

U.S. GENERAL ACCOUNTING OFFICE  
STRATEGIC PLAN FOR ADMINISTRATIVE ADP SYSTEMS  
1981-85



OFFICE OF INFORMATION SYSTEMS AND SERVICES  
GENERAL SERVICES AND CONTROLLER

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## EXECUTIVE SUMMARY

GAO operates 18 ADP systems in support of its management and administrative operations. These systems fall into three broad categories--personnel, financial, and management information. Eight of these systems currently operate as parts of an integrated information system called AMPS, and the others exist as independent applications on various Government computers. The 8 systems in AMPS generally provide effective support, having replaced other systems that had become obsolete. The viability of the AMPS applications is due to the quality and scope of AMPS's original design, to the use of a "database management system" for most parts of the system, and to the resources that GAO has applied to operate, maintain, and enhance the system in response to changing requirements.

The remaining application systems that are not part of AMPS require a disproportionate amount of management attention and technical resources. Most of these systems use earlier technology; they are not integrated with or supportive of the procedures and objectives of the organizations that use them; and they frequently provide inconsistent data on basic GAO operations.

Chapter 3 examines the systems in operation from the point of view of GAO's functional area managers, and concludes that the personnel and financial systems could better support GAO's needs. The personnel systems need improvement in the long term because they lack critical functions needed to support management and personnel operations; because of the lack of control by GAO of the software and computer facility; and because of the inherent difficulties in synchronizing personnel data with other systems. The financial systems are deficient in the support they provide for clerical operations; in the data they provide for financial management; and in the scope of functions that they support.

The three management information systems are all part of the integrated AMPS system. By far the largest and most important of these is the assignment management ("Jobs") subsystem that tracks the status of GAO audits in progress. The Jobs system is probably the most effective automated system in GAO. It is used virtually daily by every audit division to update the audit database and to produce ad hoc reports. The Jobs system should be preserved in its current form, at least in terms of its inputs, database concept, and reporting functions. Although the current implementation of AMPS functions well, there is no long run requirement that AMPS remain in its current computer and software environment. It could be converted to any comparable DBMS on any adequate computer.

Major new application systems are needed to meet GAO's requirements in the areas of financial management and personnel management. Those new systems would replace the 11 "stand alone" systems that are not now part of AMPS. The complete set of systems--new financial, new personnel, and converted MIS--should be operated on one computer facility, using a database management system (DBMS) to provide consistent access to all administrative data.

GAO has three principal options to acquire consolidated ADP services of the type it needs for administrative systems--sharing with other agencies, building an "inhouse" computer center, or using contractor services. Chapter 5 analyzes

these options, and the clear choice is for GAO to use a contractor's computer facility for at least the next several years. The plan proposes that one contractor have full "life cycle" responsibility for all administrative systems from conceptual design through programming, installation, and continuing operation. That contractor would also provide all computer and telecommunications services needed to develop and run the systems. This single-contractor approach is designated the "Consolidated Administrative Systems" (CAS) concept. This is the contracting strategy that has been used for the development and operation of AMPS, and it appears to be the best approach for the full CAS development and operations cycle. In using this approach, GAO will be building on its successes.

Available information indicates that pursuing the consolidated administrative systems approach will cost the agency approximately \$4.5 million over and above the cost of continued operation under the current "independent" configuration of administrative systems. This amount reflects the costs associated with software development and migration of data to the new system, and simultaneous maintenance of duplicate systems until each existing file is integrated into the new consolidated system. The "steady-state" or day-to-day cost of operating the consolidated system, once the system has become operational, should be approximately the same as that for maintaining the existing independent administrative files. However, there are several major advantages to implementing the consolidated system.

- . the integrated system would provide greater assurance of timely and consistent data in the area of personnel, financial management, staff year projection, budgeting, and numerous other functional areas. At present, the systems maintain duplicate data derived from different sources, and thus are highly susceptible to conflicting data and are highly dependent on the availability of this data from various sources.
- . the integrated system approach will increase staff productivity through elimination of duplicative data entry, maintenance, and processing functions. In addition, the ability to make correlations amongst previously independent data will result, greatly enhancing managements reporting capabilities.
- . an integrated or consolidated system would also provide the agency with better assurance and confidence that it will meet commitments such as payroll, pay adjustments, legal and personnel obligations, and numerous other areas which are presently very cumbersome and difficult to execute and result in a fire-fighting type of approach, routinely.
- . an integrated system will also serve as the backbone for support of future improvements in the agency's administrative systems, such as possible linkage to the agency's "corporate memory" requirements, audit report production, and other appropriate administrative activities.

## 1. INTRODUCTION

### 1.1 Purpose

The U.S. General Accounting Office spends over \$3 million each year for all computer related services. Although every decision to spend money is made deliberately in support of some specific objective. The goal of this plan is to establish an overall strategy for providing administrative ADP support for GAO.

The plan has the following specific objectives:

- (1) To identify GAO's current systems and to enunciate GAO's objectives for administrative ADP systems. This will enable GAO to periodically assess its success in improving ADP services against a baseline set of objectives.
- (2) To identify and consolidate all known requirements for the period 1980-85 into a framework that permits consolidated planning.
- (3) To provide a basis for strategic policy decisions in the areas of:
  - . ADP support capability
  - . staffing
  - . budget
  - . organizational responsibilities
- (4) To provide a means to communicate GAO's ADP plans to other agencies.
- (5) To demonstrate that individual procurement actions or system development projects fit into a cohesive long term plan designed to yield technically superior and cost effective ADP support.

The plan describes how GAO provides administrative ADP services in 1980 and how GAO proposes to provide these services in the period 1981-85.

### 1.2 Scope

GAO has three major categories of computer applications--administrative, audit support, and programmatic.

- (1) Administrative applications are the business-type systems that provide support for the basic administrative functions--budgeting and accounting, purchasing, making payments, payroll, personnel management, etc.--and for the management control of GAO operations.
- (2) Audit support applications are the uses of computers in direct support of GAO audits. Audit support consists of many relatively small, independent projects done principally through timesharing or remote batch. The balance of audit computer work uses proprietary econometric models.

- (3) Programmatic applications support the operation of independent non-audit groups in GAO. While each of these systems may be relatively complex, there are few interactions among these systems. This category includes the correspondence control system of the Office of General Counsel; the systems that support GAO's Claims group; the system for the GAO Fraud Task Force; PAD's budget and sourcebook applications; and the bibliographic databases used by the library.

These three broad categories are distinguished by the organizations they serve; by the nature of the data processing functions they perform; by the computer facilities available for the different categories; and by the different requirements for formal documentation and procedures. These three categories constitute essentially "autonomous" groups of systems that serve different purposes and share no data or other computer resource.

This plan deals only with GAO's administrative systems requirements. The plan provides a statement of the computing resources used by GAO for administrative support systems and the benefits that GAO receives; it estimates the resources likely to be needed for the next 5 years; and it proposes strategic policies for improving the services in an economic and efficient way. The plan does not attempt to forecast the future, but to define how GAO will respond to changing ADP requirements and changing computer technology.

### 1.3 Approach

The plan distinguishes two related categories of planning: information systems plans and ADP services plans.

- (1) Information Systems Plans (The "Applications" Perspective)

This component of the plan establishes the functions that should be supported by ADP and the broad outlines of the resulting automated systems. The information systems plan is based on functions that should be automated without regard to the specific computer(s) that support those functions.

- (2) ADP Services Plan (The "Hardware" Perspective)

This part of the plan takes the requirements and analyzes how these requirements can best be provided to the Government. Planning for ADP services depends on combining the requirements that each individual application or category of applications imposes on the total ADP capacity. The resulting strategy to provide computer services must be flexible enough to accommodate future expansion and to provide for later changes in managements' information needs.

Given GAO's current situation, in which the Office has no central computer facility and no "omnibus" computer support contract, it is important to consider those issues separately. The systems plan deals basically with GAO's requirements, and the services plan deals with how those requirements will be met from a procurement point of view.

## 2. EXISTING ADP SUPPORT

This chapter defines the current state of ADP equipment, contracts, and systems that support administrative activities—the components of the total systems picture that cannot be immediately modified in favor of some alternative. These are the components of the "baseline" from which the GAO ADP plan can be developed. The value in enumerating the existing ADP support is that all alternatives can be checked for consistency with the commitments that exist in 1980. For example, no critical existing contract (e.g. for GAO's MIS) may be permitted to expire without some replacement installed and operational.

### 2.1 Owned and Leased Equipment

GAO has minimal commitments to any currently installed ADP equipment. Two minicomputers on the 4th floor of the GAO building are used in support of administrative operations. Both of these computers are owned by GAO, but there is no major investment in applications software for these machines that should be preserved, and the application systems that these machines support do not appear to fit into an ideal long run systems plan. Figures 2.1 and 2.2 show the configuration of the two minicomputer systems.

#### (1) Microdata Royale

This machine was purchased in 1978 to support the inventory control system for the GAO stockroom. Although the machine was purchased as part of a "turnkey" inventory system, the computer had excess capacity and other minor administrative support applications have been installed on this machine. The following applications are currently operated on the Microdata computer:

- . ADP Fund Accounting (AFACS)
- . Invoice Tracking
- . Travel Order Tracking
- . Payroll Reports Distribution and Task List
- . Minority Sourcebook (Personnel)

Those systems are described in Section 2.3 "Administrative Systems in Use." The two largest applications that were operated on the Microdata were terminated in 1980. The inventory control system was removed after most of GAO's stockroom functions were transferred to the GSA store and the benefits from the system no longer justified the effort to maintain the data. The GAO locator system was terminated after that function was merged into the AMPS management information system.

The Microdata computer provides an ideal environment for installing very small (1 to 3 file) online applications with straight forward updating and reporting requirements. Although this machine is not capable of supporting any major application, like payroll or accounting it is useful for applications like the Minority Sourcebook that do not interface with any other system.

FIGURE 2.1

Microdata Minicomputer Configuration

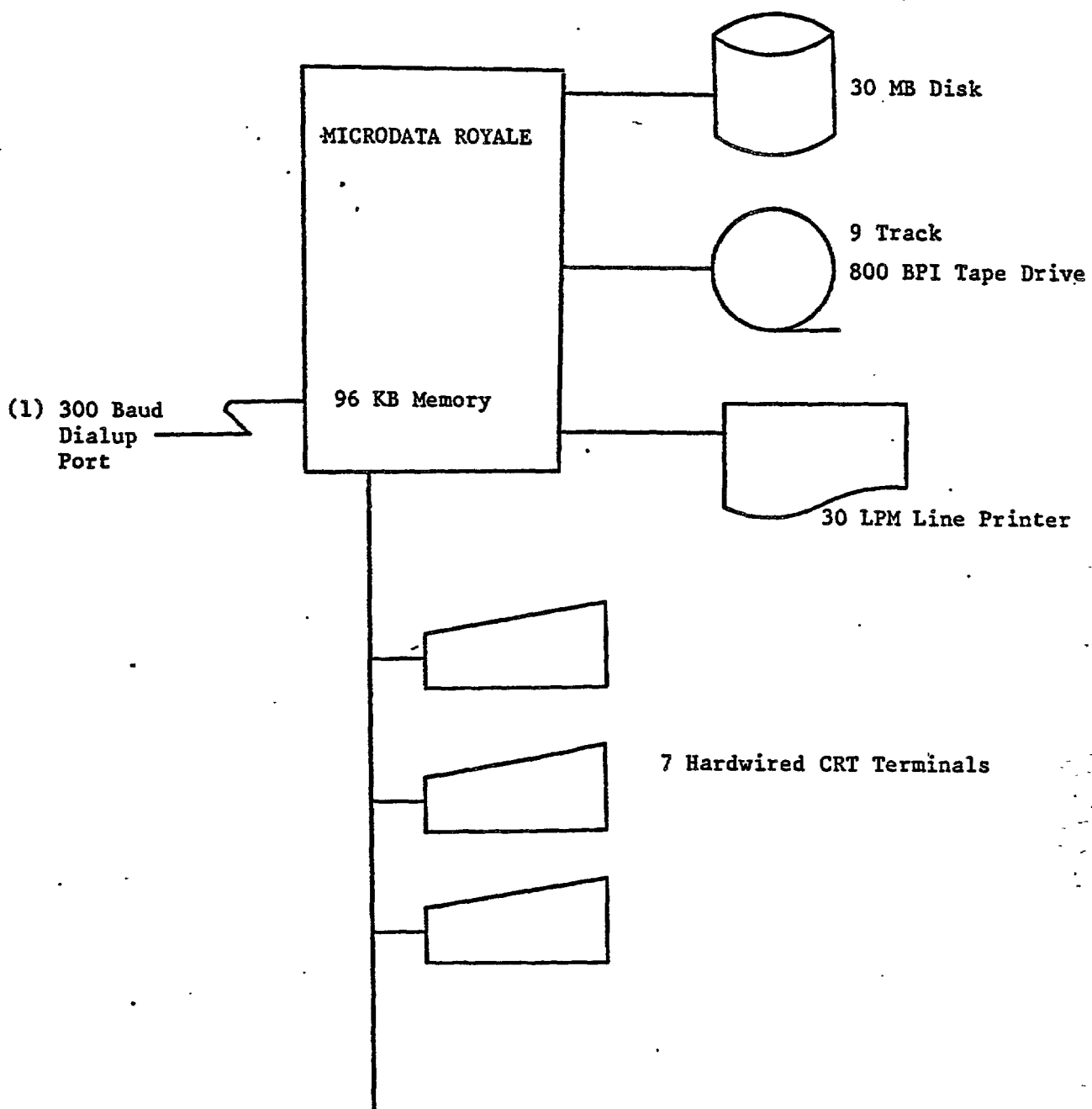
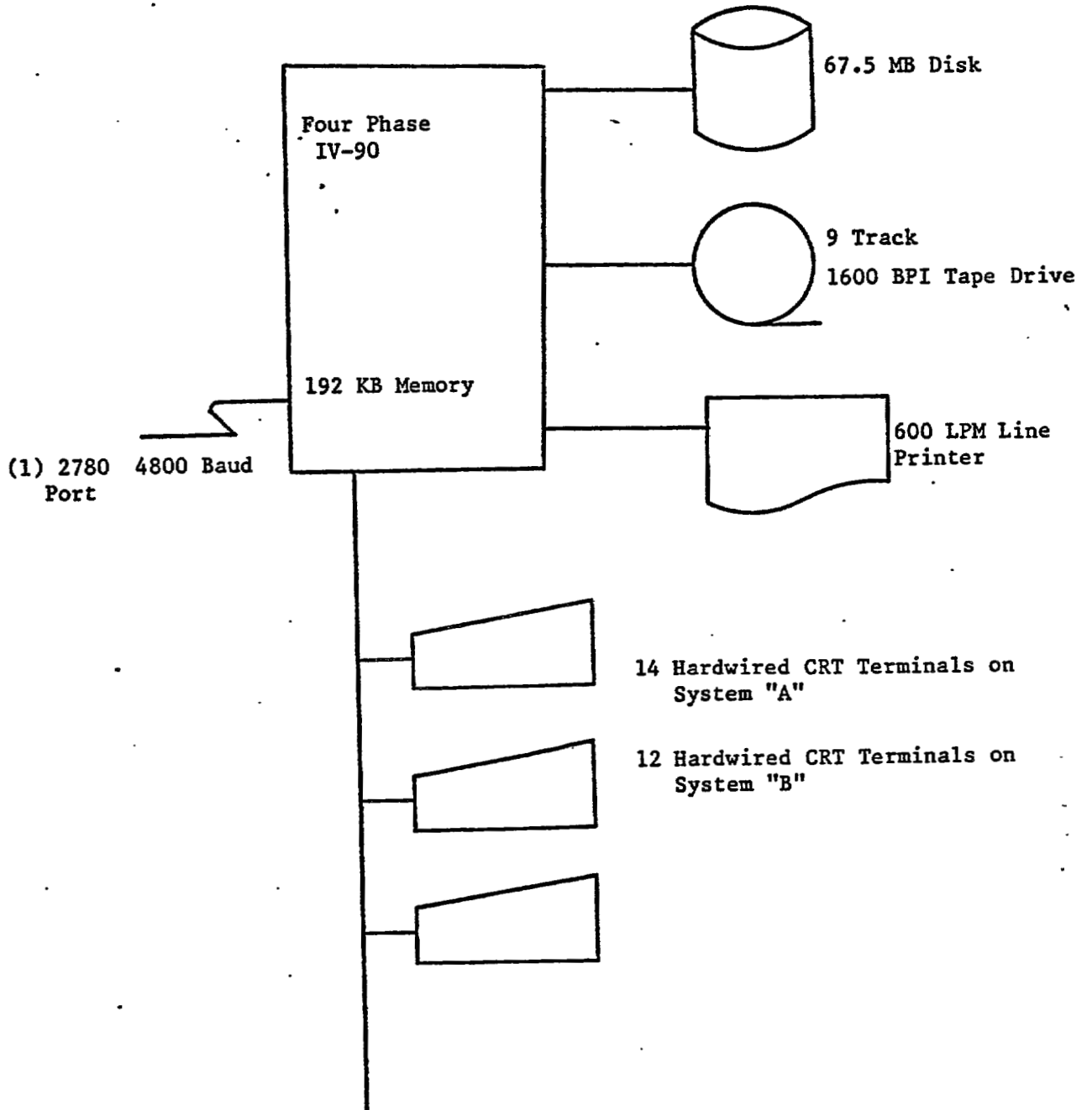




FIGURE 2.2

Four Phase Minicomputer Configuration



The annual direct cost of operating the Microdata is approximately as follows:

Hardware Maintenance	\$12,000
Software Maintenance	1,100
1 Full time Analyst (GS-7)	13,925
Overhead @ 20%	2,785
Supplies (est.)	2,000
Total Direct Operating Cost	<u>31,810</u>

(2) Four Phase IV-90

Two Four Phase minicomputers acquired in 1977 support online data entry and remote job entry (RJE) for administrative and audit applications. The Four Phase computers each have the same configuration and provide redundancy in case of the failure of one system. Each system is configured with 12 terminals, 192 KB of memory, and a 67 MB disk. Each Four Phase machine supports 1 4800 baud telecommunications port for RJE under IBM 2780 protocol. Detailed parameters of each host system's protocol are set under program control. The Four Phase provides data entry and RJE service for the following active administrative systems:

- . Personnel (APAS)
- . Payroll
- . Travel and Miscellaneous Payments (TAMPS)
- . Property Accounting

Those systems are described in Section 2.3 "Administrative Systems in Use." The Four Phase also supports data entry and RJE service for the following audit and programmatic systems:

- . Claims
- . Library Periodicals Index
- . PAD's Presidential Budget
- . Correspondence Control for Office of the General Counsel
- . Monitoring System for Fraud Task Force

The Four Phase computer is also used purely as an RJE station by staff in the audit divisions requiring remote batch access to several computer centers.

Considering all the applications above, the Four Phase computers function as remote batch terminals to the following large host computer centers:

- . USAMSSA
- . U.S. Department of Agriculture-Washington Computer Center
- . U.S. Department of Labor-Departmental Computer Center
- . U.S. Department of Justice
- . National Institutes of Health-DCRT
- . House Information Systems
- . COMNET

Since the Four Phase computers are used for data entry and as remote batch stations, there is little applications programming associated with these machines.

The approximate annual cost of the Four Phase computers is:

Maintenance	\$12,000
Operators GS-7, full time	13,925
GS-5, half time	5,622
Overhead @ 20%	3,910
Supplies & Miscellaneous	10,000
Total Direct Operating Cost	41,547

### (3) Hewlett Packard Terminals

GAO leases 45 Hewlett Packard 2649A intelligent terminals for use with the "AMPS" management information system. Each terminal consists of a CRT, a keyboard, and a 120 CPS serial printer. The CRT supports formatted data entry and minimal local editing. The terminals operate at speeds up to 9600 baud, and are currently attached to VADIC or Bell 1200 baud modems. 31 of these terminals are installed in the divisions and administrative offices at GAO headquarters and 1 terminal is installed at each regional office outside Washington. These terminals support the following functions within AMPS:

- . Entry of biweekly time and attendance
- . Update of personnel and locator data
- . Original entry of approved audits
- . Update of audit status
- . Staff year planning
- . Entry of allotment ledger and general ledger transactions
- . Ad hoc queries
- . Listing reports associated with each of above

These terminals are leased for \$282,500 per year including maintenance. A 30% purchase credit applies effective October 1, 1980, to 35 of the terminals, with an additional credit of 2.5% per month until September, 1982, at which time a 90% purchase credit will have accrued. No additional credits apply beyond that point.

## 2.2 Contracts in Force

GAO has two major contracts for support of administrative ADP systems. Both of the following contractors are providing critical services to GAO.

### (1) American Management Systems, Inc. (AMS)

Under this contract AMS provides GAO all professional services, computer and telecommunications support, and related services to maintain and operate the AMPS management information system. This contract is on a fiscal year basis (October 1 thru September 30) and the final option year is FY 1983. The contract is currently scoped at about 15 full time equivalent contractor personnel, plus about \$1 million of nonlabor costs per year. The specific applications that are included in this contract are described in Section 2.3 "Systems in Use."

Although GAO does not own the computer used under this contract (GAO is billed on a "service bureau" basis), a significant amount of software has been developed that is used for updating the MIS databases and for production of periodic reports. That software represents a considerable investment, and the issues of conversion--technical feasibility and allocation of costs--have to be carefully considered in planning for the continuation of these services when this contract expires.

The second major asset acquired under this contract is the AMPS database itself. Even more than the AMPS software, the data constitutes property valuable to GAO. This data base is now the source for virtually all division-level and GAO-wide management reporting on the status of GAO audits. Fortunately the data base management system that supports AMPS provides a general purpose interchange facility that makes it possible to transfer the AMPS data base to any other software environment that provides comparable capabilities.

## (2) Computer Data Systems, Inc. (CDSI)

GAO has a contract for CDSI to provide programming and systems analysis in support of existing administrative ADP systems, except AMPS. This contract is for professional services only--no computer, telecommunications, or other nonlabor services are included in the scope of the CDSI contract. This contract is scoped at about 10 full time ADP professionals, for an annual cost of about \$350,000. All work performed under this contract is defined and authorized under task orders issued to the contractor. The contract is renewable on a fiscal year basis (October 1 - September 30) through FY 1982.

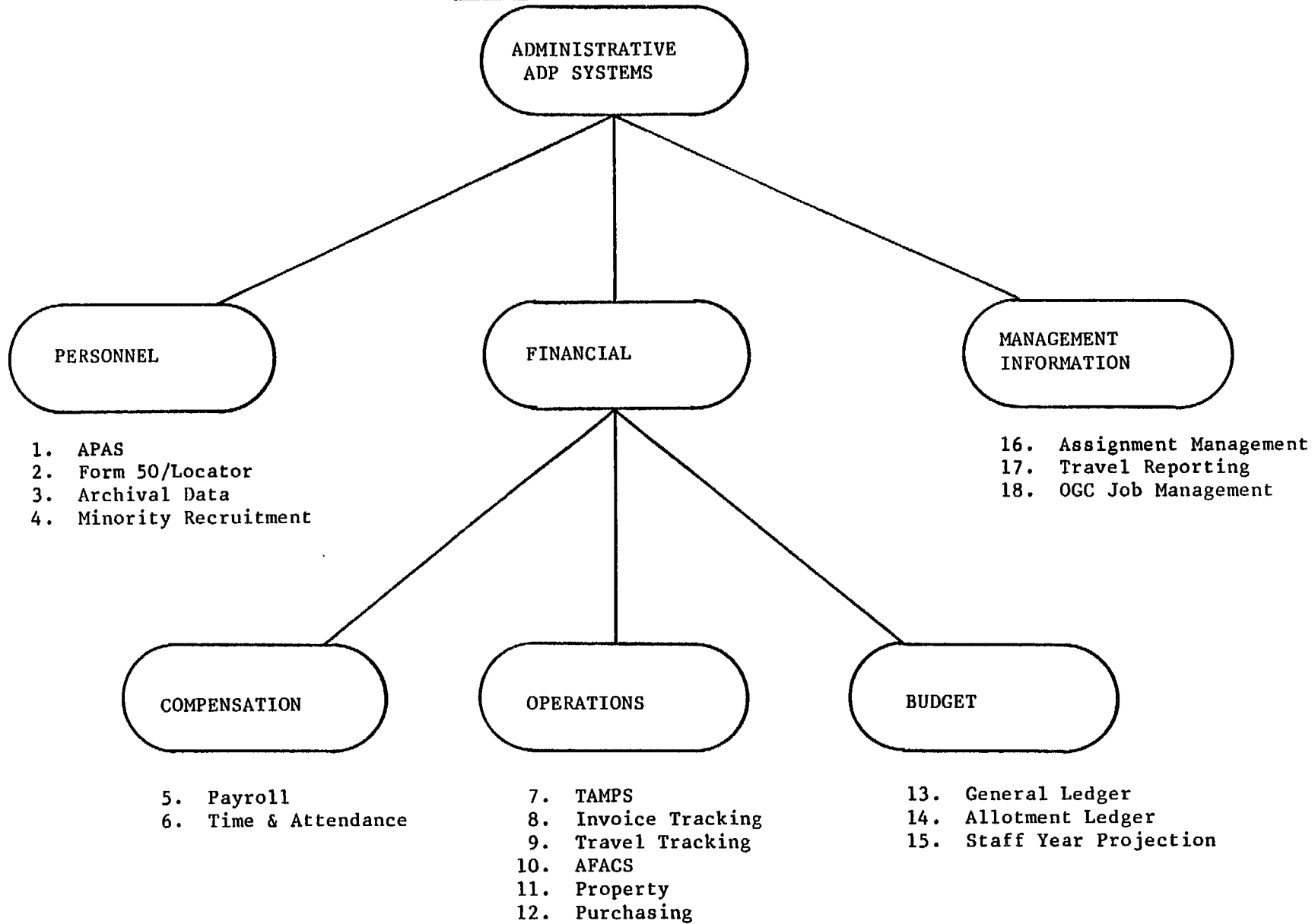
The purpose of the CDSI contract is to provide a consolidated source of ADP expertise in the principal systems that GAO uses. Although this contract is centrally administered by the Office of Information Systems and Services, the work is performed for the other "user offices"--the Office of Budget and Financial Management and Personnel. The scope of this contract includes both the operation and maintenance of administrative systems. The intention is for CDSI to assume full responsibility for running GAO's current personnel system, payroll system, and payables system.

## 2.3 Administrative Systems in Use

GAO's existing administrative ADP systems support the agency's requirements in the areas of personnel management, financial management, and management of GAO's audit work. The 18 systems in operation are shown in Figure 2.3, and are described briefly below. Although 18 administrative ADP systems are listed, 8 of those systems currently exist as part of an integrated information system called AMPS, which was installed in 1979 and is being enhanced in 1980 and 1981. Although AMPS was originally conceived as a modest replacement for GAO's earlier computer systems to monitor the status of the agency's audits in progress, the generality of the design approach and the comprehensiveness of the database have made AMPS a natural foundation for the development of related applications. Consequently a number of extensions--all associated with the basic premise that AMPS supports the management information needs of GAO--have been added. GAO's experience with these extensions has confirmed that the AMPS database does constitute a viable base for a wide range of administrative support applications.

FIGURE 2.3

Administrative ADP Systems in Use



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The following table shows which of the 18 systems are incorporated in AMPS and which systems are now independent computer applications:

<u>Not in AMPS</u>	<u>In AMPS</u>
APAS	Form 50/Locator
Archival Data	Time & Attendance
Minority Recruitment	General Ledger
Payroll	Allotment Ledger
TAMPS	Staff Year Projection
Invoice Tracking	Audit Management
Travel Tracking	Travel Reporting
AFACS	OGC Job Management
Property	
Purchasing	

The 8 systems listed as part of AMPS operate as cooperative applications that update and retrieve data from the central AMPS database. No one of the 8 systems "owns" the entire database, and numerous parts of the database are used by all of the AMPS subsystems. For example, the PERSON file that contains employees' names and the VALID file that contains GAO organization codes are used by almost every AMPS subsystem. The database approach makes it easier to develop new applications because only the new data for a subsystem has to be added to the data base. All existing data (like the GAO organization codes) are guaranteed to be accessible and current so that complex intersystem interfaces are unnecessary.

The AMPS computer environment consists of the AMS DEC 2060 computer using the "System 1022" database management system. 31 terminals are installed at GAO headquarters, plus 14 terminals are installed in GAO's regional offices outside Washington, D.C.

1. Automated Personnel Accounting System--APAS

"APAS" is an adaptation of the Army's Civilian Personnel Accounting System (CPAS). APAS performs personnel management functions for GAO's 5,500 employees, and contains the Master Employee Record for the agency. This file includes the pay plan, step, salary, pay basis, tour of duty, leave category, etc. on all employees. It collects, stores, and reports personnel information on every employee and passes this information to the Payroll and AMPS systems.

APAS operates on the United States Army Management Systems Support Agency (USAMSSA) IBM 3033 computer. Data entry and some limited editing is performed on GAO's Four Phase terminals.

2. Form 50/Locator

The "Form 50/Locator System" is the personnel information subsystem of AMPS. The AMPS database has one master personnel file ("PERSON") that serves as the source of information on all employees of GAO (plus OTA, CSCE, CASB, and

the Oversight Commission). The PERSON file is updated from online formatted data entry programs (the FORM 50 system) and from interfaces to other administrative systems.

The AMPS personnel file is designed to hold only those data elements needed to support AMPS's management reporting functions. Consequently the data in AMPS and APAS has considerable overlap, but the data elements are far from being identical.

The personnel file of AMPS is partially synchronized with the formal personnel status maintained by the APAS and the Payroll system. The following procedures are used to synchronize these personnel files:

- (1) Periodically a tape of transactions processed by APAS is used to selectively update the AMPS personnel file. New hires and terminations are added to AMPS, and other personnel actions are applied if they relate to employees of the administrative offices. Other personnel transactions for employees of the audit divisions are noted and a report of discrepancies is sent to the divisions.
- (2) The audit divisions enter their own personnel transactions using the AMPS "Form 50" data entry screens. These transactions will typically take effect before the matching transaction from APAS described in (1) above.
- (3) Biweekly, a tape from the payroll system is used to confirm individuals' leave balances so that the correct balances will appear on the input screens for the entry of the next pay period's time and attendance data.

The GAO Locator system is a subset of the AMPS personnel system that maintains data on employees' work location and telephone, plus employees' home address. This data is entered by (and accessible only by) employees' own division or office. The data on office location and telephone number is used to print the GAO telephone book; employees' home address data is used only to mail W-2 forms at the end of the year. The decentralized entry of locator information appears to have improved the quality of the information available.

### 3. Archival Personnel Data

GAO needs to be able to analyze data related to employment and personnel actions over an extended period of time. This information is available in machine readable form in a database created using the DBMS System 1022. The database was created from the history files of GAO's predecessor personnel system called SRS. This database exists independent of the AMPS database and programs, although the DBMS and machine environment are identical to AMPS. Although the archival personnel data is not an active system, the databases must be maintained in an accessible form so that they will be available for

EEO-related analysis. Use of the System 1022 DBMS provides an ideal medium for this purpose, since its file definition facility is largely self documenting and it provides a powerful report generator and an interface to statistical packages.

#### 4. Minority Recruitment System

The "Minority Recruitment System" is an automated file of organizations affiliated with minority groups maintained by the Personnel Office. The file provides a source of organizations that GAO can use in its affirmative action recruiting efforts. There are about 4,500 items in the file, with the organizations' name, address, type, and minority classification.

The Recruitment System operates as an online application on the Microdata computer. The data in the master file is updated by the Recruitment Branch of Personnel using the file maintenance facilities of the PORTAL data management system on the Microdata. The principal outputs of the system are mailing labels selected by geographical location and type of organization, and reference lists for Personnel. Although there are updates to the master file (change of address, primarily), growth in the file is only about 5% per year. This system has no interfaces to any other automated system.

#### 5. Payroll

The "Payroll System" produces GAO's payroll tapes for the U.S. Treasury Department to print checks and savings bonds for GAO's employees. In addition, the Payroll System generates time and attendance reports, leave reports, and approximately 150 other reports, most of which are used for reconciliation and control purposes.

Adapted in 1976 from the Department of Justice's payroll system, it insures that all employees are paid and the proper deductions are made from their salaries for savings bonds, charities, taxes, etc. To accomplish this, GAO sends to the Department of Justice:

- . tapes from GAO's Four Phase system containing changes in allotments, deductions, bond information, check mailing information, etc.
- . tapes from APAS system at USAMSSA containing changes in personnel data promotion, step increases, reassignments, etc.
- . tapes from AMPS containing time and attendance data for all GAO personnel.

#### 6. Time and Attendance (T&A)

The "T&A System" is the AMPS subsystem that accepts biweekly pay data. The data collected includes detailed time charges to

- (1) active audit assignments
- (2) permanent codes for nonaudit activities like training



- (3) administrative codes for categories of leave (annual leave, sick leave, home leave, etc.)

and also adjustments to charges made in previous pay periods. Each division, regional office, and administrative office enters the data into the AMPS terminals from its employees' certified time and attendance form. The accumulated data is then transmitted to the Payroll System to provide a basis for payment, and used to update the level of effort data in the AMPS database. This procedure guarantees that the data in the AMPS data base that is used for management reporting agrees with the data stored in the payroll system.

#### 7. Travel and Miscellaneous Payables (TAMPS)

The "TAMPS System" processes data and reports on accounts payable, including obligations, accruals, payments, and refunds. Its reports are used primarily by the Audit and Control Unit, Office of Budget and Financial Management (OBFM) to keep track of GAO's outstanding commitments and advances, and to provide GAO divisions with reports detailing travel costs by individual employee and by totals for the division. TAMPS data on payables and travel expenses is drawn from purchase orders, receiving reports, invoices, training requests, GSA Fedstrips, refunds, cancellations, and cashier disbursement vouchers. Data on travel expenses is obtained from transportation requests, travel orders, travel vouchers, and claims for reimbursement.

All inputs to TAMPS are entered on the Four Phase minicomputer and the information is processed at the House Information Systems (HIS) computer center. The system is composed of about 25 COBOL and utility programs and 50 EASYTRIEVE programs for report production. TAMPS uses 4 ISAM files and one sequential file for archival transaction history. TAMPS' output includes several management reports, a computer tape of items to be paid which is sent to the Treasury Department where checks are printed and issued, a tape that is used to update GAO's allotment ledger, and a tape of invoices paid that is sent to the Invoice Tracking System.

#### 8. Invoice Tracking

The "Invoice Tracking System" is an extension of the Travel and Miscellaneous Payables System (TAMPS) that keeps track of the status of all vendor invoices received by GAO's Administrative Finance Section until those invoices are paid thru the TAMPS system. This system operates on GAO's Microdata minicomputer. It is written in BASIC, ENGLISH (the Microdata report generator language), and in PORTAL, a proprietary data management system.

The system was installed to give positive control over invoices and to insure prompt payment to vendors. Records in the master file are created by keying the information into a Microdata terminal. Invoice records are updated when the invoice is sent to another office or returned to Administrative Finance. Invoiced records are closed out when a record is received on tape from TAMPS that indicates payment has been made. About 20 reports on invoice status are available from this system.

Because the data to identify an invoice overlaps the data to make a payment, the Invoice Tracking master file and the TAMPS master file have about 10 data elements in common, including purchase order number, vendor ID, invoice amount, batch number, etc. This redundancy of data requires that the same tables be maintained on 2 systems and requires constant intersystem communications to assure that the information in TAMPS and the invoice tracking system is synchronized.

#### 9. Travel Order Tracking

The "Travel Order Tracking" system is another extension of TAMPS that operates on the GAO Microdata minicomputer. This system monitors outstanding (unliquidated) travel orders, and provides reports for control of travel orders.

#### 10. AFACS

The "AFACS" system provides information on procurements in the ADP-related budget object classes (lease of equipment, purchase of equipment, Government and non-Government ADP services, maintenance, and software). AFACS provides management reports on obligations and costs; provides details on the identification and physical location of ADP equipment; and assists the ADP Administration staff of OISS in monitoring the line item details of purchase orders and invoices.

AFACS operates on GAO's Microdata minicomputer. It is written in ENGLISH (the Microdata report generator language) and PORTAL, a proprietary data management system. The AFACS files overlap the TAMPS master file significantly especially in the area of basic accounting data (purchase order number, vendor, obligation amount, costs to date), but the AFACS files also contain much more detailed information on ADP procurements, such as the user of the equipment or service; the serial number of every line item; the location of the equipment; and the monthly projected budget.

#### 11. Property

The "Property System" supports GAO's accounting for fixed assets. The system provides data to support entries to the general ledger on fixed asset additions, retirements, and depreciation, and it serves as a fixed asset control and location system that lists capitalized property by control number and location. This system operates on the House Information System (HIS) computer with data entry on the Four-Phase minicomputer. The programs are all written in the EASYTRIEVE language. There are only two principal files—the master property file and the retired property file.

The system's reports show monthly activity of additions, changes, and retirements, as well as asset location and assets by manufacturer. Cost information taken from TAMPS printouts under four budget object codes (freight, installation, non-ADP equipment, and ADP equipment) is used to create manual input transactions into the Property System. The data in the Property System is used to calculate depreciation entries for the general ledger, and to calculate general ledger property additions and deletions. None of the interfaces to TAMPS or the General Ledger are automated.

## 12. Purchasing

Note: The "Purchasing System" is planned for installation in FY 1981. Technical specifics will be available upon contract award scheduled 1 October 1980.

The "Purchasing System" is to support the "front end" of the procurement cycle—the ordering of goods and services, including the creation of purchase orders. The purchasing function in the General Accounting Office is divided between two administrative offices:

- . All printed material (books, monographs, periodicals, training materials, etc.) are ordered by the Technical Information Sources and Services (TISS).
- . All other purchases are made through the Procurement Branch of the Office of Administrative Services (OAS).

Each of these offices has obligating authority and budget allocations to which they are held accountable. The system will operate from online computer terminals in these two offices, and will be designed to provide automated support for the purchasing function. For the TISS, the system is to support the following functions:

- . Bibliographic verification of items ordered against a master bibliographic database.
- . Ordering of printed materials under a purchase order, blanket purchase agreement, deposit account, or gratis order. Includes printing of purchase orders and update of online database.
- . Receipt of serials and monographs, including checkin and claiming of individual periodicals, whether weekly, daily, quarterly, etc.
- . Control, financial, and management reports.
- . For the Procurement Branch, this system will print purchase orders and provide the budget control and reports functions.

## 13. General Ledger

The "General Ledger System," a subsystem of AMPS, maintains appropriation-level financial status for GAO, its supported agencies, and several miscellaneous appropriations. Inputs to the system (debits and credits to general ledger accounts) are keyed in batches into AMPS terminals using formatted screens. The system maintains a "current balances" file with fiscal year opening balances, balances as of the end of the previous month, and fiscal year to date balances, plus a transaction history file. The system produces control reports that record detailed activity, and monthly financial reports.

## 14. Allotment Ledger

The "Allotment Ledger System," a subsystem of AMPS, maintains budget, obligation, and expense data for each budgeted object class for each major organization of GAO. Inputs to this system come from three sources:

- (1) "Manual" transactions are entered into AMPS terminals in the Office of Budget and Financial Management. These are budget data and non-TAMPS obligations and expenses.
- (2) Payroll expense transactions are generated from a tape produced by the Payroll system.
- (3) Obligation and expenditure data are consolidated from detailed transactions on a tape output from TAMPS.

This system has two principal files, a "current balances" file and a transaction history file. The system also relies heavily on the AMPS tables database for organization codes, object class definitions, etc.

The allotment ledger system produces detailed daily control reports, monthly control reports, and financial status reports. All the control reports are used by the Administrative Finance Section of OBFM to monitor transactions that are posted to the allotment ledger. The financial status reports are used by the Budget and Financial Planning Branch of OBFM, and one standard report is distributed to each division that shows the division's financial status relative to its allotments for the fiscal year.

#### 15. Staff Year Projection

The "Staff Year Projection" subsystem of AMPS is a modelling tool to enable the budget office and individual divisions to estimate the usage of staff years for the current fiscal year. The database holds actual staff years used to date in several categories (full time, part time, and consultants) and the estimated new hires and terminations for future pay periods. The program extrapolates staff year utilization using the hires and fires, making allowance for the percentage of time that part time employees and consultants work, and adjusting for partial pay periods at the beginning and end of the fiscal year. The user may also enter a final staff year total, and the system will provide the implied staff year usage for the rest of the year. The system also supports projections for future fiscal years.

#### 16. Assignment Management ("Jobs") System

The "Jobs System" of AMPS provides GAO with data on budget allocations for jobs, actual resources utilized, and milestones for all active audits and audits completed in the current and preceding fiscal year. The Jobs database contains about eight major System 1022 files. These files contain the staff year budget data for each division; each issue area; division master records; job master records; job milestone schedule and completion data; level of effort summaries for each organization/job combination; level of effort summaries for each person/job/pay period. One file also contains many "tables" that support AMPS, including organization codes; job codes for non-audit work; issue area definitions; members of Congress; agency codes; etc. The job descriptive data (title of audit, issue area, agency code, etc.) is created and updated online using a major interactive program. The system restricts each division's ability to update data for audits managed by another division. The level of

effort information (hours spent on audits by organization; total hours spent by person; and hours charged by individuals for each pay period) is updated biweekly using the data collected by the Time & Attendance System.

The Jobs system provides the following categories of reports:

(1) C-Reports

The C reports are control reports that serve as audit trails for changes to the database, and to report certain inconsistencies between AMPS data and personnel or payroll.

(2) J-Reports

These reports list the complete, detailed descriptive and status information about individual audits. They are for the audit manager, and are also used as a turnaround document for audit managers to report changes in schedules or staffing, and to report accomplishment of milestones.

(3) D-Reports

The D reports contain summary information on audits programmed by each division. They are a basic management tool for the divisions.

(4) T-Reports

The T reports provide information of interest primarily to senior management. They summarize the status of all audit work currently underway in GAO, with statistics for divisions and GAO "issue areas."

The 4 categories of reports above are produced by the contractor biweekly. AMPS also provides 3 methods by which users can get non-standard reports from the AMPS database:

(1) User Library

AMPS users may execute from their terminals any of about 60 preprogrammed reports. A "User Library Manual" describes the reports and how to request them.

(2) User Reports

AMPS users frequently program and execute their own reports using the System 1022 reporting language.

(3) Contractor "Ad Hoc" Reports

AMPS users may request the contractor to prepare special reports not otherwise available. These may be variations of the standard or library reports, or they may be original requirements.

The fact that AMPS is built around one integrated database guarantees that all AMPS reports are based on the same data. The design of the database with minimum redundancy guarantees that the AMPS database is internally consistent, since each item of information about an audit appears only once in the database.

#### 17. Travel Reporting

The "Travel Reporting" subsystem of AMPS provides the Field Operations Divisions (FOD) with statistics on travel by GAO auditors in the regional offices. Each month, every auditor who travelled prepares a special form that lists places travelled, days in travel status, audit(s) worked on, and in what capacity (team leader, staff, etc.) That data is entered into AMPS and validated against the appropriate master files. The system keeps an archive of travel to compare individuals' travel demands and to examine patterns of travel by GAO employees.

The travel system produces about 7 reports that analyze travel by individual, by location, and by regional office. These reports are available to each regional office and to FOD headquarters.

#### 18. OGC Job Management (Planned Start October, 1980)

The "OGC Job Management" subsystem of AMPS provides management information on the participation of GAO's legal staff in audit work. The database supporting this system identifies tasks assigned to lawyers in the Special Studies and Analysis group in the Office of the General Counsel. For each task, the system records the product(s) expected, the attorney(s) assigned the staff days the task is expected to take, and text describing the legal issues being investigated. This information is entered into an AMPS terminal in the Office of the General Counsel.

### 3. SYSTEM OBJECTIVES AND REQUIREMENTS

#### 3.1 Objectives for Information Systems

This chapter critically examines GAO's administrative systems and identifies specific requirements that they should meet. The success of an ADP system can ultimately be determined only in the context of the organizational objectives it is meant to support. Organizational objectives are the functions of the system as perceived by the users of the system and the functional area managers. The organizational objectives ultimately form the basis for the using organization's judgment that an automated system is a success or a failure. For example, "Facilitate payment of all invoices within 30 days" is a typical objective of a payables unit. If the system is seen as speeding payment of invoices, the organization will probably view it as a success, and if the system is perceived as slowing payment of invoices, it will be criticized.

Six broad objectives are outlined here that can be used to evaluate the success of almost any administrative-type ADP system. The objectives describe desirable attributes of an automated system that will, in general, result in an automated system that will serve an organization and enable that organization to achieve its goals. For any real system, these 6 points will imply specific, testable objectives that should be met. The 6 objectives for administrative ADP systems are:

- (1) Systems should be integrated with and supportive of the administrative procedures and the objectives of the organization. In general, systems should:
  - . Reduce the number of manual clerical steps
  - . Reduce paperwork (number of copies, duplicative forms, etc.)
  - . Reduce the organization's error rate
  - . Minimize the amount of original data entry required
  - . Provide rapid feedback from the computer
  - . Minimize the need for artificial cut-off dates.
  
- (2) Systems should be designed to minimize "barriers" among related systems. Specifically the ADP systems that support an organization or a function should:
  - . Minimize the intersystem transfers of data that create problems of synchronizing the data in different systems
  - . Where intersystem transfers of data are absolutely required, use automated interfaces (i.e. minimize manual processing that only accomplishes communication among automated systems.)
  - . Have the same codes for common data elements
  - . Minimize duplication of functions
  - . Minimize duplication of data
  - . Share common data files when possible
  - . Share programming languages and data management systems

- (3) Systems should provide information that is useful to management. ADP systems should:
  - . Provide information on the system's use of resources
  - . Provide timely information in a form that management can use
  - . Support requirements for unpredictable ("ad hoc") requirements for information
- (4) Systems should promote entry and control of data near the source of that data. Specifically, ADP systems should:
  - . Minimize data transcription and encoding
  - . Detect errors and give meaningful error messages
  - . Maximize immediate edit and validation of input transactions
  - . Permit organizations in which transactions originate to enter and correct their own data, except where audit or control requirements require centralized controls.
- (5) Systems should be comprehensive. A system need not encompass all potential functions, but its scope must be deliberately determined to include data and functions that "belong together." Failure to include one or more critical functions in an automated system can render it valueless from the organization's point of view. If an ADP system is not comprehensive enough, the result is too often the imposition of procedures for the automated system on top of an existing manual system.
- (6) Systems should be flexible. A major system always undergoes major changes, no matter how carefully the requirements have been studied. An ADP system should be designed to permit changes in its inputs, processing, and outputs. This flexibility is enhanced by the use of various technical design approaches, including modular specifications and programming, and the use of data management systems.

### 3.2 Personnel Systems

GAO's principal personnel system, APAS, was installed in fiscal year 1979 after a preliminary study of GAO's requirements and test of the feasibility of using a CPAS-based personnel system at GAO. In spite of that test, current experience in Personnel shows that:

- (1) APAS only partially supplies Personnel's need for information.
- (2) Transactions are not entered into APAS until all manual processing is completed.
- (3) APAS is not designed for the operating environment of GAO, resulting in:
  - . additional manual processing of personnel actions
  - . increased time to enter personnel transactions



- (4) Current control procedures verify the accuracy, but not the completeness, of the total personnel process.

An effective GAO personnel management system would satisfy the following requirements that derive from the 6 broad objectives identified above and from the specific duties and responsibilities of Personnel and the EEO Office.

- (1) Support all the personnel management functions now provided by APAS, including:
  - . Serving as the single master source of all personnel related data.
  - . Producing periodic reports for personnel management.
  - . Printing final notices of personnel actions (SF-50's).
- (2) Provide immediate online retrieval and query capability to access information that a user is authorized to have access to.
- (3) Improve (or eliminate) the many intersystem transfers of personnel data.
- (4) Assure that all administrative systems use consistent data on GAO personnel.
- (5) Provide consistent access methods and capabilities to retrieve information on personnel experience, education, training, professional certification, and GAO work experience.
- (6) Assure that the system protects the privacy of confidential personnel information, but makes that data easily accessible to persons with legitimate need to know.
- (7) Provide support for daily personnel processing operations, including tracking and reporting on the status of SF-52's, GAO 313 & 314's, SF-1126's, etc., and reduce the staff time devoted to preparing reports on the status of personnel actions.
- (8) Maximize the effective support provided to the Competitive Selection Unit and the EEO Office. This includes possibly reducing the large paperwork load of the competitive selection process by automated production of applicant lists, automated scoring using a computer terminal, and automated production of referral lists of selected candidates. This also includes maximizing the support for the analytic projects of EEO and competitive selection.
- (9) Intergrate personnel history files from APAS and SRS in order to provide one source for all retrospective analyses of GAO personnel actions.
- (10) Maximize the support for "position management" by providing current information on approved slots, approved position descriptions, open vacancies, and applicant pools (from inside and outside GAO).

### 3.3 Financial System

Section 2.3 identified 11 systems on 4 computers that support GAO's financial operations. The table below lists these systems and their computer environments:

<u>System</u>	<u>Computer</u>	<u>Language</u>	<u>DBMS</u>
Payroll	IBM 370/168	COBOL	---
Time & Attendance	DEC 2060	COBOL	System 1022
TAMPS	Amdahl	COBOL	---
Invoice Tracking	Microdata	ENGLISH	PORTAL
Travel Tracking	Microdata	ENGLISH	PORTAL
AFACS	Microdata	ENGLISH	PORTAL
Property	Amdahl	EASY TRIEVE	---
Purchasing	(?)	(?)	(?)
General Ledger	DEC 2060	COBOL	System 1022
Allotment Ledger	DEC 2060	COBOL	System 1022

Although these systems support GAO financial operations, they do not provide a fully integrated and effective support of the type GAO needs. Improvement is needed in 4 areas:

- (1) Clerical operations that are now predominately done manually.
- (2) Barriers among systems that now preclude spot checking and reconciliation of records as well as allowing for occasional unsynchronized and inaccurate financial records.
- (3) Information for management that could provide capabilities of using both financial and non-financial data in statistics and reporting.
- (4) Comprehensiveness so that the systems could support budget formulation, cost accounting and commitment accounting.

An effective GAO financial management system would satisfy the following requirements:

- (1) Support equally the operational functions of GAO's financial office (OBFM) and the need for management-oriented financial information.
- (2) Provide automated support for the following areas of financial management:
  - . Appropriation-level Accounting (General ledger)
  - . Budget Formulation & Budget Tracking
  - . Commitments
  - . Purchasing and Contracts
  - . Other Obligations
  - . Accrued Expenditures
  - . Invoices and Payments
  - . Advance to Employees
  - . Receivables
  - . Collections

- . Payroll
- . Property Accounting
- . Accounting for ADP Equipment & Services
- . Cost Accounting

The specific requirements for each of these areas are outside the scope of this plan. The formal accounting requirements are in "General Accounting System Design Accounting Requirements," GAO Order 0201.3. The payroll system requirements are in "Payroll System Design Accounting Requirements," GAO Order 0201.2

- (3) Provide an integrated financial data base that includes the general ledger and all subsidiary ledgers (summary level, document level, and transaction-level files.)
- (4) Provide fully integrated file updates (from transaction history to general ledger) to guarantee that control and subsidiary ledgers in the data base are kept in balance.
- (5) Provide flexible reporting and online query capabilities, to include display of specific obligation documents, receivable balances, etc., and display sets of related records (for example, all paid invoices against a contract, or all open contracts with a given vendor).
- (6) Provide full batch controls, audit trails, and other mechanisms necessary for internal control.
- (7) Provide automated interfaces to other systems, where interfaces are necessary.
- (8) Minimize the likelihood of operator error by providing online edit and validation of all transactions, by using menu selections to identify functions, by providing an online "error suspense" file, etc.

#### 3.4 Management Information Systems

"Management information systems (MIS)" are those systems whose principal objective is to provide information on some aspect of GAO's main line operations. There are 3 automated management information systems, all of which function as subsystems of AMPS:

- . Assignment Management
- . Travel Reporting
- . OGC Job Management

The largest of these by far is the "Assignment Management (Jobs) System." Unlike most GAO systems, the Jobs system did have "organizational objectives" specified for it prior to its implementation. A 1977 study performed for GAO described the intended system this way:

"Above all this system must be designed to support management. To do so, it must provide timely, relevant information; it must provide analytic information, not just list "undigested" data; and it must be adaptable to change. The following requirements define the scope of a management and planning system that would satisfy the requirements that have been identified in this report. The system must:

- . Include all job codes - finite, permanent and administrative...
- . Be GAO-wide, not just serve Washington or Field Offices...
- . Include planning as well as monitoring capabilities...
- . Integrate selected personnel management functions...
- . Support effective responses to AD HOC enquiries...
- . Include limited history on each assignment..." 1/

All of those objectives have been met in the Jobs system of AMPS. Furthermore, the Jobs system meets the six general objectives listed in Section 3.1. The success of the Jobs system is illustrated by:

- . The increased use of the system by divisions and regions for ad hoc reporting.
- . The elimination of reports previously prepared manually in the divisions.
- . Direct use of the system by the Assistant Comptroller Generals to analyze the status of audits.
- . The agreement by division managers that the level of effort data in the computer system is accurately maintained—a problem in all previous GAO reporting systems.
- . The number of functional enhancements that have been requested by various parties, including automating the Firm Assignment List (FAL), adding milestones for performing organizations, and independently tracking multiple products for an audit. Some enhancements that have been made are large enough in themselves to be considered subsystems of AMPS.

The Jobs System has proven to be flexible enough to accommodate a steady stream of reorganizations and changes in policy regarding audit management. On the whole, the Jobs System is functioning smoothly and proving to be adaptable to changing requirements.

The other two management information systems are the "Travel Reporting" and "OGC Job Management" subsystems of AMPS. The Travel System is fully integrated with the AMPS database, relying on the master files of employees and jobs to validate travel reported by auditors in the regional offices.

1/ "A Study of the Management Information Needs of GAO," Control Data Corporation, pp 4-5,6, 1977.

There is not yet enough experience with the OGC Job Management Subsystem to evaluate its success. The requirements specification for this subsystem went through several revisions, and the initial system represents management's careful judgment prior to any experience actually using such a system. The use of a computerized system to record attorneys' work is a departure from traditional policy in the Office of the General Counsel. The ultimate success of the system as perceived by OGC management will probably depend more on whether the organization is prepared to provide and use the information, and less on the system itself.

### 3.5 Conclusions Regarding Administrative Systems

The preceding reviews of GAO's administrative ADP systems justify the following conclusions:

(1) The fact that the payroll, personnel, assignment management, and financial systems all operate on different computers results in:

- additional computer resources being used to maintain interfaces (the same data is stored and updated many times).
- additional professional and clerical time to reconcile data differences.
- lost opportunities to correlate information stored in different systems.
- decreased effectiveness of technical staff spread across many computers, with the result that there is little backup and every programmer is critical to the functioning of the administrative systems.
- inability to establish effective standards for operating procedures, data files, or programming languages, since at each site GAO is subject to other organizations' "local standards."

(2) The functions to be supported in the administrative area are fairly well understood. Most of the problems result from GAO's installing systems with narrowly defined objectives in the absence of a long term system strategy.

(3) The APAS system should be replaced as a long term personnel system for GAO because of the functions it cannot provide; the lack of control by GAO of the software and the computer; and the problems of synchronizing personnel data with other systems.

(4) The whole set of financial systems are too cumbersome in their present form. Although they are minimally acceptable technically and as they serve their users, they are collectively inefficient and ineffective.

(5) The systems supporting GAO's management information needs (principally the "Jobs System" of AMPS) are providing effective service to GAO. In the areas in which these systems are deficient, the AMPS data base environment appears to provide a good base from which to enhance the system.

(6) The systems that are now part of AMPS are technically sound, function at an acceptable level, and their data base reporting and online query capabilities should be preserved in any new system. (The allotment ledger and general ledger systems in AMPS are interim systems subject to total replacement in a new financial system, if appropriate).

## 4.1 STRATEGY FOR ADMINISTRATIVE SYSTEMS

### 4.1 Principles

There are three basic principles that together will guide the direction of GAO's future administrative systems. These principles derive from the general objectives for information systems and from GAO's specific requirements for administrative information processing described in Chapter 3. The three principles are:

- (1) Integrate administrative ADP systems.
- (2) Develop responsive, comprehensive systems.
- (3) Use a "database approach" and build on successes.

These principles are discussed below.

#### (1) Integrate administrative ADP systems

Integration describes the degree of "cooperation" that exists among systems. Integration implies that systems will:

- . Use common styles of interaction with users at terminals, fostering the sense of unity and consistency among systems.
- . Use common definitions for all coded data elements, guaranteeing that edits and outputs of different systems use consistent lookup and translation rules.
- . Automatically propagate database effects from one system to the next, so that multiple independent transactions are unnecessary.

Systems can be highly integrated yet operate on different computers, although that is highly undesirable. Conversely, systems can coexist on the same computer and not be integrated at all. GAO financial systems are highly integrated as shown in Figure 3.1. That integration was largely created as an after the fact attempt to make data files balance when synchronization was not designed into these systems.

#### (2) Develop responsive, comprehensive systems

Systems that are developed must be designed to meet the criteria of Chapter 3. They must support the requirements that GAO offices identify as being most critical to their operation, and they must do so in a way that is "user friendly." All systems must be designed to provide accurate and timely administrative data. While not all processes require "real time" update of computer files, those that do require immediate updating must provide that. In no case should updating of computer files take longer than overnight.

Systems must have their "scope" identified and agreed to by the organization(s) that will be served by those systems. In general, systems should be designed to permit the addition of functions at minimal expense. Separate, non-integrated systems should not be planned when closely related functions of that system could be combined into another more comprehensive system.

### (3) Use a database approach and build on successes

The essential concepts of the "database approach" to system design are that:

- . Data is a critical management resource of an organization and the control of data should be the focus of system design.
- . Each data item should be stored in one master location and should not be copied indiscriminately for new applications. Although there may be many files, their contents should not overlap and the relationship among the files should be well defined.
- . An "application" should be viewed as a use of data. If an application requires data not in the files, the data should be added to the common files shared by all applications. Applications should be insensitive to changes in the data base that the application does not use.
- . The updating of the data files should be an independent function not tied to any one application.
- . All changes to the definition of the central files must be coordinated so as not to violate the preceding principles.

The central repository for data must often be very complex, since it is designed to satisfy the requirements of many different user applications while providing for the application to be independent of the physical structure of the data base. Without the benefit of computer software especially designed to deal with this complexity, it is difficult to program a system that takes full advantage of the database approach. Such software is designed to insulate the "applications programs" from the full complexity of a database. Each program is permitted access only to those parts of the database that it needs. Because of the complexity of the data base in AMPS and the other requirements like support for ad hoc queries all future systems should be designed for a general purpose data base management system.

#### 4.2 New Administrative Systems Needed

The preceding principles and the systems requirements in Chapter 3 lead to the following steps to be taken for administrative ADP support:

- (1) Determine how GAO can best provide consolidated computer services. This includes timesharing, remote batch services, telecommunications, and technical assistance. All administrative system should ultimately operate on the consolidated facility. All new administrative systems should be built around a common data management and reporting system. The absence of such a consistent means to process data is a major impediment to improving the existing administrative systems.
- (2) Develop a new financial management system that will incorporate the functions of the following systems now in operation:
  - . TAMPS
  - . Allotment Ledger
  - . General Ledger

- . Invoice Tracking
- . Travel Order Tracking
- . Property
- . AFACS

and will also support budget formulation and tracking, commitment accounting, purchasing, and cost accounting. The payroll system is functioning at an acceptable level and a decision on whether to retain it or to replace it should be made only after a detailed analysis of available alternatives.

(3) Develop a personnel management system that meets the requirements described in Chapter 3, and incorporates the functions of

- . APAS
- . Form 50/Locator
- . Recruitment
- . Archival Data

and effectively supports EEO, Competitive Selection, and the personnel teams. That system must be integrated with the financial management system and the management information system through the use of data base management (DBMS) technology.

(4) Maintain the functionality of the AMPS system and most of its subsystems, including:

- T&A
- Jobs System
- OGC Job Management
- Staff Year Projection
- Travel Reporting



## 5. ALTERNATIVE SERVICES STRATEGIES

### 5.1 Options for Acquiring Computer and Related Services

GSA policy establishes a "hierarchy" of means by which Federal agencies are to meet their ADP requirements. The hierarchy is designed to provide effective ADP services at the lowest cost to the Government. The GSA-mandated sources of supply are, in order of preference:

- (1) ADP sharing program
- (2) ADPE reutilization
- (3) Mandatory requirements contracts
- (4) Teleprocessing Services Program
- (5) Federal Supply Schedule
- (6) ADP/ADTS Schedule contract
- (7) Fully competitive procurement
- (8) Non-competitive acquisition

Clearly not all of these options are viable methods of supporting GAO's requirements. To decide which of these procurement methods is most appropriate for GAO, it is necessary to select a basic support strategy. There are only 3 basic approaches that GAO can follow to provide the consolidated administrative ADP services it needs:

- (1) Share some other Government agency's computers
- (2) Establish an "inhouse" computer facility
- (3) Use a contractor's computer facility

The 3 approaches have several variations, and even more possibilities in terms of how the services could be procured. We examine here the management considerations that apply to these 3 approaches. It should be noted that due to the nature of the alternatives under consideration, the evaluation of alternatives must be in general rather than detailed terms. Given the generic nature of alternatives such as "Use a contractor's computer facility," no detailed assessment of such areas as systems performance and reliability can be done. Later in the procurement process, much more detailed evaluation criteria must be developed for use in evaluating vendors' responses to an RFP. These two sets of criteria have different purposes, and should be kept separate. At a later date, when the alternatives to be evaluated are specific vendors or equipment, specific means of assessing "systems performance", for example, can be defined. For the present purposes, however, these criteria must be general and qualitative in nature. The following general criteria have been defined to assess the pros and cons of the basic alternatives:

- Systems Performance - This criterion includes factors such as response time and throughput, that relate to the ability of the alternative to handle the projected workloads.
- System Availability - This criterion includes all areas that impact on the ability and ease of providing continuous customer service, including reliability, fault tolerance, backup and recovery, maintainability and ease of use.

- . System Flexibility - In order to meet changing and growing needs within GAO, the alternatives will be assessed in terms of configuration flexibility.
- . Organizational Impact - This criterion will be used to assess the impact of each alternative, both in terms of managing and operating the computer center and the impact on users. Management personnel required, numbers and kinds of staff required, and staff reorganization, will be assessed.

(1) Sharing Other Agencies' Computers

The preferred method for Federal agencies to satisfy their ADP requirements is to use excess (available) time on computers owned by other agencies. This is most suitable, however, for limited requirements that have relatively low priority and that do not require long term high levels of service. The theoretical advantages and disadvantages of this approach are listed below. In fact, it is highly unlikely that any Government agency could be found that could meet GAO's requirements. This is because GAO needs a major share of a medium to large computer, and GSA rules prohibit upgrading a computer facility to satisfy the requirements of an "external" user. As the host agency's own requirements increased over 5 or more years, the excess resources available originally would decrease and GAO would have no remedy except to look elsewhere. That was the conclusion of the Computer Acquisition Task Force in 1977, and also the conclusion of a study by the ADP Administration Branch of OISS in 1980. Because of these considerations, sharing will not be considered further as an alternative in GAO's ADP planning. (This does not relieve us of the requirement to "clear sharing" at GSA for any major procurement).

Advantages

- . No significant procurement activities. Handled by inter-agency agreements.
- . Charges reflect actual resources used.
- . Host agency maintains physical facility, hardware and software.
- . GAO's requirement for operational personnel would be minimal.
- . Facilities and services required by GAO are already established and readily available.

Disadvantages

- . Very limited choices in terms of hardware and software configuration.
- . Expansion of service to GAO is limited by host agency's ability to acquire additional capacity, but GSA policy restricts agencies' authority to add capacity to serve external users.
- . GAO would be subject to the priorities and schedules of the host installation.

- . GAO would be subject to reduction or loss of service on short notice (typically 6 months) from providing agency.
- . Host agency can change hardware or software packages regardless of impact on GAO.
- . There are no contractual guarantees of service levels (response time, turnaround, storage availability, etc.) and no remedy in case of inadequate service.

(2) Creating an "Inhouse" Computer Facility

GAO could acquire a computer to operate its administrative ADP systems. The computer could be acquired through one of several methods, including reutilization of excess Government owned equipment, purchase through ADP schedule contract, or through a competitive procurement. In addition to the computer proper and its maintenance GAO would then also have to provide:

- . A fully conditioned computer room with proper power, cooling, raised flooring, security controls, fire protection, and ancillary support facilities.
- . Telecommunications capability for regional offices to access the computer.
- . An operations staff.
- . A programming staff to maintain the operating system and other system software.

Establishing a computer facility requires a management decision to commit resources far beyond the purchase cost of the computer. Over the evaluated life of the procurement, the cost of the computer itself is typically only 20% to 30% of the "life cycle costs." The balance of the total cost is due to labor, supplies, maintenance, software, and other direct and indirect operating costs.

There are significant non-financial aspects to the decision to create a new facility. In particular, the facility would:

- . Commit valuable floor space that could be used for "mainline" GAO functions.
- . Commit a minimum of 21 staff years to the computer operation.
- . Reduce GAO's flexibility to use additional resources, since all upgrades are subject to GSA hardware procurement regulations.
- . Reduce GAO's immediate backup capability, unless 2 full computers were installed. System availability would be less than ideal.

Staffing an inhouse computer operation can be accomplished through Government employees or under a "Facility Management" contract . If the computer facility were staffed with Government employees, a minimum of 21 staff years would be requirements when the facility was fully operational, consisting of:

Director of Computer Facility	1
Secretaries	3
Manager of Computer Operations	1
Prime Shift - Operators	4
- Tape Librarian	1
Second Shift - Supervisor	1
- Operators	2
- Tape Librarian	1
User Consultants	2
Documentation Specialist/Librarian	1
Manager of Systems and Programming	1
Software Specialists	3
Total Personnel	<u>21</u>

This is the minimum staff required to provide service comparable to what GAO could get under a sharing or contractor arrangement. This staff would support computer operations only—it does not include programmers and analysts for maintenance of applications or development of new applications. The software specialists would maintain the operating and other software supplied by the computer manufacturer, and would install and maintain software purchased from third party vendors, like a database management system.

Recruiting and keeping a high quality technical staff is a difficult problem, especially in the Federal Government. In this case, the problem is compounded because:

- . GAO's computer operation would be small compared to most Government installations, and would not tend to attract technically talented individuals, since promotion potential and technical challenge would be limited.
- . GAO's computer operation would be new start with no procedures or staff in place. It would probably be perceived as a "high risk" career move.

Some of these problems could be eliminated by the use of a "facilities management" contract that provided for a contractor to be responsible for operating the computer. Although that approach could reduce the day to day operations problems, it would not materially affect the overall management concerns of establishing an inhouse computer facility.

The procurement of a facility is in itself a very costly and lengthy endeavor. A competitive computer acquisition typically takes 2 1/2 to 3 years, and would probably cost over \$1/2 million, including full cost of salaries and other expenses incurred in the procurement.

Because of the inherent uncertainty of GAO's computer workload requirements over the next 5 years (as explained in Chapter 4), there is a good chance that GAO might "overbuy" or "underbuy" the computer capacity it truly needed. Once the machine was installed, it would be virtually impossible to adjust the configuration (and the cost) quickly and flexibly to accommodate GAO's processing needs.

The final management consideration is that the very existence of a significant inhouse computer operation would constitute a continuing drain on management resources. The daily crises of computer operations, staffing, and relations with users and vendors invariably require the attention of senior management. This is an indirect cost that should be avoided if at all possible.

### (3) Using a Contractor Computer Facility

The third possibility is for GAO to use the computer facilities of a commercial contractor. Under this approach GAO would contract with a computer services vendor for timesharing, remote batch service, telecommunications and related services like COM. The contractor would provide these services to GAO from either a dedicated or shared computer, and would guarantee minimum service levels for the life of the contract. If the service to GAO degraded due to increased usage, the contractor would be free to upgrade the computer system in order to restore the guaranteed service to GAO. The contractor would be responsible for maintaining the computers, the physical facility, and the software.

This approach has the following advantages:

1. System performance is the responsibility of the contractor. If additional ADP resources are needed they can be applied without any GAO procurement action.
2. Because a contractor typically has many computers, availability can be assured. If one computer becomes unavailable, GAO work could be reassigned to an alternate machine.
3. A contractor-supplied ADP resource is flexible in several dimensions--
  - . "Invisible" technological improvements not apparent to the casual GAO user (new hardware or improved software) can be installed by the contractor to maintain a "state of the art" and economically competitive computer operation, as long as service to GAO is not disrupted.
  - . GAO can use very little or very much of the computer's capacity and pay an equitable price for resources actually used. A contractor can provide capacity for "peak usage" without GAO necessarily paying the full cost of providing that capacity.
  - . GAO can experiment with and use for production a variety of software packages (graphics, DEBS, financial modeling, report generators, etc.) without having to buy and maintain those packages.

4. A contractor facility is a simpler procurement than a procurement for an inhouse computer, and eliminates the start up problems of an inhouse computer operation.
5. Organizationally, this approach has the least impact. The management issues are reduced essentially to contract management, plus the determination of whether GAO is receiving the amount and quality of service provided for in the contract.

Disadvantages to this approach are:

1. The contractor services must be recompeted at the end of the contract life (5 years), thus creating the potential for interruption in service, additional costs associated with designing a new system, and retraining system users.

The requirements of this contract will state that the contractor is to develop software using standard commercially available systems, and that the software must be transportable to other hardware. Therefore, when the initial contract has expired, GAO will basically procure computer services and move the existing software to a compatible system, with minimal interruption to service and little need for user retraining. In addition, the software development costs associated with a reprocurement will be minimal, and will probably only be required for front-end interfacing with the existing programs.

2. Developing a system which resides on a contractor-owned, contractor-operated system requires effective controls to avoid contract cost over runs.

The OISS is recommending a cost-plus-award-fee type contract for this procurement. It is felt that this type of contract will allow GAO the most flexibility for development of a responsive system, while at the same time providing the agency with maximum control over contractor costs. The award-fee concept should provide adequate incentive for the contractor to adhere to predetermined cost guidelines. The contractor will be routinely evaluated in areas such as control of direct and indirect costs, control of overtime, facilities utilization and property control practices, purchasing and subcontracting, and staffing levels.

3. Dependence on external computer support, especially contractor services, can be a risky proposition for critical agency functions, unless there is adequate control over the provider of the services.

Again, dependence on the reliability of the contractor services would be minimized with the cost-plus-award-fee type of contract. The incentive to provide reliable service would be provided by the award-fee concept.

4. Consolidating all administrative services into one system, which is contractor operated, can present problems with security and system failures.

Prior to negotiating a contract, the OISS will require that the contractor sufficiently demonstrate that comprehensive controls on system/data security will be provided, and that adequate backup and recovery procedures will be included in the proposed system, and that off-site disaster recovery backup for hardware, software, data, and telecommunications is included.

## 5.2 Optimum Procurement Approach

This section addresses the best procurement approach for GAO to acquire the consolidated ADP resource and develop the new systems described in Chapter 4. GAO's current situation presents a dilemma: 2 major efforts selection of a computer facility (hardware, software, and telecommunications) and design of major administrative systems depend on each other. This dilemma would not exist if GAO already had a principal computer facility (like most other agencies), or if we had major systems in operation that were simply to be converted. In that case the "given" situation would reduce the complexity of the procurement process by reducing the number of possible options.

There are 3 ways in which GAO could do the procurements needed to develop and operate its new systems:

### Approach (1) - Sequential

- . Pick a computer facility (1 contract)
- . Design and install systems (1, 2, or more contracts)

### Approach (2) - Sequential

- . Preliminary design of systems (1 contract)
- . Pick a computer facility (1 contract)
- . Final design & installation of systems (1, 2, or more contracts)

### Approach (3) - Simultaneous

- . Pick a computer facility & select design/installation contractor (1 or 2 contracts).

Approach (1) is a risky approach because there is little information on which to select the computer, and it would be difficult to abide by the standards that apply to Federal ADP procurements. Also, the contract(s) for development of application systems would be largely constrained by the Government's choice of computer and DBMS. There is no assurance that the Government would pick the best computer for the job.

Approach (2) is closest to the theoretically, correct methodology. Unfortunately, the functional "requirements" that result from an initial design concept usually have 1 of 2 flaws:

- (1) They are so vague as to be useless in actually selecting a computer, or
- (2) They are so specific that they virtually dictate the specific machine and DBMS that will meet the requirements.

Even under the best of circumstances there is enormous uncertainty regarding the quantitative estimates that can be made after a preliminary design. The uncertainty comes from 2 sources:

- (1) Estimation of the resources needed to operate systems as they are perceived at the time the estimates are made.
- (2) Estimation of the operating experience with those systems, including demands for functional changes, additional on-line processing, increases in storage, and interaction with other processes.

The result is that although in a situation like GAO's, Approach (2) offers the theoretical comfort of "doing it right," in fact there is little to be gained, since the costs and delays of such a protracted series of procurements outweigh any probable benefit to the Government.

Approach (3) attempts to deal directly with the interdependence of the computer facility and the systems that are to be designed. This approach attempts to identify the feasible combinations of computers and system development contractors and select the combination that is most likely to give GAO effective and economical ADP support. There are really 2 possibilities here that need to be considered:

Approach (3a) Award 1 contract for computer services and 1 (or more) contracts for system design or development

Approach (3b) Award a single contract for computer services and system design & installation.

Simultaneous award of 2 contracts as under (3a) would be very difficult to evaluate and negotiate, and would still leave the possibility of "finger pointing" between the development contractor and the computer services vendor. Approach (3b) appears to offer an ideal type of contract for GAO. Although such an all-inclusive contract is unusual in the government, GAO's dilemma described above makes this approach worth considering. A single, all-inclusive contract for administrative systems offers the following advantages:

- (1) Clear assignment of responsibility for overall success of administrative systems, since the contractor has responsibility for all aspects of the ADP systems development.
- (2) Known computer environment (hardware, DEMS, telecommunications, screen handler, etc.) for the entire design cycle.
- (3) System designers/implementers will be totally familiar with with computer environment.
- (4) The development and production environments would be selected by the contractor and approved by GAO.



- (5) The contractor would be free to use the computer at the earliest productive stage of design (e.g. for a data dictionary, documentation, draft database schema, etc.)
- (6) Treats the problem of administrative systems in an integrated manner, so that the contractor has maximum flexibility in proposing cost-effective solutions.
- (7) Permits the total requirements to be expressed more in "functional" terms.

This is the procurement approach that GAO feels is most likely to provide superior ADP systems for GAO. Designated "Consolidated Administrative Systems (CAS)", this procurement would include:

- (1) Design and development of a financial management system.
- (2) Design and development of a personnel management system.
- (3) Conversion of the parts of AMPS not included in (1) or (2).
- (4) Onsite operations support personnel, similar to the AMPS "hotline" room.
- (5) Maintenance and enhancements to administrative systems.
- (6) Full operations responsibility for all administrative systems.
- (7) Computer and telecommunication services for all systems operated under this contract.
- (8) Related services like COM, courier services, and consulting assistance regarding administrative systems.

## 6. GAO ANALYSES OF FEDERAL ADP PROCUREMENTS

Over the past few years, GAO has conducted evaluations of many procurements for ADP services by numerous Federal agencies. During the process of evaluating existing GAO administrative ADP systems, and defining GAO's long term ADP requirements in this area, the Office of Information Systems and Services (OISS) conducted a review of many of the findings and decisions/recommendations regarding ADP procurements in the Federal Government. This review was undertaken to both gain an insight into the advantages and disadvantages of similar ADP procurements, thus benefiting from the experience of other agencies, and to comply with the precedents established by GAO and recommend actions to the Congress and the Federal sector. While analyzing the various GAO reports, decisions, and other publications on ADP procurements, OISS has ascertained that the subject matter contained therein can be related to GAO's plan/procurement for administrative ADP services in six broad areas: (1) Planning, (2) Requirements Analysis, (3) Cost Analysis, (4) Consolidation of ADP Services, (5) Compliance with Procurement Regulations and Guidelines, and (6) Project Management. Following is a very brief discussion of each of these issues, along with references to pertinent GAO publications, and action(s) taken on GAO's procurement for an integrated ADP administrative system, in light of the material contained in these reports.

### PLANNING

One of GAO's major concerns with Federal ADP procurements is the lack of adequate ADP planning within the organization involved. On many occasions, GAO found that the agencies either lacked an ADP plan altogether, the conceived plan was not comprehensive and/or did not incorporate long-range objectives of the agency, or that the plan was not clearly defined. It was felt that effective long-range ADP planning was essential in order to effectively and efficiently utilize ADP services.

References:	B-163074/8-13-70	CED-79-39	HRD-78-169
	CED-78-68	FGMSD-78-27	PAD-77-18
	EMD-79-102	FGMSD-78-41	FPCD-76-23
	ID-79-34	FGMSD-79-35	B-164031(4)/4-19-74
	LCD-78-103	FGMSD-80-34	
	LCD-78-117	HRD-77-57	

In addition to internal evaluations of GAO's utilization of ADP resources, an exhaustive contractor study of GAO ADP utilization was completed in August, 1979. These studies have included audit, programmatic, and administrative computer services used by GAO, and have provided the basis for GAO's long range (5-year) ADP plan, which recommends the integration of GAO's administrative ADP systems. The GAO ADP Plan addresses in-depth such key areas as existing ADP support, systems objectives and requirements, strategy for administrative systems, and alternative service strategies. The plan incorporates ideas and requirements from key administrative/management staff throughout the agency.

### REQUIREMENTS ANALYSIS

GAO is concerned that many systems encounter major problems and/or failures because the organization has not performed an appropriate requirements analysis, incorporating both functional requirements and overall systems requirements, as well as user input.

References: FGMSD-80-15 LCD-80-22A  
LCD-78-115 LCD-75-108  
LCD-78-122 FGMSD-79-35  
LCD-80-22

The August 1979 contractor-produced requirements analysis of GAO utilization of computer resources addresses in detail GAO's requirements for financial management, assignment management, and personnel management, as well as general functional and data base requirements. During the drafting of the Request for Proposals (RFP) associated with the pending integration of GAO administrative systems, these requirements are being given extensive consideration, and substantial portions will be included as appropriate. In addition, OISS is working closely with appropriate divisions within GAO in compiling the user requirements to be included in the RFP, and is obtaining formal approvals of the final requirements documentation. OISS is also working closely with the Department of Defense Computer Institute (DODCI), GAO Legal Counsel, and outside consultants to insure that the requirements are stated clearly and objectively.

#### COST ANALYSIS

GAO is also concerned that agencies sometimes procure computer services without having performed adequate economic analyses of current and future operations. Also, on occasions, inappropriate costing techniques are employed in such analyses.

References: LCD-78-122 B-164031(4)/1-24-74  
FGMSD-80-35 LCD-75-115  
GGD-78-57 LCD-77-104  
LCD-74-110 LCD-75-108

In preparation for the pending procurement of an integrated administrative ADP system for the agency, OISS is expending considerable effort in this area, and OMB Circular A-76 guidelines will be followed. Although GAO has chosen not to rely on in-house computer resources, the cost of doing business externally is being ascertained, for both Government and private support. For each application area, internal and external manpower costs are being determined, as well as hardware, software, and maintenance costs.

#### CONSOLIDATION OF ADP SERVICES

GAO feels that agency systems are often characterized by redundancy of data and applications. In most instances, GAO has recommended that the agency re-evaluate the system configuration, and consider consolidation/integration of systems when appropriate.

References: LCD-76-129 EMD-79-120  
LCD-79-113 FGMSD-78-27  
LCD-75-108 FGMSD-80-22  
EMD-78-60

Analyses of the GAO administrative systems, by both GAO staff throughout the agency and by contractor personnel, have led to the conclusion that the present "independent configuration of GAO's administrative systems have

resulted in redundancy of data and applications. This has resulted in excessive processing costs and a high potential for contradiction in data and subsequent reporting errors. OISS has therefore recommended that the eighteen existing administrative systems be consolidated/integrated into one logical system.

#### COMPLIANCE WITH PROCUREMENT REGULATIONS AND GUIDELINES

GAO is also concerned that many times Federal ADP procurements fail to comply with standard procurement regulations and guidelines. Contracting Officers are often not adequately involved in the early stages of procurement; delegations of procurement authority are not obtained, and data within the RFP is insufficient, biased towards a particular contractor, or unduly limits competition.

References: FGMSD-80-34                      LCD-78-122  
                  FGMSD-80-15                    HRD-76-139  
                  LCD-75-115                    EMD-79-102

During the drafting of the RFP for the integrated/consolidated administrative system for the GAO, OISS is working closely with both the GAO Office of Administrative Services-Procurements Branch, and the General Services Administrative (GSA). Appropriate approvals, such as GSA Sharing Clearance and Delegation of Procurement Authority (DPA) are being requested, and subsequent GAO approvals will be requested as required, prior to releasing the RFP. To insure that the data/information within the RFP is adequately stated, and that the RFP is not in any way biased or restrictive, OISS is requesting reviews by the Department of Defense (DOD), external consultants, and the GAO Legal Counsel.

#### PROJECT MANAGEMENT

The lack of centralized ADP program/project management is another area in which GAO feels that many agencies appear to be weak. Also, there appears to be a lack of direction and involvement by top management.

References:                      EMD-79-102                      FGMSD-78-41  
                                    FGMSD-78-27                    FGMSD-80-72  
                                    FGMSD-79-49                    HRD-78-169  
                                    LCD-78-105                    HRD-79-71  
                                    CED-78-68

The Office of Information Systems and Services (OISS) is the central body within GAO responsible for overall administrative and control of ASP programs within the agency; the Systems Development and Implementation Branch (SDI) within OISS is charged with the day-to-day monitoring of projects involving systems design and implementation within GAO. Also, very specific operating guidelines have been established to ensure top-level management awareness and participation on major information/computer projects and procurements. These guidelines include reviews by the GAO Information Policy Committee (IPC) and the Assignment Review Group (ARG), and final approvals by the Comptroller General, as appropriate.