation, at least 25% of all other students will have learned about the computer; during subsequent years, 50% of all other students will have learned about the computer.

2. Faculty

   a. Three-fourths of the faculty in problem areas identified in 1 and 2 above will have learned how to use the computer.

   b. One-half of the remaining faculty will have learned about the computer.

3. Staff

   a. Fifty percent of the professional staff will have learned how to use a computer, i.e., how it can be used to help them do their work.

   b. Fifty percent of the remainder will have learned about

will interact--lecture, demonstrate, etc.--with a secondary school faculty or student body, service organization, etc.

5. Instruction

   a. Of the students using the computer (approximately 30% during each quarter) each will consume one and a half terminal-hours per week of interactive service, and 1/20 minute per week of batch service for instructional activities, on the average.

   b. Of the faculty using the computer (approximately 50%-60% each year) each will consume, on the average, three terminal-hours per week of interactive service.

VB. ADMINISTRATIVE OBJECTIVES

a. The following computer applications should be operational by opening day, September, 1971:

Admissions

Facilities Inventory

Job Cost Accounting

Student Accounting
Housing
Financial Aids Accounting
Fee Collection and Distribution

Purchasing

Inventory (Equipment)

General Accounting

Position Control

b. These systems will be developed during the first two years of operation:

Testing and Counseling

Registration

Financial Aid

Mailing and Public Information

Payroll and Personnel

c. These are longer term goals for implementation:

Alumni Records

Placement

Job Scheduling & Control

Investment Control

Police and Security

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