Management and Efficiency Study Committee On Automated Data Processing and Telecommunications

Final Report
October, 1984

October 24, 1984

The Honorable Richard D. Lamm
Governor, State, of Colorado
136 State Capitol
Denver, Colorado 80203

The Honorable Ted L. Strickland   The Honorable Carl "Bev" Bledsoe
President of the Senate   Speaker of the House
227 State Capitol   242 State Capitol
Denver, Colorado 80203   Denver, Colorado 80203

Gentlemen:

The Management and Efficiency Study Committee on Automated Data Processing and
Telecommunications has completed its analysis. The study was a volunteer effort
involving information processing professionals, primarily from private industry.

This study differed from previous M&E studies, in that this was not a departmental
review, but rather a functional analysis that crossed the boundaries of all execu-
tive departments and branches of state government. It was chartered by both the
Governor and the Legislature.

The committee believes that significant improvements can be made in the effec-
tiveness and efficiency of information processing in Colorado State Government.

The report is divided into five sections, each representing the observations,
conclusions and recommendations of the following five subcommittees:

- Statewide Planning
- Automated Data Processing Operations
- Telecommunications
- Higher Education
- Legislative Data Processing Operations.

The first four sections deal with executive branch operations, while the fifth
section deals with legislative branch issues. The study process was educational
for all concerned, and we enjoyed the assignment. Without exception, we received
excellent cooperation from all state employees with whom we worked and interviewed.

It is our hope that the recommendations will assist the State in resolving some of
the difficult problems of information processing. Our committee is committed to
that end, and accordingly, would like to offer our ongoing assistance as you
implement the recommendations.

Sincerely,

Tom Hallin

Thomas M. Hallin
Chairman

enclosure

Management and Efficiency Study Committee

on

Automated Data Processing and Telecommunications

October 17, 1984

State of Colorado
Department of Administration
712 State Services Building
1525 Sherman Street
Denver, Colorado   80203
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The Committee wishes to dedicate this report to one of our
members, and a fine friend, Donald E. Cunningham, who passed
away in March, 1984. We are grateful for his contributions
and believe he would be proud of this final report.

COMMITTEE MEMBERSHIP

Thomas M. Hallin, Chairman; Partner, Arthur Andersen and Company, Denver;

STATEWIDE PLANNING SUBCOMMITTEE

Del D. Hock, Chairman; Vice President, Public Service Company of Colorado, Denver;

Benjamin S. Chao, Manager of Information Systems, Anaconda Minerals Company, Denver;

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Rodman H. Heath, Vice President, Mountain Bell, Denver;

LEGISLATIVE DATA PROCESSING SUBCOMMITTEE

Robert G. Foster, Jr., Chairman; Executive Director of Information Systems, Petro-Lewis Corporation, Denver;

LEGISLATIVE DATA PROCESSING SUBCOMMITTEE (continued)

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Del D. Hock, Vice President, Public Service Company of Colorado, Denver;

Marvin Hollenbeck, Manager of Information Services, Amoco Production, Denver;

Jeffrey C. Pond, Attorney, Cohen, Brame and Smith, Denver.

STAFF TO THE COMMITTEE

E. Robert Turner, Executive Director, Department of Administration; Administrator, Management and Efficiency Study Program;

Barbara A. Alexander, Legislative Liaison, Department of Administration; Project Director, M&E Study;

Alan Y. Levine, Deputy Director, Department of Administration;

Linda R. Bell, Administrative Assistant to the Director, Legislative Drafting Office;

Douglas G. Brown, Director, Legislative Drafting Office;

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Robert J. Miller, Director, Division of ADP;

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Robert D. Tolman, Director, Division of Telecommunications;

Robert W. Yackel, Statwide ADP Coordinator, Division of ADP.

The Committee also wishes to acknowledge the staff assistance provided by Mary Griffith and Deborah Price, Arthur Andersen & Company.

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EXECUTIVE SUMMARY

BACKGROUND

The State of Colorado spends over $60 million on computerized information processing per year. Despite decreasing equipment cost, more widespread use of information processing techniques will cause the State's budget in this area to grow in future years. For this reason, both Governor Lamm and the leadership of the Colorado Legislature, recognized the need for an independent review of the State's involvement in information processing.

The Management and Efficiency Study Committee on ADP/Telecommunications was created in November, 1983, by Governor Lamm and approved by House Joint Resolution #1005 of the Legislature. Most of the members of the committee have extensive private industry background in management and control of computers and information processing.

SCOPE

The committee's charter was to conduct an investigation into the use, control and investment in computers and information processing within State Government. The committee's scope was limited at first to the executive branch, but upon the invitation of the Legislature, expanded to include legislative information processing as well. Particularly, the committee was charted to:

° undertake a study of the various computer operations of State Government

° make recommendations as to how the State can organize, manage, and control data processing and telecommunications activities in the most efficient and effective way.

Due to the broad scope of the project, the committee was divided into five subcommittees as follows:

Subcommittee	Chairman
Telecommunications	K. Dieter Heidrich
Data Processing Operation	J. D. MacFarlane
Planning	Del D. Hock
Higher Education	Raymond T. Clarke
Legislative	Robert G. Foster, Jr.

Overall direction of the project was provided by a General Chairman, Thomas M. Hallin.

REVIEW PROCESS

Each subcommittee followed the same basic process. Users of information processing services were interviewed on a sample basis. In

some cases, these interviews were supplemented with questionnaires, and the subcommittee members were furnished with documentation already available. Because of the size of the operation involved, as well as limitations on the time of volunteers, this study should not be considered a complete review and analysis of all information processing operations in the State of Colorado. The subcommittees made a selected review and analysis of major policy areas, and attempted to concentrate on areas having large dollar effects on the State's information processing performance.

PLANNING

Information processing hardware and software is the type of investment that, when made properly, should last many years. Furthermore, well-designed systems may outlive a number of hardware changes. Investments in this area typically impact the productivity of state personnel. Effective planning and coordination of information processing activities can significantly decrease large, unnecessary costs, as well as improve employee productivity.

In addition, there is no statewide planning to ensure compatible information processing from department to department. There is insufficient coordination, and in many cases, there is a need for guidance and assistance. Furthermore, the planning process is out-of-sync with the budget process, and therefore, the budgeting process cannot take advantage of the overall planning effort that now exists.

A planning and policy board with rule-making authority should be established, which would be attached to the Department of Administration and would provide a vehicle for review and monitoring of planning and policy decisions.

TELECOMMUNICATIONS SUBCOMMITTEE

The Division of Telecommunications' mission should be broadened to enable them to utilize the opportunities offered by the reorganization of American Telephone and Telegraph, and to fully develop the unfinished microwave system. A revolving fund should be created for this division with fair, reasonable and competitive charges allocated to users within the State of Colorado. Seed money would be required for start-up.

On a short term basis, three additional communications specialists should be authorized to resolve deregulation issues. On a longer range basis, a study should be conducted of the Division's future requirements under deregulation, and the options for operating and maintaining the telecommunications system.

DATA PROCESSING OPERATIONS COMMITTEE

The review of data processing operations was limited to the five major data centers containing mainframe computers. These five data

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centers are staffed, operated, and financed as separate, autonomous entities and do not function on a coordinated basis.

The daily computer operational services at GSCC should be administered under a revolving fund, with users assessed fair and reasonable charges. The revolving fund would finance additional hardware acquisitions and necessary improvements. An inventory of all hardware, software and services should be initiated immediately.

A new position, Chief Information Officer, should be created to oversee the data center consolidation. This person should report to the Executive Director of the Department of Administration.

The five data centers are presently unable to communicate with each other, share data resources and make maximum use of the computer equipment pool. Compatibility can be achieved by reducing the number of data centers from five to two (at a potential savings in hardware alone of $3 million), placing the data centers under the control of the Department of Administration, and developing standards for information processing.

The State of Colorado should encourage computer manufacturers to achieve a higher level of compatibility. Accordingly, the Governor should impose a moratorium on any activities that reduce the compatibility of mainframes in the existing five data centers.

On a longer range basis, compatibility programs should include an analysis of data applications and access to data needed statewide. The State should strive for single-integrated systems which are shared by all departments, particularly in the administrative area.

EDUCATION

There are numerous issues that are unique to higher education, as information processing is used extensively for research and education, in addition to normal administrative functions. It is recognized that there are broad questions beyond the scope of this committee concerning governance of higher education. Currently, there exists a "Memorandum of Understanding" (MOU) which allows each institution of higher education to manage its own budget and administration within overall budget guidelines. The statutory responsibilities of the Department of Administration are in conflict, however, and we urge that the statutes be revised to conform with the MOU. At the same time, public policy requires that decisions on computers be reviewed by the Legislature to ensure that our institutions maintain excellence in computer operations.

Research and educational use of information processing should be the exclusive concern of each institution of higher education within the guidelines of the Memorandum of Understanding. In contrast, however, administrative systems such as accounting, general ledgers, and personnel/payroll should be developed on a statewide basis.

There are a number of information processing resources which should be shared among the institutions of higher education. This ought to be accomplished both to provide equal access, and to avoid the risk of duplicative facilities paid for by the taxpayers. A vehicle initiated and supported by the institutions should be established to coordinate those aspects of information processing that transcend the boundaries of individual institutions.

LEGISLATURE

The Colorado Legislature has been a leader in the use of computers for the administration of legislative activities. One early pioneering effort, ALTER is now in use in 15 states. Another early effort, CLEAR, has been less successful. Overall, the Legislature's computer investment has been modest.

The Legislature does not need its own mainframe computer center. Adequate service can be obtained from the General Government Computer Center at fair and reasonable cost. Use of executive branch computers gives the Legislature a long-term advantage in extracting information, particularly as mainframe computers in the executive branch become more compatible and integrated. The technology to extract and use this information should increase rapidly over the next five years. Access to the executive branch transactions for both the Legislature and the State Auditor is an important public benefit.

Presently, the only staff service provided to the Legislature from full time computer professionals is provided by the General Government Computer Center, primarily to service ALTER. Information processing personnel concerned with legislative matters should be under the direction of the Legislature. Accordingly, a start-up staff of one or two persons should be authorized in 1985, over and above the effort needed to maintain ALTER.

Legislative computing support has grown by independent needs being addressed one at a time. While this has been satisfactory in the past, it will not suffice in the future where the cost and information benefits of an integrated approach could be realized. Prudent planning and implementation measures are essential.

SECTION II

SUBCOMMITTEE ON STATEWIDE PLANNING

SUBCOMMITTEE ON STATEWIDE PLANNING

SCOPE

The major focus of the Planning subcommittee was the statutory requirements of the Department of Administration for developing, administering, reviewing, and reporting on the current and long-range data processing plans of the various state agencies and the State of Colorado as a whole.

RESOURCES AND METHODOLOGY

We reviewed both the 1983 and the 1984 ADP Master Plan documents submitted to the Governor. Since there was a significant change from 1983 to 1984 in the approach and format of the Master Plan in terms of long-range planning (a change which, in our view, was an improvement), our comments are directed primarily at the 1984 document.

In addition to our review of the Master Plan document, we also met with the agency directors and data processing management at the Departments of Revenue, Social Services and Institutions. In conjunction with those visits, we reviewed the most current data processing plans for these agencies. We also reviewed the most current data processing plan for the Department of Agriculture; however, we were unable to schedule a meeting with that agency.

CURRENT CHARTER AND STRUCTURE

The Division of Automated Data Processing (DADP), a division of the Department of Administration, was created by Article 24-30-602, Colorado Revised Statutes, 1973 as amended, to establish central planning control and coordination of automated data processing activities. It formulates recommendations for a current and long-range automated data processing plan, in consultation with state agencies, for approval of the Executive Director of the Department and the Governor; and administers the approved current and long-range plan for ADP, and exercises general supervision over all ADP applications, planning, systems, programs, personnel, equipment and facilities of state government in accordance with the approved plan.

OBSERVATIONS

Current Planning Process

The ADP Master Plan does address the major issues which must be considered in developing a strategic ADP Plan for the State of Colorado. However, the Department of Administration does not have the resources to comprehensively and effectively address these issues and to take the lead in actually developing and implementing the resulting strategic plan.

In reviewing the ADP planning process, we noted that the major agencies are doing both tactical and strategic planning, which appears to be fairly effective. However, since there is no comprehensive

strategic data processing plan for the State which can be used by the agencies as a planning guideline, and by the Department of Administration as the basis for reviewing and approving these plans, the agency plans are not compatible. Therefore, the ADP Master Plan is simply a statement of strategic objectives with a summary of the agency plans which are not directly related to these objectives. This fragmented approach to planning has resulted in a duplication of investment in computer hardware, software, and other related resources, and the State of Colorado cannot take full advantage of the cost-effective technological capabilities now available for sharing of data and data processing resources.

Planning/Budget Cycles

The present requirement for submission of agency plans to the Department of Administration is not coordinated with the timing for submission of the annual agency budgets. Since the budgets are usually prepared well in advance of the long-range plans, the Department of Administration cannot effectively evaluate the compatibility of the budgets and strategic plans, and the statutorially-mandated planning process becomes one of form over substance.

Current Equipment

Currently, the State does not have a complete inventory of all hardware and software in use throughout the State. This adds to the difficulty in developing a strategic plan and establishing control over future acquisitions.

Agency Support

The agencies have recognized problems with redundancy, incompatibility of hardware and software, and opportunities for sharing data in state data processing. Most of the agencies acknowledge the need for some centralized direction and control of the ADP planning function. To address those problems, they would like to see positive enforced guidelines and effective oversight from the Department of Administration, and they suggested that the Department of Administration's assistance would be most beneficial if oriented toward service and consulting in information systems. Based on our observations, we concluded that the agencies also need more effective communication with the Division of ADP regarding planning and new technology.

RECOMMENDATIONS

The State of Colorado has a significant and growing investment in information systems, which must be managed like any other asset of the State. Among other things, this requires effective planning, which is integrated with the yearly budget process; is developed, revised, and administered on a state level; and is clearly understood and utilized by all agencies.

Based on these observations, the Planning Subcommittee has developed the recommendations outlined below.

Commission

Establish an appointed commission to provide a strategic planning oversight function for State Information Systems.

A. The majority of Commission membership should be drawn from the private sector. This should provide the State with highly-qualified data processing expertise without expending more resources.

B. Staff support for the Commission should be provided by the Department of Administration.

C. The Commission should be established by Statute and appointed by the Governor to ensure continuity in planning and controlling the State's data processing investment.

D. The responsibilities assigned to the Commission should include the following:

1. Annually review and approved the strategic data processing plan for the State and the long-range plans of the agencies developed in accordance with this state plan.

2. Assess status of current state data processing systems, and evaluate other potential systems.

3. Determine an approach for gradually achieving statewide compatibility.

4. Approve a set of standards to control future purchases by state agencies, as well as criteria to be used in approving or rejecting agency procurements.

Planning Guidelines

Develop and implement planning guidelines and standards to be used by all agencies. These guidelines and standards must be developed with considerable input and participation from the various agencies. As noted above, the Commission should assist in enforcing these standards and guidelines for all major systems and applications.

Planning/Budget Cycles

Revise the timing for submission of agency data processing plans so that the planning process will precede the preparation of the annual budget and can be based upon the plan and the planning guidelines provided by the Division of ADP.

Assess State Investment

Take a complete inventory of all state computer equipment. The inventory should be categorized by type of hardware, age, condition, and whether it is leased or owned. This data should be computerized

so that it can be maintained as new resources are obtained. The inventory process should be kept to minimal expense, and should not take longer than 90 days.

Redirect Information System Responsibilities of Division of ADP

Recognizing that additional resources may be required, the Planning Subcommittee recommends that the following responsibilities of the Division of ADP and the Department of Administration be redirected as follows:

1. Annually develop/update a strategic data processing plan and related planning guidelines and standards for review and approval by the Commission, and assist the agencies in using the plan, guidelines and standards in the annual preparation/update of their data processing plans.

2. Utilize more resources for the consulting function, with emphasis on more information exchange with the agencies on new technology and the evaluation of their existing and planned systems.

3. Coordinate and/or direct inner agency project teams, or task forces, to plan, develop, and implement shared systems and computer resources.

SECTION III

SUBCOMMITTEE ON AUTOMATED DATA PROCESSING OPERATIONS

SUBCOMMITTEE ON AUTOMATED DATA PROCESSING OPERATIONS

SCOPE

This report contains findings and recommendations which address
the subject areas of organization, cost and funding of computing ser-
vice, control and standards, and compatibility of data and interde-
partmental information access. The processing focus of the subcommit-
tee's study was on the five largest departmental data centers. Dis-
tributed processing and personal computing, while recognized as impor-
tant components of state data processing, were not studied in any
depth, because of time limitations.

RESOURCES AND METHODOLOGY

Staff support and extensive material on the mission, functions,
organization and operations of the three information services division
of the Department of Administration were provided by many members of
the department, who cooperated fully with the subcommittee. Added
insight and perspective were gained through interviews with the Execu-
tive Directors of Revenue, Labor and Employment, and Institutions, the
Director of the Colorado Bureau of Investigation and the Colorado
Judicial Administrator.

CURRENT CHARTER AND STRUCTURE

The Division of Automated Data Processing was statutorily created
in 1973 (CRS 24-30-602, 1973) as a Division of the Department of Ad-
ministration, to formulate and administer a long-range automated data
processing plan and to exercise general supervision over all ADP ap-
plications, planning, systems, programs, personnel, equipment, and
facilities of state government in accordance with that plan. The
division is further charged with the responsibility for establishing
ADP procedures and standards for management of the facilities for all
state departments, agencies, and institutions, and for preparation of
required reports to the Governor and General Assembly.

CRS 24-30-603 (1) (k) requires the division to provide automated
data processing services, equipment and facilities for state depart-
ments, institutions, and agencies according to their needs. To ful-
fill that mandate, the General Government Computer Center operates a
facility in southeast Denver, a data entry center in Pueblo, and a
system analysis and development support staff in central Denver.
Additional mainframe computer centers are operated by the Departments
of Revenue, Institutions, Labor and Employment, and Public Safety.

OBSERVATIONS

In overview terms, the subcommittee was struck by three elements
in the State's data processing approach: 1) central control, imposed
by law, is often circumvented as a matter of convenience or when the
central guidance is contrary to the views of the department concerned;
2) independent hardware acquisitions of the past have led to a wide
range of incompatible computing equipment and systems in today's in-

ventory; and 3) the method of funding for computers at both the
General Government Computer Center and in other state departments en-
courages a go-it-alone philosophy and probably results in both ex-
cessive spending and inconsistent levels of service. Details of these
findings and conclusions as well as others are described below.

Organization

The Division of ADP is the focal point for statewide control over
data processing planning and equipment acquisition. The Division,
together with its two sister divisions, Telecommunications and the
General Government Computer Center, are assigned to the Department of
Administration. The Division of ADP appears to be viewed by other
state agencies as "looking over their shoulder" in the negative sense
of that term. The Division is seen more as a stumbling block than a
help, and the stronger the personalities involved on the supported
end, the stronger will be that view. The Division's image probably
stems from several causes:

1. Staffing: The Division is inadequately staffed to perform
   its chartered responsibilities. It cannot be all things to
   all people unless it can get to their requests and needs and
   deal with them competently and promptly. When it cannot, it
   is viewed as unresponsive, negative or incompetent, and the
   service requestor will probably do the work himself.

2. Clout: The Division of ADP does not have the clout it re-
   quires to deal effectively with strong-willed department ex-
   ecutives. This problem, which can be troublesome in busi-
   ness, is compounded in government by the political influences
   that are sought and brought to bear in the day-to-day opera-
   tion of the State.

3. Confidence: There appears to be some lack of confidence in
   the Director of ADP and members of his staff as a result of
   the environment in which they have been placed.

4. Credibility: The Division, rightly or wrongly, is not always
   viewed as being totally objective in its exercise of con-
   trol. The degree to which this is a problem varies widely
   and is generally related to a specific past report, action or
   recommendation which ran counter to the views of the recipi-
   ent.

Cost of Computing

Colorado spends at least $62MM on computing and employs at least
1,100 full-time people in the field. The term "at least" is used, be-
cause it is clear that no one with whom the subcommittee spoke knows
exactly which state organization has what equipment and personnel or
what is spent in total for such service. It is likely that the total
bill could be as much as 50 percent higher than it is believed to be.
Word processing, personal computers and outside services are three
specific cost areas about which little is reported from the agencies
and departments or known centrally.

While the inability to capture and report costs accurately and completely is troublesome, the basic issue with respect to cost is that the State is probably paying too much for the support it receives. The diversity of equipment architectures, the number of major data centers, the outdated nature of the computers installed at several of these centers, the broad license taken by a number of departments in procuring their own equipment and the inability to share data and software among multiple users all contribute unnecessarily to the State's bill for computing. In a specific case that was explored in some detail, the annualized cost just for mainframe hardware in the State's five largest departmental mainframe data centers is 1.5 times the cost of two modern mainframes. And, the current machines in the aggregate provide only 60 percent of the corresponding capacity. (See "Cost Analysis" exhibit on following page.) Economies of scale are real when the added costs of staff, floor space, utilities and peripheral equipment at five data centers versus two are taken into account.

Funding for Computers

The method of budgeting for computing equipment and service is a phenomenon which deserves immediate attention. Two examples should serve to illustrate the problem:

1. A User of the General Government Computer Center Needs More Support: GGCC is a service organization which provides computing capability to a number of state users. As a well managed data center, GGCC tries to operate with as little excess capacity as possible in order to keep costs down. Against that backdrop, Department A notifies GGCC that its volumes are growing and that it is having a hard time getting its work done with the computing time it is allocated. GGCC examines the situation, adjusts priorities as much as it can and alleviates the problem for the present. Several months later, volumes continue to increase at Department A and the GGCC cup is full. There is no more capacity to give, and on-line response times and batch turnaround times have increased for all users. With no money in the GGCC budget this year to obtain more equipment, GGCC issues notice to all users that a moratorium must be imposed on all new applications and that degraded service can be expected for the rest of the year. The net result is twofold: GGCC gets another black eye for failing to provide support; and users across the board get less service than they need to carry on their businesses in an efficient and timely manner.

2. A User of GGCC Needs More Support and Has the Budget to Pay For It: The scenario here is the same as above except that Department A in this example has notified GGCC that it has undertaken a new project and will need a significant increase in its allocation of computer time to meet the requirements of the new project. GGCC examines the situation and responds that it has very little open capacity to give and no money to obtain more in this year's budget. Hence, the needed addi-

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COST ANALYSIS
(CPU, MAIN MEMORY, CHANNELS & RELATED EQUIPMENT ONLY)

Current Configurations & Annualized Costs:

CENTER	PROCESSOR	MIPS*	ORIGINAL PURCHASE COST	ANNUAL** PURCHASE $	ANNUAL MAINTENANCE	ANNUAL PURCH. $ PLUS MAINT.	COST PER MIP
GGCC	3033 MP	8.5	$ 4,505,682	$ 901,114	$147,078	$1,048,192	.123
Revenue	3031	1.3	912,000	182,400	46,284	228,684	.176
Employment	66/80	2.143	3,749,843	749,969	81,880	831,849	.388
AJCC (CBI)	1182	4.2	2,662,761	532,552	76,320	608,872	.182
Institutions	1161	.6	384,366	76,873	17,928	94,801	.158
TOTALS		16.743	$12,214,652	$2,442,930	$369,490	$2,812,420	.168

Purchasing Power in Up-To-Date Hardware:

3084	3084	26.0	$ 7,686,317	$1,537,263	$145,272	$1,682,535	.065
Dual 3081	3081-2	28.0	$ 8,322,560	$1,664,512	$165,024	$1,829,536	.065

*Millions of instructions per second.
**Five-year amortization of purchase cost without interest.

tional support cannot be provided. Department A responds that the new project is funded and that the department can "pay" for the increased use. GGCC replies that while department A's budget may be able to afford the added resources, GGCC's cannot. Faced with this dilemma, Department A takes the "then I'll do it myself" approach and acquires a computer or use of one from another source. The net result is three-fold: GGCC gets another black eye for failing to provide support; the State gets yet another computer; and the bill for state computing takes another jump.

The problem is clear. GGCC has its own budget for added resources which may well be inconsistent with and out of phase with the budgets and needs of its major users.

Control and Standards

Central control over state data processing activities is not as comprehensive in actual practice as the statute envisioned. Control seems to be viewed less as necessary and desirable by those who are controlled than as something inherently bad and to be avoided where possible. The beneficial results of control, consistency, compatibility, cost-effectiveness and economy of state administrative data processing are, therefore, not being achieved as planned. Not everything needs to be standardized, but clearly some things do. Equipment acquisition; data interfaces across departmental lines; planning guidelines, directions and constraints; information ownership and access; communications protocols; systems and programming conventions; personal computing; text processing and employee career paths are a few subjects about which standards should be strengthened.

Compatibility of Data

There is increasing need in several departments to share data with other departments. The Business Tax System being developed by the Revenue Department is an example of a system which will contain data useful to other departments, among them Labor and Employment. The Colorado Bureau of Investigation routinely uses motor vehicle data from the Revenue Department. The General Assembly uses revenue data in its CLEAR System, and a number of similar examples are available. The trend in industry is broadened use of data obtained, edited and maintained in one organization by any other organization "authorized" access to it, rather than duplicating the time consuming and expensive process of getting the data again from the source, or, more likely, from another source. The challenge posed by this trend, and the challenge Colorado is not well positioned to overcome, is that the data are typically maintained on computers of several, incompatible vendors, manipulated by application programs written to run under different operating systems, with potentially different communications protocols and terminal architectures. In short, the systems and, hence, the data, were meant to be used by a single user and overcoming that stand-alone design approach will be difficult. It will become increasingly difficult if the current entrepreneurial approach to computing in Colorado is allowed to continue.

RECOMMENDATIONS

The following actions are recommended. While they are expressly directed toward the executive branch, any improvements in the system which result will also be of benefit to the legislative and judicial branches to the extent that they receive support from executive branch information services activities. These recommendations should be viewed as being a single, integrated package and selective implementation should be discouraged:

Short Term

The following recommendations should be implemented as soon as possible:

Moratorium on Further Incompatibility

An immediate moratorium should be placed on further development of systems which will worsen or prolong unnecessarily the current incompatibilities which exist.

Revolving Fund and Service Charging

THIS RECOMMENDATION IS ABSOLUTELY CRITICAL. The General Government Computer Center(s) should be made self-financing through establishment of a revolving fund and the use of service chargebacks. Computer use should be budgeted and defended by the using department, not by GGCC. Once approved, the user then spends against his budget at GGCC for service received, and GGCC uses the revolving fund to assure that capacity keeps pace with demand.

Statewide Inventory

A statewide information services inventory of computers and associated equipment of all sizes, application systems, data, software, word processing, and consulting and contract services usage should be made as the starting point for future control of administrative computing throughout the State.

Organization

The "Chief Information Officer" concept should be adopted in the Executive Branch of government to achieve oversight control over all Executive Branch information services activities. The following aspects of the concept should also be implemented:

1. The CIO should report functionally to an Information Systems Commission, appointed by the Governor to staggered terms to assure continuity, and composed of experienced, technically qualified, private sector executives. The Commission should be given rule-making authority.

2. The CIO should report administratively to the Executive Director of Administration. The CIO position should be es-

tablished as a Deputy Director of Administration. If the
State Personnel System permits, the CIO should be appointed
by the Executive Director of Administration with the concur-
rence of the Information Systems Commission.

3. Statutory authority and functions now vested in the Director
of the Division of Automatic Data Processing should be trans-
ferred to the Chief Information Officer.

4. Staff support to carry out CIO responsibilities should come
from the Divisions of ADP and Telecommunications and GGCC.
The staffing levels and organizations of the three divisions
will need review.

5. The Directors of ADP, Telecommunications and GGCC should
report administratively to the Chief Information Officer.

6. The key to these recommendations is the Chief Information
Officer himself/herself. In the opinion of the subcommittee,
great care must be taken to fill this position with a candi-
date who possesses outstanding technical, managerial and in-
terpersonal qualifications.

Long Term

The following recommendations are no less important than those
discussed above. However, they will require more time, and in some
instances study, before implementation can be completed:

Standards

Statewide standards on selected hardware, software and telecom-
munications subjects, including architectures, protocols and con-
figurations, should be developed, issued and enforced. The thrust of
these standards must be achievement of object code program compatibil-
ity among the major data centers. Standards on related subjects, such
as personal computers, distributed data processing, and word process-
ing are needed as well, in order to guide the anticipated future ex-
plosion of those technologies in a direction which is consistent with
the overall information services plan.

Compatibility

A program to achieve compatibility of common-usage data, applica-
tions and access capabilities must be developed and implemented on a
phased basis, beginning with today's needs and gradually expanding to
accommodate future requirements as they are identified in the planning
process.

Data Center Consolidation

The number of major mainframe data centers should be reduced from
five to two over the next three-to-five years, and both data centers
should then be managed by the Chief Information Officer. The result-

ing consolidation should be made in the least disruptive way possible and keyed to planned hardware or software upgrades or changes. The revolving fund and service charging are prerequisite to the data center consolidation. The funding issue must be solved before the economies of consolidation can be achieved smoothly and effectively.

Administrative Information System

The State should evolve to a single, integrated information "system" for common-usage administrative data. Unique, special purpose applications should remain separate from the integrated system, but also be candidates for servicing by one of the major data centers. Free-standing, independent computing installations should be kept to a minimum and justified on a case-by-case basis.

SECTION IV

SUBCOMMITTEE ON TELECOMMUNICATIONS

SUBCOMMITTEE ON TELECOMMUNICATIONS

SCOPE

Pursuant to the charter of the Management and Efficiency Study Committee on ADP/Telecommunications, the Telecommunications Subcommittee focused on the relationship between the Department of Administration's Division of Telecommunications (DOT) and other state agencies. The subcommittee reviewed the historical and current activities of the DOT and compared those activities to the DOT's present statutory charter. In view of the radically changing telecommunications landscape, the subcommittee extrapolated the DOT's current activities into future needs.

RESOURCES AND METHODOLOGY

Members of the subcommittee met with the DOT's staff and management to obtain an overview of the Division's genesis, the evolution and present status of its organization and functions, the budgetary process which funds the Division's operations and the opinions and forecasts of the Division's personnel as to the direction of the State's telecommunications requirements.

The subcommittee received the continual and invaluable assistance of Mr. Robert Tolman, Director of the DOT, in this process of orientation. Mr. Tolman provided the subcommittee's members with job descriptions of the Division's present personnel, descriptions of the communications infrastructure in its present and projected configuration, insight into the Division's role as both a telecommunications carrier and coordinator, and the significance of the AT&T divestiture and reorganization for the development of a cohesive statewide telephone data network.

The subcommittee contacted all state agencies who are served by the DOT and invited input. Questionnaires were distributed to the "customer" agencies, written responses were reviewed and, if desired by the agency, individual interviews between members of the subcommittee and agency personnel were conducted. Written responses were received from and/or interviews conducted with virtually all agencies contacted. The subcommittee received the evaluation of the agencies of the efficacy of the DOT in meeting the telecommunications needs of the agencies over time and at present, the perspective of the agency as to the role of the DOT in responding to user needs and providing technical advice at present and in the future. Agency personnel were asked to define and describe the role of the DOT as desired by user agencies, to evaluate the ability of the Division to perform its present role, and to give the ideas and suggestions for improvement of working relationships. Information obtained from user agencies covered not only conventional telephony but state data communications and office automation.

The subcommittee reviewed available materials relating to performance of the state telecommunications function both within Colorado and in other states. Personnel of the counterpart divisions of the

telecommunications of 15 other states were provided with a written questionnaire and their responses were polled. In instances where other states have recently conducted a parallel management and efficiency study of the telecommunications function, those reports were obtained and reviewed.

Status reports of the telecommunications subcommittee's activities and tentative evaluations were provided to members of the other Management and Efficiency Study Subcommittees for their consideration in connection with their separate investigations.

CURRENT CHARTER AND STRUCTURE

The Division of Communications was created in 1968, developing out of activities related to the two-way radio system requirements of the Colorado Highway Patrol. Its early statutory responsibilities reflected the available technology of the 1960s. In the interim, the scientific community has graduated from the vacuum tube, telephone, telegraph and teletype to the transistor, closed circuit television, fiber optics, satellite communications, etc. In order for the Division to encompass the problems and opportunities associated with this rapid technological revolution, Senate Bill 227 was enacted in 1983, creating the Division of Telecommunications in the Department of Administration.

The amended statute provides the necessary latitude for the Division to function as a general service organization providing telecommunications support to all state agencies and those local government agencies that interface with the state telecommunications network.

The Division of Telecommunications presently performs the following functions:

1. Prepares and administers current and long-range telecommunications plans involving telephone, two-way radio, microwave, television and all telecommunications transmission systems (data transmission, facsimile, etc.);

2. Continually assesses and studies the telecommunications needs of all state agencies;

3. Coordinates and manages all telecommunication systems for state government;

4. Approves or disapproves the acquisition of telecommunications equipment by any state agency;

5. Develops the engineering criteria for detailed telecommunications systems with emphasis on microwave, public safety and administrative two-way radio, data transmission and telephone systems, as well as advises and coordinates telecommunications budget preparation for state agencies;

6. Coordinates all telecommunication facilities for state government and those local government entities utilizing state resources; and

7. Provides maintenance for the State's microwave system and two-way radio systems.

Since 1968, the Division has replaced 25 telephone switching systems, and eliminated four others by combining systems. The Division has a program to monitor tariffs for use to the advantage of the State. In 1974, all state telephone numbers were placed under an intrastate toll tariff that has generated an average of $35,000 a month in savings. A toll network implemented at the State Capitol generates monthly savings of approximately $20,000.

The Division has established and continues to improve, expand and maintain statewide microwave carrier and two-way radio systems, statewide networks, consolidated dispatch centers, remote solar bay stations, portable emergency communications packages, a solar-powered emergency communications van, centralized records and billing systems for networks, and a number of discreet systems which it is hoped will eventually be combined in a composite, interacting telecommunications network.

At present, the Division continues to implement many portions of its five-year plan. Five more major telephone systems are in a process of replacement, two-way radio systems for the Highway Department and State Patrol are being redesigned and upgraded, two intracity microwave loops will be completed and interpositioned with the main distribution system.

OBSERVATIONS

Perspective of User State Agencies

The strong consensus of representatives of state agencies who provided input to the Telecommunications Subcommittee was that the DOT is at present doing an excellent job of performing its immediate functions. The DOT is perceived as having been highly effective to date, within its limited resources, in accomplishing the essential maintenance and repair function, serving as a clearinghouse for interaction with the Bell system landline companies and in providing a consulting and design service for communications installations.

However, user agencies, as well as the DOT itself, envision a greatly expanded role if the communications needs of the State are to be met in the future. User agencies emphasized that the DOT must be instrumental in the future in establishing Colorado's common data communications network and assisting individual agencies in designing, justifying and acquiring needed hardware and software to interface into that network. The DOT must consult with individual agencies in needs and methods to estabish local area networks within the agency and consult with agencies in integrating data and voice systems. The Division must play an increased role in educating other state agencies

in how to achieve maximum utilization of existing and projected systems. Most critically, the DOT must greatly enhance its capacity to perform long-range analysis, to develop long-term communication plans and to assist the agencies in order to meet these plans. The DOT must be staffed to investigate new technology and evaluate on a continuing basis the cost alternatives which are presented.

Major Influencing Factors

Technological advances have radically changed the scope of available telecommunications functions and the means by which services are delivered. The divestiture and reorganization of AT&T, together with a profound modification of regulatory approaches at both the state and federal level, have resulted in the emergency of a competitive rather than a monopoly industry structure. The traditional means of delivery of telecommunications services to state agencies is no longer an available alternative. Further, the choice of competing technologies involves the potential for both substantial cost savings or substantial economic dislocations if decisions are made prematurely or without consideration of long-range needs.

Integration of diverse types of communications traffic is an all-embracing trend, an inevitable outcome of the convergence of computer and communications technologies. The dynamic power of advancing technology is driving these two fundamental and inter-related characteristics--convergence and competition.

These developments in the technology and structure of the telecommunications industry mandate that the DOT undertake a fundamental reorientation toward the planning and design function to meet the future telecommunications needs of the user state agencies.

Funding and Budgetary Constraints

With few exceptions, the DOT has historically been budgeted on a "line item" basis and its funding has reflected the needs of its user agencies as much as its own internal requirements. By way of example, the state microwave network evolved from the safety and emergency needs for two-way radio communications throughout the State. The DOT, while attempting to develop telecommunications on a statewide basis, must presently solicit resources from specific agencies to plan and implement their programs. As a result, the temptation is to develop subsystems for agencies on a piecemeal basis, resulting ultimately in duplication and inefficiency.

The overall efficiency accomplished by the DOT in terms of its present orientation is remarkable in view of its funding constraints. In the past ten years, the DOT has added only five full time employees to its staff. At the same time, the land mobile radio systems, for which the DOT is responsible, has increased by 54 percent, and voice and other transmission demands have grown by 75 percent.

The AT&T divestiture and reorganization will require additional staff to fill functions that were previously performed by AT&T. The

potential instability of reliance upon outside sources for communica-
tions functions within the new configuration of the telecommunications
industry is inconsistent with the DOT's responsibilities for public
safety functions such as the disaster emergency communications sys-
tem. Finally, both technological innovation and the competitive
nature of the industry resulting from the AT&T divestiture foretell an
indefinite period of price fluctuation and uncertainty. For all these
reasons, the present mechanism for funding the DOT does not appear to
allow the Division to devote sufficient present resources or develop
sufficient future capacities to make appropriate decisions as to the
nature and source of services, technology and equipment.

It is significant that 65 percent of the current personnel of the
DOT, as well as 68 percent of its current budget, are devoted to the
maintenance and repair function. The remaining 32 percent is devoted
to agency support. However, it is the planning and design function of
the DOT that represents the most critical capacity for meeting future
telecommunications needs. At present, the DOT has no personnel nor
any portion of its budget devoted to the planning and development
function.

The telecommunications subcommittee's survey of the Departments
of Communications of other states indicates that the Colorado DOT has,
on a comparative basis, less funding and fewer personnel than virtual-
ly any other state contacted. The achievements of the DOT under the
circumstances are the more remarkable given the topographical features
of the State, involving substantial distances and formidable physical
obstacles and climactic variations. Other states, furthermore, appear
to have foreseen much earlier that the telecommunications function of
state government must be proactive rather than reactive.

In general, the experience of other states indicates that the
accomplishment of a comprehensive and cohesive approach to telecommun-
ications planning and implementation requires a funding basis whereby
user agencies pay the direct costs for service plus a surcharge which
supports the design and installation of new facilities and the attrac-
tion of personnel with the special skill levels that are in high
demand in the competing private sector. In each instance, the thresh-
old focus is on a method of funding of capital construction which
allows the implementation of a state telecommunications network on an
orderly basis. Once the network is in place, the state
telecommunications agency can transmit official business telephone
calls and computer data, in addition to accomplishing the traditional
public safety related functions, without utilizing toll call rates of
commercial telephone companies. Once maximum usage of state
telecommunications capability and capacity is accomplished, the cost
of voice communication and data transmission can be minimized and
quantitative cost benefit relationships can be analyzed.

RECOMMENDATIONS

Notwithstanding the profound implications of technological change
and the reconfiguration of the telecommunications industry, the Tele-
communications Subcommittee believes that the Division of Telecommuni-

cations statutory charter is adequate for the present and the near
term. However, the DOT is <u>not</u> adequately staffed to accomplish its
present responsibilities, much less to take on the required new re-
sponsibility for long-range planning and implementation. Neither the
present funding level nor budgetary mechanism is adequate or appropri-
ate to enable the DOT to fulfill its necessary role in state govern-
ment.

Staffing

In the near term, at least three senior systems designers should
be added to the DOT staff. The DOT's budget must be increased as
promptly as possible to add planning specialists to assure that the
current performance of the state communications network does not
deteriorate and to initiate the DOT's reorientation to meet future
requirements.

Funding

"Seed money" must be provided on a targeted basis to allow ex-
pansion of the present state microwave system. The cost benefit
analysis associated with the proposed expansion of the Western Slope
microwave loop is a compelling argument for such "seed money" appro-
priations.

Budgeting

Flexibility must be provided in the Division of Telecommunica-
tions' budget process by eliminating the requirement that virtually
all activities take the form of a separate line item. In particular,
acquisition and modernization of telecommunications facilities must be
treated as capital expenses, particularly by allowing expenditures to
be extended over more than a one-year period and by including depre-
ciation in user charges.

Revolving Fund and Service Charges

A charging mechanism must be implemented whereby direct Division
expenses related to the operation and management of the state telecom-
munications systems are recovered from users, along with a surcharge
whereby users will provide the future capital requirements for network
expansion. This mechanism should be set up as a revolving fund, non-
appropriated, with user charges placed in the budgets of individual
agencies.

Further Study

The Legislature should authorize and fund a study to analyze and
define in depth the future structure of the Division of Telecommunica-
tions. The study should focus on the orientation of the Division of
Telecommunications which will best allow it to fulfill its charter in
the emerging telecommunications landscape; i.e., should the State run
its own telephone network or act as a "master contractor?" How can
the State best exploit available cost effective technology? A person-

nel resource profile should be reoriented towards the planning, and long-range functions should be developed. Finally, such a study should examine pricing structures and charging mechanisms for services delivered by the Division of Telecommunications which will accomplish the overall objective of self-funding.

SECTION V

SUBCOMMITTEE ON HIGHER EDUCATION

SUBCOMMITTEE ON HIGHER EDUCATION

SCOPE

The overall objective of the subcommittee was to review the responsibilities of higher education in promoting and developing the use of computer technology in developing state system plans. Specifically, the subcommittee analyzed responsibilities for data processing functions and the role of higher education in promoting effective use of computer technology for research, education and administration.

The Divisions of Automated Data Processing (DADP) and Telecommunications (DOT), statutorily established in the Department of Administration, perform various activities related to the planning, procurement, use, disposition and control of ADP and telecommunications equipment and services by state departments, institutions and agencies. Some functions are currently performed by these central organizations (DADP and DOT); some are performed by the various agencies (and institutions) on a decentralized basis.

Various oversight functions, as they relate to automated data processing and telecommunications, are performed by the Division of ADP and Division of Telecommunications, primarily in the administrative operations, not in research or educational activities.

RESOURCES AND METHODOLOGY

The subcommittee on Higher Education conducted interviews with designated representatives of the following institutions:

> University of Colorado
> Colorado State University
> Colorado School of Mines
> University of Northern Colorado
> Metropolitan State College; and
> Board of Community Colleges

The subcommittee also conducted interviews with the Directors of the Divisions of ADP, and Telecommunications, and Colorado Commission on Higher Education.

The Subcommittee also solicited and received copious documentation to ascertain whether the institutions of higher education had written procedures to confirm the execution of the oversight functions that were being investigated. These documents were solicited from all institutions of higher education.

CURRENT CHARTER AND STRUCTURE

All institutions of higher education in Colorado are governed by one of seven governing bodies, those being: (1) the University of Colorado Board of Regents, (2) the State Board of Agriculture, (3) the State Board for Community Colleges and Occupational Education, (4) the Trustees of Consortium of State Colleges, (5) the Trustees of the

Colorado School of Mines, (6) the Board of Trustees of the University of Northern Colorado, and (7) the Auraria Higher Education Center Board.

In addition to authorities vested by the Colorado statutes, the higher education governing boards function under a Memorandum of Understanding (MOU) between those boards and the Joint Budget Committee, which grants them increased responsibilities and fiscal flexibility; allows them to set each institution's expenditure level, including tuition levels, subject to applicable statutes and to the authority of the CCHE; reduces emphasis on line item appropriations and increased flexibility to transfer resources between appropriations; and authorizes each governing board to expend all cash revenues generated or to retain them from one fiscal year to another, as necessary.

OBSERVATIONS

The mission and objectives of higher education differ significantly from those of regular administrative agencies. These differences include the use of computer systems by the institutions as they relate to academic and research activities and the funding sources for higher education. However, there are recognized commonalities within the execution of administrative functions such as personnel, accounting, facilities management, retirement programs, etc.

Procurement Responsibility

The Divisions of ADP and Telecommunications are mandated by their statutes to investigate every data processing-related purchase; however, they lack the resources needed given the high volume of purchases made in higher education. For example, approximately 2,700 microcomputers were purchased in the last three years within higher education. Considering software, over 2,000 terminals and other data processing services and products, the Division of ADP is insufficiently staffed to execute its legal mandate.

In addition, a significant portion of education's funding is provided by private sources, which cannot be subject to Division approval or rejection. The funding sources for the institutions of higher education include: appropriated funds, federal appropriations and grants, institutions affiliated foundations, private foundations, private corporations, non-profit and research-oriented organizations, and tuition paid by students, financial aid agencies and private corporations.

The oversight functions that are the responsibility of the Divisions of ADP and Telecommunications are being performed adequately by the institutions of higher education. In today's world, computers are a normal tool used in the execution of academic and research functions and should not be treated as a separate funding or oversight item.

The funding emphasis should be focused on the priorities and directions of education to meet the needs of the citizens of the State

of Colorado rather than on the means and tools for implementing them. Management of the means and tools should be a responsibility of those who are charged with managing the institutions of higher education.

Based on these factors, the Memorandum of Understanding (MOU) was drafted, giving the institutions the authority to operate as they wish. The institutions now are acting under conflicting guidelines, their statutes and the MOU.

Governance Structure

The institutions of higher education in Colorado could benefit by coordinating their efforts and sharing resources. However, they lack a common decision-making vehicle with the necessary resources and clout. For example, the governance issue affects state and higher education planning, inter-institutional communication assistance, and promotion of a shared and balanced use of resources. It does not lead to the best use of resources and causes frustration both within and without higher education.

The current structure makes it difficult for higher education to resolve its own issues and this has necessitated legislative intervention. A more rational governance structure would permit institutions of higher education to resolve problems internally and to address priorities of education.

Telecommunications systems in higher education provide an illustration of the disadvantages of the current governance structure. Because the schools are controlled by different boards and have their own internal competition for funds, they have no incentive to develop a common communications system. Yet, facilities could be shared that would be in the best interest of the State, its citizens and the institution. There is no forum within higher education to effect such a network, and there is no source for funding such a common network, given the MOU apparatus.

Imbalance of Computer Resources

There is an imbalance of resources between the institutions of higher education. Within the past three years, the University of Colorado has purchased over 1,724 microcomputers and 20 minicomputers, CSU over 450 microcomputers and one super computer, in contrast to Metro State College's acquisition of only 53 microcomputers.

Levels of State Appropriated Funding

State funding for higher education may not be at the level required for support programs in the computer areas. Various institutions are encouraging students to purchase microcomputers as a way of augmenting their computer resources. This is shifting the burden for computer funding to the student, thus increasing the student's cost of education.

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RECOMMENDATIONS

This subcommittee recognizes that it may take several years to achieve the following recommendations given the fragmentation of funding and governance. However, the benefits to the State of Colorado and the resultant savings could be considerable.

Governance

Resolve and address governance issues to enable higher education to approach issues on a higher education level in regard to the use and sharing of computer resources. In resolving these issues, attention should be paid to overall balancing and adequacy of computer resources.

Statutory Responsibilities

Resolve the Statute and MOU issues. The institutions of higher education should have the responsibility for carrying out the following functions previously mandated by statute to the Divisions of ADP and Telecommunications:

  ° Acquisition,
  ° Institutional Planning,
  ° Development and Research activities involving data processing programs and tools,
  ° Computer facilities management.

Until the governance and MOU issues are resolved, the Department of Administration should be funded to enforce the statutes.

Common Administrative Systems

Include the institutions of higher education in common administrative systems prescribed by the State Departments of Personnel and Administration such as payroll, personnel, general ledger, maintenance and materials management, etc. Promote and assist in the establishing of policies and standards for the design of common higher education administrative systems, such as admissions and registration, etc.

Centralized Functions

Have the following functions centrally performed and coordinated for higher education. The agency or location of performance of the following functions should be decided by the Legislature and the Governor, given the resolution of the governance issues:

  ° Purchasing contractual support,
  ° ADP technical training, standards and methodologies for systems development,
  ° Development of guidelines for disaster planning and security,
  ° Provide advice on internal communication systems,
  ° Provide network facilities to connect various institutions to eliminate the inefficiencies of individual links, and promote

common usage of facilities for administrative, research, and academic programs,

° Provide advice and education on technological advancements in ADP and telecommunications,

° Maintain a directory of applications for the purpose of exchange and upgrading of existing and new functions,

° Promote and assist in the establishing of standards and policies for the design of common higher education administrative systems such as: payroll, accounting, materials management, retirement programs, admission and registration.

Mission Evaluation

The mission of the institutions of higher education should be evaluated by the Legislature to determine whether the amounts funded for computers are adequate to meet their educational missions.

ADP Audits

More frequent ADP performance audits should be performed.

SECTION VI

SUBCOMMITTEE ON LEGISLATIVE DATA PROCESSING

SUBCOMMITTEE ON LEGISLATIVE DATA PROCESSING

SCOPE

The views of subcommittee members on the legislative data processing subject areas of current capabilities, planning and needs assessment, cost impacts, security and confidentiality, organization and computing equipment support are addressed.

RESOURCES AND METHODOLOGY

The subcommittee was formed on March 13, 1984 at the request of the legislative leadership; and the kick-off meeting was held with House of Representatives leaders on April 7. With Department of Administration and Legislative Drafting Office help, information from other states about the ways they address similar problems was obtained and analyzed in April and May. A representative cross-section of involved, informed and interested people both within and outside the Legislature was then selected for interview. The interviews, 32 in all, were conducted in June, July and August. The results were correlated and summarized in early September. The subcommittee met in September to reach agreement on its recommendations and to prepare this report.

OBSERVATIONS

The subcommittee recognizes that the Colorado Legislature has been at the leading edge of state legislatures in the use of computers for a number of years. However, compared with other organizations about which subcommittee members have direct knowledge, the Legislature and its staff agencies and support groups make modest use of computers in the conduct of day-to-day business and, with few exceptions, most of today's usage is by staff members performing staff functions. Most legislators appear to have neither the time nor the interest to use computing facilities personally. Against that backdrop, the subcommittee had these additional impressions.

Current Capabilities

ALTER is the most widely used system in the current inventory, is for the most part satisfactory, and seems to provide the best jumping-off point for greater staff use of large-scale computers and computer systems. CLEAR offers bill tracking capabilities and is used sparingly for data analyses, but it does not appear to have realized its original design expectations or anticipated value as a "legislator's tool." CLEAR was clearly a pioneering effort at the time it was developed. However, in the ensuing years, it has acquired only a limited legislative constituency; it has not been fully completed to original specifications; and it has not been integrated with other state data access and processing capabilities. Because CLEAR is used by only a few other states, changes to keep the system responsive to user needs will be more expensive to Colorado than would be the case if many states shared the costs and all contributed improvement ideas. Personal computers are a growing influence and offer both a

significant and cost effective computing capability and a major man-
agement challenge to the legislative leadership in the months and
years ahead. Word processing is partially integrated into the paper-
work flow of the Legislature, but it could be even more effective and
offer more in the way of productivity improvements if the flow itself
was studied and streamlined.

Planning

Historically, legislative needs for computing support seem to
have been surfaced and studied one at a time. The computing capabil-
ities to satisfy the needs were then chosen and approved one at a
time. The result is the collection of discrete systems, hardware and
capabilities which now support the Legislature. If that is the bad
news, the good news is that legislative data processing has not pro-
gressed so far that it cannot still be brought under control through
the application of a straight-forward planning approach.

Cost Trends

The two pacing factors influencing costs are the extent to which
computers are used and the cost-effectiveness of the chosen capabil-
ities. While the cost of legislative data processing activities was
not studied in detail, the Legislature probably spends more than it
needs to for the support it receives; and the cost can be expected to
rise in the future, primarily because the Legislature will presumably
make increased use of computers and computer-based information.

Security and Confidentiality

The subcommittee found little concern over the adequacy of cur-
rent access controls. The ability to assure the confidentiality of
personal correspondence and to secure draft bills prior to introduc-
tion, the only two requirements consistently mentioned, seem to be
available already.

Organization

The lack of single, legislative staff focal point for informa-
tion services support to the Legislature is the key organizational
shortcoming observed by the subcommittee. This fact adversely impacts
the extent to which computer-based information is known about, avail-
able to, and used by legislators; aggravates the proliferation of
single-purpose equipment and systems that cannot communicate with or
support one another; and inhibits the preparation of a comprehensive
legislative information services plan. A legislative data office
would also strengthen the Legislature's ability to deal as a single
entity with the executive branch on matters relating to computers and
information access. It would also permit the Legislature to capital-
ize on the many similarities that exist between the two houses and
expedite rather than confound the legislative process.

Computing Equipment Support

The views of a number of key interviewees notwithstanding, the subcommittee believes that the establishment of a legislative computer center, owned and operated by the Legislature, should be discouraged. Such an approach would be unnecessarily expensive and would likely do no more to improve service levels than can be done by working closely with the General Government Computer Center when problems arise. It is also to the Legislature's advantage to be able to access data stored on the GGCC computer(s). The issues about cost of GGCC services should be addressed as part of the service charging program recommended to the Governor and the Legislature by another of the M&E subcommittees.

RECOMMENDATIONS

The recommendations discussed below are divided into those on which action should be taken as soon as it is convenient to do so, and those which should be studied further before implementation. While the recommendations are intended as an integrated package, a few are clearly more important or urgent than the others. They are listed first and in priority sequence:

Short Term Recommendations

The following recommendations are focused on achieving or paving the way for responsive, cost-effective information services support within the Legislature in the short range:

Develop Organization

Establish a Legislative Information Center. This Center should serve as a focal point for all data processing, personal computing and word processing activities carried on in support of the Legislature. The Center, initially with a start-up staff of one or two user-support specialists (not traditional computer technicians), should be assigned to the Legislative Drafting Office. Over the longer term, as demands on the Center grow and the Legislature becomes more interested in and reliant on computers and computer-based information, it may prove beneficial to make the Center a free-standing legislative staff agency. However, the overhead and cost associated with that placement in the structure appear unwarranted at this time.

Stop Personal Computer Proliferation

Promulgate a legislative policy on personal computers. This policy should establish guidelines for justification and approval of the machines, address funding and acquisition considerations, specify minimal interconnection requirements of the hardware, and assign responsibility to configure the hardware and software to the Legislative Information Center. Any substantial delay in bringing personal computers under central oversight control can be expected to magnify the problems of decentralized selection and purchase.

Connectivity

Centralize hardware selection. Today, the computers and terminals in legislative offices stand pretty much alone doing the job they were initially acquired to do. The hardware selections of the past have each been made on the basis of a single need, with a view to satisfying today's need, but have neglected to keep tomorrow's options open in the meantime. This has led to the existence of a number of different, incompatible devices that cannot be connected readily to one another into a "Legislative Network." This fact does not present a serious problem today only because no need has yet been identified to make connectivity an issue. However, one is likely to emerge in the foreseeable future. As a precaution against that eventuality, the independent approval and procurement activities of the various legislative agencies should be centralized under the Legislative Information Center, which can keep the legislative branch's inventory from looking in five years like the executive branch's does today.

CLEAR

Consider replacing CLEAR. The CLEAR System could be replaced by a combination of additional features in ALTER (to handle bill tracking) and greater use of personal and mainframe computers (for data analyses). However, a more in-depth look at this recommendation is warranted by the high degree of sensitivity that is associated with CLEAR. The study should be commissioned and a disinterested third party retained to examine alternative ways to perform the functions. The comparative costs should also be weighed. The work should be done in time for a final decision to be made on CLEAR before the current PSA contract expires in mid-1985.

Education and Awareness

Initiate an aggressive education program. As reported to and observed by the subcommittee, few people associated with the Legislature are conversant or comfortable with computers. Of perhaps greater importance is the similar finding about information that is already available within the State's numerous data bases. If the Legislature and individual legislators are to capitalize on the promise computers offer to simplify the legislative process and improve the quality and timeliness of legislative decisions, additional research needs to be completed. The issue is not becoming familiar with and using computers and terminals personally; it is becoming familiar with what can be done, what is available, and what questions can legitimately be asked. The key responsibility of the recommended Legislative Information Center will be to focus on this need. Group training sessions, one-on-one instruction for individual legislators, demonstrations and perhaps some outside seminar attendance by key people will all be effective in this area.

Inventory of Current Equipment and Capabilities

An inventory should be made of all computer-related hardware, software and capabilities available to and/or used by the Legislature

and staff, including the cost of each, as a starting point for the needs assessment and plan development.

Longer Range

The following recommendations address subjects that are somewhat less immediate and others which may need more work to implement:

Future System Development

Broaden the use of ALTER. Subject to additional system review, the subcommittee recommends use of the ALTER System as the springboard for future mainframe systems development. From interviews, the subcommittee determined that the system enjoys strong user acceptance and has better-than-average capabilities. Using ALTER would also eliminate the need for extensive user retraining and would immediately provide a "standard" to guide systems growth.

Needs Assessment and Plan

Identify functional legislative needs. A small, task-oriented work group should be formed to articulate in detail the functional needs of the Legislature and its staff. Although there is widespread recognition of the "need" for better computing resources, few individuals were able to identify precisely what those needs are. The work group would be most effective if it were composed of representatives of a cross-section of the organizations making up the legislative branch and led by the Legislative Drafting Office, either by the director, or by the head of the recommended Legislative Information Center.

Data Access

The Legislature should make better use of the data which the executive branch maintains. Redundant and duplicative data entry is rampant throughout the legislative process, and better use should be made of the data collection already performed by the executive branch. Either through electronic transmission or tape/disk/diskette exchange, the Legislature should better utilize the data available in government records.

Computing Equipment

Adopt the distributed processing approach to computing hardware. Systems and applications that require access to and use of large-scale computer mainframes should run at the General Government Computer Center, while the smaller, more self-contained needs can be met through the use of personal computers and intelligent work stations located in the various legislative staff agencies. These smaller devices can also be connected to the GGCC computers for such activities as data retrieval and data input. GGCC should be viewed as a public utility by the Legislature. It is not necessary to own and operate the computer to get good service or insure confidentiality any more than it is necessary to own and operate the power plant to get

electricity. More important than dedicated equipment are dedicated personnel, as suggested in the Legislative Information Center recommendation. The distributed approach is also the most cost-effective one for the Legislature, given its modest needs and volumes at the present time.

SECTION VIII

SUMMARY: MATRIX OF RECOMMENDATIONS

MANAGEMENT AND EFFICIENCY COMMITTEE
RECOMMENDATION SUMMARY

Description	Action Required	Budgetary Impact	Time Horizon	Benefits
Planning				
Establish a commission, composed of a majority of qualified representatives fom the private sector, to review and approve policy.		Minimal Cost	This Fiscal Year	Provide private sector expertise without increasing Department of Administration staff; promote continuity beyond political terms.
Develop planning guidelines for State Agency Data Processing Planning.		Annual Cost	Long Range	Provide structure for future systems development.
Correlate the planning cycle so that the annual plan can influence the next annual budgeting process.		None	Long Range	Identify budget needs to meet long range goals in a timely manner.
Assess and inventory the State's computer resources		Minimal	This Fiscal Year	Provide a basis for identifying needs and developing plans to meet these needs.
Redirect information system responsibilities of the Division to provide greater resources for planning, provide greater consulting-oriented services to state agencies, and coordinate and direct inter-agency project teams.		None	Long Range	Provide expertise to encourage effective decision-making.

Description	Action Required	Budgetary Impact	Time Horizon	Benefits
Major Computer Centers				
Place an immediate moratorium on incompatible systems development--software and hardware.		None	This Fiscal Year	Minimize excess cost of incompatibility decisions in the future.
Establish revolving funds and service charge-backs to self-finance General Government Computer Center initially, then all main frame computer centers.		None	This Fiscal Year	Encourage efficient computer utilization. Assure that funding will be available for needed expansion.
Compile and maintain statewide inventory of computer equipment, software and services.		Minimal One-time Cost	This Fiscal Year	Provide a starting point for establishing control.
Create a Chief Information Officer position in the Department of Administration		Annual Cost	This Fiscal Year	Achieve improved oversight control over an Executive Branch information services activities.
Develop and enforce statewide standards for selecting hardware, software and telecommunications.		Annual Cost	Long Range	Control quality and compatability.
Implement a phased plan for achieving statewide systems compatibility.		One-time Cost	Long Range	Move towards increased efficiency with minimum disruption to current operations.
Reduce the number of data centers from five to two, and re-equip with more cost effective computers.		Annual Savings- Equipment Alone $3 million	Long Range	Realize substantial cost savings from reduced overhead and more modern, cost effective equipment.
Encourage development of single, integrated information systems for common use administrative data.		One-time Cost Annual Savings	Long Range	Eliminate duplicate systems, redundant data.

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Description	Action Required	Budgetary Impact	Time Horizon	Benefits
Telecommunications				
Add three technical communications specialists to the DOT staff.		Annual Cost	This Fiscal Year	Analyze opportunities for high return on investment by altering present systems to better cope with deregulation and split-up of AT&T
Provide "seed money" to the Division.		One-time Cost Annual Savings	This Fiscal Year	Allow expansion of the present microwave system where there is a high payout.
Set-up telecommunications as a revolving fund.		None	This Fiscal Year	Encourage modernization by allowing capital expenses.
Charge users of telecommunications for services at competitive rates or less, and use capital generated to expand the system.	Legislative	None	This Fiscal Year	Enhance accountability and ensure future cost savings.
Conduct a study to define long-range plans for telecommunications services.		One-time Cost	This Fiscal Year	Ensure that current and future needs will be met effectively via a coordinated design.

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Description	Action Required	Budgetary Impact	Time Horizon	Benefits
Higher Education				
Resolve and address governance issues relating to use and sharing of computer resources for research and education.		None	This Fiscal Year	Realize efficient resource use by a statewide coordination of education and research computing for higher education.
Revise statutes to allow higher education to perform specified data processing functions related to research and education.		None	This Fiscal Year	Revising the statutes would eliminate the confusion over responsibilities created by conflicting messges in the statutes and the MOU.
Include the institutions of higher education in common administrative system to be developed for the state as a whole.		One Time Cost Avoidance	This Fiscal Year	Avoid developing separate systems in each institution of higher education, thus saving considerable development cost.

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Description	Action Required	Budgetary Impact	Time Horizon	Benefits

Higher Education (cont.):

Form an organization with higher education and perform the following functions centrally for all higher education computer activity related to research and education.

   Budgetary Impact: One-Time Cost *Time Horizon:* Long Range Annual Savings

   Benefits: Ability to share resources and communicate among all Colorado higher education, plus communicate with out-of-state institutions.

    ° Contractual Support
    ° Technical Training
    ° Methodology for Systems Development
    ° Internal Communications Advice
    ° Technological Advancements Education
    ° Assistance in Installing Common
       Administrative Systems
    ° Directory of Applications
    ° Network facilities for common use of
       administrative, research and
       academic programs.

Assess the adequacy of computer funding to meet education goals.

   Budgetary Impact: One-Time Cost *Time Horizon:* Long Range

   Benefits: Ensure that computer academic goals will be met with proper level of funding. Set policy on whether computer cost shifting to students is desirable.
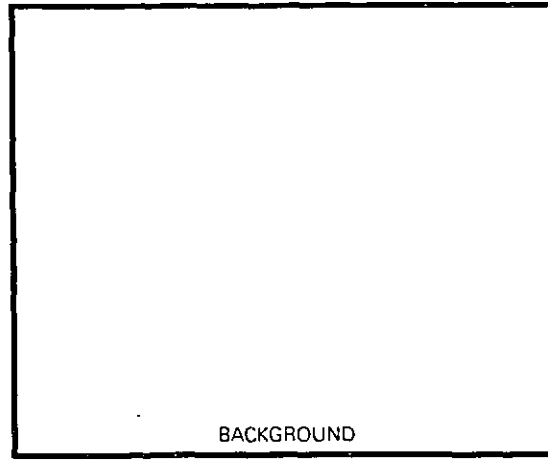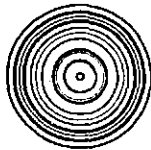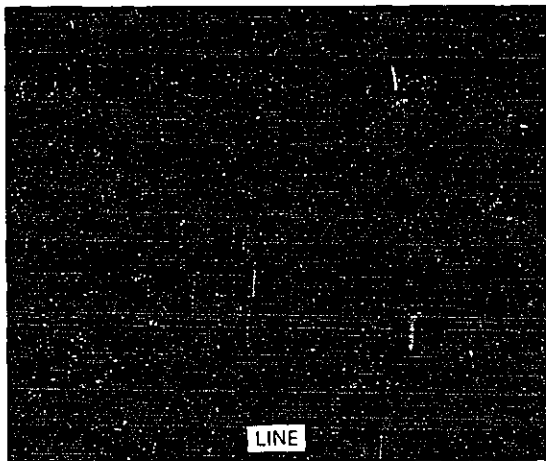
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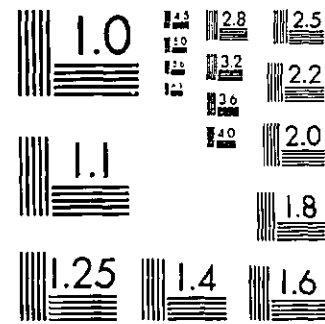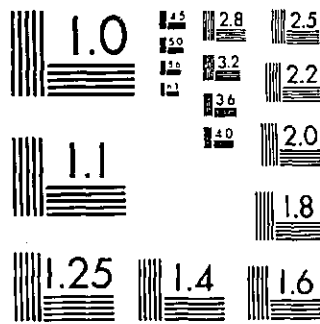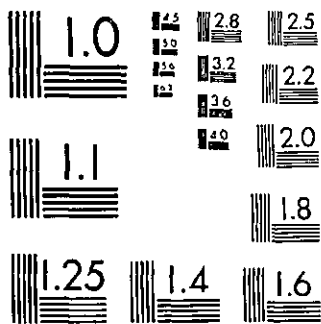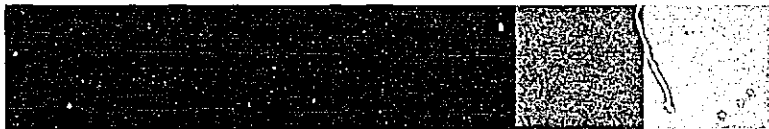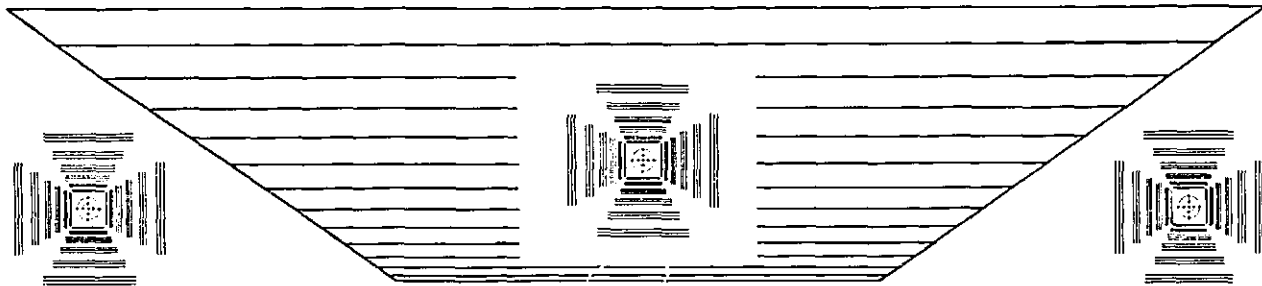
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