Implementation of the Consultant's
Recommendations for the
Improvement of the
ESV Information System

SYSTEM ARCHITECTURE PLAN

April 3, 1981

Consultants Report for EDUCATION DEPT
assist with implementation of mandate 1980 Laws c 609, Art VII, sec 10
subd 4 - - coded as Mn Stat 121.931)
Preliminary plan due 12/31/1980
Reports also due 7/1/81&9/15 even yr

Peat, Marwick, Mitchell & Co.

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Minneapolis, Minnesota 55402
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April 3, 1981

Mr. Charles Coskran
Minnesota State Department
of Education
Capitol Square
550 Cedar Street
St. Paul, Minnesota 55101

Dear Mr. Coskran:

Peat, Marwick, Mitchell & Co. (PMM&Co.) is pleased to present this implementation of the Consultant's recommendations for the improvement of the ESV Information System. There are two separate reports which are the result of this work: ESV-IS Systems Architecture; and ESV-IS Long Range Planning Process. The ESV-IS Systems Architecture is transmitted with this letter.

We enjoyed the opportunity to assist the State of Minnesota in this project.

Very truly yours,

Peat, Marwick, Mitchell & Co.

TIB:JF

EXECUTIVE SUMMARY

Peat, Marwick, Mitchell & Co. (PMM&Co.) was retained by the State Department of Education (SDE) to assist in the implementation of the recommendations resulting from the 1979-80 evaluation of the "Administrative Management Information Systems for Elementary and Secondary School Districts and the State Department of Education", conducted for the Governor. Two major recommendations from that study were the focus of this effort: the definition of an ESV-IS systems architecture and the development of a long-range planning process. This summary presents an overview of the systems architecture.

The development of the ESV-IS systems architecture commenced with a reassessment and refinement of the findings in the original Governor's report of January 31, 1980. Reviews were conductd at regional service centers, the Minnesota Educational Computing Consortium (MECC) and SDE to determine the nature and extent of changes occurring since the previous study.

The attached final report presents the architecture for integrating: (a) hardware; (b) communications; and (c) applications in a cohesive and comprehensive manner. The long-range planning process, which provides the means for achieving the objectives of the ESV-IS systems architecture, is described in a separate report.

FACTORS AFFECTING THE ARCHITECTURE

The state has a 13.4 million dollar investment in Burroughs large-scale hardware systems, with approximately 3.5 million dollars invested in ESV-IS application software. The return on these investments will not be fully realized for an extended time to come.

Current (FY81) communications costs are $665,434, with projected rises in tariffs by telephone companies. Annual costs for maintenance and support of the application systems is expected to be over $1,320,148 in FY81. These ongoing costs are expected to increase in the future due to inflation, increased demand and other factors.

Computer equipment, software and communications technology trends will also affect the architecture. The more significant of these trends for the State are: (a) rising data communication costs; (b) improving software development and reporting tools; and (c) improving equipment capabilities, particularly smaller systems. These factors will significantly influence the ESV-IS systems architecture.

ESV-IS SYSTEMS ARCHITECTURE

The basis for the proposed systems architecture is user information requirements. The user information requirements are divided into three general levels:

1. Simple informaton requirements, for which users typically need limited automation, except where reporting standards necessitate more complicated data collection, processing and reporting.

2. Intermediate information requirements, for which users need some automation, but do not require on-line inquiry or other elaborate technical capabilities.

3. Complex information requirements, where users are highly dependent on automated support for district operations and management decision-making.

The proposed applications systems architecture recognizes these levels of district information requirement and recommends a set of data processing support options from which the school district can select based on their perceived needs and associated costs. Districts may choose, for example, to describe their information requirement as complex in finance, and intermediate in payroll/personnel and student. The architecture will support that

level of diversity by making multiple technical solutions available to meet differing user needs.

Finance Systems

It is recommended that the primary State standard finance system (ESV-FIN) be GEMCOS-based and batch oriented, with intelligent data entry. To reach this goal: (a) the TIES ESV-FIN should be enhanced to more fully meet district requirements and adopted as the State standard system; and (b) intelligent terminals/microcomputers should be used as data entry devices for the ESV-FIN.

In addition to the standard ESV-FIN system, which is designed primarily to operate on a large host, ESV-FIN versions should also be developed to operate independently on medium-scale and microcomputer systems.

Payroll/Personnel Systems

The State standard payroll/personnel system should also be GEMCOS-based, batch oriented, with intelligent data entry. To reach this goal, user information requirements for payroll/personnel should be gathered and compared to the TIES payroll system and commercially available payroll/personnel systems. The costs and benefits associated with each option should be presented to the ESV Computer Council for determination as to which alternative should be selected. In addition, an intelligent front-end and a medium-scale computer version of the payroll/personnel system should be developed.

Student Systems

The State standard student system should be GEMCOS-based, batch oriented, with intelligent data entry. To reach this goal, the MECC/METRO II ESV-SSS system should be enhanced for State-wide applicability, based on district information requirements. Before adoption as the State standard, however, the ESV-SSS should be modified to provide logical groupings of

batch data transactions and to eliminate on-line update, which is resource intensive. A front-end data collection and edit capability using intelligent data entry devices should also be developed, as should a medium-scale computer system version.

Hardware

The proposed hardware systems architecture optimizes the current investment in Burroughs large-scale computer systems by: (a) gradually offloading the host processing workload to smaller systems; (b) making better use of available resources, particularly at night; and (c) introducing smaller, less expensive computer equipment to augment existing resources.

Four types of hardware have been proposed to support the defined levels of informaion requirements:

- microcomputers to provide front-end edit of district batch data, and stand-alone support for a UFARS compatible finance system;
- small-scale satellites to support intermediate level information requirements by providing front-end edit/valuation of district batch data, and file creation/maintenance/inquiry of host downloaded district data; and
- medium-scale satellites to support complex level information requirements by providing front-end edit/validation of district batch data, and stand-alone support of ESV-FIN, PPS and SSS systems.
- large-scale host systems to provide regional processing capabilities for those school districts preferring the present service approach.

Support Software

To provide a consistent and well controlled processing environment for the district user, the proposed ESV-IS systems architecture should include the following attributes:

- GEMCOS for all on-line user input to the application program to ensure data integrity, security and recovery of the data base; and
- CANDE for all application development in the controlled environment of the Central Development Group.

There are also a number of software development productivity tools available from Burroughs and other vendors. These tools should be used to the maximum extent practicable. In evaluating other vendor hardware to be used in the ESV-IS, the availability of similar development tools should be a factor in the selection and approval process.

Communications

Current and projected communication costs are an increasing percentage of the cost of operation of the ESV-IS, in part due to increased use and in part due to telephone service price increases. To reduce the exposure to the price increases and to lower the usage levels, the ESV-IS systems architecture recommends:

- microcomputers for data collection and edit to reduce connect time with the large-scale processor;
- a microcomputer finance system, which would operate in stand-alone mode and only communicate summary financial data at specific reporting intervals to the large-scale processor; and
- line usage analysis using diagnostic routines in GEMCOS to aid in improving the analysis of communications load, improve line utilization and reduce contention problems.

Development

The ESV-IS systems architecture proposes a Central Development Group to better support cost-effective delivery of applications systems to the ESV-IS. This group would:

- develop and maintain standard software;
- train users and implement standard software for regional service centers and school districts; and
- support a central applications library.

The Central Development Group should be competitively staffed by technical personnel currently resident at MECC, METRO II and TIES, and other personnel not presently employed within the ESV-IS organization. The Group should be organized and placed in a manner to make it more responsive to the

school districts, possibly by reporting to a board representing the regional service centers. Policy setting for the ESV-IS is the responsibility of the ESV Computer Council.

Cost Considerations

There is approximately $3,000,000 of large-scale Burroughs hardware scheduled to be acquired for the ESV-IS in the near term. The proposed hardware for the ESV-IS systems architecture, on the other hand, is projected to cost approximately $1,800,000. The proposed approach should defer or eliminate the need to acquire these additional large-scale host processors. Communications costs are also expected to be reduced with this architecture to as low as $280,000 (FY81) from current costs of $665,450. Actual savings may vary significantly, since they are dependent upon the nature and timing of school district service level decisions and the availability of the options identified. Most of the identified savings will not be immediately achievable, since the new options will have to be in place before existing service approaches can be reduced.

Current development and maintenance costs for the ESV-IS total $1,320,148 (FY81). The application recommendations of the ESV-IS systems architecture are achievable with current MECC, METRO II and TIES development funding levels.

A prioritized list of activities to be completed by the Central Development Group is included in the attached report, as is the proposed transition path. There are, however, two immediate priorities to be addressed:

- rework of TIES payroll/personnel or acquisition of a new payroll/personnel system; and
- completion of the current Ortonville microcomputer finance project, or development of a new microcomputer finance system.

If the Central Development Group reworks the TIES payroll/personnel system and completes the current Ortonville finance project, development costs are estimated at $421,500. If a new payroll/personnel system is acquired and modified and a new microcomputer finance system developed, the cost for these two activities is estimated at $609,000. Costs of other options and priorities are included in the report. For all costs - hardware, communications, and applications systems - the proposed ESV-IS systems architecture is cost competitive, more flexible and should deliver better information support for district operations.

BENEFITS OF THE ESV-IS SYSTEMS ARCHITECTURE

The benefits that will accrue to the State and to district users from the adoption of this ESV-IS architecture are:

- improved use of installed equipment and available resources;
- improved overall quality and flexibility of services provided to the school districts;
- more direct school district control over resource allocations and service alternatives; and
- minimal incremental investments in hardware, software, communications and other resources.

Some reductions in cost for the present hardware and communications architecture have also been projected. While similar savings have not been projected for software development, greatly improved flexibility should be available to the district user for a comparable level of cost.

ESV-IS
SYSTEMS ARCHITECTURE

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EXHIBITS

I - INTRODUCTION AND BACKGROUND

Peat, Marwick, Mitchell & Co. (PMM&Co.) completed an evaluation of the administrative management information systems for elementary, secondary and vocational school districts and the State Department of Education on January 31, 1980. This evaluation was requested by the State legislature and was contracted through the Governor's office. The evaluation resulted in a series of recommendations directed to strengthening the consortium and improving the planning and operational management of the systems supported by the Minnesota Educational Computer Consortium (MECC).

In September 1980, the State Department of Education (SDE) requested the following assistance* in implementing the PMM&Co. recommendations for the Elementary, Secondary and Vocational Information Systems (ESV-IS):

- develop a systems architecture;
- create a long-range planning process; and
- assist in developing the long-range plan for ESV-IS.

This report represents the ESV-IS systems architecture plan. The ESV-IS long-range planning process is described in a separate report.

SYSTEMS ARCHITECTURE

A comprehensive systems architecture is critical to the future success of the ESV-IS. The architecture described in this report integrates a series of elements into a strategy for the delivery of data processing services that is both effective and efficient. The scope of the architecture includes:

- recognition of user needs;
- design and implementation of application systems;

*This level of assistance was reduced from the original June 17, 1980 request for proposals, which detailed two additional tasks: (a) develop a formula or process for subsidy; and (b) develop a financial and performance monitoring system. These two tasks were deleted as a consequence of the State of Minnesota budget recission.

Table I

CURRENT ESV-IS SITUATION
as of January 31, 1981

	FINANCE	PAYROLL/PERSONNEL	STUDENT
VERSIONS	MECC - stable TIES - stable	MECC - unstable - extensive rework required METRO II - unstable - extensive rework required TIES - payroll stable personnel not available and must be created	MECC/METRO II - "new" version, not formally released TIES - stable, but large number of improvements identified
PROCESSING APPROACH	MECC - CANDE/batch TIES - GEMCOS/batch	MECC/METRO II - CANDE/batch TIES - GEMCOS/batch	MECC/METRO II - CANDE/on-line TIES - GEMCOS/batch
CONSUMPTION OF PROCESSING RESOURCE (PER YEAR)	MECC 1.36 hr/100 student (small district) .942 hr/100 student (large district) TIES .947 hr/100 student	MECC - 5.2 hr/100 employees (small district) 3.48 hr/100 employees (large district) TIES - 4.0 hr/100 employees	MECC - 2.08 hr/100 students (small district) 3.658 hr/100 students (large district) TIES 2.02 hr/100 students
DEVELOPMENT AND MAINTENANCE	$323,556 FY81	$365,217 FY81	$631,375 FY81
DIRECTLY DEFINED DEVELOPMENT TASKS	$85,086 FY81	$173,482 FY81	$403,293 FY81
DIRECT DISTRICT SUPPORT (COORDINATORS AND I/O CLERK)	$602,762 FY81	$327,347 FY81	$424,860 FY81
# DISTRICTS USING SYSTEM	437	139	72

- assessment of communication systems; and
- assessment of technical hardware considerations.

The long-range planning process builds on the components of the system's architecture to ensure that resources are directed to support the architecture.

STUDY APPROACH AND ACTIVITIES

To analyze the status of current operations, the PMM&Co. study team went back to the original Governor's report of January 31, 1980, so that subsequent efforts could be focused on changes that had occurred since that work. Data collection requests were then prepared for all regional centers, MECC and SDE. These requests were followed up by on-site reviews which were conducted during November and December 1980.

Analysis of the gathered data was conducted, and recommendations formulated in January and February 1981. This final report, the result of a comprehensive examination of current operations for MECC, regions and SDE, presents an architecture for integrating: (a) hardware; (b) communications; and (c) applications in a cohesive and comprehensive manner.

The long-range planning process, which provides the means for achieving the objectives of the ESV-IS systems architecture, is described in a separate report.

UPDATE OF CURRENT SITUATION

The examination of the current status for application systems, communications systems, and hardware operations revealed a number of changes from the situation described in the October 1979 PMM&Co. report. The current situation is described in the remaining paragraphs of this section. A summary of the situation is presented in Table I on the facing page.

Current Application Systems Status

The current status of the ESV-IS application systems is a follows:

- Financial Systems. There are two stable versions available which are UFARS compatible from TIES and MECC. MECC processes with CANDE and TIES uses GEMCOS as the message controller. There are 437 districts using these finance systems (377 on the MECC version and 60 on the TIES version).

- Payroll/Personnel Systems. There are three versions available, one each from MECC, METRO II and TIES. MECC/METRO II process with CANDE, and TIES uses GEMCOS as the message controller. The MECC/METRO II version consumes extensive processing resources. The TIES version is a complex system, but is stable. Personnel capability does not exist on the TIES system. There are 139 districts using payroll/personnel (79 on MECC/METRO II and 60 on TIES).

- Student Systems. MECC has completed a revised ESV-SSS but it has not formally been released. Both MECC and TIES versions use GEMCOS message processing. TIES has an extensive student system with a large number of enhancements defined. There are 72 users of student systems (12 on MECC and 60 on TIES).

- Instructional Management Systems. There are two stable versions, both regionally produced. The METRO II and TIES version both use GEMCOS message processing. TIES and MECC have no current development effort underway on these systems. There are 63 districts using Instructional Management (6 at METRO II and 57 at TIES).

Current Costs

The aggregate FY81 costs for each of the systems, development groups, and regions are as the follows (See Exhibits, I-1, I-2 and I-3):

- $1,320,148 for MECC, METRO II, and TIES development and maintenance (See Exhibit I-A);

- $661,861 for MECC, METRO II, and TIES directly defined development tasks (See Exhibit I-B);

- $1,367,469 for direct staff in support of district operations at all regions (See Exhibit I-C).

Current Hardware Environment

The hardware used to support the ESV information systems is predominantly large-scale Burroughs equipment. The seven regions currently have various combinations of Burroughs hardware to support district processing.

Actions are now underway to set up another computer center at Moorhead to service regions I and IV. The hardware for this center (Dual B6900's) will cost $958,282. Region VII (TIES) plans to add a third B6800 processor to their current configuration of Dual B6800's. In addition, Region VI (METRO II) is examining the need for a third B6800, with Minneapolis acquiring a B1900 to link to this region. At the present time the aggregate investment in equipment by the State and the Regional Service Centers to support ESV-IS is approximately $13.4 million.

Current Communications Environment

The communications networks presently installed in Regions I through VI are not extremely complex. Communications capability is provided to terminal operators in remote locations primarily through the use of CANDE. Exhibit I-D shows the regional distribution of (a) remote job entry devices; (b) cathode ray tube (CRT) terminal devices; and (c) other vendor equipment.

Remote Job Entry (RJE) equipment is used in some regions to enter and receive larger volumes of data at remote locations. All editing, verification and processing of data is done at the regional host computers.

The communications network currently supported by Region VII (TIES) is somewhat different. Although CANDE is utilized, its use is restricted to development staff. GEMCOS (Generalized Message Control System) is used to control communication by routing transactions initiated at a remote site to the appropriate application program or transaction process. Region VII does not currently support any RJE equipment.

Current Projects

There are two projects currently underway that have direct bearing on the ESV architecture:

- Adrian Apple II data collection; and
- Ortonville Apple II financial system.

Adrian Project. The Adrian system, developed over an eight month time frame, is an Apple II microcomputer data collection and edit front end for the ESV-FIN system. Approximately $36,670 has been spent by the State through MECC for the development of the Adrian system. The system when completed will be able to create, edit, modify and transmit batches to the host computer. The Apple II is defined as a teletype device to the Burroughs mainframe and operates under CANDE. As a result, a user of the Adrian system has the full range of operating system capabilities available to any CANDE user for file creation, file inquiry, program development and applications processing. This presents a control weakness that should be corrected before widespread use of the Adrian system is allowed.

Ortonville Project. Ortonville has created a financial system to operate on an Apple II microcomputer. The system features currently include:

- cash disbursement;
- expenditure reporting;
- check reconciliation;
- check register/bill list;
- receipts listing; and
- cash receipts journal.

At the time of the review, the Ortonville system did not meet UFARS standards for general ledger or encumbrance accounting, although it is our understanding that substantial progress has been made since the review in meeting UFARS requirements on the Apple II microcomputer.

In order to produce a financial system that will operate on a micro computer and meet UFARS requirements, detailed specifications must be completed. These specifications can then be used by technical personnel involved in the review and approval process for this system.

Approximately $30,000 has been spent to date on the Ortonville project by the Council on Quality Education (CQE). This funding will expire at the end of FY81. This amount does not include funds expended by Ortonville to develop this system.

Although not specific projects, Region III and Region VII (TIES) have made extensive study of the impact of distributed processing. TIES has a report on their work which includes a search of the technical literature on distributed processing.

TIES/MECC/METRO II

TECHNICAL SUPPORT

FY81 BUDGET

	Finance	Payroll/Personnel	Student
Date Base Administration			
MECC	$ -	$ -	$ -
METRO II	-	-	-
TIES	10,000	9,000	28,500
	10,000	9,000	28,500
Manager			
MECC	36,136	31,342	29,112
METRO II	13,465	13,465	13,465
TIES	24,700	24,000	55,600
	74,301	68,807	98,177
Systems Analyst			
MECC	26,629	50,280	16,000
METRO II	51,515	38,860	73,120
TIES	36,500	32,000	112,000
	114,644	121,140	201,120
Programmer			
MECC	51,374	44,372	14,878
METRO II		30,000	121,600
TIES	36,000	20,000	84,000
	87,374	94,372	220,478
Documentation			
MECC	-	-	-
METRO II	-	-	-
TIES	6,000	5,500	17,400
	6,000	5,500	17,400
Implementation			
MECC	27,237	28,398	
METRO II			
TIES	4,000	3,000	10,700
	31,237	31,398	10,700
Contract		35,000 *	55,000 *
SYSTEM TOTALS	$ 323,556	$ 365,217	$ 631,375

TOTAL TECHNICAL SUPPORT (ALL) $ 1,320,148

* METRO II

Exhibit I-A

DEFINED DEVELOPMENT/ENHANCEMENT ACTIVITY
TO BE ACCOMPLISHED

FY81 BUDGET

	Finance	Payroll/Personnel	Student
MECC	$ 48,627	$ 49,956	$ 39,612
METRO II		106,640*	263,185
TIES	36,459	16,886	100,496
SYSTEM TOTALS	$ 85,086	$ 173,482	$ 403,293
Total Defined Development/Enhancement			$ 661,861

* METRO II is undertaking a major rework of ESV-PPS system.

Exhibit I-B

DIRECT STAFFING SUPPORT
FY81 BUDGET

	Finance	Payroll/Personnel	Student
Region I	$ 87,400	$ 57,350	$ -
Region II	65,000	39,000	41,000*
Region III	117,175	54,322	40,125
Region IV	76,627	30,575	-
Region V	111,030	44,375	-
Region VI	64,980	82,325	208,185
Region VII	80,550	19,400	148,050
SYSTEMS TOTALS	$ 602,762	$ 327,347	$ 437,360
Total Direct Staffing Support			$ 1,367,469

*This figure presumes implementation of the ESV-SSS system on schedule. If there is delay, the figure will be reduced.

Note: Direct staff support to districts includes processing coordinators, input/output clerks, shared accountants and shared business managers.

DISTRIBUTION OF REMOTE DEVICES BY REGION
as of January 31, 1981

	SYS 34	RJE			TD830	CONRAC	APPLE-II	TELECOM COST FY81
		B1000 SERIES	B80/800	DATA 100				
Region I		1		1	57			$118,326
II					5		1	20,756
III			11		30			124,282
IV		1			21			99,572
V		2						49,101
VI		3	1		80			26,670
VII						130		95,000
TOTAL		7	12	1	193	130	1	604,391

Exhibit I-D

II - SYSTEMS ARCHITECTURE GOALS AND ASSUMPTIONS

Preparatory to defining the systems architecture, the architecture goals were formulated, a basic set of assumptions developed and impacting technological factors identified.

This section describes (a) those ESV-IS systems architecture assumptions; (b) current trends in technology that are expected to affect the architecture; and (c) the ESV-IS systems architecture goals.

ASSUMPTIONS

The following assumptions have been made in constructing the systems architecture for the ESV-IS:

- the State and regional service centers do not want to make additional large capital investment in hardware and software unless absolutely necessary;
- the Burroughs large-scale hardware systems owned by the State and regional service centers will continue as host processors for the near term;
- current data standards for finance will remain in effect and other standards in payroll/personnel and student may be added;
- centralized development is the most economic approach to developing standardized software for use in multiple locations;
- all districts will be members or affiliates of regional service centers; and
- each district is capable of planning its use of ESV-IS.

CURRENT TECHNOLOGY TRENDS

Current trends in technology were evaluated and the impact of these trends on the alternatives proposed for the ESV-IS architecture were assessed. As a result of that evaluation, the following technology trends have been identified as significant to future evolutions of the ESV-IS:

- data communication costs will continue to rise and may accelerate with the advent of message unit and usage sensitive pricing;
- distributed data processing use will expand and data base management systems and report generators will become more practical at the local nodes;

- microprocessor technology and capabilities will continue to improve;
- software development tools and productivity aids such as screen formatters, report generators, and other general purpose software will continue to improve people productivity.

SOFTWARE ARCHITECTURE FACTORS

While these trends in technology are and will be factors which must be considered in the ESV architecture, the following additional considerations must be taken into account when developing the ESV-IS software architecture:

- application software should become increasingly device independent and capable of operating on a range of a single vendor's hardware offerings;
- monolithic development and enhancement of application software can be achieved best through a central development group;
- application software will most likely be designed and built using vendor software tools and aids to the maximum extent practicable;
- multiple versions of the application software should be available for different levels of hardware and based upon stratification of user information needs; and
- districts, with assistance of regional service centers, are capable of, and must be responsible for, defining their information requirement in terms of complexity by application.

SYSTEMS ARCHITECTURE GOALS

The ESV systems architecture proposed by PMM&Co. has two primary goals:

- efficiency; and
- effectiveness.

Efficiency means that, for a given unit of input, the maximum reasonable amount of output will be derived. Effectiveness means that the activities of a system directly support organizational objectives for the ESV.

Efficiency

The following four objectives support the systems architecture goal of efficiency:

1. Central Development. There are four advantages to this approach. First, redundant development efforts currently underway at MECC, TIES, and METRO II will be reduced. Second, standards and procedures can be established for this central development effort that will more closely support the requirements of the ESV-IS. Third, technical expertise that currently exists in regions and at MECC can be consolidated into a single group that can maximize the benefits of this expertise. Finally, a central development effort will be more capable of developing, maintaining and implementing standard ESV systems.

2. Standardized Applications. Standardized application systems have a common design philosophy. The evaluation of the current ESV-IS application software reveals a variety of technical solutions to application requirements. The basis for the standardized system is a common core of requirements which is translated into a nucleus of capability applicable to all application system levels.

Based on defined data standards, the standardized application should support standard input and processing. Output standards should be defined, but flexibility should be provided to the user to define their own special reports.

Common data structures should make up the standard system so State data requirements in finance, payroll/personnel and student systems would have defined interfaces, minimizing redundant data input for the district.

3. Maximum Use of Software Tools and Development Techniques. The objective of maximizing the use of software tools is to reduce development and maintenance costs. These costs have been substantial with current MECC ESV-IS systems. The State has been forced to focus on correcting software problems rather than new development opportunities.

The changes recommended for the State-wide application systems should be implemented by a Central Development Group using the software development tools available from Burroughs.

Standardized applications should be created using a system development life cycle (SDLC) methodology with the following milestones:

- request definition;
- conceptual design;
- detail design;
- development/unit test;
- system test;
- acceptance test;
- implementation/conversion; and
- post implementation review.

By requiring the development team to solve application problems through use of a standard methodology, better use can be made of technical resources currently available and more maintainable systems will result.

The separation of application programs from communications requirements simplifies the development of application systems. GEMCOS, a generalized message control program provides that separation. CANDE, the most prevalent message control program, does not.

4. Maximum Use of Computer Resources. To take better advantage of the installed large-scale host processors, the State and regional service centers should spread usage of resources across the 24 hour day. This can best be achieved by concentrating on a batch processing approach in which updates to the data base are executed as processing resource is available. The use of on-line, interactive transaction processing with on-line update for all applications and immediate access to the updated data base is not warranted

for the current ESV-IS applications. Front-end processing is also recommended to: (a) reduce the use of on-line resources at the host computer; and (b) improve district input and control of data.

Effectiveness

The goal of effectively meeting ESV-IS information requirements must be met through the following five means.

1. Service Level Definition and Costing. In defining information requirements by level of complexity, it is important to support these information requirements through the use of service level definitions. These definitions of service should include: (a) turnaround time specified for district reporting requirements; (b) volume and frequency indexes to support district needs; and (c) costing alternatives for districts to ensure awareness of the actual cost involved for each level of service.

2. Better Management Information to the District. The need for inquiry into subsets of data for district management information should be based on the information requirements complexity index described in Section III. Rather than providing on-line inquiry capability without regard to information requirements, this capability should only be given to those districts that have defined their information needs to this level of complexity and are willing to pay the price for this level of service.

To speed the responsiveness to district ad hoc reporting requests we recommend maximum use of reporting aids such as REPORTER II on the large- and medium-scale systems* and DOMAIN, or similar products, for small-scale satellites.

*Through this report B6800 systems are referred to as large-scale systems, B1000 series are medium-scale systems, and the CP9500 is a small-scale series. These are not Burroughs definitions but reflect the size equipment in the ESV-IS.

3. SDE, MIS, and Federal Reporting Requests. To support the State Department MIS and Federal reporting requirements, data standards should be used to drive the application systems. Defined requirements from the UFARS Council and the Payroll/Personnel and Student Task Forces should be the major focus for application development and enhancement. The objective in this instance is to minimize the need for specialized information requests addressed to districts. By building in the information elements defined and required at Federal and State levels, these ad hoc requests can be reduced to a minimum.

4. Legislative Requests and Mandated Requests Supported by Flexible Reporting. As noted in the previous subsection, data standards should be established, which will then serve as a guideline for application system development. For ad hoc legislative requests, maximum use should be made of REPORTER II and related tools.

5. Defined Reporting Requirements. Data standards should begin the application development cycle. Standards now in existence, or planned to be developed by the UFARS Council and the Payroll/Personnel and Student Task Forces, are the basis from which defined information requirements can be addressed. These groups should coordinate information requirements mandated by State and Federal agencies into data collection and reporting standards.

III - USER NEEDS

User information needs have been categorized for each of the elementary, secondary and vocational information systems (ESV-IS) into three general levels:

- simple;
- intermediate; and
- complex.

Simple information requirements typically need little automation, except where standards in reporting have defined a more rigorous collection method, such as UFARS has done for district financial accounting.

Intermediate information requirements require some automation, but this level does not require inquiry into current sets of data for the management of district operations.

Complex information requirements are highly dependent on automated support for district decision-making. Complex levels of information require selection, summarization, and display capabilities.

The determination of simple, intermediate or complex information needs should be made by each individual district based on their unique information requirements, which may not be size dependent. Districts may also have simple information needs in one area (e.g., payroll) and intermediate or complex needs in another (e.g., student).

FINANCE SYSTEM

For the Finance system, the simple information requirement is for financial and budgetary data with the ability to produce vendor checks and reconcile these checks. Because of funding shortfalls, there is also interest in cash flow analysis at this information level. At the intermediate level, the same basic requirements defined for the simple pertain, with the

addition of a more complex chart of accounts. For the complex, the same requirements as for the intermediate level prevail, with the addition of the capability of inventory control and fixed asset accounting.

PAYROLL/PERSONNEL

For the Payroll/Personnel area, the simple information requirement has few needs in personnel, and payroll is not complex. Typically this payroll could be supported manually or at a local service bureau. For the intermediate level, personnel information on current pay, retirement systems, records of base pay and extra pay and ESV-FIN chart of accounts linkages, and check reconciliation procedures are required. At the complex information level, there is the need for a comprehensive personnel and pay information system which includes all the intermediate level requirements plus position control, civil service reporting, training/experience/assignment records, employee evaluation data, job openings/placement, and linkages to the Finance system chart of accounts.

STUDENT SYSTEM

For the Student system, those with simple information requirements have no needs, or limited needs for mark reporting, attendance, and/or scheduling. The intermediate level district has some requirements in scheduling, attendance reporting, mark reporting, and test scoring. For the district with complex information requirements, all of the intermediate level needs prevail, with the addition of instructional management. The instructional management area may become important even to those districts that define their information requirements as simple or intermediate due to increasing pressures for results-focused education and for accountability in meeting objectives set for individual students.

IV - ARCHITECTURAL ALTERNATIVES

A variety of architectural alternatives are available to the State for ESV-IS. Before an architecture was selected, a variety of alternatives were considered. This section presents the alternatives considered for the ESV-IS systems architecture for each of the following components:

- hardware;
- supporting software;
- application systems;
- communications; and
- development.

The current situation and each considered alternative is presented in the paragraphs that follow.

HARDWARE

The current hardware strategy calls for the delivery of district data processing support via large scale Burroughs hardware. There are three approaches to this service. The first, in METRO II, uses remote job entry (RJE) medium-scale hardware devices installed in user locations and attached to the large-scale host processor to provide remote job entry (RJE) services. These B1830 RJE devices are not presently used for local district processing. The second approach, in use at Regions I, IV, and VII, relies on remote cathode ray tube (CRT's) for entry of data and for requesting district reports.

A third approach has been implemented in Region III with intelligent data collection on Burroughs B-80 devices. Due to equipment failures, this approach is being abandoned. Efforts are now underway in Region III to acquire CP9500 small-scale satellite computers for intelligent data entry. This project has not yet received SDE approval.

The first two approaches have limited use of intelligence at the district or node. CRT devices are used for batch and transaction creation and for limited inquiry. Remote job entry (RJE) devices are used only for batch input and remote printing. In the third approach, Region III is beginning to use intelligent data entry. TIES has identified in their Long Range Plan the need to integrate intelligent data entry into their current processing environment.

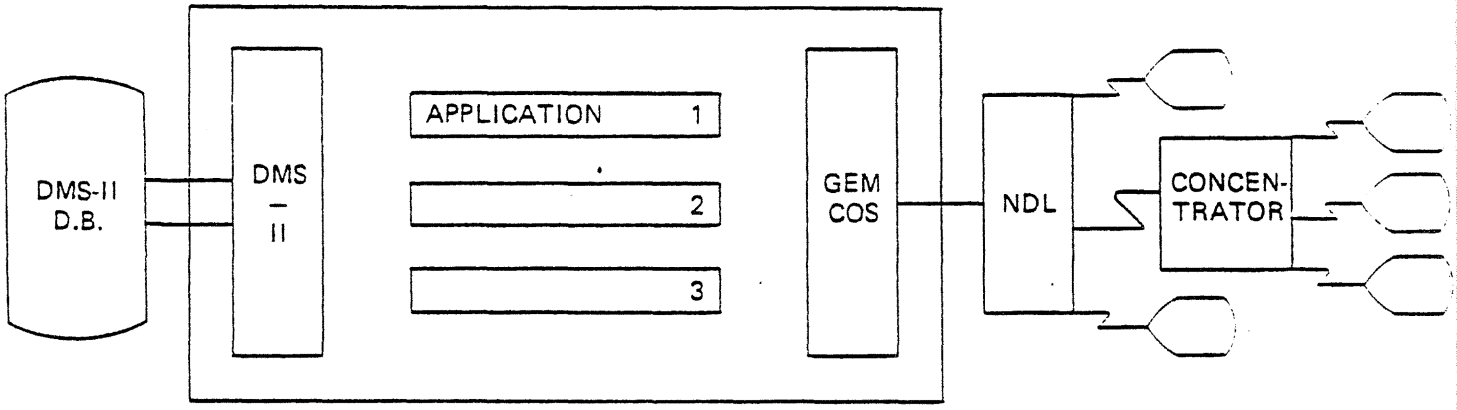
Exhibit IV-A illustrates the current architecture. For the MECC ESV-SSS and all TIES application systems, GEMCOS is used as the message processor to a network. Operating under GEMCOS, user access is limited to the initiation of application programs and access to the data base. The MECC ESV-FIN and ESV-PPS systems, on the other hand, use CANDE as the message control program. Operating under CANDE, the user can access application program source code, and modify or change data in an unstructured (uncontrolled) manner.

The advantage for those districts that have CRT input or remote job entry (RJE) capabilities is that data entry is at the user site. Those districts which must rely on mailing of hand-coded, batch entry forms must wait for data entry at the regional center and turnaround of error reports to complete their input cycle.

There are several disadvantages to the three present strategies. The most significant is high resource consumption at the host to support on-line access during the day. The use of this on-line approach, in which terminals are controlled as slaves within a host-controlled, polled network, results in heavy daytime demand on the host processor. CRT's and remote job entry (RJE) devices perform little or no preprocessing and are driven by host-loaded formats. These devices typically have no local storage facilities and often generate substantial overhead and high communication costs.

CURRENT ARCHITECTURE

ESV-SSS AND ALL TIES APPLICATION SYSTEMS



ESV- FIN AND ESV-PPS

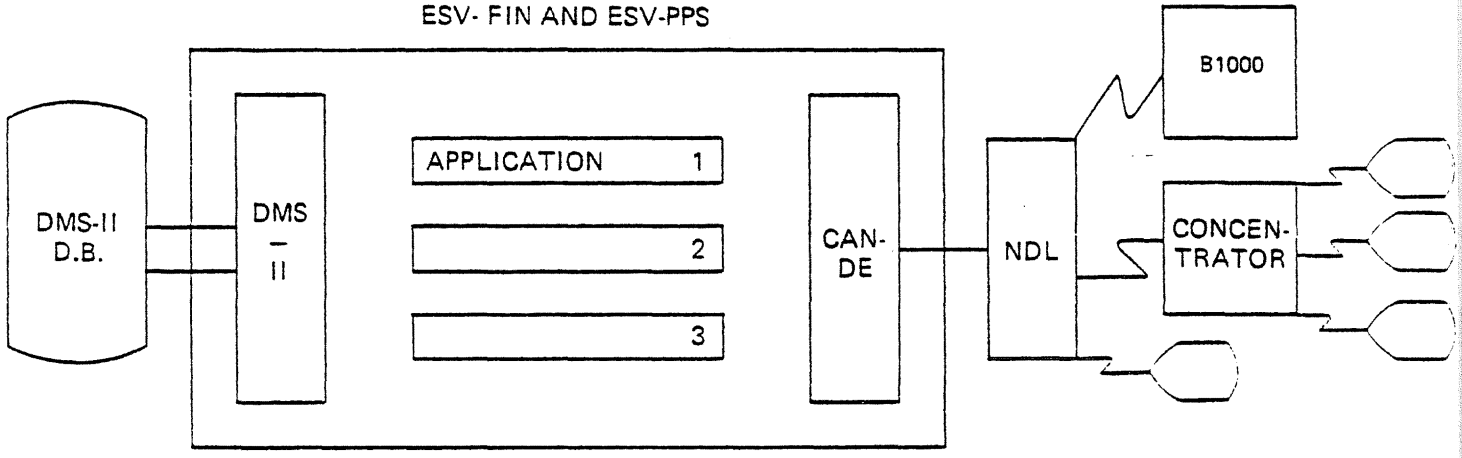


Exhibit IV-A

Although these terminals provide for rapid host capture of information from outlying locations, responsibility for error detection, editing, and data validation resides at the host, increasing resource utilization and causing processing delays.

ALTERNATIVE HARDWARE SOLUTIONS

In addition to the option of continuing with the present approaches, three other hardware alternatives are described in the paragraphs that follow:

1. Distributed Systems. The use of distributed systems, in which most of the processing power and machine readable data are placed close to the user, is the first option. In this approach, satellite processors of varying sizes are used to move processing power away from the host. Data is usually shared between these processors by linking the processors together in a communications network.

In this environment, a more sophisticated data base management approach is necessary to maintain the integrity of the user's data. Security provisions for user data must be included with password protection or device identification, or both. Additional hardware resources may also be required and more sophisticated communications software is necessary. Substantial new expertise is also required in the development group to support this processing method.

2. Host Processors with Remote Intelligence. Another alternative is to migrate portions of the processing workload away from the large-scale host environment to medium-scale hosts, or small-scale satellite operations. The medium-scale host could be used for local terminal support, data entry, edit and validation, or could operate stand alone versions of selected State software. The small scale satellite would be used primarily for data entry,

edit and validation, and some limited inquiry to the host. Small-scale satellites could also provide the capability to receive subsets of district data from the large-scale host and support inquiry and report generation from that subset of data. Validation tables could be stored locally to ensure that accurate data was transmitted to the large-scale host. Updates of district data would continue at the host.

3. Decentralized Systems The last alternative is a decentralized hardware strategy in which each district determines its own hardware solution to meet the mandated UFARS requirement and to support other district required applications. Little or no economy of scale is available and multiple, redundant development efforts may be needed to support each district's needs.

SUPPORTING SOFTWARE

Operating software controls the use and functioning of the data processing resource. Since Burroughs provides only one operating system, this subsection concentrates on support software (including data communications and reporting software).

Data communications software available from Burroughs consists of two types of products:

- a data communications network definition product called Network Definition Language (NDL); and
- message traffic management systems, including: Generalized Message Control System (GEMCOS), Command and Edit (CANDE), and Remote Job Entry (RJE).

Reporting and data base software available from Burroughs consists of the following three types of products:

- data base or file management software.
  - Data Management System II (DMS-II)
  - DOMAIN

- reporting software
  - DMS-INQUIRY
  - REPORTER

- data entry software
  - ODESY

An examination of the current Burroughs hardware line reveals that these software development, data communications management, and performance improvement tools are distributed across large-, medium- and small-scale processors (See Exhibit IV-B). These support software tools can be used to speed the development, implementation and enhancement processes for application systems. With the exception of DMS-II, they are not widely used in the ESV-IS environment at the present time.

SUPPORTING SOFTWARE ALTERNATIVES

The only supporting software alternatives are to make better use of Burroughs products, or to use other vendor products on the machines for which those products were designed. This becomes a viable option as more vendors concentrate their new product offerings at the small-scale satellite and microcomputer level. The proliferation of data base management systems, file generation and maintenance systems, and screen generation systems will provide an alternative to current Burroughs offerings.

APPLICATION SYSTEMS

The current inventory of application systems supported by State funds includes the following:

- Finance;
- Payroll/Personnel;
- Student; and
- Instructional Management.

A summary of alternatives is presented for each of these systems.

SUPPORT SOFTWARE

	LARGE SCALE B6000	MEDIUM SCALE B1000	SMALL SCALE CP 9500
DATA COMMUNICATIONS			
NDL	X	X	X
MESSAGE TRAFFIC MANAGEMENT			
GEMCOS	X	X	X
CANDE	X	X	X
RJE	X	X	
DATA BASE or FILE MANAGEMENT			
DMS-II	X	X	
DOMAIN		X	X
REPORTING SOFTWARE			
REPORTER	X	X	X
INQUIRY	X	X	
DATA ENTRY/DATA COLLECTION			
ODESY		X	X

Exhibit IV-B

Finance System

There are currently two different finance systems installed and operational in the State: the MECC supported ESV-FIN and the TIES supported ESV-FIN. These systems are fundamentally different financial systems. (See Exhibit IV-C). Both the TIES and MECC ESV-FIN systems are stable, fully developed, operational systems. They both meet UFARS standards for processing of financial transactions and for reporting results to the State. In FY81 the State and regional service centers are projecting the expenditures of $141,376 with MECC, $116,200 with TIES and $64,980 with METRO II,. for a total of $323,556, for maintenance and support of the ESV-FIN systems.

The MECC ESV-FIN system has been operational since 1976. The TIES ESV-FIN was completed in 1980 and was implemented for FY 1981. Current maintenance at MECC consumes approximately 70%* of the total ESV-FIN staff of six. TIES has four staff assigned to ESV-FIN with approximately 60% involved in maintenance of the current system.

The TIES ESV-FIN does not currently provide cash flow analysis. This support requirement has been identified in the TIES long-range plan and would take, according to TIES estimates, approximately 120 person-hours to complete. Financial modeling is available and includes the use of Consumer Price Index (CPI) inflator tables to aid in budgetary projection.

Alternative Financial Systems

The UFARS requirement has a direct impact on alternatives considered by the State. The acquisition of another large-scale finance system for which UFARS compatibility must be demonstrated, or developed, is an expensive and time-consuming process, with little benefit to be derived. The current

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* Work reporting system recently installed. No reliable data available. Estimate made by MECC staff.

COMPARISON OF CURRENT ESV-FIN VERSIONS

	TIES ESV-FIN	MECC ESV-SSS	
Message Processing	GEMCOS	CANDE	
Processing Logic	Multi-district run	Single district	
Data Element Structure	General to specific	Specific to general	
Annual Processing Time per 100/Students	.947 hours	(Large District) .94 hr	(Small District) 1.6 hr

Exhibit IV-C

finance systems are compatible with UFARS and are stable, maintainable systems. The acquisition of a large-scale finance system for the State is not recommended. One of the two major systems should be selected as the State-wide system.

Another option is the creation of an ESV-FIN which could operate independently on a Burroughs medium-scale system (B1000 series). For districts that have defined their finance information requirements as complex, such an option is attractive. MECC has explored this possibility and has determined that their ESV-FIN could be modified to operate in such an environment. Two thousand person-hours will be required to complete the project. It appears that the current TIES ESV-FIN version is more easily downsized to a medium-scale B1000 than the current MECC ESV-FIN. However, no estimates of time or cost have been completed by TIES for this downsizing.

Those districts that have defined their finance information requirements as simple should have an option of a microcomputer-based, UFARS-compatible finance system. This stand-alone microcomputer finance system would be used for the creation, storage processing, and output of district financial data. At periodic intervals, such as monthly, financial results of the district could be reported from the MICRO-FIN system to the regional service center for subsequent summarization and reporting to the State.

Personnel with UFARS expertise at the State Department of Education (SDE) and the UFARS Council should meet and establish the final UFARS technical specifications for such a system by May 15, 1981. Using this specification as a guide, Ortonville personnel and the MECC ESV-FIN manager should meet to devise a workplan to meet the technical specifications for the MICRO-FIN version. Upon completion of the project, MECC, SDE, and UFARS Council members should meet to review the MICRO-FIN and approve or disapprove its technical merit. Upon approval, this MICRO-FIN would become a

product supported in the State's approved library of application programs. This UFARS finance technical specification could be used to obtain proposals of other vendors hardware solutions.

While the Ortonville project is considered close to completion, at this point the Ortonville project cannot be considered as an alternative ESV-FIN system. At best, this system currently can be used only for data collection and edit for transmission to a regional service center for processing using the current ESV-FIN. It is estimated that about 120 hours will be required to complete the technical specifications by SDE, MECC, and UFARS personnel. An additional 320 hours are projected to be needed by Ortonville personnel to complete the programming necessary to meet this specification.

Personnel/Payroll System

There are currently three different payroll/personnel systems installed and operational in the State. MECC supports an ESV-PPS; TIES supports a payroll system and METRO II supports an ESV-PPS variant. The MECC ESV-PPS and TIES payroll systems are fundamentally different systems. (See Exhibit IV-D).

The MECC ESV-PPS system is implemented in 139 districts through the State. In FY81, the State and regional service centers expect to expend $154,392 with MECC, $93,500 with TIES, and $117,325 with METRO II, for a total of $365,217 for payroll/ personnel support.

The MECC ESV-PPS is not stable as many problem reports (25 to 30) continue to arrive on a monthly basis. Current maintenance efforts at MECC consume approximately 60%* of the total MECC ESV-PPS staff of six.

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* Work reporting system recently installed. No reliable data available. Estimate made by MECC staff.

COMPARISON OF CURRENT PAYROLL/PERSONNEL VERSIONS

	TIES Payroll	MECC ESV-PPS	
Message Processing	GEMCOS	CANDE	
Processing Logic	Multi district run	Single district run	
Data Element Structure	General to specific	Specific to general	
Annual Processing Time per 100 Employees per year	4 hours	(Large District) 3.45 hr.	(Small District) 5.2 hr.

Exhibit IV-D

There are several problems with the current MECC payroll/personnel system:

- the ESV-PPS data base contains imbedded data structures, which complicate access;
- the use of variable-format data sets contribute to high overhead;
- the data-base design is inefficient for ad hoc reporting;
- the system does not support position control and other personnel management functions; and
- reporting tools available from Burroughs are not used.

METRO II has modified the ESV-PPS data structures. A number of other modifications to improve the data base design have been defined to improve running time and to support large district users in METRO II. These additional modifications are expected to total $106,640 of METRO II personnel resources in FY81.

The TIES payroll system is approximately 10 years old and is nearing the end of its life cycle. It relies on a "bridging" program to operate with DMS-II. The TIES long-range plan recognizes the need to re-work this payroll system to meet current user requirements, particularly in personnel reporting. TIES has a four person staff assigned to the payroll system with approximately 60% of their time involved in maintenance of this system.

Alternative Payroll/Personnel Systems. There are three alternatives to the current situation. The first is to modify the existing MECC ESV-PPS to improve: (a) the data base design; (b) the editing process; (c) the data elements available for reporting; and (d) processing time required. The second alternative is to evaluate the modifications needed to improve the TIES payroll system to: (a) eliminate the "bridging" to the Burroughs Data Base Management System, DMS II; (b) modify the complex update process to reduce processing time; and (c) add personnel data required to meet the

needs of districts who defined their information requirements as intermediate or complex. The third alternative is to acquire a payroll/personnel package supported by a commercial vendor. A fourth alternative, development of a new payroll/personnel system was not considered due to the time and dollars required for such an effort.

Regardless of the alternative selected, data standards proposed by the Payroll/Personnel Task Force must be used as the basis for the requirements definition and specification.

Student System

There are currently two different student systems installed and operational in the State: the MECC-supported ESV-SSS; and the TIES-supported student system. These systems are fundamentally different student systems. (See Exhibit IV-E).

The MECC ESV-SSS system is in a "pilot" stage and has not been officially released. The system is undergoing pilot at METRO II, Region II, and Region III. The State is planning to expend $59,990 with MECC for the support of this system in FY81. METRO II has budgeted $263,185 for FY81 support.

The TIES student system is fully developed, stable and operational. TIES plans to spend $308,200 for maintenance of this system during FY81 and would receive no subsidy for its maintenance. Total FY81 costs for student systems for the State and regional service centers are $631,375.

The MECC ESV-SSS system has relational data structures for the data base, simplifying reporting or comparison of data elements contained in the data base. The TIES system has a hierarchical data structure which reduces reporting flexibility and increases processing time for report requests. TIES has identified major enhancements to their current student system in their long-range plan.

COMPARISON OF CURRENT STUDENT VERSIONS

	TIES Student	MECC ESV-SSS	
Message Processing	GEMCOS	GEMCOS	
Processing Logic	Multi-district run	Single-district run	
Data Element Structure	General to Specific	Specific to General	
Annual Processing Time per 100 Students	2.0193 hours	(Large District) 3.658 hr.	(Small District) 2.08 hr

Exhibit IV-E

Alternative Student Systems. The primary data standards currently in effect for student systems are derived from the State's teacher certification requirements. As there are few such standards in effect, there are a number of commercially available systems which could be considered as alternatives to perform:

- mark reporting;
- census reporting;
- attendance reporting; and
- scheduling

Instructional Management

There are two Instructional Management Systems. Both systems have been developed at regional expense, and both systems use GEMCOS as a message processor.

The TIES Instructional Management System (IMS) was completed in late 1978. This system is stable, and no development or enhancement efforts have been defined.

The METRO II Instructional Management System was first available in 1979. METRO II has budgeted $49,990 for maintenance in FY81, with no direct State support. Few modifications or enhancements have been scheduled for FY81.

COMMUNICATIONS

The current communications approach varies between regions. Regions I and IV rely on CRT input of data to the host processor. Region III uses CRT input and B80/90 intelligent data entry. Regions II and V input data at the host site, relying on mail or ground transport of batched input forms to the center. Region VI uses Remote Job Entry (RJE), medium-scale hardware for

data input and remote printing. Region VII uses CRT devices for data entry and also provides for batch keypunching service at the center. The current approach as can generally be characterized as non-intelligent nodes attached to large-scale hosts via a large, fixed network.

Current (FY81) telecommunications costs are based on second quarter FY81 results, and are projected at $586,434 for regional operations and $79,016 at MECC, for a total of $665,450. Although MECC provides central communications bill-payment services and some consulting, the networks are based primarily on regional plans.

Alternative Communications

The primary alternative to the present communications approach is to offload selected aspects from the host processor workload to intelligent devices located at the school districts. Offloading should result in reduced connect time and a corresponding reduction in communication costs. By reducing connect time to an minimum, the State can insulate itself somewhat from the major price increases currently requested by telephone companies. The major increases requested are in leased line costs. Communications analysts are predicing that there will continue to be large price increases in data transmission costs until new modes of operation, (e.g., satellite and "light" wire,) are in place and supported commercially. These options are 5-7 years away. In the interim, there opportunities for communications cost reduction.

There are several alternatives to consider when purchasing data communication service to support the ESV-IS network including:

- dial up versus leased lines; and
- point-to-point versus multidropped

Each of these options has particular cost and performance advantages. The determination of which option is preferable relies primarily on load, distance and dispersion factors. To reduce cost, line useage analysis must be performed to identify opportunities for reducing connect time, minimizing contention problems and optimizing load on the communications network. GEMCOS, the generalized message control system provides a number of features to facilitate line usage analysis.

The final communication alternative considered is to continue mail or ground transport delivery of batched data input (either hand-coded, or floppy disk), and for return of batched error reports. Mail and ground transport of hand-coded batch input has distinct disadvantages because of: (a) turnaround time; (b) lack of district control over the input process; and (c) lack of district involvement in the input process. Their principal advantage is that they are inexpensive relative to the other two options.

DEVELOPMENT

There are three development groups currently in operation that provide support for ESV-IS:

- MECC;
- TIES (Region VII); and
- METRO II (Region VI).

MECC has a staff which is currently supporting ESV-FIN and ESV-PPS. Teams are in place for these applications. The Student System does not have MECC systems analysis and programmer team assigned. MECC is relying on METRO II for the development of this system. The MECC FY81 development, enhancement and modification budget is $355,758.

TIES has a full development team in place to support their versions of the following applications:

- ESV-FIN;
- Payroll;
- Student; and
- Instructional Management.

The TIES FY81 development, enhancement and modification budget for these systems is $518,900. METRO II is currently active in modifying the ESV-PPS and developing the ESV-SSS systems. They also have personnel assigned to maintain the Instructional Management System. The METRO II FY81 development, enhancement and modification budget is $445,490.

Alternatives for Development

There are three alternatives to the present, fragmented development approach.

1. Central Development. The first alternative is to centralize development in a single group that would be responsible for developing, enhancing and maintaining State software. This was an original goal of MECC and continues to be attractive in terms of economy of scale and efficiency.

The placement of this central group in such a manner as to make it more responsive to user needs is critical. The primary problem with the current MECC placement is that it is too removed from the users of the software. Without some form of the direct service orientation and accountability, product quality and effectiveness can fall short of user needs.

2. Regional Development. The second alternative is for each region to develop, enhance and maintain software for their respective district customers. Such an approach directly addresses the need for proximity to the user. However, there are problems with this strategy in terms of district cost, redundant efforts, maintainability and State-wide applications software consistency.

3. Contract Development. The last option is to contract for software. With this option there is an absolute need for accurate statements of user requirements to define information needs prior to negotiation with vendors. This option has the advantage of expediting the implementation of the software application, but necessitates careful contractual definition of training, documentation, enhancement and maintenance responsibilities and costs.

V - PROPOSED ESV-IS ARCHITECTURE

In the previous section, the range of practical alternatives available to the State were defined. This section describes a model system based on those alternatives.

There are six characteristics to the model system:

- front-end data collection and edit;
- stratified approach with controlled transition;
- district processing for unique requirements;
- controlled data communication costs;
- move toward vendor independence; and
- centralized development.

FRONT-END DATA COLLECTION AND EDIT

There are a number of advantages to placing the data collection and edit processing near the user. The primary advantage of this approach is to off-load the host central processor of data collection and edit routines. This approach also keeps error correction and identification of errors near the user, allowing transmission of batches to the host with a minimum number of errors. By concentrating front-end data collection and edit activities at the district, batch control integrity is maintained, resulting in simpler audit and control procedures. This approach preserves the standard communication interfaces and current approaches to security controls and access to the host processor. Finally, by transmitting only completed batches to the host, data communication costs for the district and the State are minimized.

STRATIFIED APPROACH WITH CONTROLLED TRANSITION

As noted in Section I, the information requirements of districts have been stratified into three groups: simple; intermediate; and complex. By concentrating development work on common batch applications for each of these levels, the State will be able to take advantage of central development and maintenance processes. By providing district support based on defined information requirements, the State will be able to place processing resources where they can be best utilized for a maximum return on investment.

This transition can be controlled by focusing development through a central development group working on projects that are defined and supported in the system architecture. Section VI defines a development strategy that will foster the creation of software to fit the architecture plan.

DISTRICT PROCESSING FOR UNIQUE REQUIREMENTS

To remain responsive to user needs, there must be means of providing for district unique software. Development methods, presented later in this report, outlines a specific procedure for this process.

The incremental cost for these district uniques should be borne by the district only, and State-developed and supported application software integrity should be maintained. By focusing development efforts on common core requirements for systems, development expertise and processing resources can be optimized.

CONTROLLED DATA COMMUNICATION COSTS

The transmittal method selected to support district information requirements should be built based on defined district needs for timeliness,

volume, complexity and geographic location. The result of this effort should be service levels based on need and an approved data processing system architecture.

VENDOR INDEPENDENCE

The State will continue to use Burroughs large-scale host processors for some period of time, most likely until the seven-year lease/purchase agreements have expired. The objective of vendor independence will be met by providing a means for the State to migrate to other vendor hardware gradually over time. The proposed ESV-IS systems architecture provides for migration beginning with intelligent data entry devices and small-scale systems.

To ensure compatability with the existing network, other vendors must provide a communications protocol which is supported by the Burroughs Network Definition Language (NDL). The second criteria is that new vendor hardware provide software tools for data collection/edit, file development, and inquiry/reporting. The third criteria is that non-Burroughs hardware must provide capabilities that conform to the definition of district information requirements for simple, intermediate and complex support levels. This hardware must be capable of meeting performance criteria for the district or districts which request use of the equipment.

Modifications to State software required for installation of non-Burroughs equipment should normally be achieved at district expense and will be subject to a technical review and approval.

CENTRALIZED DEVELOPMENT

A single, centralized development group accountable to the districts through the regions can provide concentrated technical expertise, greater commonality of systems and improved responsiveness to user needs. Such a

group could be formed through competitive staff selection and would provide some opportunity to consolidate technical staffs presently resident at MECC, METRO II and TIES.

CURRENT STATUS

As will be discussed in subsequent sections, there are several areas in this model system that are not currently supported. There are projects underway to support front-end data collection and edit with intelligent devices. There are also attempts to provide different levels of software solutions to user information requirements (See Section IV, Application Systems).

In other areas, such as district processing for uniques, minimizing data communication costs, and maximizing use of vendor software tools, there is much work to be done. The recommended ESV systems architecture, and an approach to its implementation, are presented in the balance of this section.

In the subsections that follow, we present our impact analysis of the proposed ESV-IS architecture as a set of Application Systems Designs, with supporting analyses of the architectural impact on Hardware, Support Software, Communications, and Development.

APPLICATION SYSTEMS DESIGN

We have divided the discussion of application systems design options into two groups: Finance; and Personnel/Payroll and Student.

Finance

The Uniform Financial and Reporting Standards (UFARS) require the use of modified accrual accounting and of encumbrance accounting. These approaches are more complex than simple cash accounting. Because of this

complexity, some sort of automation will be required to support modified accrual and encumbrance accounting for all school districts.

As in the discussion of user needs, this discussion of application systems design options has been divided into three levels of information requirement:

- simple;
- intermediate; and
- complex.

For the finance system, those with simple information requirements should have two options available. These options would be:

- microcomputer for data collection/edit; and
- microcomputer Financial System (MICRO-FIN).

At present there are 310 districts out of 437 districts in the State of Minnesota that have Apple II microcomputers. Other microcomputers are in use in many other districts. There is substantial opportunity to combine administrative and instructional use of these Apple II devices or other microcomputers to exploit this base of intelligent devices and off-load much of the data collection and edit from the regional host processor.

Implementation of these simple information requirements should be achieved in two phases (See Exhibit V-A). During Phase I the district should prepare each batch of financial data using sound accounting operational procedures for the collection of these batches. Once collected, the batches would be input into the microcomputer, aggregated, edited, then transmitted to the region. This approach would continue to use the current batch systems which reside on host processors at the region.

In Phase II, MICRO-FIN would be made available as a stand-alone microcomputer with the functionality required to support the UFARS financial accounting standards. This is a different approach from the microcomputer

SIMPLE INFORMATION REQUIREMENT

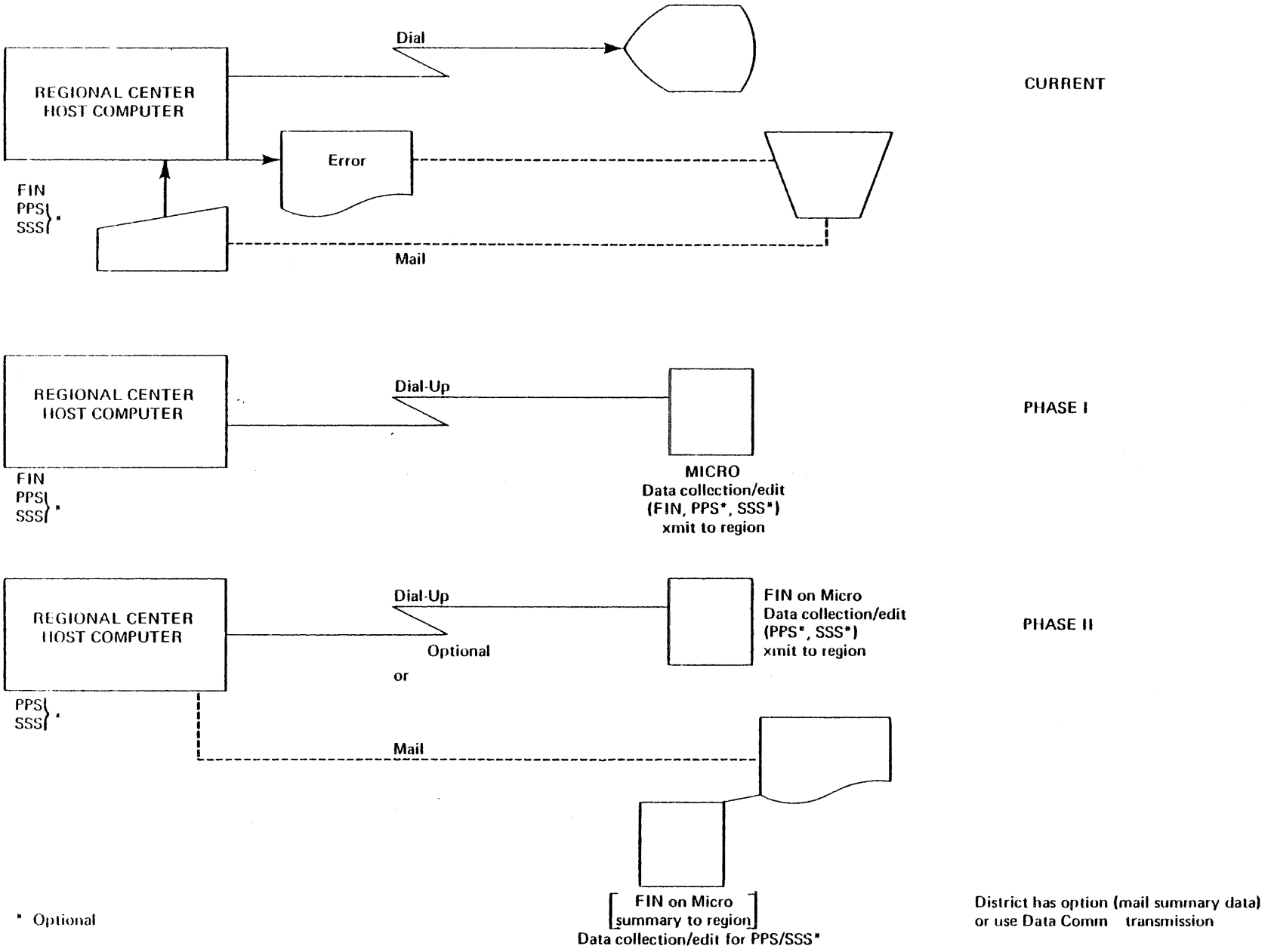


Exhibit V-A

as a data collection and edit device. In this instance a transaction-oriented data processing system at the local district is employed. This system would be capable of data input/edit/validation, transaction processing, and output. To be an approved system, the MICRO-FIN should undergo an EDP audit to ensure that detailed transactions are processed in a manner consistent with UFARS requirements and sound accounting practices. Summary data from the MICRO-FIN would either be mailed or transmitted over dial-up lines to the regional host. At the regional host, the chart of account structure would be recreated. Summary level information would then be input into this structure to meet financial report requirements.

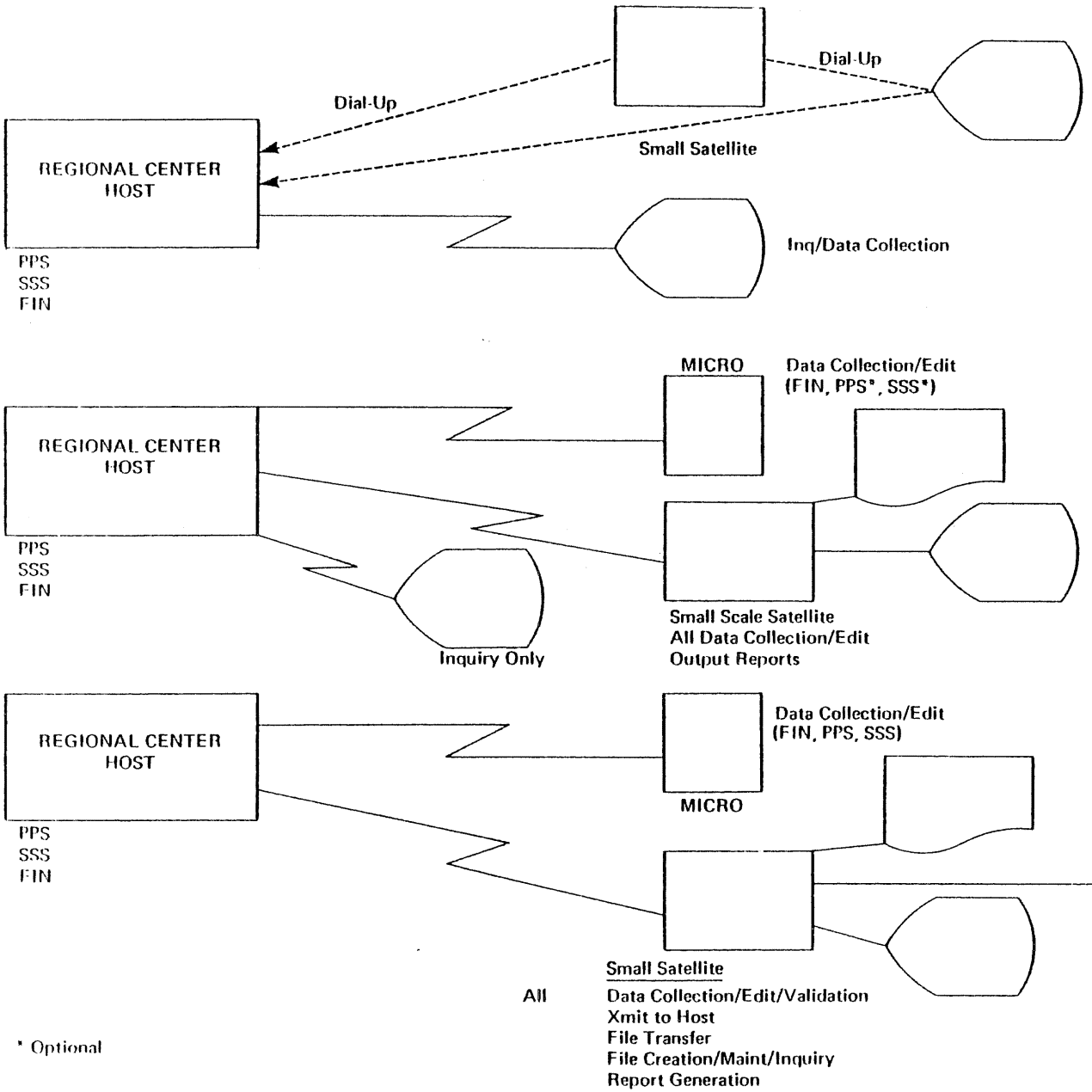
For the intermediate level information requirements, there are two options:

- microcomputer for data collection/edit, and
- small satellite for data collection/edit.

The microcomputer data collection/edit routines, described under the simple information requirement, are an option at the intermediate level for Phase I implementation. Again, detailed transactions would be transmitted to the region for batch processing. (See Exhibit V-B).

Also in Phase I, the option of a small satellite would provide for data collection and edit similar to that described under the microcomputer data collection and edit. The edited data would then be communicated to the host processor. In Phase II, an additional capability could be added to support file transfer from the host to the small satellite where file creation/maintenance/inquiry and report generation could be supported. The small satellite is the lowest level at which local intelligence could support limited file manipulation for output reports from subsets of the host data base.

INTERMEDIATE INFORMATION REQUIREMENT



* Optional

Exhibit V-B

At the complex information requirement level, there are three options:

- microcomputer for data collection/edit;
- medium-scale computers with a version of ESV-FIN resident and data collection/edit for ESV-SSS and ESV-PPS; and
- medium-scale computers with versions of ESV-FIN, PPS and SSS resident.

In Phase I, the microcomputer with dial-up to the medium scale systems is the same approach described previously for data collection and edit for the simple and intermediate levels. This system is tied in via dial-up lines to the host (See Exhibit V-C). Also in Phase I, medium-scale satellites would be configured with the front-end edits for ESV-FIN, PPS and SSS. Limited local processing and reporting would be supported.

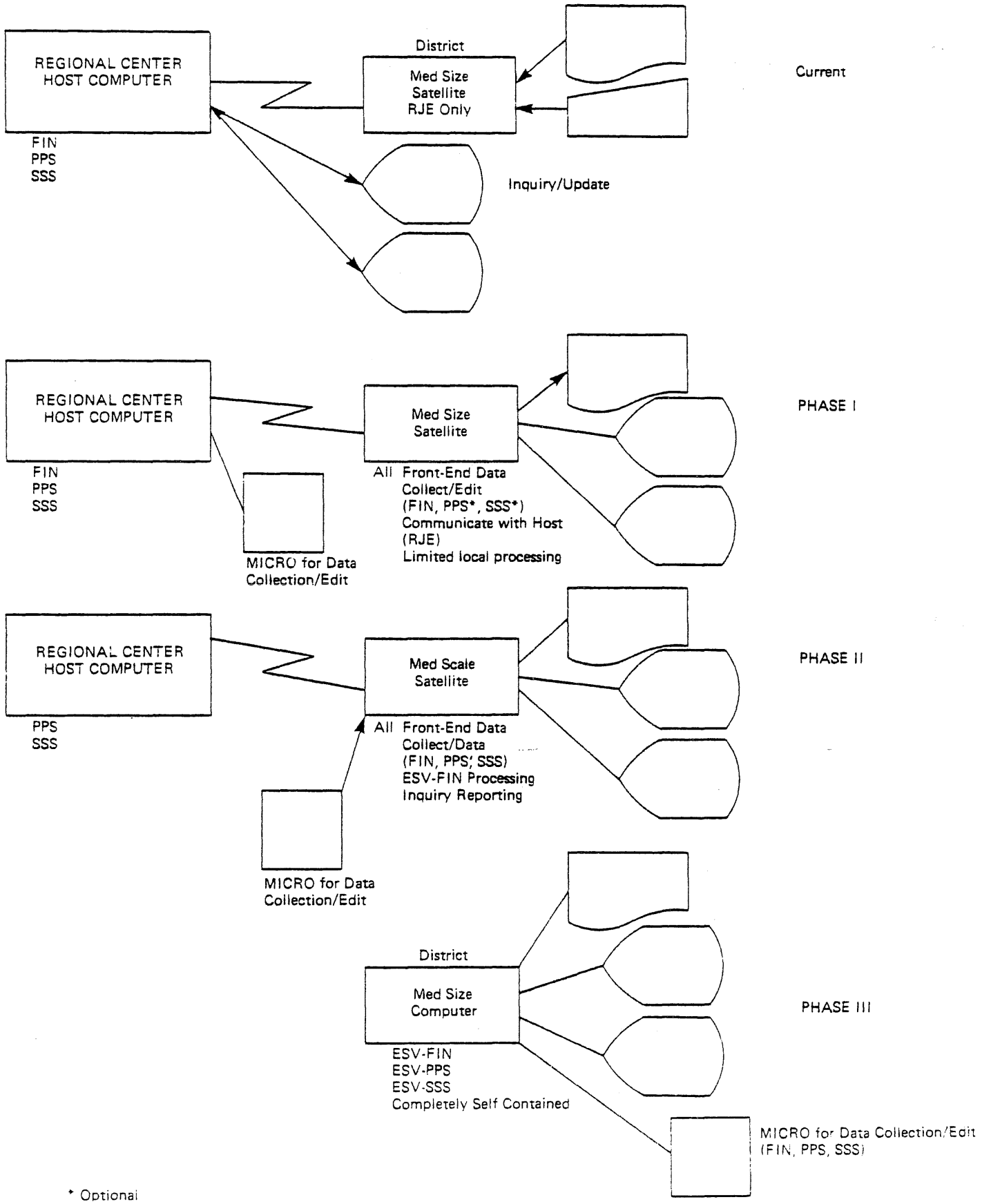
During Phase II, the medium-scale computer would provide a subset version of the ESV-FIN. Front-end edits from the ESV-PPS and SSS would be supported and these systems would remain at the host.

For Phase III, "down scale" versions of the ESV-FIN, PPS and SSS would operate on a stand-alone basis at the medium-scale satellite. Microcomputer data entry to the medium-scale satellite would continue to be supported.

Payroll/Personnel and Student Systems

For the simple information requirement in payroll/personnel and student, it is not necessary to create microcomputer versions of the payroll/personnel and student systems. The information complexity does not warrant such action, and it is not a high priority for district information needs. Therefore, there are two options for the simple information level: manual/local service bureau; or microcomputer for data collection/edit. This microcomputer would produce a "clean" batch of data for transmittal to the region. The systems at the host processing site would remain batch oriented (See Exhibit V-A).

COMPLEX INFORMATION REQUIREMENT



* Optional

Exhibit V-C

For the intermediate level there are two options:

- microcomputers for data collection/edit; and
- small satellites for data collection/edit and file manipulation.

In Phase I, the microcomputer would support the same data collection and edit routine as described for the simple information requirement. These batch transactions would then be transmitted to the region for processing.

Alternatively in Phase I, a small satellite could be used to provide two levels of capability. First would be data collection and edit to produce clean batches for regional processing. The second would be communication capability to the host to transmit these batches and to receive subsets of the data bases resident on the regional system. By Phase II, a third capability would be added to support file creation/maintenance/inquiry and report generation on the subsets of the data base (See Exhibit V-B).

For the complex information requirement there are two options:

- microcomputer for data collection/edit to the medium-scale system; and
- medium-scale computer with self-contained versions of ESV-PPS and ESV-SSS.

In Phase I, the microcomputer would have the same data collection/edit routines as described for the simple and intermediate levels. In Phase II, the microcomputer could be used to input edited transactions to the medium-scale system at the local district (See Exhibit V-C).

In Phase III, the medium-scale computer would operate with self-contained versions of ESV-PPS and ESV-SSS. It is our understanding that "down-scale" versions of these systems are not currently available. As new versions of these systems are developed, this down-sizing should become part of the specification.

HARDWARE

The State Department of Education and regional service centers have a sizable investment in Burroughs hardware and application software. To protect and capitalize upon that investment, it is recommended that there be no change in host computer equipment at this time, although reductions in large-scale host processor needs over time are expected. Burroughs small- and medium-scale computer systems are currently installed, but are under-utilized in various parts of the State system. The proposed architecture includes increased utilization of these systems. The major advantages to the present Burroughs environment are that problems associated with multivendor interfaces are minimized and the same software development tools are available on the entire product line. This equipment, when operating properly and utilized to its capability, can provide significant benefits to the State.

A complete Burroughs system architecture is an alternative that has been considered in developing an overall system of architecture for the State. If this alternative were chosen, however, the State would not be in a position to take advantage of new technology from other vendors, particularly microcomputers, small systems, and CRT devices vendors. A standard set of specifications should be developed and used as selection criteria for these devices. In so doing, the State will be better able to take advantage of technological advances in micro/minicomputer and CRT devices at the least possible cost and provide a basis for gradual migration from the present vendor.

The architecture is based on a mix of microcomputers, small satellites, medium-scale processors and large host processors which can fit coherently to support district information requirements.

Microcomputers

Microcomputers will be used to: (a) provide front-end edit of district batch data; and (b) stand alone support for a UFARS compatible finance system.

Small-Scale Satellites

Small-Scale Satellites will be used to support intermediate level information requirements, including:

- front-end edit, validation, and data collection; and
- file creation/maintenance/inquiry.

This size processor is capable of locally supporting data files, including subsets of the data base at the regional host computer. Using this capability, the front-end data collection and edit routine can be expanded to include data validation. An example of data validation would be the routine of checking financial transactions to ensure the transactions are in conformance with the chart of accounts.

At the small-scale satellite there should be the capability to report using subsets of district data which have been down-loaded from the host processor. These files could be used for district inquiry.

Medium-Scale Hardware Applications

Those districts that have complex information requirements may have the need or desire to operate independently on a medium-scale computer. Such an approach would have to be implemented in stages. The local computer might initially have front-end edit and validation routines resident on the machine. At the next stage, stand-alone, down-loaded versions of the ESV-FIN system could be used to support district operations, with the regional

host computer continuing to be used for the payroll/personnel and student systems. During the final stage, down-loaded versions of the ESV-PPS and SSS might be used in this stand-alone operation at the district.

At all three levels the host is off-loaded of data entry and correction routines. Simple financial information requirements can be met with little or no host processing load by means of a stand-alone MICRO-FIN application. Data entry and correction remains at the user site. The security and simplicity of the batch processing design is retained at the host processor. The MICRO-FIN would be the only application which is off-loaded from large- or medium-scale hosts.

The disadvantages of these approaches are that a microcomputer version of the UFARS financial requirements must be completed, intelligent data entry front-ends for the three applications systems must be built, and down-size versions of the applications must be developed.

BURROUGHS SUPPORT SOFTWARE

Burroughs support software includes several types of data communications control, including:

- CANDE (Command and Edit), a message control system that enables users at remote terminals to enter programs or date files into disk storage, compile and execute programs, edit and alter programs or files, search files, send messages to other terminals, and perform a variety of other tasks;

- GEMCOS (Generalized Message Control System), a generalized system which uses parameters for generating an installation-tailored Message Control System. The Message Control System provides the link between the network controller and user application programs. Recovery capabilities include: (a) dynamic restoration of the network configuration; (b) audit mechanisms for logging messages; (c) network control commands for graceful degradation of the network in case of system failure; (d) synchronization with DMS-II to ensure data base integrity, and (e) a password security system to control access.

- RJE (Remote Job Entry), a Message Control System designed to support remote batch terminals. RJE permits introduction of programs and/or data from the remote card reader, printing of output data on the remote line printer, and monitoring and controlling program via the remote console.

Each of the data communications control systems has specific advantages and disadvantages. Their usage should be as follows:

- GEMCOS for all on-line user input to the application program to ensure data integrity, security and recovery of the data base;
- CANDE for all applications development in the controlled environment of the Central Development Group; and
- RJE for current district operations until medium-scale versions of the ESV-IS are available to support complex information requirements.

GEMCOS is normally defined for use in an on-line environment where data is input, the data base is immediately updated, and reports reflecting the new data are immediately available. In this case, the use of GEMCOS is recommended primarily to provide the advantages of data security and integrity. The types of transactions which would be available are:

- input, or batch creation transactions;
- inquiry transactions for limited portions of the data base; and
- reporting, or output transactions.

By limiting the on-line aspects to data input and report generation, systems design and maintenance can use the less complicated method of batch processing. In this approach, data which is input would then be run against the data base at such time as processor resources are available to execute the update request.

Software Development Aids

There are a number of other software development aids which are available on the Burroughs product line.

ODESY is a data entry and verification system. Visual display units (CRT's) are used to enter, verify and correct batches of data. ODESY is a package that is currently available on the Burroughs 1000 series and will be available on the Burroughs CP9500. ODESY is not currently available on the Burroughs 6000 series. ODESY should be investigated for use as a front-end data entry subsystem on both the B1000 series and CP9500. Both pieces of equipment will be utilized in the regions.

REPORTER-11 and AUDIT-REPORTER are two report generator packages available on the entire Burroughs product line. These two software packages are designed to accelerate the development of nonstandard and ad hoc reports, a major bottleneck in the current ESV-IS environment. REPORTER is designed to interface with DMS-II data base structures. Although there is some processing time penalty, the advantage gained from faster development, combined with processing resources that will be freed from data collection chores, makes REPORTER a viable approach. PMM&Co. recommends the use of these tools.

DOMAIN is a file creation and maintenance product designed to ease those tasks. Similar software development tools are available on other vendor hardware offerings. These tools must support district information requirements for the levels of simple, intermediate and complex.

COMMUNICATIONS

The evaluation of current communication approaches has determined:

- extensive communication costs are and will be incurred to support CRT-to-host communication;
- future telephone service price increases for telecommunications will necessitate rigorous evaluation of all communication nets; and
- substantial unused capacity exists in the current communications configuration.

These strategies are recommended to reduce communication costs:

- microcomputer data collection and edit;
- MICRO-FIN system; and
- line usage analysis.

Each of these strategies is explained in the balance of this section. While no definitive cost savings can be calculated until a final implementation plan is developed and future communications costs more precisely projected, preliminary estimates suggest that communications costs for the proposed ESV-IS system architecture; when fully developed, should be 40% or less of FY81 expenditures of $665,450.

Microcomputer Data Collection and Edit and MICRO-FIN

A major objective of this proposed architecture is to obtain the maximum resource utilization possible from current equipment. To support that goal, the use of microcomputers for data collection and edit and MICRO-FIN processing is recommended. In performing these functions, intelligent devices would reduce the need for data collection and edit work to be done at the regional host. This would minimize the need for cathode ray tubes (CRT's) to be connected to the host and for costly communication line support for this architecture.

Districts frequently desire inquiry capability into their data base. Current approaches use DMS-INQUIRY via CANDE access to obtain inquiry at the host. DMS-INQUIRY is resource intensive and CANDE has few data security features. Increased use of REPORTER to meet district ad hoc inquiry and report requests appears to be more cost effective. There appears to be little justification for "instant" information as few administrative decisions are made under such time constraints.

Line Usage Analysis

Line useage analysis can be supported with diagnostic routines which are presently available under GEMCOS. In addition, TIES has developed additional tools to describe communication loads which are being encountered in the communications network. Application of these tools will aid in the analysis of load, improve utilization and reduce contention problems.

DEVELOPMENT METHODS

Currently, systems development and maintenance tasks are being conducted in various locations throughout the State. MECC supports the State-wide payroll/personnel (ESV-PPS) and the State-wide financial system (ESV-FIN). The development of the State-wide student system (ESV-SSS) is coordinated by MECC with many tasks being done by METRO II and Region III. Because of a differences in design strategies and specific district needs, TIES has developed and maintained a separate set of applications in the financial, payroll/personnel, and student systems. The TIES financial system meets the UFARS requirements.

To satisfy the objectives of cost effective delivery of service, continuation of separate and independent developments will be costly and the objective of standard applications software problematic. A centralized development effort will best satisfy the State Board of Education's objectives, and the needs of the individual districts through achievement of standard applications software.

Standardized Software

To establish a set of standard software for ESV-IS, the characteristics of standard software must first be defined. For the purposes of building a

model system, standard software is defined as having the following attributes:

- common user/management functions;
- common design philosophy - batch or transaction driven;
- range of software applied across a range of same vendor hardware;
- centrally developed and maintained;
- device independent;
- standard input/processing;
- common data structures;
- standard interfaces - system-to-system and between subsystems.

To establish standard State wide applications, three steps should be taken. First, one central group must be responsible for all application software that will be utilized as part of ESV- IS. Second, a system development life cycle (SDLC) approach is recommended for all such activities involved in ESV-IS. Such a methodology includes a number of phases. For example,

- Phase I - requirements definition;
- Phase II - conceptual design;
- Phase III - detailed design;
- Phase IV - development/tasks;
- Phase V - implementation;
- Phase VI - post implementation review.

Third, the central group should appoint a quality assurance team that will review all applications for technical performance. This group should also be responsible for establishing a change control procedure.

Software Categories

The preferable situation is for the State to allow only a limited number of common sets of application programs for each functional area (i.e., payroll/personnel, student, finance). Because of the unique requirements and operating environments of the various school districts and regional processing centers, this concept may be impractical at the present time. Therefore, exceptions to the standard systems may be incorporated. All exceptions must be controlled and reviewed for technical acceptability by the central development group. The following categories of software products could be incorporated as part of SDE-IS systems architecture. (See Exhibit V-D).

- State standard system;
- State funded/field developed systems;
- allowable/field developed systems; and
- grandfathered systems.

State Standard System. Software in this category will be entirely developed, funded, maintained and reviewed by the State. This category will be made available to all regions/districts as a basic level of service.

State Funded/Field Developed. Software in this category may originate as a unique regional or district request. Upon approval, the State may elect to fund development of this software, allowing a region or district to conduct the development. A technical review should be performed on a continual basis during development by the Central Development Group. Maintenance of this system may become the responsibility of the Central Development Group.

Allowable/Field Developed. Software in this category will not be developed or funded by the State. The requesting district/region must fund, develop, and maintain the software. The use of this software will be

TYPES OF APPLICATION PROGRAMS

	DEVELOP.	STATE FUNDED	MAINTAINED/ SUPPORTED	TECH. REVIEW & APPROVED
STATE STANDARD SYSTEM	X	X	X	X
STATE FUNDED FIELD DEVELOPED		X	X	X
ALLOWED-FIELD DEVELOPED				X
GRANDFATHERED				X

allowed subject to a comprehensive technical review and approval by the Central Development Group's quality assurance team.

Grandfathered. Software in this category will be allowed but funded only to ensure continuity during the current transition to the ESV-IS systems architecture. No State funds should be provided to support nonessential system enhancements or modifications. This software must meet minimum requirements set forth by the State. It is recommended that software in this category be used during transitional stages only. The State should not fund, support or maintain this software after the transition period.

CENTRAL DEVELOPMENT GROUP

The systems architecture proposed for ESV-IS is a dynamic and complex set of alternatives. Strong technical resources are dispersed throughout the regions and existing MECC organization. Because of the duplication in development activities currently underway, there is a dilution of the technical resource available to solve problems. A Central Development Group should be organized in a manner to foster responsibility to the regional service center. A Central Development Group is the best mechanism available to satisfy the objectives of an overall systems architecture. Through such a group: (a) a common methodology can be established; (b) a common pool of technical resources can be made available to all regions/districts; and (c) a set of applications software can be developed and implemented in a cost effective manner.

Many of the technical resources currently employed at MECC, METRO II, and TIES should be considered in a competitive selection to form the nucleus of the Central Development Group.

To be most productive and effective, this group should be divided into four functional areas (See Exhibit V-E):

- technical support;
- applications development;
- applications implementation/support; and
- quality assurance.

Each of these functional groups is described below.

Technical Support. A technical support function is required to support operating systems, data base management and data communications.

- operating software
  - --operating systems and utilities for micro, small, medium, and large computer systems
  - --performance measurement tools/reporting
  - --software release control
- data base management
  - --data base design
  - --application support/trouble shooting
  - --reporting tools and procedures
  - --data base naming conventions and standards
  - --data dictionaries
- data communications
  - --network configuration planning
  - --network control
  - --line protocols
  - --standard interfaces
  - --vendor supported software such as NDL, CANDE, GEMCOS, RJE
  - --applications support

CENTRAL DEVELOPMENT GROUP

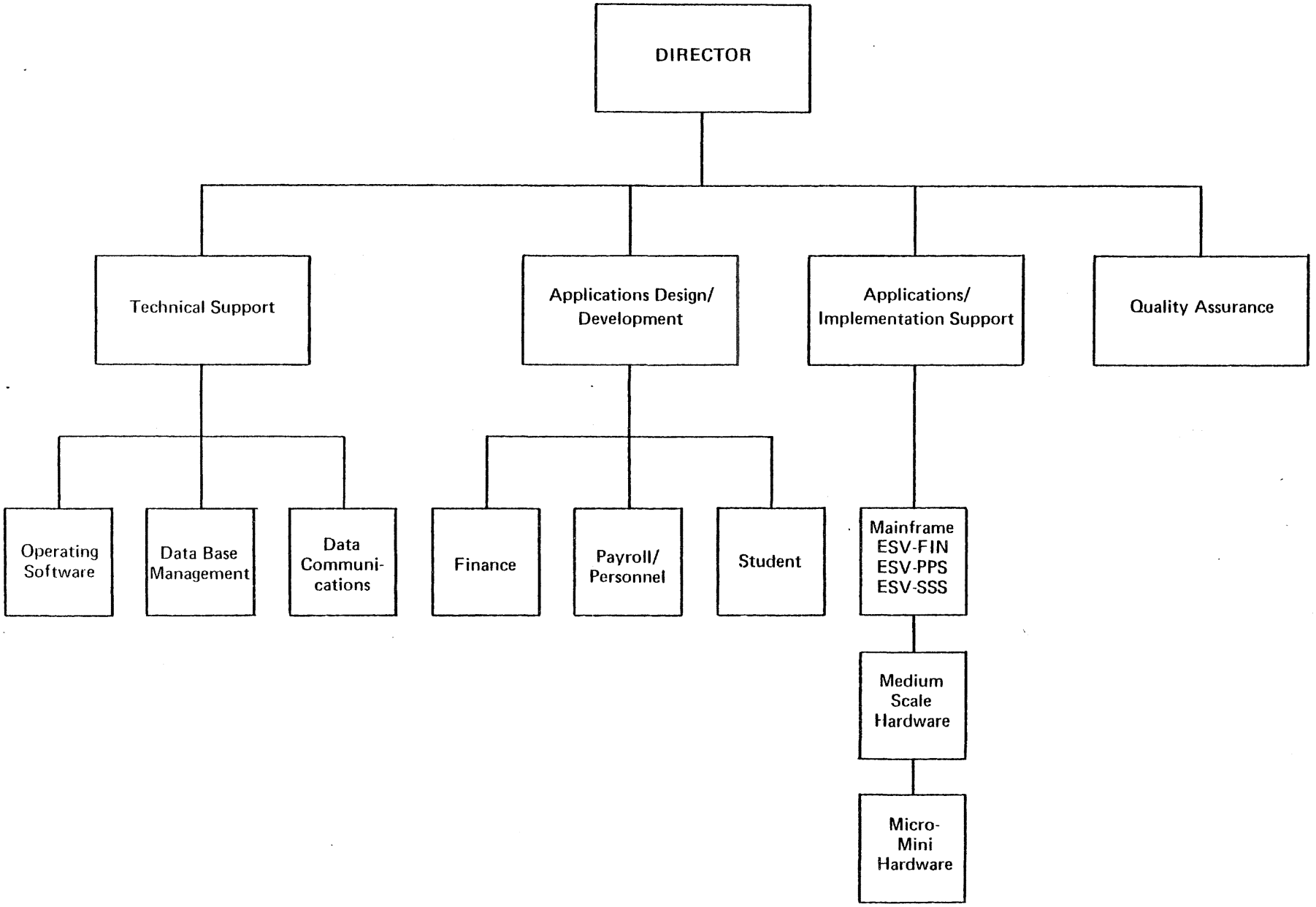


Exhibit V-E

Applications Development. The application development function should be responsible for developing, maintaining and documenting the functional systems:

- finance system
- payroll/personnel system
- student system

Applications/Implementation Support. The applications/implementation support function should provide: (a) functional expertise based on computer size; (b) implementation support with software releases and new product installations; (c) trouble shooting and training for districts and regional service centers; and (d) support for work requests using REPORTER II.

- provide functional expertise
  - --mini computers
  - --micro computers
  - --small/medium scale satellites
  - --large host mainframe
- provide implementation, training and trouble shooting support in functional areas

Quality Assurance. The quality assurance function should undertake the following activities:

- review technical performance in all areas
- conduct technical reviews
- enforce standards and procedures
- control and regulate change
- issue system change packages
- maintain centralized software library

Creation of the Central Development Group

Additional legislation is not recommended to form the Central Development Group. A method which should be considered is to create a joint powers agreement with a Board of Directors composed of representatives from each regional service center. The purpose of the Central Development Group is to be responsive to district user needs. Regional service centers are the delivery vehicles for district service and have mechanisms in place to channel and prioritize user requests. Regions therefore have a stake in the performance of the Central Development Group, and make a logical choice for the Group's Board of Directors.

ORGANIZATIONAL RELATIONSHIPS

The Central Development Group should be responsible to the school districts through the regional service centers as shown in Exhibit V-F. Since policy setting for the ESV-IS is the responsibility of the ESV Computer Council, projects over a certain size, e.g., $100,000, or 4000 person-hours effort, should be referred to the ESV Computer Council for prioritization. Normal day-to-day trouble shooting and minor development and enhancement activities should be the responsibility of the Central Development Group, subject to working priorities established by the Central Development Group Board.

ESV-IS
ORGANIZATIONAL RELATIONSHIPS
CENTRAL DEVELOPMENT GROUP

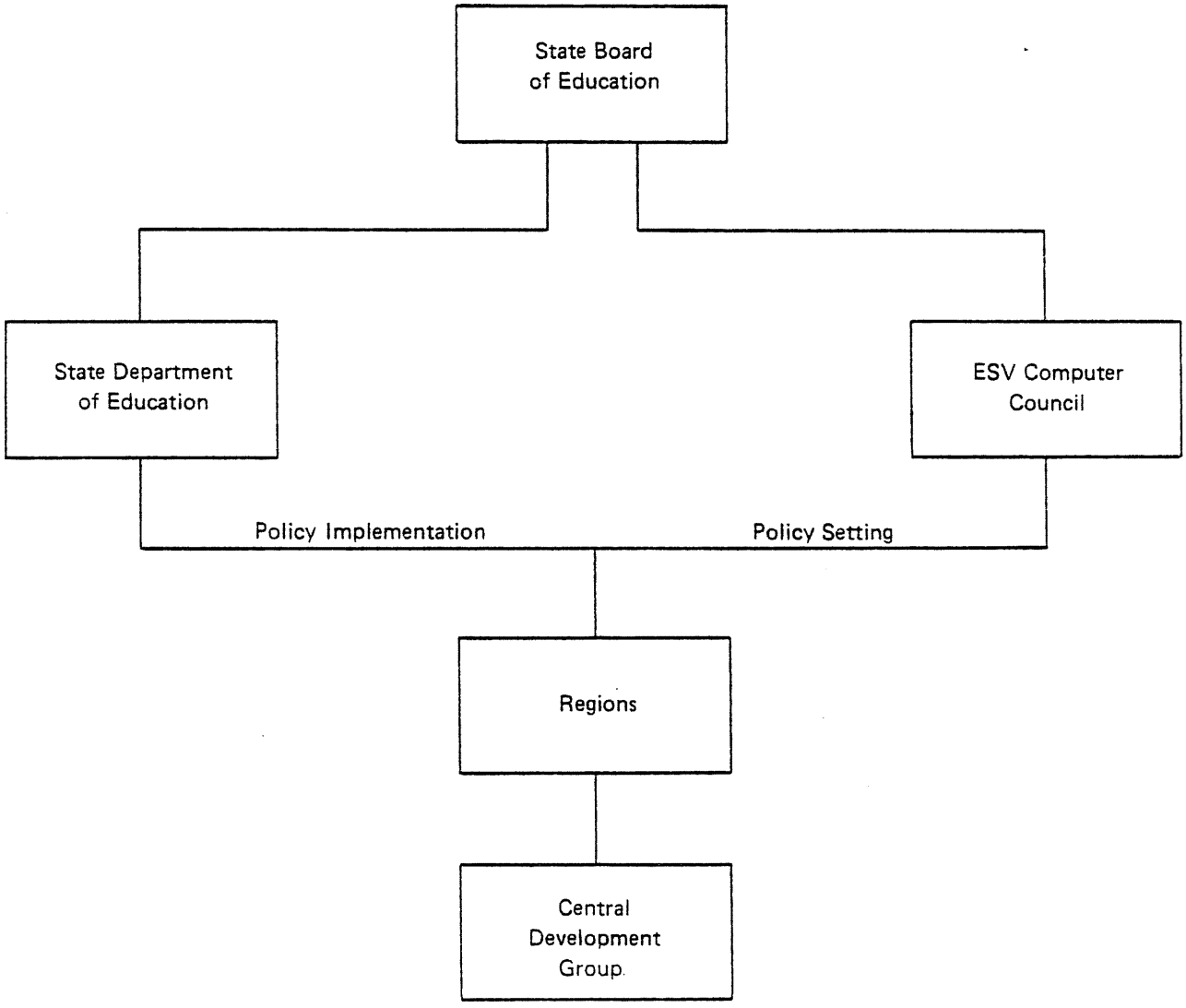


Exhibit V-F

VI - COSTING AND OTHER CONSIDERATIONS

In Section I, current (FY81) costs for the ESV-IS were summarized. In this section estimated future costs are presented for the following components of the proposed ESV-IS systems architecture:

- central development group;
- application development;
- hardware; and
- communications/intelligent data entry.

The ESV-IS applications implementation priorities, with associated cost estimates, are presented at the conclusion of the section. The implementation cost estimates are a restatement of the costs presented in the first four subsections.

These cost estimates are provided for planning purposes only. Actual costs may vary significantly as a consequence of unforeseen or non-predictable factors such as vendor actions, regulations, inflation, and the like.

CENTRAL DEVELOPMENT GROUP

The cost estimates prepared for the proposed Central Development Group reflect two alternative approaches to development:

- internal development of all ESV-IS systems architecture components; and
- external contracts for development of all ESV-IS system architecture components.

Internal Development

If the ESV-IS architecture is adopted completely and the Central development Group is formed with the responsibility to complete all components of the architecture, this group will require the following complement:

- director
- technical support (6-9 persons);

- applications development (14-16 persons);
- applications/implementation support (7-9 persons); and
- quality assurance (2-3 persons).

The estimated cost of such a group ranges between $1,000,000 and $1,550,000 per year, in FY81 dollars. (See Exhibit VI-A)

External Contract

If the proposed ESV-IS systems architecture is adopted completely and the Central Development Group is formed only as an implementer and maintainer of externally contracted systems, it is estimated that this group would consist of the following staffing:

- director
- technical support (5-6 persons);
- applications development (9 persons);
- applications/implementation support (7-9 persons); and
- quality assurance (2-3 persons).

The estimated cost of this staff complement ranges between $800,000 and $1,150,000 per year in FY81 dollars. (See Exhibit VI-B).

APPLICATION DEVELOPMENT

The ESV architecture requires that application systems have: (a) front-end edit and data collection on remote intelligent devices; and (b) GEMCOS message processing for security of district data and to reduce the time required to develop or modify systems by separating the application from communication requirements; (c) stratified software solutions based on district information requirements; and (d) utilization of district processing for district unique needs. The paragraphs that follow describe the efforts required for each ESV system to bring it into conformance with the proposed ESV-IS systems architecture.

Finance

The ESV-IS architecture calls for the following capabilities for finance:

- microcomputer finance system (MICRO-FIN) for districts with simple financial information requirements;
- front-end data collection and edit software for the ESV-FIN to operate on medium-scale, small-scale and microcomputer hardware; and
- medium-scale versions of the ESV-FIN for districts with complex financial information requirements.

Approximately 6,680 person hours, or 3.630 person years are estimated to complete these finance projects. Our estimates of cost for all these activities are (See Exhibits VI-C):

- $176,000 for internal Central Development Group; and
- $400,600 for external contracts for development.

The TIES ESV-FIN is suggested as the basis for the State-wide system because it meets the criteria of the architecture for data-base design and security. However, an ESV-FIN user requirements definition should be developed as a means of identifying modifications to the TIES ESV-FIN which would make this product acceptable throughout the State.

The current ESV-FIN from MECC is in use in a large number of districts throughout the State. A transition strategy must be created to define: (a) the time frame of State support to continue maintaining this system with future modifications of UFARS requirements; (b) logical groupings of districts to transition to the new ESV-FIN; and (c) district subsidy support for conversions of district operations.

Payroll/Personnel

The ESV-IS architecture proposes the refinement of the existing TIES payroll/personnel system or the acquisition of a package system and the

development of front-end data collection and edit software for ESV-PPS to operate on medium-scale, small-scale and microcomputer hardware.

The estimates of cost for these activities are (See Exhibit VI-D).

- Alternative I - modify current TIES payroll and develop front-end edit and data collection capability:
  - $155,000 if internally developed by the Central Development Group; or

    $372,000 if externally contracted for development.
- Alternative 2 - acquire, modify and install a new payroll/personnel system with front-end edit and data collection capability:
  - $330,000 if internally developed by the Central Development Group; or

    $720,000 if externally contracted for development.

Both approaches necessitate the development of a user requirements definition. Without this definition, the alternative selected may not be responsive to user needs. From the requirements definition, the Central Development Group can prepare a general system specification. This specification should be used to obtain time and cost bids from software vendors for system replacement and to prepare the Central Development Group bid for modification of the existing TIES payroll/personnel system. The ESV Computer Council should then decide which approach is most satisfactory and which development groups (TIES, MECC, METRO II) should receive interim maintenance funding. When the new personnel/payroll system is complete, a transition strategy will be needed to provide for an orderly migration to the new ESV-PPS.

Student

It appears the MECC/METRO II ESV-SSS is best suited to serve as the basis for the future ESV Student System because this system uses GEMCOS and the data-base structures are more efficient than those in use at TIES.

Since a detailed user requirements definition has not been performed to establish that the MECC/METRO II ESV-SSS meets the needs of school districts, however, such a definition should be developed to confirm the applicability of this system or portions of the TIES Student System for Statewide use. Capabilities such as transportation modeling and AFTI have district user interest.

From this user requirements analysis, the Central Design Group can prepare detailed costing and task plans to accomplish the modifications required. In the interim, the TIES Student System should continue to be supported.

The ESV-IS architecture recommend the following student system changes:

- Rework current MECC/METRO II ESV-SSS teleprocessing screens and improve logic of input process;
- Build an interface for ESV-SSS to support batch data collection; and
- Develop front-end data collection and edit software for the ESV-SSS to operate on medium scale, small scale and microcomputer systems.

Approximately 4,000 person hours, or approximately 2.17 person years are estimated to complete these student projects. The estimated cost for these activities are (See Exhibit VI-E):

- $100,000 if internally developed by the Central Development Group; and
- $240,000 if externally contracted for development.

HARDWARE

To fully implement the architecture plan will require some reorientation of current hardware configurations. Medium-scale satellites will not be used only for RJE, but will be used for district unique processing and may eventually become stand-alone processors for districts that have complex

information requirements. Small-scale satellites will be used for data collection/edit/verification, and could support file transfer/inquiry/reporting of district data for intermediate levels of information requirements.

The following pricing quotations have been obtained from Burroughs Corporation with the current 40.9% ESV discount:

- a small-scale satellite to support the intermediate information requirement has been quoted at (See Exhibit VI-F):
  - $44,430 for Phase I data collection and edit; and
  - $55,862 for Phase II data collection/edit/validation, and file transfer, creation, maintenance and inquiry).
- a medium-scale satellite to support the complex information requirement has been quoted at (see Exhibit VI-G):
  - $133,916 for Phase II data collection/edit and ESV-FIN local processing); and
  - $175,557 for Phase III.

These prices do not include monthly maintenance, site preparation, utilities or personnel costs.

COMMUNICATIONS/INTELLIGENT DATA ENTRY

To provide a range of cost estimates for the intelligent data entry approach, the following alternatives were evaluated based on FY81 dollars (See Exhibit VI-H):

- use current instructional Apple microcomputers purchased and in use in 310 districts for administrative computing, with the balance of the districts (127) acquiring microcomputers. The total cost of this alternative is estimated to be $247,650;
- upgrade existing Apples microcomputers to provide more capability, but still using current inventory in 310 districts with the rest (127) being new purchases, is estimated at $434,400;
- add additional Apple microcomputers for 60% (262) districts to provide for single use by Administration is estimated at $576,400; and
- add Apple microcomputers in all 437 districts exclusively for Administrative computing is estimated at $961,400.

The costing for the alternatives presented above range from $247,650 to $961,400. The Apple II is used to illustrate a range of capability and cost and should not be the only microcomputer considered by the State.

The actual microcomputer option selected (and the associated cost) is dependent on in-district plans and usage levels on existing instructional microcomputers and the hardware support requirements of the new MICRO-FIN and the microcomputer-based ESV-IS front-ends.

The current telecommunication cost of $665,450 should, using MICRO-FIN and intelligent front-end capabilities, and implementing network load analysis reports available from GEMCOS, be reduced to approximately 40% of the present level, or $280,000 per year (FY81 dollars).

ESV-IS APPLICATIONS IMPLEMENTATION PRIORITIES AND ASSOCIATED COSTS

Based on the requirements of the architecture plan, a prioritized listing of work to be done and a suggested transition path to implement the system's architecture have been prepared. Cost estimates are based on projected internal development costs and estimates of external contract development costs presented previously in this report section.

There are two levels of priority in this plan:

- Rework of TIES payroll/personnel, or development of a new payroll/personnel system; and
- Completion of the current MICRO-FIN (Ortonville) project, or development of a new MICRO-FIN.

Referencing Exhibit VI-I, the four development options are as follows:

Option 1. If the TIES Payroll system is modified (priority 3A) and the current Ortonville MICRO-FIN project is completed (priority 6A), estimated costs are:

- $421,500 for internal development by Central Development Group.

ESV-IS SYSTEMS ARCHITECTURE ESTIMATED COST SUMMARY

TABLE II

FY81 Dollars

Current Service Rates

		PHASE I		PHASE II		PHASE III	
		Internal develop	External contract	Internal develop	External contract	Internal develop	External contract
ESTIMATED ONE-TIME COSTS							
1. ESTIMATED ONE-TIME DEVELOPMENT COST							
Finance	Front-end data collection/edit to operate on micro, small-, medium-scale computers	$ 36,500	$ 87,000	-	-	-	-
	Microcomputer Finance System (Complete Ortonville or develop new system)	-	-	$ 12,000-37,500	$ 90,000	-	-
	ESV-FIN to operate on medium-scale computers	-	-	-	-	$ 105,000	$ 252,000
Payroll/ Personnel	Front-end data collection/ edit to operate on micro, small-, medium-scale computers	30,000	72,000	-	-	-	-
	Refine TIES payroll and add personnel capabilities. Develop medium-scale version.	137,500	330,000	-	-	-	Medium scale included-Phase I development
	OR	or	or				or
	Acquire/moficy new payroll/ personnel system, including medium-scale version.	300,000	720,000	-	-	-	Medium scale included-Phase I development
Student	Revise current teleprocessing programs on ESV-SSS. Develop medium-scale version	50,000	120,000	-	-	-	Medium scale included-Phase I development
	Build interfaces to support batch data collection.	25,000	60,000	-	-	-	
	Develop front-end data collection/edit to operate on micro, small-, medium-scale computers.	-	-	25,000	60,000	-	-
	TOTAL ESTIMATED ONE-TIME DEVELOPMENT COST	$ 279,000 to 441,500	$ 669,600 to $ 1,059,600	$ 37,500 to 62,500	$ 150,000	$ 150,000	$ 252,000

ESV-IS SYSTEMS ARCHITECTURE ESTIMATED COST SUMMARY

TABLE II, Continued

	PHASE I		PHASE II		PHASE III	
	Internal develop	External contract	Internal develop	External contract	Internal develop	External contract
2. ESTIMATED ONE-TIME HARDWARE ACQUISITION COST						
127-Apple II	$ 353,800	$ 353,800	$ -	$ -	$ -	$ -
10-Burroughs small-scale satellites - Phase I	444,300	444,300	-	-	-	-
10-Burroughs small-scale satellites - Phase II	-	-	558,610	558,610	-	-
3-Burroughs medium scale satellites			-	-	401,745	401,745
TOTAL ESTIMATED ONE-TIME HARDWARE ACQUISITION COST	$ 798,100	$ 798,100	$ 558,610	$ 558,610	$ 401,745	$ 401,745
TOTAL ESTIMATED ONE-TIME COSTS	$ 1,077,100 to $ 1,239,600	$ 1,467,700 to $ 1,857,700	$ 596,110 to $ 621,110	$ 708,610 $ 708,610	$ 551,745 $ 551,745	$ 653,745 $ 653,745

ESTIMATED ANNUAL ONGOING COSTS	PHASE I	PHASE II	PHASE III
1. ESTIMATED COMMUNICATION COSTS			
60% of FY81 cost for Phase I	420,000	-	-
50% of FY81 cost for Phase II	-	350,000	-
40% of FY81 cost for Phase III	-	-	280,000
2. ESTIMATED ANNUAL PERSONNEL COSTS* (Internal Development)			
Development	$ 321 - 476,000	$ 321 - 476,000	$ 321,000
Maintenance	321 - 476,000	321 - 476,000	321,000
Regional Support	130 - 234,000	130 - 234,000	234,000
	$ 1,992,100 to $ 1,606,000	$ 1,121,000 to $ 1,432,000	$ 1,156,000 $ 1,156,000

*Includes one-time estimated development costs.

Option 2. If the TIES payroll system is modified (priority 3A) and another microcomputer finance system is developed (priority 6B), costs are estimated at:

- $446,500 for internal development by the Central Development Group; or
- $1,071,600 for externally contracted development.

Option 3. If a new payroll/personnel system is developed (priority 3B) and the current Ortonville MICRO-FIN project is completed (priority 6A) estimated costs are:

- $584,000 for internal development by the Central Development Group.

Option 4. If a new payroll/personnel system is developed (priority 3B) and another microcomputer finance system is developed (priority 6B), costs are estimated at:

- $609,000 for internal development by the Central Development Group; or
- $1,461,600 for externally contracted development.

COSTING SUMMARY

The summary of the estimated ESV-IS systems architecture costs is presented in Table II on the facing page. The assumptions for Table II are:

- 127 districts will add Apple II microcomputers as intelligent data entry devices for Administration use only, and 186 districts will share Apple II's with Instructional users;
- three medium-scale satellites will be acquired for Phase II to support ESV-FIN processing in districts with complex financial requirements;
- twenty small-scale satellites will be acquired for Phase I to support districts with intermediate information requirements;
- one hundred districts will migrate to the MICRO-FIN system;
- gradual reductions in communication costs will result; and
- all software development will be done by, or controlled through, the Central Development Group.

These assumptions have been made for cost estimation purposes only. These estimates should be further refined as part of the long range plan

development. Exhibit VI-J shows the estimated distribution of new hardware acquisitions by regional service center.

TIMING

The time required to implement the ESV-IS systems architecture is estimated as follows:

- 3.6 person years for the finance projects;
- 4.0 person years for the payroll/personnel projects; and
- 2.2 person years for the student projects.

Assuming the alternative of internal development by the Central Development Group and assuming 60% new development effort for the staff of the Central Development Group, it is estimated that:

- Fourteen months will be required to complete the finance projects;
- Thirteen-to-sixteen months will be required for the payroll/personnel projects (minimum to maximum effort); and
- Eleven months will be required to complete the student projects.

COMPARISON TO CURRENT COSTS

There is approximately $3,000,000 of large-scale Burroughs hardware scheduled for acquisition over the near term for Regions I, IV, VI and VII. The proposed ESV-IS systems architecture will require approximately $1,760,000 of expenditure to implement and will result in considerable costs savings in telecommunication costs (estimated to be a 60% reduction upon completion of Phase III of the ESV-IS systems architecture, based on FY81 communications costs), and reduced need for large scale host processors.

Currently (FY81) development and maintenance budgets for MECC, METRO II and TIES total $1,320,148. If the Central Development Group is charged with developing the software for the proposed ESV-IS systems architecture, its

operating budget is estimated to be approximately $1,003,600 to $1,541,800 (FY81 dollars). These costs include development, maintenance, implementation and training.

This proposed ESV-IS systems architecture provides the potential for direct cost savings in the acquisition of hardware, maintains costs for the development and maintenance of software at or near current levels, and reduces communication costs. Further savings may be possible through elimination of selected host processors as the work load shifts to the smaller systems.

OTHER CONSIDERATIONS

The most important component to the success of the ESV architecture is the Central Development Group. The Central Development Group has a pivotal role as: (a) concentrator of technical expertise; (b) facilitator of regional and district operations; and (c) producer of application systems.

To provide for an orderly transition to this group, the following actions are recommended:

- The ESV Computer Council should review the joint power's organizational approach and obtain legal opinion from the State Attorney General;
- TIES, MECC and METRO II should review the Central Development Group proposal and analyze the impact on pension plans, salary levels and staffing; and
- Regional Boards should review the Central Development Group proposal and the TIES MECC and METRO II analyses and prepare position statements on the Central Development Group recommendation for the ESV Computer Council.

After the Council has decided on the general form, funding, legal status, and staffing of the Central Development Group, TIES, MECC and METRO II should revise their budget projections for presentation to the ESV Council. These revised budgets will provide the Council with more refined cost reduction information.

The ESV Council should consider the following alternatives when defining the funding approach to the Central Development Group:

- partnership funding with the State initially supporting a large percentage of the initial Central Development Group effort;
- gradual decline of the percent and absolute dollar levels of State support to occur over a period of 3 or more years;
- direct district support of the Central Development Group through Regional fee structures; and/or
- direct regional support of the Central Development Group through membership fees in the Group.

The primary objective of this funding approach is to make the Central Development Group directly controlled by, and responsive to, the school districts. A second objective is to reduce the rate of State funding of applications development and thus insulate the ESV application systems from abrupt State budget reductions. A third and final objective is to decentralize the decision making on the support of ESV systems by providing the districts with a direct stake in the performance and operation of ESV systems.

ESV-IS SYSTEMS ARCHITECTURE

CENTRAL DEVELOPMENT GROUP

ESTIMATED STAFFING AND COSTS

INTERNAL DEVELOPMENT PRIORITY

Number of Personnel	Position	Estimated Cost	Group Cost	Total Cost
	Director	$ 45-50,000		
	Technical Support			
1	Manager	35,40,000		
2	MCP/Utilities			
	($25-30K/yr.)	50-60,000		
2-3	Data Base Administration			
	2/1-($30-35K/yr.)	30-35,000		
	3-($20-25K/yr.)	60-75,000		
2-3	Data Communications			
	1-($30-35K/yr.)	30-35,000		
	2/3-($20-25K/yr.)	40-50,000		
7-9	People	Technical Support Group	$ 290-345,000	
	Applications Development			
1	Manager	35-40,000		
	Finance Team			
2	($30-35K/yr.)	60-70,000		
3	($18-28K/yr.)	54,84,000		
	Payroll/Personnel Team			
2	($30-35K)	60-70,000		
3-5	($18-28K)	54-140,000		
	Student Team			
1	($30-35K/yr.)	30,35,000		
3	($18-28K/yr.)	54,84,000		
15-17	People	Applications Development Group	312-523,000	
	Applications/Implementation Support			
	Manager			
1	($25-30K/yr.)	25-30,000		
3	Mini/Micro			
	($18-25K/yr.)	54-75,000		
2-3	Small/Medium Scale	36-75,000		
	($18-25K/yr.)			
2-3	Large Scale	40-84,000		
	($18-25K/yr.)			
8-10	People	Applications/Implementation Support Group	130-234,000	

Exhibit VI- A

Number of Personnel	Position	Estimated Cost	Group Cost	Total Cost
	Quality Assurance			
1	Group Manager	25-28,000		
2	($20-28K/yr.)	40-84,000		
3 People		Quality Assurance Group	65-84,000	

33-39 People	TOTAL SALARY	797.1,186,000
	FRINGE BENEFITS (30% of gross pay)	239.1-355,800
	TOTAL SALARY & FRINGE	$1036.2-1,541,800

Assumptions

- The group is responsible for all development, maintenance and enhancement for ESV-IS Systems;
- Costs based on FY81 dollars; and
- Sizing, composition and staffing costs are PMM&Co. estimates are based on discussions with MECC, METRO II and TIES management.
- Group formed with competitive selection process.

ESV-IS SYSTEMS ARCHITECTURE

CENTRAL DEVELOPMENT GROUP

ESTIMATED STAFFING AND COSTS

EXTERNAL CONTRACT DEVELOPMENT PRIORITY

Number of Personnel	Position	Estimated Cost	Group Cost	Total Cost
	Director	$ 45,000		
	Technical Support			
1	Manager	35,000		
1	MCP/Utilities	25,000		
	Data Base Administration			
1	($30K/yr.)	30,000		
1	($20K/yr.)	20,000		
	Data Communications			
1	($30-35K/yr.)	30-35,000		
2-3	($20-25K/yr.)	40-50,000		
7-8 People	Technical Support Group		$ 225-240,000	
	Applications Development			
1	Manager	35,000		
	Finance Team			
1	($30-35K/yr.)	30-35,000		
2	($18-28K/yr.)	36-52,000		
	Payroll/Personnel Team			
1	($30-35K/yr.)	30-35,000		
2	($18-28K/yr.)	36-52,000		
	Student Team			
1	($30-35K/yr.)	30-35,000		
2	($18-28K/yr.)	36-52,000		
10 People	Applications Development Group		233-296,000	
	Applications/Implementation Support			
1	Manager	30,000		
	Mini Micro	54-75,000		
3	($18-25K/yr.)			
	Medium Scale	36-75,000		
2-3	($18-25K/yr.)			
	Large Scale	40-84,000		
2-3	($20-28K/yr.)			
8-10 People	Applications/Implementation Support Group		160-234,000	

Number of Personnel	Position	Estimated Cost	Group Cost	Total Cost
	Quality Assurance			
1	Manager	25-28,000		
2	($20-28K/yr.)	40-84,000		
3 People				
		Quality Assurance Group	65-84,000	

28-31 People	TOTAL SALARY	683-854,000
	FRINGE BENEFITS (30% of gross pay)	204.9-256,200
	TOTAL SALARY & FRINGE	$ 887.9-1,110,200

Assumptions

- This group does not build or develop new systems but is responsible for implementation, training and maintenance of ESV-IS systems;
- All development work is contracted out;
- Costs are FY81 dollars with internal cost (fringes included) at $25/hour and external contract at $60/hour.
- Sizing, composition and staffing costs are PMM&Co. estimates based on discussions with MECC, METRO II and TIES Management.
- Group formed with competitive selection process.

ESV-IS SYSTEMS ARCHITECTURE

ESTIMATED FINANCE SYSTEM COSTS

MICRO FIN

Requirement Definition	80 hr.
Detailed Design	480 hr.
Programming	800 hr.
Test	160 hr.
	1520 hrs. x $25./hr = $ 38,000 internal cost
	x $60./hr = $ 91,000 external cost

MEDIUM SCALE STAND-ALONE ESV-FIN

- Conversion 26 weeks x 2 people x 40 hr. week = 2080 hours.
  2080 hr. x $25 hr. = $ 52,000 internal cost
  x $60 hr. = $124,800 external cost

• Requirement Definition	200 hr.
• Conceptual Design	500 hr.
• Detailed Design	700 hr.
• Programming	2100 hr.
• Test	700 hr.
	4200 hr. x $25/hr. = $105,000 internal cost
	x $60/hr. = $252,000 external cost

FRONT-END PROCESSOR for MEDIUM/SMALL SCALE

Requirement Definition	80 hr.
Detailed Design	80 hr.
Programming	800 hr.
	960 hr. x $25/hr. = $ 24,000 internal cost
	x $60/hr. = $ 57,600 external cost

TOTAL ESTIMATED FINANCE SYSTEM COSTS $167,000 internal cost

$400,000 external cost

Note: No management time estimates included.

ASSUMPTIONS

- Levels of effort for each activity were arrived at after consultation with MECC and TIES.
- Costs are FY81 dollars with internal cost (fringes included) at $25/hour and external contract costs at $60/hour.

ESV-IS SYSTEMS ARCHITECTURE REQUIREMENTS

ESTIMATED PAYROLL/PERSONNEL SYSTEM COSTS

1. DEVELOP FRONT-END/DATA COLLECTION

Requirement Definition	80 hr.		
Detailed Design	80 hr.		
Programming	1040 hr.		
	1200 hrs.	x $25/hr. =	$ 30,000 internal cost
		x $60/hr. =	$ 72,000 external cost

2. SELECT PAYROLL/PERSONNEL ALTERNATIVE:

Alternative 1 - Rewrite payroll update and add personnel capability to TIES system.

Develop position/control modules			
Requirement Definition	250 hr.		
Conceptual Design	500 hr.		
Detailed Design	750 hr.		
Programming	2500 hr.		
Test/Implementation	1000 hr.		
Incl.	5000 hrs.	x $25/hr. =	$125,000 internal cost
		x $60/hr. =	$300,000 external cost

Alternative 2 - Contract for acquisition and modification of new payroll/personnel system. Include medium scale version as deliverable. Acquisition cost estimated at $100,000 with 12,000 hours for installation and training estimated:

12,000 hr.	x $25/hr. =	$300,000 internal cost
	x $60/hr. =	$720,000 external cost

TOTAL ESTIMATED PAYROLL/PERSONNEL COSTS

Alternative 1:	Alternative 2:
$155,000 internal	300,000 internal cost
372,000 external	792,000 external cost

Note: No management time estimates included.

* Estimate does not include external contract expenses for payroll/personnel project.

ASSUMPTIONS

- Levels of effort for each activity were arrived at after consultation with MECC, METRO II and TIES;
- Costs are FY81 dollars with internal (fringes included) cost at $25/hour and external contract at $60/hour.

ESV-IS SYSTEMS ARCHITECTURE

ESTIMATED STUDENT SYSTEM COSTING

1. Rework Current Teleprocessing programs to reduce number of TP screens and improve logic of input.

2000 hr. x $25/hr. = $ 50,000 internal cost

x $60/hr. = $120,000 external cost

2. Build interface to support batch data collection

1000 hr. x $25/hr. = $ 25,000 internal cost

x $60/hr. = $ 60,000 external cost

3. Develop Front-end for data collection and edit for medium scale, small scale and micro-computers.

1000 hr. x $25/hr. = $ 25,000 internal cost

x $60/hr. = $ 60,000 external cost

TOTAL ESTIMATED STUDENT SYSTEMS COSTS $100,000 internal cost

240,000 external cost

Note: No management time included in these estimates.

ASSUMPTIONS

- Levels of effort for each activity were arrived at after consultation with MECC;
- Costs are FY81 dollars with internal cost (fringes included) at $25/hour and external contract at $60/hour.

ESV-IS SYSTEMS ARCHITECTURE

ESTIMATED SMALL-SCALE SATELLITE NEEDS TO SUPPORT

INTERMEDIATE INFORMATION REQUIREMENT

PHASE I CP500 SMALL SCALE SATELLITE

Criteria: All data collection/edit for ESV-FIN/PPS/SSS
Remote Job Entry (RJE)
Output Reports

Equipment: Memory - 65,536 bytes
Disk - 65.2 MB
Printer - 350LPM

$ 44,430.49*

PHASE II CP9500 SMALL SCALE SATELLITE

Criteria: Inquiry into subsets of district data
Report generation from district data

Equipment: Same as Phase I, plus:

Memory - 131KB
Disk - 130.4 MB
Printer - 650LPM

$36,999.55* for new devices

$55,861.90* overall (less 350LPM Printer, 65.2 MB Disk).

*Net prices, include 40.9% discount

ASSUMPTIONS

- Capability of small scale satellite based on intermediate information requirements of district; and
- Costs provided by Burroughs are subject to change.
- Similar equipment from other vendors should be considered for competitive bid.

ESV-IS SYSTEMS ARCHITECTURE

ESTIMATED MEDIUM-SCALE SATELLITE NEEDS TO SUPPORT

COMPLEX INFORMATION REQUIREMENTS

PHASE II B1955 MEDIUM SCALE SATELLITE

Criteria:
- Run ESV-FIN
- Front-end data collection/edit
- Remote Job Entry (RJE) for ESV-PPS and ESV-SSS
- Limited local reporting

Equipment:
- Memory - 1MB
- Tape - 1 drive
- Disk - 130MB
- Printer - 750LPM

$133,915.54*

Software:
- MCP + Utilities
- RJE
- NDL
- GEMCOS
- ODESSY
- DMS II
- COBOL 74
- REPORTER II

$1,093/mo.

PHASE III B1955 MEDIUM SCALE SATELLITE

Criteria:
- Run ESV-PPS and SSS
- Extensive local inquiry

Equipment: Same as Phase II, plus:
- Disk - 260MB total
- Printer - 1500LPM

$56,170.72* for new devices
$175,557.12* overall (less 750LPM printer)

*Net prices, include 40.9% discount

ASSUMPTIONS

- Capability of medium scale satellite based on complex information requirement of districts; and
- Costs provided by Burroughs are subject to change.
- Similar equipment from other vendors should be considered for competitive bid.

Exhibit VI-G

ESV-IS SYSTEMS ARCHITECTURE

ESTIMATED INTELLIGENT DATA ENTRY NEEDS

OPTION 1: Minimal Apple II (single disk, 48K) for all current districts, add Apple capability to 127 new districts. In this configuration, the current data entry program would require some modification, estimated at 80 hours.

Assumption: Piggyback on current instructional user of Apple II's.

Currently 310 of 437 districts have Apple II's, with the following characteristics, installed:

- 32K
- Single disk
- CRT

Current cost of these Apple II's is $1,800.00

To operate as data entry to region will require installation of:

• 16K (to be 48K memory)	$ 50.00
• Modem - 300 BPS	100.00
Total Apple II Unit Cost	$1,950.00

To add 127 districts at $1,950/district = $ 247,650

OPTION 2: Upgrade all 310 districts with Apple II's to 48K with dual disk and add new Apple II's for 127 districts.

Assumption: Piggyback on current instructional user of Apple II's.

Upgrade 310 districts to a minimum data entry configuration:

• Add 16K (to memory) to 48K	$ 50.00
• Add Dual disk (plus controller card)	350.00
• Add Modem - 300 BPS	$ 100.00
	500.00
	x 310 districts
	$155,000.00

Exhibit VI-H

Purchase 127 new 48K, dual disk Apples:

Unit cost of dual disk 48K configuration is $2,200.00

$ 2,200.00

x 127 districts

$ 279,400.00

Total cost of upgrade and new purchase $ 434,400

OPTION 3: Add Apple capability for Administrative computing to 60% of 437 districts - 262 districts

Assumption: Piggyback on 60% of current instructional user base.

Apple II dual disk, 48K configuration

$ 2,200.00

x 262 districts

$ 576,400

$ 576,400

OPTION 4: Add Apple capability for Administrative computing in all 437 districrs

Apple II dual disk, 48K configuration

$ 2,200.00

x 437 districts

$ 961,400

$ 961,400

GENERAL ASSUMPTIONS

- Apple II is an example of a microcomputer capable of performing data collection and edit of batches for ESV-IS systems;
- Costs are FY81 costs; and
- These devices have been purchased with District funds.

ESV-IS SYSTEMS ARCHITECTURE REQUIREMENTS

PROPOSED IMPLEMENTATION PRIORITIES AND ASSOCIATED COST

FOR

ESV-IS APPLICATION SYSTEMS

PRIORITIES		PERSON HOURS*	INTERNAL COST	EXTERNAL COST
1.	Modify current microcomputer data entry to provide security features. Refine system and release as State software.	500	$ 12,500	$ 30,000
2.	Develop front-end data collection/edit for medium/ small-scale satellites using ODESY for FIN system.	960	24,000	57,600
3.	Option A Rewrite TIES payroll	500	12,500	30,000
	Develop position control module and add personnel capability	5,000	125,000	300,000
	Option B Acquire/modify new payroll/ personnel system to operate on large- and medium-scale systems (separate front-end edit for medium/small scale satellites-using ODESY).	12,000	300,000	720,000
4.	Develop front-end data collection/edit for new State payroll/personnel system for microcomputer.	1,200	30,000	72,000
5.	Develop medium-scale version of finance system with separate front-end edit for medium/ small-scale satellites. (Use ODESY for front-end.)	4,200	105,000	252,000

Exhibit VI-I

		PERSON HOURS	INTERNAL COST	EXTERNAL COST
6.	Option A Complete development of Ortonville microcomputer version of finance system, acceptance test product, and release as field-developed, State funded.	500	$ 12,500	$ 90,000**
	Option B Develop new microcomputer finance system	1,500	37,500	90,000**
7.	Rework teleprocessing modules to streamline data entry and logic of ESV-SSS system. Complete front-end data collection/edit for micro-computer. Prepare medium-scale version.	2,000	50,000	120,000
8.	Build batch data collection interface for ESV-SSS system.	1,000	25,000	60,000
9.	Develop front-end data collection and edit for ESV-SSS system.	1,000	25,000	60,000
TOTAL ESTIMATED COSTS				
OPTION 1	Priority 3A - TIES payroll Priority 6A complete MICRO-FIN	16,680 (8.8 person years)	421,500	---
OPTION 2	Priority 3A - TIES payroll Priority 6B develop MICRO-FIN	17,860 (9.92 person years)	446,500	1,071,600
OPTION 3	Priority 3B - new payroll Priority 6A complete MICRO-FIN	23,360 (12.97 person years)	584,000	---
OPTION 4	Priority 3B - new payroll Priority 6B develop MICRO-FIN	24,360 (13.53 person years)	609,000	1,461,600

* Note--No management time included in these estimates.

** PMM&Co. recommends contracting out for the entire development of MICRO-FIN versus obtaining external assistance to complete current project.

Estimate does not include external contract or expenses for developing payroll/personnel system.

ASSUMPTIONS

- Priorities based upon (1) phases for the levels of information requirement of simple, intermediate, and complex, (2) reduction in communications costs, (3) reduction in need for large scale hosts;
- Person year calculated at 1840 hours; and
- Staffing costs based on discussions with MECC, METRO II and TIES management.

ANTICIPATED ADDITIONAL HARDWARE REQUIREMENTS

	Apple II Microcomputers (Administrative Use)	Burroughs Small-Scale (CP9500)	Burroughs Medium-Scale (B1000)
Region I	34	3	-
II	15	3	-
III	15	5	-
IV	33	3	-
V	15	3	-
VI	-	-	3
VII	15	3	-
	127	20	3

ASSUMPTIONS

- Majority of larger districts have multiple Apple II's.
- Major communications cost reductions can come from use of Apple II in Regions I and IV.
- Region VI should not need Apple II's for Administrative computing as large numbers are available from Instruction.
- Burroughs does not refer to the B1000 series as a medium-scale computer. This description was chosen to illustrate a level of performance in relation to the B6000 series used as host computers in the regional service centers.