

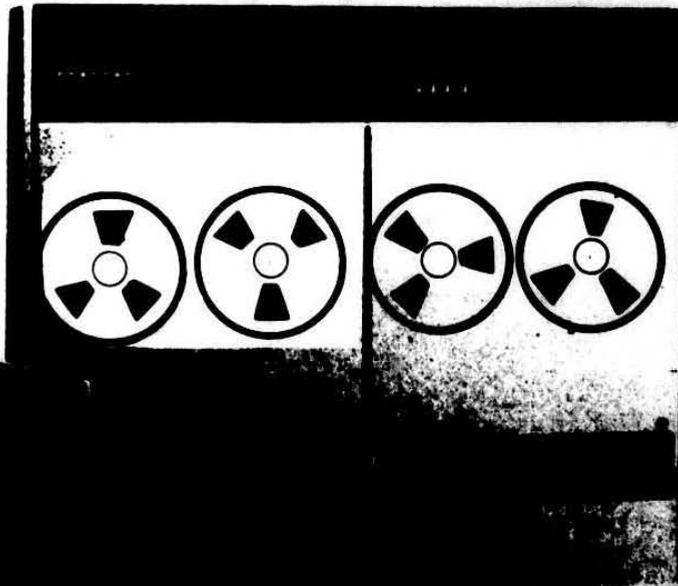
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GUIDE FOR EVALUATING AUTOMATED SYSTEMS

UNITED STATES GENERAL ACCOUNTING OFFICE
MARCH 1977



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EXPOSURE DRAFT



**UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548**

**DIVISION OF FINANCIAL AND
GENERAL MANAGEMENT STUDIES**

The Financial and General Management Studies Division prepared this audit guide for use on audits of automated or computerized systems. It should be used by the auditor once the decision has been made to review either an automated system or selected applications within a system.

The guide provides the auditor with a structured approach for evaluating the system from the initial gathering of background data and identification of controls, through analysis of system data flows and detailed conformance testing. It is designed to help the auditor identify systems problems and determine the related causes and effects which are necessary to support a finding. In other words, the guide contains detailed procedures for conducting a comprehensive review of an automated system or individual applications.

To review an automated system with this guide, or conduct a reliability assessment with a previously issued "Guide for Reliability Assessment of Controls in Computerized Systems (Financial Statement Audits)", the auditor must gather general background information and identify control points. For consistency in conducting this part of a review, we included identical background and control questionnaires in both guides.

Although this guide is being issued as an exposure draft, we encourage its use on any ADP system review. Your comments and suggested revisions should be forwarded to J. L. Boyd, Assistant Director, Financial and General Management Studies Division.


D. L. Scantlebury
Director

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INTRODUCTION

These guidelines were developed to provide the auditor with a structured approach for evaluating an automated or computerized system. This "system approach" places primary emphasis on determining the reliability of the automated system, including the information and reports it produces.

This guide contains audit procedures for reviewing a complete system including an evaluation of controls and detailed conformance testing. It differs from the previously issued draft, "Guide for Reliability Assessment of Controls in Computerized Systems (Financial Statement Audits)," which was designed to help the auditor make a brief survey at the beginning of a financial statement audit to determine the degrees and types of risks involved in relying on computer-processed information.

The following guidelines are discussed in the order that an auditor would normally follow in reviewing a system.

- Collect general system information to find out what the system does and generally how it works, and briefly evaluate data processing department controls.
- Review the system or part of the system (individual application) to evaluate the network of internal controls.

- Prepare a detailed data flow diagram to help evaluate documentation, document controls, computer program efficiency, and usefulness of output reports.**
- Conduct detailed conformance tests. Methods of testing include evaluations of samples of agency records, computerized data retrieval and analysis, and test decks.**

A brief overview of this "system approach" follows.

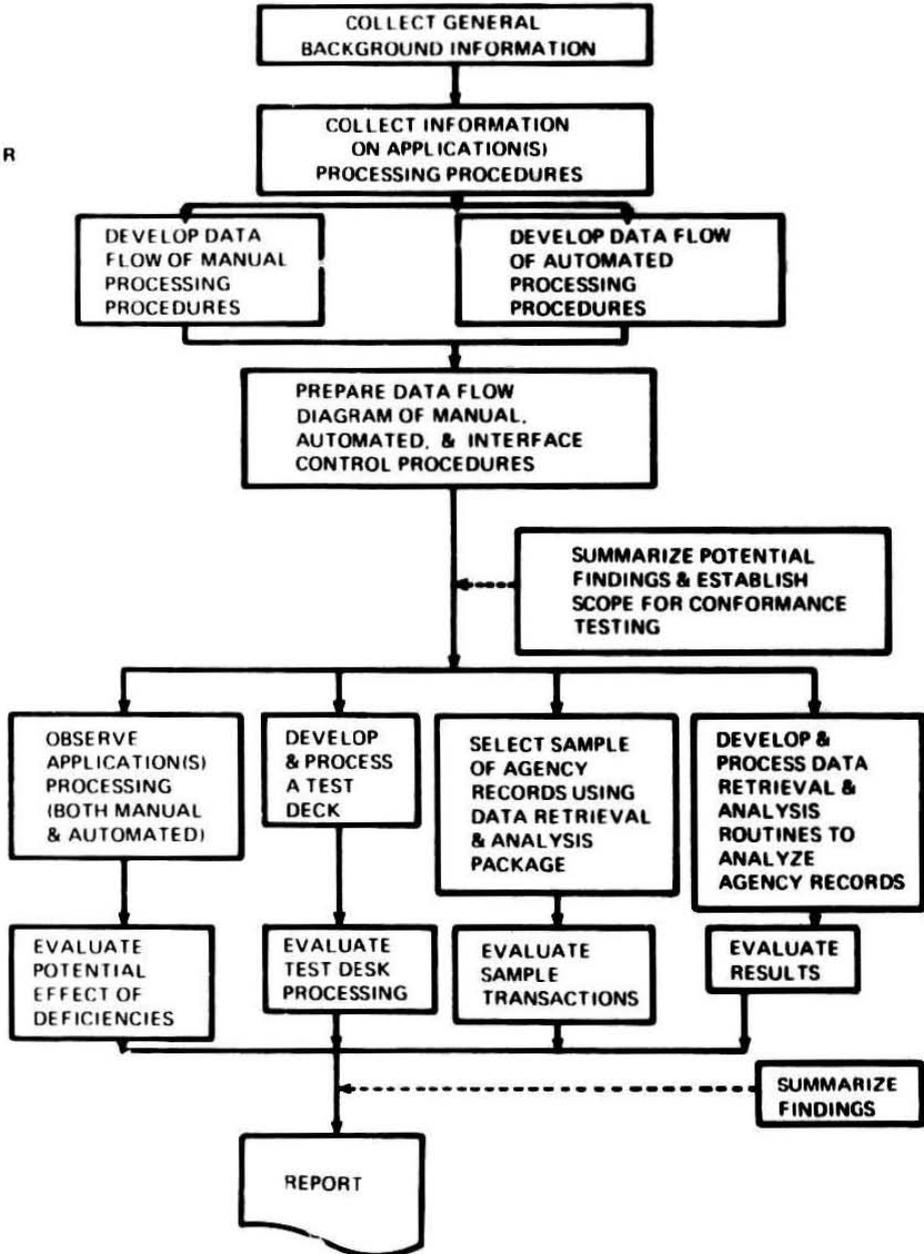
**OVERVIEW OF A SYSTEMS APPROACH TO AUDITING
AN AUTOMATED SYSTEM**

SECTION I
GENERAL SYSTEM
INFORMATION

SECTION II
REVIEW OF COMPUTER
APPLICATION(S)

SECTION III
ANALYSIS OF DATA
FLOWS THROUGH
THE SYSTEM

SECTION IV
DETAILED
CONFORMANCE
TESTING



SECTION I

GENERAL SYSTEM INFORMATION

BACKGROUND INFORMATION

The auditor should obtain an orientation and general understanding of the system being reviewed, including the data processing department where the system's computer programs are processed, so that he can plan a detailed audit. Reviewing agency documentation that provides a general description of the system and interviewing agency personnel should provide the necessary knowledge.

SYSTEMS APPROVAL

The accounting systems of all executive departments and agencies are subject to the Comptroller General's approval, with the exception of Government corporations subject to the Government Corporation Control Act (31 U.S.C. 841) and certain quasi-governmental entities that, by law, are subject to that act.

1. Determine if the system design has been approved by GAO where applicable. If not applicable, go to ORGANIZATION below.
2. If the system has been approved, obtain and review the system design documentation package retained by the Financial Management Group in the Financial and General Management Studies Division, Washington, D.C.

3. If the system design has been approved, it should have been implemented as designed. Any significant deviations from the approved design should be reported to the Financial Management Group.

ORGANIZATION

1. Obtain applicable agency organization charts.
(See exhibit 2, item 1.)
2. Interview key agency officials to determine how the system works. Summarize individual functions and responsibilities of key officials.

INTERNAL/EXTERNAL AUDITS AND STUDIES

Audits or studies of the system and the data processing department should be reviewed to help determine the audit coverage necessary and preclude unnecessary duplication. The auditor should try to identify control strengths and weaknesses, evaluate offsetting or compensating controls where weak controls are identified, and, in general, assess the audit coverage.

1. Interview agency internal audit personnel and complete the internal audit questionnaire in exhibit 1A.
2. Obtain applicable internal audit reports covering the data processing department and the system being

- reviewed. Review the reports to identify strengths or weaknesses in the system and assess audit coverage.
3. Obtain, review and comment briefly on other applicable studies or reports prepared by consultants, outside auditors, etc.

ADP STEERING COMMITTEE

An ADP steering committee can be a valuable asset to top management in its efforts to monitor the quality and reliability of computer-produced information. The auditor should determine whether the ADP steering committee has been given enough responsibility and authority to effectively oversee the data processing function.

1. Obtain a description of the ADP steering committee's duties and functions.
2. Obtain minutes of the ADP steering committee's meetings.
3. Interview ADP steering committee personnel and complete the steering committee questionnaire in exhibit 1B.

DATA PROCESSING DEPARTMENT

1. Obtain a copy of the computer center organization chart and complete the background questionnaire in exhibit 2.
2. Agency manuals needed include
 - computer operations policies and procedures,
 - computer operator instructions, and
 - data processing user's manual.

3. Review copies of reports of user complaints to identify potential problems.
4. Tour the data processing center.
5. Evaluate the ADP departments' day-to-day operating procedures, computer center physical conditions, and general approaches to control.
--Complete questionnaire on data processing department controls in exhibit 4.
6. Exhibit 5, computer center controls profile, is intended to provide information and can be used by the auditor at his discretion. Reliability assessment and use of this profile is discussed in GAO's "Guide For Reliability Assessment of Controls In Computerized Systems (Financial Statement Audits)."

EXHIBIT 1A

INTERNAL AUDIT

	<u>Yes</u>	<u>No</u>
1. Does the agency's internal auditing department audit the ADP function?	_____	_____
2. Does the auditing department have an ADP section within its staff?	_____	_____
3. Does the department have a continuing program for ADP education?	_____	_____
4. Does it participate with data processing personnel in developing ADP systems?	_____	_____
5. Do any ADP personnel participate or assist auditors in ADP audits?	_____	_____
6. Are copies of operating computer programs maintained under control of the auditing department for the principal ADP applications?	_____	_____
7. Are the control copies of operating computer programs compared with production programs at least annually?	_____	_____
8. Are test decks used by the auditing department to test operating programs?	_____	_____
9. Are specially written computer programs used for audits?	_____	_____
10. Are test decks and/or computer audit programs stored under audit department control?	_____	_____
11. Does the audit department supervise the running of the audit programs and/or test decks?	_____	_____
12. Does the internal audit department verify data on ADP output reports against related source documents?	_____	_____
13. Does the internal audit department review test procedures for all changes to ADP programs and systems?	_____	_____

EXHIBIT 1B

STEERING COMMITTEE

- | | <u>Yes</u> | <u>No</u> |
|---|------------|-----------|
| 1. Does the agency have an ADP steering committee? (Attach a copy of the committee's organization.) | _____ | _____ |
| 2. Does a representative of top management chair the committee? | _____ | _____ |
| 3. Are major users of computer-produced information represented on the committee? | _____ | _____ |
| 4. Does the steering committee: | | |
| --Approve agency policies for ADP? | _____ | _____ |
| --Approve short and long range plans to develop and implement new computer systems, considering user priorities? | _____ | _____ |
| --Evaluate the needs for new computer equipment and help make sure it is acquired expeditiously? | _____ | _____ |
| 5. Explain any "No" answers. Note alternate control procedures, and, if none, describe how the lack affects overall system reliability. | | |

EXHIBIT 2

Computer Hardware System

- * CPU manufacturer _____
- * CPU model number _____
- * Date CPU installed _____
- * CPU physical location _____
- * Internal storage capacity _____
- * Direct access storage capacity _____
- Console typewriter model number _____
- Number of peripherals:
 - Magnetic tape drives:
 - 7 track _____
 - 9 track _____
 - Magnetic disk drives:
 - 2311 series _____
 - 2314 series _____
 - 3330 series _____
 - Magnetic drum units _____
 - Other mass storage units _____
 - Card Readers _____
 - Card Punches _____
 - Card Reader/Punches _____
 - Line Printer #1 _____
(Lines per minute _____)
 - Line Printer #2 _____
(Lines per minute _____)
- * Online terminals _____
- * Remote batch terminals _____
- * Communications controllers (note a) _____
- * Optical scanners _____
- * MICR readers _____
- * Mark sense readers _____
- * Key-to-tape units _____
- * Key-to-disk units _____
- * Key punch/verify _____
- Card sorters _____
- Card collators _____
- Card accounting machines _____
- Other (specify) _____

a/ Attach schematic of data communications network.

*See note on last page of exhibit.

Computer Software and Utilization

Facility software

- * Operating system: Name _____
Version _____
Release number _____
- * Operational efficiency software
(HASP, GRASP, POWER, etc.) _____
- * Data base/data communications
software: (CICS, TOTAL, etc.) _____
- * Specialized software designed by
installation (describe) _____

System utilization

Number of scheduled 8-hour shifts per day _____

Number of scheduled days per week _____

Average number of jobs per day _____

Monthly averages for past 3 months

 Total hours scheduled _____

 Actual hours:

 Production _____

 Testing _____

 Rerun _____

 Maintenance _____

 Idle _____

 Other _____

 Total actual _____

Multiprograming factor (average number
of programs running concurrently) _____

* See note on last page of exhibit.

EXHIBIT 2

ADP costs

Total budgeted
Current fiscal year _____
Next fiscal year _____

Actual costs for most recently ended
fiscal year _____:

Rental of leased CPUs (note a) _____

Rental of other leased hardware
(note a) _____

Cost of purchased equipment:

CPUs _____

All other _____

Hardware maintenance _____

Personnel:

ADP general management _____

Data entry _____

Computer operations _____

Systems design _____

Applications programing _____

Technical support _____

Library/control, etc. _____

Clerical and administrative _____

Supplies (cards, printer paper, etc.) _____

Contracts:

Data conversion _____

Other services _____

Facility costs:

Space _____

Utilities _____

Other annual costs (specify)

a/ Names of lessors:

EXHIBIT 2

ADP staffing

	<u>Number</u>		<u>Name of section supervisor</u>
	<u>Authorized</u>	<u>Assigned</u>	
ADP general management	_____	_____	_____
Systems analysts	_____	_____	_____
Applications programers	_____	_____	_____
Systems programers	_____	_____	_____
Other technical support	_____	_____	_____
Computer operators	_____	_____	_____
Data entry operators	_____	_____	_____
Control clerks	_____	_____	_____
Schedulers	_____	_____	_____
Librarians	_____	_____	_____
Secretarial/clerical	_____	_____	_____
Other	_____	_____	_____
Totals	_____	_____	_____

Anticipated staffing additions and deletions during the next 2 years:

EXHIBIT 2

NOTE: Questions preceded by an * deal with accounting controls which should be asked about during each visit to the agency. Other questions deal with the day-to-day operations of the agency's computer center and the design of computerized financial systems. These questions should be asked during the first visit to the agency, after a new computer system has been implemented, and every 3 years.

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EXHIBIT 3

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DATA PROCESSING DEPARTMENT CONTROLS

Organizational Controls

- | | <u>Yes</u> | <u>No</u> |
|---|------------|-----------|
| 1. Is the ADP department independent from other agency operations? | _____ | _____ |
| 2. Are all the following functions performed by different individuals?
(adequate separation of duties) | _____ | _____ |
| a. Systems design | _____ | _____ |
| b. Programing | _____ | _____ |
| c. Acceptance testing | _____ | _____ |
| d. Authorizing program changes | _____ | _____ |
| e. Accepting programs and program changes | _____ | _____ |
| f. Handling source documents
(keypunching, etc.) | _____ | _____ |
| g. Machine operations | _____ | _____ |
| h. File maintenance (librarian for data and programing files) | _____ | _____ |
| 3. Are operators denied access to programmer run books and other systems design and programing documentation? | _____ | _____ |
| 4. Explain any "No" answers. Note alternate control procedures, and, if none, describe how the lack affects overall system reliability. | | |

EXHIBIT 4

System Documentation

	<u>Yes</u>	<u>No</u>
* 1. Does a procedures manual cover the preparation of all source documents?	_____	_____
* 2. Does this manual:		
a. Include control procedures?	_____	_____
b. Define data preparation responsibility?	_____	_____
* 3. Is there a data entry/conversion manual?	_____	_____
* 4. If the answer to question 3 is yes, does the manual:		
a. Include instructions for entering data?	_____	_____
b. Identify all fields subject to key verification?	_____	_____
* 5. Is there an overall narrative description of the system?	_____	_____
* 6. Is there an overall flow chart of the system?	_____	_____
* 7. Are there program run books for each application program?	_____	_____
8. Does program documentation include:		
a. General narrative description of program?	_____	_____
b. Specifications - both original and modifications?	_____	_____
c. Detailed narrative description of program?	_____	_____
d. Detailed logic diagram or decision table?	_____	_____
e. Input record formats?	_____	_____
f. Input record descriptions?	_____	_____
g. Output record formats?	_____	_____
h. Output record descriptions?	_____	_____
i. Master file formats?	_____	_____
j. Master file description?	_____	_____
k. List of constants, codes, and tables used?	_____	_____

* See note on last page of exhibit.

EXHIBIT 4

	<u>Yes</u>	<u>No</u>
l. Source program listing?	_____	_____
m. Object program listing?	_____	_____
n. Operating instructions?	_____	_____
o. Description of test data used to test program?	_____	_____
* 9. Is access to program documentation restricted to persons who do not operate the equipment?	_____	_____
*10. Are there computer operations run manuals?	_____	_____
*11. Are these run manuals provided to computer operators?	_____	_____
*12. Do operator's run manuals:		
a. Define input data, source, and format?	_____	_____
b. Describe setup procedures?	_____	_____
c. Characterize all halt conditions and actions to be taken?	_____	_____
d. Delineate expected output data and format?	_____	_____
e. Formulate output and file disposition at completion of run?	_____	_____
f. Include copy of normal console sheets for run?	_____	_____
*13. Do operator's run manuals exclude:		
a. Program logic charts or block diagrams?	_____	_____
b. Copy of program listing?	_____	_____
*14. Are program listings inaccessible to computer operators?	_____	_____
*15. Are copies of all documentation stored off the premises?	_____	_____
16. If so, is stored program documentation periodically compared with that being used?	_____	_____
17. Is there written evidence of who performed the systems and programming work?	_____	_____

* See note on last page of exhibit.

Computer Operations Controls

	<u>Yes</u>	<u>No</u>
* 1. Have documented procedures been established covering the operations of the data center?	_____	_____
2. Are daily equipment operating logs maintained?	_____	_____
3. Is downtime shown and explained?	_____	_____
* 4. Is there an error log or report for each such run?	_____	_____
* 5. Are these logs reviewed daily by the ADP operations manager:		
a. Input/output?	_____	_____
b. Equipment?	_____	_____
c. Error?	_____	_____
* 6. Does the ADP manager initial each log to indicate that the review has been performed?	_____	_____
7. Are all processes and operator decisions recorded in a daily log?	_____	_____
8. If the system does not have a console typewriter, does the method used afford adequate control and record the activities performed by the computer and by the operator?	_____	_____
* 9. Is the console typewriter used to list:		
a. Date?	_____	_____
b. Job name and/or number?	_____	_____
c. Program name and/or number?	_____	_____
d. Start/stop times?	_____	_____
e. Files used?	_____	_____
f. Record counts?	_____	_____
g. Halts (programed and unscheduled)?	_____	_____
*10. Is all time accounted for from the time the computer is turned on each day until it is shut down?	_____	_____
* See note on last page of exhibit.		

EXHIBIT 4

	<u>Yes</u>	<u>No</u>
*11. Are disposition notes entered on the console log showing corrective actions taken when unscheduled program halts occur?	_____	_____
*12. Are reruns shown on the console log?	_____	_____
*13. Is the reason for each rerun recorded?	_____	_____
*14. Are console sheets sequentially numbered?	_____	_____
*15. Is the log reviewed and signed at the end of the day by the supervisor and filed as a permanent record?	_____	_____
*16. Are the console printouts independently examined to detect operator problems and unauthorized intervention?	_____	_____
*17. Does the authorized person initial console sheets to show that they have been reviewed?	_____	_____
*18. Are provisions adequate to prevent unauthorized entry of program changes and/or data through the console or any other device?	_____	_____
*19. Does some form of printout indicate every operating run performed?	_____	_____
*20. Is there a procedure to prevent superseded programs from being used by mistake?	_____	_____
*21. Are only the current program decks maintained?	_____	_____
*22. Are programs revised only after written requests approved by user department management?	_____	_____
23. Do these written requests describe the proposed changes and reasons for them?	_____	_____
*24. Are changes in the master file or in program data factors authorized in writing by initiating departments?	_____	_____

* See note on last page of exhibit.

EXHIBIT 4

Access Control

	<u>Yes</u>	<u>No</u>
* 1. Is access to the computer area limited to necessary personnel?	_____	_____
2. Do combination locks, security badges, or other means restrict access to the computer room?	_____	_____
* 3. Are combination locks or similar devices periodically changed?	_____	_____
* 4. Are account codes, authorization codes, passwords, etc., controlled to prevent unauthorized usage?	_____	_____
* 5. If terminals provide access to the system, are they adequately secured to prevent unauthorized usage?	_____	_____
* 6. Is the responsibility for issuing and storing magnetic tapes and/or disk packs assigned to a tape librarian?	_____	_____
* 7. Is this duty the librarian's chief responsibility?	_____	_____
* 8. Are library procedures documented?	_____	_____
* 9. Is access to the library limited to the responsible librarian(s)?	_____	_____
*10. Does the agency use automated methods (e.g., a file management system) to restrict access to computerized files?	_____	_____
*11. Are all data files logged in and out to prevent release to unauthorized personnel?	_____	_____
*12. Are inventory records of tapes and disks maintained?	_____	_____
*13. Are status records of tapes and disks maintained?	_____	_____
*14. Have external labeling procedures been documented?	_____	_____

* See note on last page of exhibit.

EXHIBIT 4

Disaster Recovery Controls

	<u>Yes</u>	<u>No</u>
1. Have procedures been documented for disaster control and recovery?	_____	_____
2. Do these procedures protect against fire and other hazards for the data center, data files, and programs?	_____	_____
3. Are these procedures implemented as defined?	_____	_____
4. Are there provisions for retaining and/or copying master files and a practical means of reconstructing a damaged or destroyed file?	_____	_____
5. Are sufficient generations of files maintained to facilitate reconstruction of records (grandfather-father-son tape routine)?	_____	_____
6. Is at least one generation maintained in a location other than the tape storage area?	_____	_____
7. Are copies of critical files stored at a remote location and restricted from unauthorized access?	_____	_____
8. Are copies of operating programs stored outside the computer room?	_____	_____
9. Are duplicate programs maintained at a remote location and restricted from unauthorized access?	_____	_____
10. Are related transaction media pertaining to critical files and programs maintained?	_____	_____
11. Have documented backup procedures been established with another compatible data center to cover a natural disaster or other emergency situations?	_____	_____
12. Explain any "No" answers. Note alternate control procedures, and, if none, describe how the lack affects overall system reliability.		

EXHIBIT 4

NOTE: Questions preceded by an * deal with accounting controls which should be asked about during each visit to the agency. Other questions deal with the day-to-day operations of the agency's computer center and the design of computerized financial systems. These questions should be asked during the first visit to the agency, after a new computer system has been implemented, and every 3 years.

COMPUTER CENTER CONTROLS PROFILE

Preparer: _____
 Date: _____
 Reviewer: _____

Department: _____ Exhibits 2 and 4 W/P index: _____
 Agency: _____ Computer center: _____
 Code: _____ Location: _____

SIGNIFICANT CHARACTERISTICS	INDICATIVE OF HIGH RISK	INDICATIVE OF MEDIUM RISK	INDICATIVE OF LOW RISK	INDEX TO COMMENTS
Organizational strength	Inadequate to handle present workload and that scheduled for development in next year.	Adequate but tight-- little or no margin of safety.	Sufficient, with reasonable margin to spare.	
Organizational structure and administrative practices:				
a) Division of duties (acceptability from standpoint of internal control-- see appendix I)	Inappropriate mixture of duties in at least one major instance.	Appropriate in major respects; reasonably well compensated for in some other manner when division violates control principles.	Appropriate in almost all respects; appropriately compensated for when necessary.	
Management (as applied to planning, scheduling, supervising, and exercising control)	Inadequate practices or ineffective application of good practices.	Good practices applied with average effectiveness or average practices effectively applied.	Good practices effectively applied.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

SIGNIFICANT CHARACTERISTICS	INDICATIVE OF HIGH RISK	INDICATIVE OF MEDIUM RISK	INDICATIVE OF LOW RISK	INDEX TO COMMENTS
Certain aspects of systems/program development				
a) User approval of system design specifications	Cursory, essentially uninformed.	Informed as to general, but not detailed, specifications; approval apt to be informal.	Written approval based on informed judgment and precise specifications.	
b) Project control and work methods	Poorly organized without standards.	Well organized but without standards.	Well organized using effective standard procedures.	
c) System test practices	Some transaction paths tested.	Each transaction path tested individually.	Each transaction path tested in combination with all others.	
d) documentation practices	Poor or no standards; uneven adherence; not part of system and program development.	Adequate practices not uniformly adhered to; documentation done "after the fact."	Excellent standards closely adhered to and carried out as part of system and program development.	
Physical conditions	<u>Unsuitable</u>	<u>Suitable</u>	<u>More than satisfactory</u>	
a) Physical safeguards against destruction or alteration of records, equipment, etc.	Easy access; little or no fire detection equipment.	Limited access; adequate fire detection equipment.	Physical isolation; severely limited access; adequate fire detection equipment, good fire-fighting equipment.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

<u>SIGNIFICANT CHARACTERISTICS</u>	<u>INDICATIVE OF HIGH RISK</u>	<u>INDICATIVE OF MEDIUM RISK</u>	<u>INDICATIVE OF LOW RISK</u>	<u>INDEX TO COMMENTS</u>
b) Alternate facilities	No arrangements.	Practices casual, or their use could be improved.	Formal arrangements; machine compatibility assured by actual tests.	
c) Records management	Poor magnetic file library control, no off-premises storage.	Effective magnetic library control, some off-premises storage.	Effective magnetic file library control; copies of programs, master files, and important data stored off-premises.	
d) Housekeeping discipline relative to input data, tape and disk files, cards, etc.	Procedures are poor or not followed.	Procedures could be improved or followed more closely.	Good practices carried out well.	
General approach to control	Willing to take risks to lower costs or unwilling to enforce good control procedures.	Sound control techniques (include most generally accepted types of control).	Very control conscious; EDP department has excellent knowledge of control techniques and soundly controls new application systems.	
a) input control and data validation --tie-in with external control --use of critical fields --computer editing --rejects --key transcriptions				
b) Computer processing --protection against processing of incorrect files --run-to-run controls				

Based on material provided by Price Waterhouse & Co., certified public accountants.

SIGNIFICANT CHARACTERISTICS	INDICATIVE OF HIGH RISK	INDICATIVE OF MEDIUM RISK	INDICATIVE OF LOW RISK	INDEX TO COMMENTS
<p>c) Output control</p> <ul style="list-style-type: none"> --tie-in with input controls --output tests --"common sense" review 	<p>Willing to take risks to lower cost or unwilling to enforce good control procedures.</p>	<p>Sound control techniques (include most generally accepted types of control).</p>	<p>Very control conscious; EDP department has excellent knowledge of control techniques and soundly controls new application systems.</p>	
<p>d) Data security</p> <ul style="list-style-type: none"> --program validation of message header --maintenance of filer suspense --recovery and retrieval of records 				
<p>e) computer room operation</p>	<p>Relatively little supervision; few established procedures for dealing with problems.</p>	<p>Supervisors observe operators to see if run-book instructions are followed; sound procedures for nonroutine situations are generally understood.</p>	<p>Supervisors observe operators and check console and utilization logs to see that each operation was carried out according to run-book instructions; excellent procedures established for dealing with problems.</p>	
<p>f) Access to time-sharing systems and responsibility for data security</p>	<p>Data security not provided for.</p>	<p>Data security provided for without specific schedule for changing authorization codes.</p>	<p>Data security part of front-end control program; specific schedules control authorization code changes.</p>	

Based on material provided by Price Waterhouse & Co., certified public accountants.

SECTION II

REVIEW OF COMPUTER APPLICATION(S)

GENERAL

The auditor should review the system or part of the system (individual application) to evaluate the network of internal controls. This means reviewing agency documentation and interviewing agency personnel. This segment of the audit provides detailed information on controls used by the agency to make sure that no data is added, lost, or altered during application processing.

APPLICATION/SYSTEM INFORMATION

1. Obtain agency manuals applicable to the computer application being reviewed. On a payroll audit, for example, obtain personnel, payroll, and timekeepers' policies and procedures manuals.
2. Review applicable manuals and interview agency personnel to determine what procedures are followed--both manual and automated--to process transactions. For payroll, include the following:
 - a. Personnel/payroll transactions (changes to the personnel/payroll master files, i.e., adding employees, separating employees, or updating existing employee records).

- b. Time and attendance documents.
 - c. Cancellation of paychecks.
 - d. Collection of overpayments.
 - e. Supplemental paychecks (checks not issued through the normal automated payroll system).
3. Determine why checks were cancelled and why supplemental checks were issued. Evaluate the adequacy of adjustment procedures to make sure that master files and related records are updated accordingly.
 4. Discuss application processing with data processing department personnel and obtain a copy of the processing schedule.
 5. Obtain copies of application system documentation, including system flow charts.
 6. Obtain copies of reports on user complaints and/or suggested application modifications and review them to identify potential problems.
 7. Evaluate the adequacy of specific controls by completing the following controls questionnaires:
 - Application systems inventory (exhibit 6A).
 - Data input controls (exhibit 6C).
 - Data error controls (exhibit 6D).
 - Application batch data processing controls (exhibit 6E).

--Telecommunications processing controls

(exhibit 6F).

--Data output controls (exhibit 6G).

The questions contained in these questionnaires are not all-inclusive; however, they are comprehensive enough to indicate the level of control over the application system. All "no" responses should generally be considered potential deficiencies, requiring review by the audit staff.

8. A computer applications controls profile is included as exhibit 7 to provide information. It can be used at the auditor's discretion.

APPLICATION SYSTEMS INVENTORY

Major System in Use 1/

System name and ID number _____

Date of implementation _____

Is system a. a standard system or
b. locally designed? _____

System type (administrative,
engineering, process control,
scientific, other (specify)) _____

Batch or on-line? _____

Number of programs _____

Size of largest program _____

Programing language _____

Was system tested with--a. test data or
b. live data? _____

Are system test results available? _____

Number of parallel processing cycles _____

Number of system modifications
in last 2 years _____

Date last modification tested _____

Date of last audit or evaluation
(attach report) _____

Processing frequency _____

Total monthly processing hours _____

1/ Complete a separate schedule for each application system.

EXHIBIT 6A

Principal Users 1/

Principal users of system output--name, organizational element, address	User functions				
	Initi- ates trans- ac- tions	Trans- cribes date	Oper- ates com- puter	Main- tains data con- trols	Designs/ programs/ appli- cation
1. _____ _____	_____	_____	_____	_____	_____
2. _____ _____	_____	_____	_____	_____	_____
3. _____ _____	_____	_____	_____	_____	_____
4. _____ _____	_____	_____	_____	_____	_____
5. _____ _____	_____	_____	_____	_____	_____
6. _____ _____	_____	_____	_____	_____	_____

Comments: _____

1/ Index to following questionnaire on user satisfaction with computer-produced reports.

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Exhibit 6B Included in Section III

EXHIBIT 6C

DATA INPUT CONTROLS

	<u>Yes</u>	<u>No</u>
* 1. Have procedures been documented to insure that all source data is entered, processed, and fed back and that no data is added erroneously or manipulated?	-----	-----
* 2. Do the initiating departments independently control data submitted for processing?	-----	-----
a. turnaround transmittal document	-----	-----
b. record counts	-----	-----
c. predetermined control totals	-----	-----
* 3. Is responsibility appropriately separated to make sure that an individual does not perform more than one phase of preparing input data (e.g., establishing new master records plus changing or updating all master records)?	-----	-----
* 4. Are source documents retained long enough in a manner which allows identification of both related output records and documents?	-----	-----
5. Is information transcribed from the source document to some other document before being sent to the ADP department input control group?	-----	-----
6. Does the transcription department, if separate from other offices, independently control data submitted for processing?	-----	-----
a. turnaround transmittal documents	-----	-----
b. record counts	-----	-----
c. predetermined control totals	-----	-----
Are these control totals balanced with those of the initiating department and are all discrepancies reconciled?	-----	-----
* See note on last page of exhibit.		

EXHIBIT 6C

Yes No

- * 7. Are source documents and coding sheets controlled once they are turned over to the transcribing department? -----

- * 8. Are the functions of coding, keypunching and verifying the same document performed by different individuals? (Separation of duties.) -----

- 9. Is turnaround rapid enough to identify and correct errors? -----

- 10. Explain any "No" answers. Note alternate control procedures, and, if none, describe how the lack affects overall system reliability.

* See note on last page of exhibit.

EXHIBIT 6D

DATA ERROR CONTROLS

	<u>Yes</u>	<u>No</u>
* 1. Are there adequate controls over the process of identifying, correcting, and reprocessing data rejected by the computer programs?	-----	-----
* 2. Are record counts and predetermined control totals used to control these rejected transactions?	-----	-----
* 3. Are all corrections and resubmissions performed promptly?	-----	-----
* 4. Are all error corrections reviewed and approved by persons outside the data processing department?	-----	-----
* 5. Do initiating departments review error listings affecting their data?	-----	-----
6. Are unmatched transactions (no master record corresponding to transaction record or vice versa) rejected and written on a suspense file?	-----	-----
7. Explain any "No" answers. Note alternate control procedures, and, if none, describe how the lack affects overall system reliability.		
	-----	-----
	-----	-----
	-----	-----
	-----	-----
	-----	-----
	-----	-----
	-----	-----
	-----	-----
	-----	-----
	-----	-----

* See note on last page of exhibit.

APPLICATION BATCH DATA PROCESSING CONTROLS

	<u>Yes</u>	<u>No</u>
* 1. Does the data processing department independently control data submitted and processed?	-----	-----
a. turnaround transmittal documents	-----	-----
b. record counts	-----	-----
c. predetermined control totals	-----	-----
Are these control totals balanced with those of the initiating department and are all discrepancies reconciled?	-----	-----
* 2. Are run-to-run control totals used to check for completeness of processing?	-----	-----
* 3. Do the computer operating instructions for each program clearly identify data files to be used as input?	-----	-----
* 4. Do the operating instructions for each program clearly identify output files and storage requirements?	-----	-----
* 5. Do all programs include routines for checking file labels before processing?	-----	-----
* 6. Are operators prohibited from circumventing instructions?	-----	-----
* 7. Are internal trailer labels containing control totals (record counts, dollars, hash totals, etc.) generated for all magnetic tapes and tested by the computer program to determine that all records have been processed?	-----	-----
* 8. Do computer programs include the following types of tests for validity:		
a. Code?	-----	-----
b. Character?	-----	-----
c. Field?	-----	-----
d. Transaction?	-----	-----

* See note on last page of exhibit.

TELECOMMUNICATIONS PROCESSING CONTROLS

	<u>Yes</u>	<u>No</u>
* 1. Are there documented procedures for using the telecommunications network?	-----	-----
* 2. Are authorization codes required to:		
a. Access the computer system?	-----	-----
b. Access the applications programs?	-----	-----
c. Perform transactions?	-----	-----
* 3. Are different authorization codes required to perform different transactions?	-----	-----
* 4. Are authorization codes controlled to restrict unauthorized usage?	-----	-----
* 5. Are authorization codes periodically changed?	-----	-----
* 6. Is a nonprinting or obliteration facility used when keying in authorization codes?	-----	-----
* 7. Is a terminal identification check performed by the computer during polling so that various transaction types can be limited to authorized data entry stations?	-----	-----
* 8. Is the polling/dial-up program used to:		
a. Send acknowledgement to terminal?	-----	-----
b. Periodically test line and terminal operating status with standardized test messages and responses?	-----	-----
* 9. Is the message header used to identify:		
a. Source, including proper terminal and operator identification codes?	-----	-----
b. Message sequence number, including total number of message segments?	-----	-----
c. Transaction type code?	-----	-----
d. Transaction authorization code?	-----	-----

* See note on last page of exhibit.

Based on material provided by Price Waterhouse & Co., certified public accountants.

EXHIBIT 6F

Yes No

- *10. Is the message header validated for:
- a. Proper sequence number from the identified terminal? -----
 - b. Proper transaction code or authorization code for terminal or operator? -----
 - c. Number of message segments received equal to count indicated in header? -----
 - d. Proper acknowledgement from terminal at end of transmission? -----
 - e. Balancing of debit/credit totals derived from adding all message segments and comparing with corresponding totals in message header? -----
- *11. Are the transaction records (i.e., message segments) validated by:
- a. A check for proper authorization/approval codes of each individual supervisor against stored authorization codes that are periodically reissued? -----
 - b. Check digits on all identification keys? -----
 - c. Check digits at the end of a string of numeric data that is not subjected to balancing? -----
 - d. Range and/or limit tests based on statistical analysis of input data values? -----
 - e. Numeric or alpha-only data field tests? -----
 - f. Extensive relationship tests that determine if data values are consistent with other input data fields or master file contents? -----
- *12. Are there either accumulators in the terminal for keeping input totals or terminal-site logging procedures that record details of transactions? -----

* See note on last page of exhibit.

Based on material provided by Price Waterhouse & Co., certified public accountants.

EXHIBIT 6F

	<u>Yes</u>	<u>No</u>
*13. Does the program or programs maintain running totals of:		
a. Number of transactions?	-----	-----
b. Credit value?	-----	-----
c. Debit value?	-----	-----
*14. Does the program summarize all transaction values processed each day as a separate record segment on the master file and on the journal file to provide an audit trail?	-----	-----
*15. Are error messages returned to originating terminal, indicating type of error detected and requesting correction?	-----	-----
*16. Is a block of characters automatically retransmitted when an error is detected (which implies some form of buffer at the terminal)?	-----	-----
*17. Are detected error transactions entered into memo/suspense accounts including:		
a. A code indicating error type?	-----	-----
b. Date, time, and transaction type, plus terminal ID?	-----	-----
c. Debit/credit value of transaction (if any)?	-----	-----
*18. Are known error correction transactions matched (using supplementary ID) against memo/suspense account entries?	-----	-----
*19. Are periodic printout or error memo/suspense account entries produced?	-----	-----
*20. Does an end-of-transmission trailer include:		
a. Message and segment counts?	-----	-----
b. Value totals, including debit and credit?	-----	-----
c. An ending symbol?	-----	-----

* See note on last page of exhibit.

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EXHIBIT 6F

	<u>Yes</u>	<u>No</u>
*21. Is there a control trailer record main-storage resident while file is open for processing?	_____	_____
*22. Is each field of the control trailer record updated as each transaction processing sequence is completed?	_____	_____
*23. Is a control trailer record written at the end of file or subfile at end of processing day?	_____	_____
*24. Is a transaction log of sequence-numbered and/or time-of-day-noted transactions maintained in addition to periodic dump/copy of the master file?	_____	_____
*25. Is the transaction data log used to provide:		
a. Part of the audit trail, including originating terminal and message ID, transaction type code, time of day that the transaction is logged, and copy of transaction record?	_____	_____
b. Transaction record for retrieval from terminal?	_____	_____
*26. At the end of the processing day, is the master file balanced, via programmed routine, by subtracting current totals from start-of-day totals and comparing the remainder to transaction log values?	_____	_____
*27. Are all master file records periodically processed to balance machine-derived totals against control trailer record totals?	_____	_____

* See note on last page of exhibit.

Based on material provided by Price Waterhouse & Co., certified public accountants.

DATA OUTPUT CONTROLS

	<u>Yes</u>	<u>No</u>
* 1. Does the initiating department balance control totals generated during computer processing with those originally established and reconcile all discrepancies?	-----	-----
* 2. Can all transactions be traced forward to a final output control?	-----	-----
* 3. Can all transactions be traced back to the original source document?	-----	-----
* 4. Is there some means of verifying master file content; i.e., are samples periodically drawn from those records being printed and reviewed for accuracy?	-----	-----
* 5. Is someone assigned to review output for general acceptability and completeness?	-----	-----
6. Is a schedule maintained of the reports and documents to be produced by the ADP system?	-----	-----
7. Is there a control procedure for the distribution of reports?	-----	-----
8. Is responsibility appropriately separated to make sure that one individual does not perform more than one phase of a transaction?	-----	-----
For:		
a. Initiating data?	-----	-----
b. Transcribing data?	-----	-----
c. Feeding data?	-----	-----
d. Processing data?	-----	-----
e. Correcting errors and resubmitting data?	-----	-----
f. Distributing output?	-----	-----

* See note on last page of exhibit.

9. Explain any "No" answers. Note alternate control procedures, and, if none, describe how the lack affects overall system reliability.

NOTE:

Questions preceded by an * deal with accounting controls which should be asked about during each visit to the agency. Other questions deal with the day-to-day operations of the agency's computer center and the design of computerized financial systems. These questions should be asked during the first visit to the agency, after a new computer system has been implemented, and every 3 years thereafter.

COMPUTER APPLICATIONS CONTROLS PROFILE

EXHIBIT 7

Preparer _____
 Date _____
 Reviewer _____

Department _____
 Agency _____
 Code _____
 Application _____

Exhibit 2 W/P index _____
 Exhibit 6 W/P index _____
 Computer center _____
 Location _____

SIGNIFICANT CHARACTERISTICS	INDICATIVE OF HIGH RISK	INDICATIVE OF MEDIUM RISK	INDICATIVE OF LOW RISK	INDEX TO COMMENTS
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System scope and complexity

a) organizational breadth

1. important functions	Must meet important conflicting needs of several organizational units.	Meets limited conflicting requirements of cooperative organizational units.	No significant conflicting needs, serves primarily one organizational unit.	
2. unrelated organizational units deeply involved	Dependent upon data flowing from many organizational units not under unified direction.	Dependent upon data from a few organizational units with a common interest, if not unified control.	Virtually all input data comes from a small group of sections under unified control.	

b) Data processing breadth

1. number of transaction types	more than 25	6 to 25	less than 6	
--------------------------------	--------------	---------	-------------	--

Based on material provided by Price Waterhouse & Co., certified public accountants.

SIGNIFICANT CHARACTERISTICS	INDICATIVE OF HIGH RISK	INDICATIVE OF MEDIUM RISK	INDICATIVE OF LOW RISK	INDEX TO COMMENTS
2. number of related record segments	more than 6	4 to 6	less than 4	
3. output reports	more than 20	10 to 20	less than 10	
c) margin of error (necessity for everything to work perfectly, for "split-second timing" for great cooperation (perhaps including external parties), etc.)	Very demanding.	Realistically demanding.	Comfortable margin.	
Technical complexity	<u>High, aggressive</u>	<u>Moderate</u>	<u>Conservative</u>	
a) number of programs, including sort/merge	more than 35	20 to 35	less than 20	
b) programing approach (number of module/functions interacting within an update/file maintenance program)	more than 20	10 to 20	less than 10	
c) size of largest program	more than 60K	25K to 60K	less than 25K	
d) adaptability of program to change	Low, due to monolithic program design.	Can surmount problems with adequate talent and effort.	Relatively high; program straightforward, modular, roomy, relatively unpatched, well documented, etc.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

SIGNIFICANT CHARACTERISTICS	INDICATIVE OF HIGH RISK	INDICATIVE OF MEDIUM RISK	INDICATIVE OF LOW RISK	INDEX TO COMMENTS
e) relationship to equipment in use	Pushes equipment capacity near limits.	Within capacities.	Substantial unused capacity.	
f) reliance on online data-entry automatic document reading or other advanced techniques	Heavy, including direct entry of transactions and other changes into the master files.	Remote-batch processing under remote operations control.	None or limited to file inquiry.	
Pioneering aspects (extent to which the system applies new, difficult, and unproven techniques on a broad scale or in a new situation, thus placing great demands on --the non-EDP departments, --systems and programing groups, --EDP operations personnel, --customers or vendors , etc.)	<u>Aggressively pioneering</u> More than a few relatively untried equipment or system software components or system techniques or objectives, at least one of which is crucial.	<u>Moderate</u> Few untried systems components and their functions are moderately important; few, if any pioneering system objectives and techniques.	<u>Conservative</u> No untried system components, no pioneering system objectives or techniques	

Based on material provided by Price Waterhouse & Co., certified public accountants.

<u>SIGNIFICANT CHARACTERISTICS</u>	<u>INDICATIVE OF HIGH RISK</u>	<u>INDICATIVE OF MEDIUM RISK</u>	<u>INDICATIVE OF LOW RISK</u>	<u>INDEX TO COMMENTS</u>
System stability	<u>Unstable, much is new</u>	<u>Moderate change, most is not new</u>	<u>Stable, little is new</u>	
a) age of system (since inception or last big change)	less than 1 year	1 to 2 years	over 2 years	
b) frequency of significant change	more than 4 per year	2 to 4 per year	less than 2 per year	
c) extent of total change in last year	affecting more than 25% of programs	affecting 10 to 25% of programs	affecting less than 10% of programs	
d) user approval of specifications	Cursory, essentially uninformed.	Reasonably informed as to general but not detailed specifications; approval apt to be informal.	Formal, written approval, based on informed judgment and written, reasonably precise specifications.	
Satisfaction of user requirements	<u>Low satisfaction, many problems</u>	<u>Reasonable satisfaction, some problems</u>	<u>High satisfaction</u>	
a) completeness	Incomplete, significant number of items not processed in proper period.	Occasional problems but normally no great difficulties.	No significant data omitted or processed in wrong period.	
b) accuracy	Considerable error problem, with items in suspense or improperly handled.	Occasional problems but normally no great difficulties.	Errors not numerous or of consequence.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

<u>SIGNIFICANT CHARACTERISTICS</u>	<u>INDICATIVE OF HIGH RISK</u>	<u>INDICATIVE OF MEDIUM RISK</u>	<u>INDICATIVE OF LOW RISK</u>	<u>INDEX TO COMMENTS</u>
c) Promptness in terms of needs	Reports and documents delayed so as to be almost useless; forced to rely on informal records.	Reports and documents not always available when desired; pre-est timetable inconvenient but tolerable.	Reports and documents produced soon enough to meet operational needs.	
d) accessibility of details (to answer inquiries, review for reasonableness, make corrections, etc.)	Great difficulty in obtaining details of transactions or balances except with much delay.	Complete details available monthly; in interim, details available with some difficulty and delay.	Details readily available.	
e) reference to source documents (audit trail)	Great difficulty in locating documents promptly.	Audit trail excellent; some problems with filing and storage.	Audit trail excellent; filing and storage good.	
f) conformity with established system specifications	Actual procedures and operations differ in important respects.	Limited tests indicate that actual procedures and operations differ in only minor respects and operations produce desired results.	Limited tests indicate actual procedures and operations produce desired results.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

SIGNIFICANT CHARACTERISTICS	INDICATIVE OF HIGH RISK	INDICATIVE OF MEDIUM RISK	INDICATIVE OF LOW RISK	INDEX TO COMMENTS
Source data origin and approval	<u>Leaves much to be desired</u>	<u>Reasonable</u>	<u>Sound procedures, well carried out</u>	
a) people, procedures, knowledge, discipline, division of duties, etc., in departments that --originate data --approve data	Situation leaves much to be desired.	Situation satisfactory but could stand some improvement.	Situation satisfactory.	
b) data control procedures outside the EDP organization	None or relatively ineffective; e.g., use of noncritical fields, loose liaison with EDP department, little concern with rejected items.	Control procedures based on noncritical fields; reasonably effective liaison with EDP department.	Control procedures include critical fields; good tie-in with EDP department; especially good on rejected items.	
c) error rate	Over 7% of transactions rejected after leaving source data department.	4-7% of transactions rejected after leaving source data department	Less than 4% of transactions rejected after leaving source data department.	
d) error backlog	Many 30-day-old items.	Mostly 10-15-day-old items.	Items primarily less than 7 days old.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

CHARACTERISTICS	OF HIGH RISK	OF MEDIUM RISK	OF LOW RISK	COMMENTS
Input data control (within EDP department)	<u>Leaves much to be desired</u>	<u>Reasonable</u>	<u>Sound, well executed</u>	
a) relationship with external controls	Loose liaison with external control units; little concern with rejected items; batch totals not part of input procedures; only use controls like item counts; no control totals of any kind	Reasonably effective liaison with external data control units; good control over new items, but less satisfactory control over rejected items; batch totals not received, but generated by computer.	Good tie-in with external control units for both valid and rejected items; batch totals received as part of input process.	
b) selection of critical control fields	Control based on noncritical fields.	Control based on a mixture of critical and noncritical fields, with effective supplementary checks.	Control established on critical fields.	
c) controls over key transcrip- tion	Control based on batch totals.	Control based on transmittal sheets; batch totals and key verification of critical fields not batch-controlled.	Control based on transmittal sheets, heets, batch totals maintained on data logs, key verification of fields, and written "signoff" procedures.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

<u>CHARACTERISTICS</u>	<u>INDICATIVE OF HIGH RISK</u>	<u>INDICATIVE OF MEDIUM RISK</u>	<u>INDICATIVE OF LOW RISK</u>	<u>INDEX TO COMMENTS</u>
Data validation (computer editing)	<u>Few, relatively simple tests</u>	<u>Reasonably effective tests</u>	<u>Extensive, well-designed tests</u>	
a) edit tests	Alpha-numeric tests.	Range and alpha-numeric tests.	Range, alpha-numeric, and check-digit tests.	
b) sophistication	Simple, based on edit of one field at a time.	Simple editing plus some editing based on the inter-relationship of two.	Simple editing plus extensive edit tests based on the inter-relationship of two or more fields.	
c) application to critical data	A considerable amount of critical data is not edited.	A few critical fields are edited only indirectly.	Editing performed on critical fields.	
d) error balancing, retrieval, and correction procedures.	Error rejected by system and eliminated from controls; treated as new items when reintroduced.	Number and value of rejected items carried in suspense account without electronically maintained details.	Error carried in suspense account in total and in detail until removed by correction.	
Computer processing control	<u>Limited--excessive reliance on manual procedure</u>	<u>Reasonable</u>	<u>Comprehensive and automatic</u>	
a) controls within machine room	Informal operating instructions.	Written operating procedures.	Operations are based on a schedule, use up-to-date instructions.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

SIGNIFICANT CHARACTERISTICS	INDICATIVE OF HIGH RISK	INDICATIVE OF MEDIUM RISK	INDICATIVE OF LOW RISK	INDEX TO COMMENTS
b) manual and electronic safeguards against incorrect processing of files.	Tape library controls by serial number; no programed checks.	Tape library controls by serial number; programed checks applied to file identification.	Programed label check applied to serial number, expiration date, and file identification.	
c) recording of run-to-run debit, credit, and balance totals for both transaction processing and master file records	Run-to-run totals not used.	Run-to-run totals printed and compared manually.	Run-to-run totals printed and compared by program.	
d) documentation status	Poor or no standards; uneven adherence; not part of system and program development.	Adequate practices not uniformly adhered to; documentation done "after the fact".	Excellent standards closely adhered to and carried out as part of system and program development.	
e) system test practices	Some transaction paths not tested.	Each transaction path tested individually.	Each transaction path tested in combination with all other transactions.	
Output control	<u>Essentially lacking</u>	<u>Reasonable</u>	<u>Good in EDP and user department</u>	
a) quantitative controls				
--in EDP department	Virtually nonexistent	Hard to tie back meaningfully to input controls	Tied back to input controls.	
--in user department	Virtually nonexistent.	Hard to tie back meaningfully to input controls.	Tied back to input controls.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

<u>SIGNIFICANT CHARACTERISTICS</u>	<u>INDICATIVE OF HIGH RISK</u>	<u>INDICATIVE OF MEDIUM RISK</u>	<u>INDICATIVE OF LOW RISK</u>	<u>INDEX TO COMMENTS</u>
b) qualitative controls	Documents and reports accepted virtually without review.	Sample documents and reports receive limited review.	Documents and reports tested in detail, in addition to receiving a "common sense" review of reasonable data limits.	
c) distribution controls	No routine report distribution procedures.	Routine procedures for distribution limited to list of users and frequency of report delivery.	Written procedures requiring that control log indicate receipt by user, time of accrual, accounting for each copy, etc.	
Online processing controls				
a) data transmission controls, including --error detection --error recovery --data security	The front-end control program does not validate operator identification codes or messages sequence number and does not send acknowledgement to origin.	The front-end control program checks terminal and operator identification codes and messages sequence number, sends acknowledgement to origin, and provides a transaction log.	The front-end control program validates terminal/operator identification codes plus transaction authorization codes and message sequence number and count, corrects errors, sends acknowledgement to origin, and provides log of transactions plus copies of updated master file records.	

Based on material provided by Price Waterhouse & Co., certified public accounts.

SIGNIFICANT CHARACTERISTICS	INDICATIVE OF HIGH RISK	INDICATIVE OF MEDIUM RISK	INDICATIVE OF LOW RISK	INDEX TO COMMENTS
b) data validation controls, including error detection and correction	Neither the front-end control nor the application processing program checks for authorization approval codes; no check digits are used with identification keys; there is little use of extensive data relationship tests; erroneous transactions are rejected without analysis or suspense entry.	The application program checks approval codes for key transaction types only, but check digits are not used with identification keys; extensive data relationship tests are used; erroneous transactions are sent back to terminal with a note, but no suspense entry is made.	The application program validates approval codes for all transactions, and check digits are used with identification keys; data relationship tests are used extensively; erroneous transactions are noted in error suspense file when sent back to terminal with note.	
c) data processing controls, including --error detection --transaction processing controls --master file processing controls --file recovery provisions	Application program produces a total number of transactions processed; no master file processing controls; file recovery provisions limited to periodic copy of master file.	Application program produces a summary record of all debit and credit transactions processed; no master file processing controls; file recovery provisions limited to transaction log and periodic copy of master file.	Stored validation range values are used to validate transaction fields; application program summarizes all transactions processed by type, with credit and debit values for each terminal, and uses a master file control trailer record that is balanced by program routine; end-of-processing file recovery provisions include transaction log of active master file records.	

Based on material provided by Price Waterhouse & Co., certified public accountants.

SECTION III

ANALYSIS OF DATA FLOWS THROUGH THE SYSTEM

GENERAL

The objective of this part of the audit is to identify control weaknesses and strengths. This audit segment will be the most time consuming; it is also the most crucial because it provides the direction for the remainder of the audit, which is geared to substantiate and determine the effect of control weaknesses. For payroll systems, GAO's Policy and Procedures Manual For Guidance of Federal Agencies, Titles II and VI, provide standards.

During this segment, the audit staff should develop a flow diagram of all information processed from source documents to final output reports. This process involves an evaluation of

- the quality of system documentation,
- the adequacy of manual and automated controls over documents,
- the effectiveness of processing by computer programs (i.e., whether the processing is necessary or redundant, whether the processing sequence is proper, etc.), and
- the usefulness of reports and records generated.

DEVELOPMENT OF DATA FLOW DIAGRAM

1. To develop the data flow diagram, the auditor should obtain copies of:
 - a. Narrative descriptions of all major application programs.
 - b. All manually prepared source documents that affect application processing, and corresponding coding sheets and instructions for transcribing data from source documents. (For payroll, obtain Notices of Personnel Actions, Bond Withholding Authorizations, Federal and State Tax Withholding Authorizations, Time and Attendance Records, etc.).
 - c. Record layouts for all major computer input and output records, computer master files, and work files (i.e., update or file maintenance tapes, computation tapes, etc.).
 - d. All major outputs produced by the automated system.
 - e. Lists of standard codes, constants, and tables used by the system.
2. Prepare the data flow diagram. The documents obtained above, along with the information developed in the background segment, should enable the audit staff to prepare a data flow diagram identifying

- a. point of origin--title or individual--for all source documents,
- b. all transfers of source documents from one person or office to another (make sure that all control points are identified),
- c. transcriptions of source documents into machine-readable format,
- d. computer processing of application data,
- e. all major outputs created from the source documents, and
- f. recipients of all essential outputs.

An example of a data flow diagram is included as exhibit 8. A detailed discussion of flow charting can be found in the National Bureau of Standard's "Flowchart Symbols and Their Usage in Information Processing", Federal Information Processing Standards Publication, FIPS PUB 24, June 1973.

EVALUATION OF QUALITY OF SYSTEM DOCUMENTATION

On the basis of answers to the questionnaire on system documentation in exhibit 4 and the degree of difficulty experienced in constructing the data flow diagram, the auditor should be able to comment on the quality of system documentation. There are two basic questions to answer:

1. Is the documentation accurate?
2. Is the documentation complete?

Documentation standards can be found in the National Bureau of Standard's "Guidelines for Documentation of Computer Programs and Automated Data Systems", Federal Information Processing Standards Publication, FIPS PUB 38, February 1976.

EVALUATION OF CONTROLS OVER DOCUMENTS

Control points identified during preparation of the data flow diagram, along with information on controls developed in the background segment, should enable the auditor to identify system controls. Determine whether the following controls are used:

1. Turnaround documents (transmittal documents should be returned to the originator to make sure that all documents were received and none added during transmittal).
2. Record counts (record counts should be maintained for all documents to make sure that none are added or lost).
3. Predetermined control totals (for payroll, predetermined control totals should be developed for important data, such as hours worked, leave taken, hourly rates, gross pay, and deductions, to make sure that records are not altered).

4. Run-to-run totals (these totals should be maintained to assure that no records are added or lost during the various computer processing steps).

A discussion of controls is included as appendix 1.

EVALUATION OF COMPUTER PROGRAM PROCESSING EFFECTIVENESS

The audit staff should identify any problem areas in the processing cycle, including, but not be limited to:

1. Redundant processing of data, or other forms of duplication.
2. Bottlenecks that delay processing.
3. Points in the operating cycle where clerks do not have enough time to review output reports and make corrections.

EVALUATION OF USEFULNESS OF REPORTS

The audit staff should review the key or major outputs (i.e., edit listings, error listings, control of hours listing, etc.) of the application system and determine if the outputs:

1. Are accurate.
2. Can be used as intended.

The auditor should confirm findings by interviewing the users of the output reports.

--Complete questionnaire on user satisfaction with output reports in exhibit 6B.

EXHIBIT 6B

USER SATISFACTION WITH COMPUTER-PRODUCED REPORTS

Report Identification

1. Report title _____
2. Data processing ID _____
3. Portion of report to be evaluated _____

4. Frequency of report _____
5. Number of copies _____
6. Number of pages (each copy) _____
7. Number of users _____

User Identification

1. Name _____
2. Title _____
3. Organization and symbol _____
4. Phone number _____
5. Extent of knowledge about report _____

User Evaluation of Report

1. Can the report be used as is without further correction, identification, or analysis?
___ Yes ___ No
2. The layout of the report is:
Very confusing Very well organized
1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10

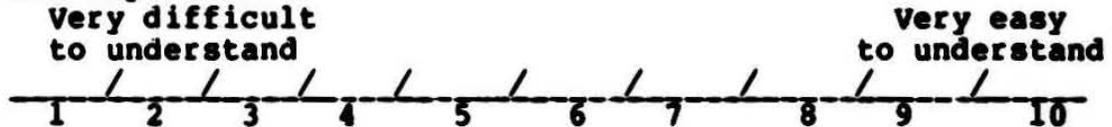
EXHIBIT 6B

3. Does the report duplicate any information you now receive?

Yes No

Comment. _____

4. The report contents are:



5. Does any portion of the report set apart from the rest of the report, or particularize within the report, those items that are beyond an acceptable range?

Yes No Not applicable

Comment. _____

6. State any additional comments on the adequacy of the form or layout of the computer-produced report.

7. Could you get the information in the report elsewhere?

yes no Where? _____

8. In your opinion, should the report:

- | | | |
|---------------------------------------|------------------------------|-----------------------------|
| --Provide more data? | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| --Provide less data? | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| --Be combined with other reports? | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| --Is any part of the report obsolete? | <input type="checkbox"/> yes | <input type="checkbox"/> no |
| --Briefly explain why for each "yes." | _____ | |

EXHIBIT 6B

9. Is the data reported:
- | | | |
|---------------------------|-----------|--------------|
| --accurate and reliable? | _____ yes | _____ no (a) |
| --complete? | _____ yes | _____ no (b) |
| --available early enough? | _____ yes | _____ no (c) |
| --current? | _____ yes | _____ no (d) |
| --useful? | _____ yes | _____ no |
| --understandable? | _____ yes | _____ no |

Please explain each "no" answer at (a), (b), (c), or (d), and obtain actual examples of the problems noted.

10. Do you maintain manual records to supplement computer-produced information? If you do, briefly explain why.

11. Can the report be improved to make your job easier?

_____ yes If yes, explain how. _____
_____ no _____
_____ unknown _____

12. Did you or your department participate in designing the report?

_____ yes _____ no _____ unknown

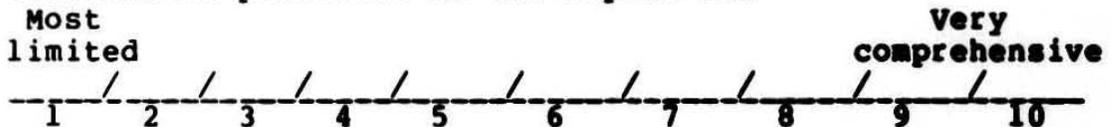
13. Are you currently planning to:

- Eliminate the report?
- Improve the report?
- Combine it with another report?
- Change its frequency?
- Other _____

14. Is the report for:

- Administrative control?
- Administrative planning?
- Information?
- External reporting?

15. With the primary function of the report in mind, the information presented on the report is:



Comment. _____

16. Do the report contents:

- a. Help you recognize problems quickly, or
 are other computations required?
- b. Allow you to measure actual progress vs. planned progress?
 yes no N/A

Please explain. _____

- c. Present information that signals you when to take preventive action?
 yes no

EXHIBIT 6B

17. In helping your agency perform its overall responsibility, the report is:

Not important at all Very important

1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10

Comment. _____

18. In the work of your office or division, the report is:

Not important at all Very important

1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10

Comment. _____

19. Is this report used in preparing:

_____ Financial statements?
_____ Cost statements?
_____ Budget statements?
_____ Variance analysis?
_____ Monthly operations report?
_____ Weekly operations report?
_____ Other? (explain) _____

20. Does this report save you any clerical effort?

_____ yes Explain. _____
_____ no _____

21. How often do you refer to this report?

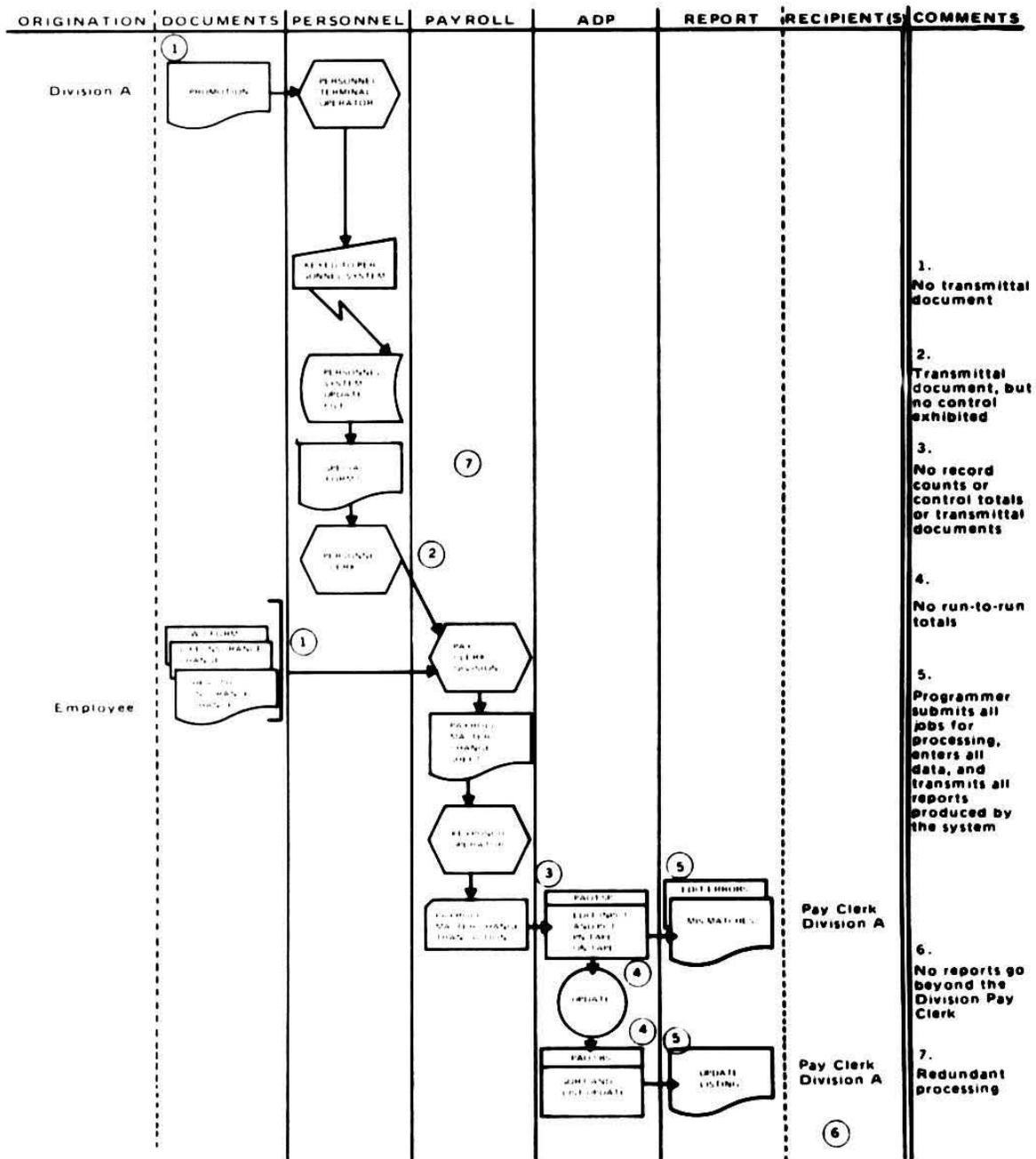
_____ hourly _____ annually
_____ daily _____ never
_____ weekly _____ other
_____ monthly

22. How long is the report kept after receipt?

_____ 1 day Filed at (location) _____
_____ 1 week _____
_____ 1 month _____
_____ 1 quarter _____
_____ 1 year _____

EXHIBIT 8

EXAMPLE OF A DATA FLOW DIAGRAM



SECTION IV
DETAILED CONFORMANCE TESTING

GENERAL

Conformance tests are used to validate the accuracy and reliability of agency computer produced data. The extent of testing is judgemental and depends on the auditors' previous review and evaluations of agency procedures and the network of internal controls. In an automated system, evidence or assurance that controls are functioning can be obtained in different ways. Several are discussed below.

EVALUATION OF A SAMPLE OF AGENCY RECORDS

A statistically valid sample of agency records should be taken and evaluated. GAO statisticians are available and should be contacted if needed to help design a valid plan. Evaluate the sample items to determine whether

- transactions were initiated in accordance with relevant laws and regulations,
- transactions were properly posted to all manual and automated records,
- reports accurately reflect the results of processing,
- reports contain useful, timely, and reliable information,
- and reports produced for external use are accurate.

The results of the sample will identify how many and what types of errors exist in the system, whether prescribed policies and procedures are being consistently followed, and whether

information reported is accurate. The results should also identify the types of tests to be used in test deck processing and errors to look for during data retrieval and analysis processing.

For example, when performing a payroll audit, the audit staff should select a sample from the universe of all employees who had payroll records maintained by the agency for the last complete year. Pay and leave administration standards and regulations are contained in the Civil Service Commission's Federal Personnel Manual (FPM). For selected employees, review pay and leave transactions for a full year to determine if

1. Correct earnings were paid based on the information recorded on time and attendance records (also verify that the person was entitled to that pay, i.e., was overtime authorized, etc.),
2. Correct amounts were deducted from regular earnings (verify that withholdings were made in accordance with the employee's withholding authorizations),
3. Correct year ending pay and leave totals were reflected in earnings statements,
4. Correct amounts of leave (taken and accrued) were posted to payroll records.

COMPUTERIZED DATA RETRIEVAL AND ANALYSIS
OF AGENCY RECORDS FOR A SELECTED PERIOD

In this segment the auditor should evaluate the effect of control deficiencies previously identified. A data retrieval and analysis package like Auditape and/or DYL-260 could be used to identify potential discrepancies. The auditor should:

- Identify what computerized data is available for analysis (this will be accomplished as a part of the previous data flow analysis).
- Determine the data retrieval/analysis applications to be performed.
- Decide on the computer system and retrieval package(s) to be used (Auditape and DYL-260 packages are available to each regional office and division through FGMS-TAG/ADP. Auditape is processed on both Honeywell and IBM computers. DYL-260 can only be processed on IBM computers, however, it can process any data which can be read by an IBM system giving it virtually unlimited usefulness).
- Arrange for the proper cycle or version of the files to be copied (the audit staff should request the data to be copied into the format which is the easiest to process on the computer system to be used).

- Request the following with the copied files
 - partial hexadecimal and graphic printouts or dumps of the data and header labels to verify that the data is as requested,
 - listing of the program which copied the files to verify that the proper files were copied, and
 - record counts of both the input and output files to verify that no data was lost.
- Prepare the specification sheets required for each data retrieval/analysis application.
- Transcribe the specification sheets onto cards.
- Process the data retrieval/analysis applications.
- Make a detailed examination of the information reported by each data retrieval/analysis application-- identifying the causes and effects of the potentially erroneous conditions.

As an example, the audit staff should consider making the following payroll audit tests.

1. Compare the personnel and payroll master files (use social security number) to identify duplicates within a file or mis-matches between the two files.
2. Compare individual employee records on the personnel master file with those on the payroll master file to identify non-matching

--grade/step,
--annual leave category,
--group health insurance coverage, and
--group life insurance coverage.

3. Search the payroll master file for invalid social security numbers. (To be valid, the first three digits must fall within 001-587 or 700-728.)
4. Compare salary rates recorded on the payroll master file with applicable salary tables. (FGMS-TAG/ADP has already developed salary tables for DYL-260 processing.)
5. Make the following comparisons of leave information recorded on the payroll master file:
 - service computation date to date file was created,
 - sick leave balances to maximum possible,
 - annual leave categories to number of years in federal service, and
 - annual leave category with 0, 4, 6, or 8.

EVALUATION OF DATA PROCESSING CENTER

The audit staff should make at least one unannounced visit to the data processing center to make sure that application processing conforms with information previously obtained. First-hand observation of processing also enables the audit staff to confirm the accuracy of system documentation and the auditor's understanding (or lack of understanding) of the system. The visit's major objectives are to evaluate the adequacy of

- housekeeping of the computer center (**General Services Administration's Federal Property Management Regulations, Title 41, Part 101-32**),
- physical protection of the computer center (**National Bureau of Standard's "Guidelines for Automatic Data Processing Physical Security and Risk Management", Federal Information Processing Standards Publication, FIPS PUB 31, June 1974, Section 5, and "Computer Security Guidelines for Implementing The Privacy Act of 1974", FIPS PUB 41, May 1975, Section 3**),
- organizational controls over computer processing (**FIPS PUB 31, Section 6.2**),
- controls to preclude unauthorized access to the computer, computer terminals, and computer programs and files. (**FIPS PUB 31, Sections 6.3-7.4 and FIPS PUB 41, Section 5**). Controls such as passwords or authorization codes are needed to protect against unauthorized use of the computer and terminals.
- information management controls for compliance with the Privacy Act of 1974 (**FIPS PUB 41, Section 4**).

Control problems in any of the above areas should be brought to the immediate attention of management for corrective action.

TEST DECKING THE SYSTEM

Test decking is designed to test the computer edits and computation routines. The audit staff, based on the informa-

tion developed through the previous audit segments, may develop test transactions (test decks) for processing through the agency's automated system. The test transactions determine what the data processing system would do with correct, incorrect, and/or invalid data processed according to existing procedures. The test deck should be processed during live application processing or during a special computer run using copied segments of the agency's actual master computer files.

Test deck design

To fully test the effectiveness of controls in computer programs, the test deck should include a wide range of valid and invalid input data. Transactions containing valid data are needed to test normal processing, while transactions containing invalid data are needed to test programmed controls. The testing of both error-free and erroneous data permits an extensive evaluation of computer programs.

The audit staff should process only one test transaction at a time against each master record. This procedure helps make sure that each test result can be attributed to a specific input transaction and it will not be influenced or "offset" by a second transaction processed against the same master record.

General types of conditions which should be tested

--Tests of normal transactions: To test the automated system's ability to accurately process valid data, the test deck should include transactions of the types that normally

occur in regular data processing operations. Provision should be made for testing both the process of adding new records to the master file and updating existing records.

For example, in a payroll, tests should include the calculation of regular pay, overtime pay, and other types of premium pay and should involve setting up master records for newly hired employees and updating existing master records for other employees. For specific payroll test transactions, see "Auditing Computers With A Test Deck (With Emphasis on Payroll Applications)," a separate booklet published by GAO in 1975.

--Tests using invalid data: Examples of tests for rejecting or "flagging" invalid data include:

- entering alphabetic characters when numeric characters are expected and vice versa,
- using invalid account or identification numbers,
- omitting data or using incomplete or extraneous data in a specific data field,
- entering negative amounts when only positive amounts are valid and vice versa,
- entering illogical conditions in data fields which logically should be related,
- entering a transaction code or amount that does not match the code or amount established by operating procedures or controlling tables. For example, if valid codes for employee status in a payroll system

are A, B, and C, something other than A, B, or C should be entered. Entering a salary amount which is not compatible with a controlling salary table is another example.

---entering transactions or conditions that will violate limits established by law or by standard operating procedures.

Steps to follow in using test decks

- (1) Determine the correct or expected end result for each test transaction for comparison with actual processing results,
- (2) Obtain copies of master records and print them out,
- (3) Determine which master records can be used for testing, and prepare simulated master records or transactions needed to perform the remaining tests,
- (4) Prepare the test transactions, using the same procedure normally employed by the agency,
- (5) Verify that the programs used for processing the test transactions are the same as those used for normal processing,
- (6) Ascertain that any changes to these programs during the period of the review have been documented and there is evidence the changes have been tested and approved by the agency. The audit staff should be alert to any indications that agency employees may have changed computer programs by removing fraudulent

- or irregular routines to prevent detection,
- (7) Arrange with data processing personnel for processing test transactions and producing normal output reports,
 - (8) Print out the contents of all master records used in the test and compare with the predetermined results, and
 - (9) Evaluate the weaknesses disclosed by the test deck with respect to the issuance of checks, accuracy of records, and validity of reports produced by the system.

CONTROLS AND STAFFING
FOR COMPUTER PROCESSING
OF FINANCIAL DATA 1/

A network of internal controls is established over automated systems. The same basic controls are generally used for all accounting applications--inventory, accounts payable, accounts receivable, cash, payroll, etc.

DOCUMENT CONTROLS

Controls help make sure that all documents are promptly received and introduced into the processing operations. Such controls include

- checking each batch of documents received against a list of document sources prepared by all points of origin,
- recording on each document the date and time received, to help identify the documents and insure prompt processing,
- assigning a sequential number to each document to insure that it goes into computer operations for processing,
- filing documents in a manner that will make it easy to find them after automated processing operations, and
- establishing record counts for all documents submitted for computer processing and returned afterwards.

PREDETERMINED CONTROLS TOTALS

Predetermined control totals are arithmetic totals, made before the data is introduced, that help make sure all data is actually processed correctly.

Corresponding totals are accumulated independently during data processing and compared with the predetermined control totals. If the totals are not equal, then some data was not processed or was processed incorrectly or data was added.

1/ A bibliography of suggested supplemental readings is included as appendix 3.

CONTROLS OVER COMPUTER PROGRAMS
AND COMPUTER RECORDS

A systematic procedure should be followed to insure that only authorized changes are made to computer programs. Computer program tapes or cards should normally be stored and controlled in a "tape library" and released only when needed for processing. Detailed computer program listings should be kept outside the computer room and unavailable to computer operators. Programers, systems analysts, or other individuals familiar with the programs should be forbidden to operate the computer. An ADP consultant to the court-appointed trustee for the Equity Funding fraud case said:

"There should be no programmer in the computer room with access to live data. You don't let the programmer operate the machine any more than you let the purchasing agent be in charge of accounts payable."

In a computer system using terminals, controls are normally established to limit access to computer terminals, system documentation, and computer files. Control can be achieved by

- locking computer terminal rooms after normal working hours,
- storing system documentation in a library for release to authorized personnel only,
- restricting access to user passwords or authorization codes needed to operate computer terminals, and
- separating the duties of designing, programing, and operating the system.

In computer systems that use terminals, special codes called passwords are assigned to individuals authorized to use the systems. These passwords are stored in the computer. To operate the system, the user must first enter his password via the computer terminal. If the computer cannot match the password to one in its file, it will not allow the user to operate the system. These passwords should be changed periodically to insure their integrity. As an additional safeguard, the computer terminal should not be permitted to print the passwords or if printed they should at least be obliterated by overprinting with other characters.

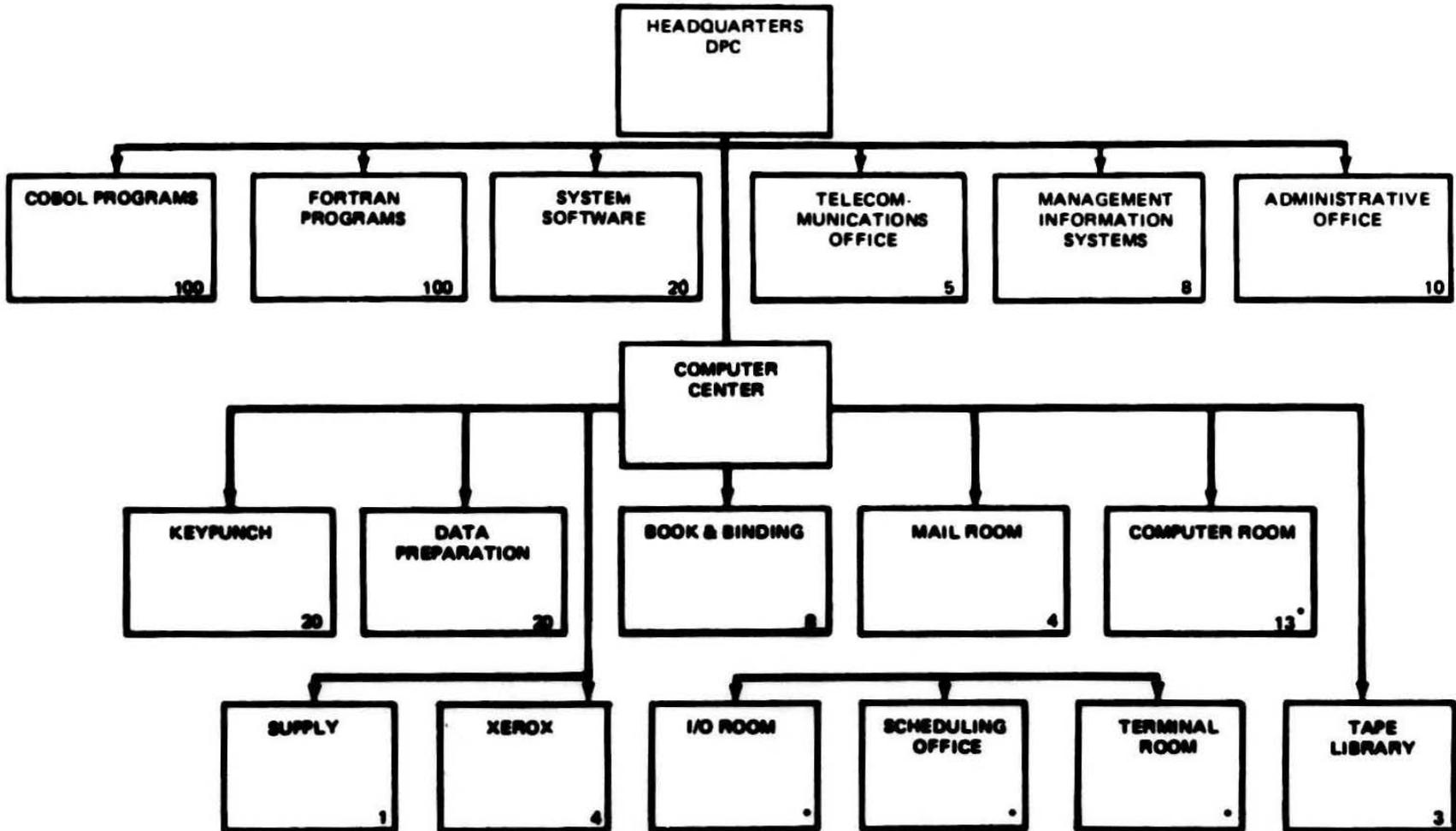
PROGRAMED CONTROLS

Programed controls represent checks incorporated in the computer instructions or programs. For example, the computer could be programed to detect missing or erroneous input or invalid transactions to help make sure that output data is accurate and reliable. Examples of programed controls include (1) predetermined limits, (2) accumulation and tests of zero balances, (3) checks on the sequence of records, (4) counts of records, (5) crossfoot balances, and (6) other tests of the validity of the data or the accuracy of processing.

CONTROLS OVER ACCESS TO
COMPUTER CENTER AND EQUIPMENT

The computer center and equipment should be restricted to authorized personnel. Locks, alarms, security guards, and authorization badges are several methods of restricting access. The computer terminal or remote job entry room should be secured when not in use. Restricting access reduces the chances of theft or sabotage and helps prevent entry of unauthorized transactions.

**EXAMPLE OF THE ORGANIZATION AND STAFFING
OF AN ADP DEPARTMENT**



**EQUIPMENT: 2 IBM SYSTEMS 370.
APPLICATIONS: 60-60 MAJOR SYSTEMS, 100 SMALL SYSTEMS.**

EXAMPLE OF THE MINIMUM
DAY-SHIFT STAFF IN THE
COMPUTER CENTER OF A
CIVILIAN FEDERAL AGENCY

MINIMUM COMPUTER ROOM STAFF
ON THE DAY SHIFT (8:00 a.m. to 4:00 p.m.)

Equipment that needs operator attention:

4 Online printers
16 Mountable magnetic disk packs
16 Magnetic tape drives
1 Computer console

37

Staff required - 1 individual
per 6 devices a/ 7

Tape librarian (brings magnetic tape to and from machine room)	1
Tape library clerks to inventory and clean tapes (note b)	2
Storeroom clerk (note b)	1
Electric accounting machine clerk	1
Input/output clerk	<u>1</u>
Minimum day-shift staff	<u>13</u>

a/ One clerk is needed for the computer console and six clerks are needed for the other devices.

b/ These clerks not needed on night shift.

Equipment: 1 IBM Systems 360/65.

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