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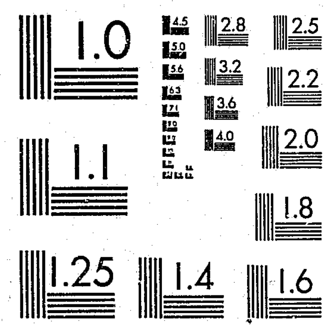

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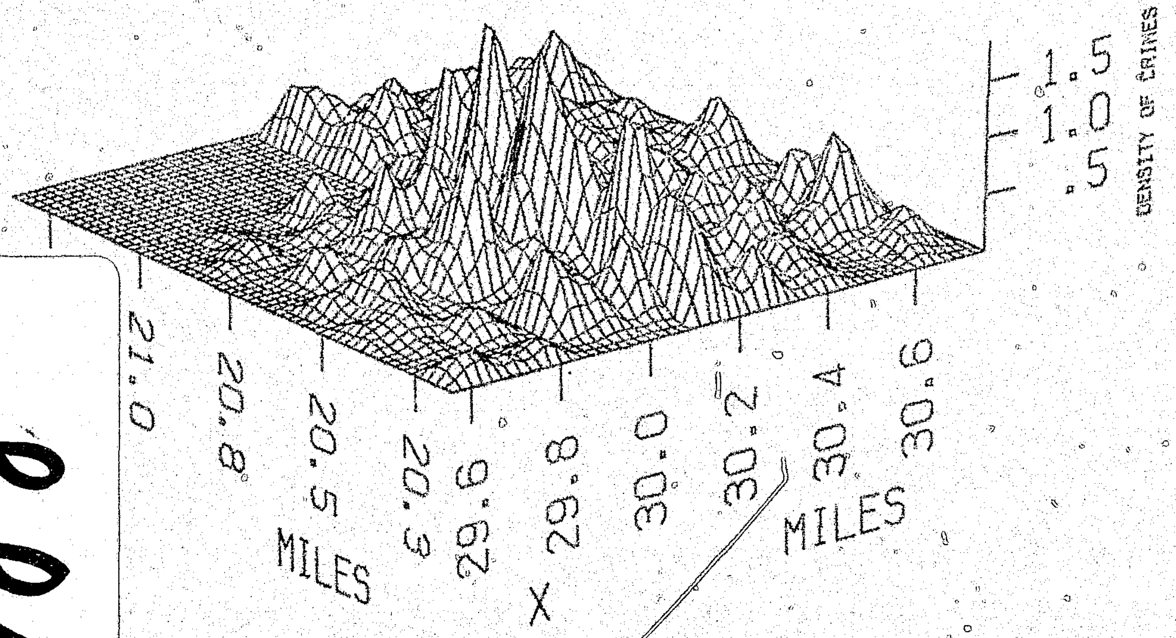
SYSTEM DEVELOPMENT GUIDELINES

An ICAP Manual



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June 1981

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DEVELOPMENT GUIDELINES

An ICAP Manual

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PREFACE

If you plan to develop a criminal justice information system, this Manual will to make your job easier. It unravels the maze of a seemingly complex process and will enable you to proceed directly toward the completion of simplified, sequential tasks. It identifies for you the steps that you will need to go through during this process and offers various suggestions about how to best accomplish these steps. Time-tested methods of system development have been translated into the law enforcement context and supplemented generously with technical guidelines and sample documents actually used in developing law enforcement systems.

Few undertakings rival the development of information systems for challenge, complexity, and opportunity. As administrators, you have the unique opportunity to direct a project which can improve information processing within your agency, increase staff productivity and, in many cases, benefit your colleagues across the nation. While it is a great deal of hard work, there is tremendous satisfaction in successful system implementation.

Computer technology is dynamic and the development of automated systems an ongoing process. Since total effectiveness or perfect efficiency can never be realized, it is essential to continually reevaluate departmental objectives to identify needs for improved service delivery. The dynamics of technology, and complicated local, state, and Federal guidelines require vigilance by the police practitioner. This Manual provides the most important information about all phases of the system development process and can be an invaluable resource to programs that will be involved in the development of systems.

System Development Guidelines: An ICAP Manual was developed by SEARCH Group's National Clearinghouse for Criminal Justice Information Systems as part of its role of providing technical assistance to ICAP projects across the nation. SEARCH Group, the National Consortium for Justice Information and Statistics, is a nonprofit corporation governed in the interest of the criminal justice community by appointees of the Governors of the states. SEARCH has been a pioneer in the exploration of computer technology for law enforcement, the courts, and corrections and is dedicated to the promotion of effective use of technology to benefit criminal justice.

This Manual was produced with the assistance of several people who deserve special recognition. Appreciation is extended to **Alvin Ash**, *Project Monitor, System Development Division*, and **Robert Heck**, *ICAP Program Manager, Office of Criminal Justice Programs, Law Enforcement Assistance Administration*, for their direction and support. Also, the following individuals participated in a working session with the National Clearinghouse and contributed greatly to the utility and quality of the final document:

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INTRODUCTION

The Integrated Criminal Apprehension Program (ICAP) is a structured approach to the management of police services. ICAP stresses the integration of all police service delivery functions and support activities. The backbone of the model is information. Since collection, collation, analysis, and dissemination of information provides the means by which all management decisions are made, more efficient handling of information increases the effectiveness of the police organization. Recognizing this, more law enforcement agencies than ever before are contemplating the development of systems, in one form or another.

The ICAP Manual provides basic information about all aspects of the system development process. It provides a step by step approach to the development of systems, in addition to valuable references and examples geared particularly to the police function. This information should go far toward helping to develop and implement efficient, model police/crime analysis programs.

The ICAP Manual stresses the necessity of planning. The successful development of an information system requires careful planning and much effort. A charted path with specific timeframes and management review at each major phase is essential for project success. The project plan should encompass time, budget, and personnel requirements as well as a time schedule and priority for all major tasks. While geared toward the automated system, the methodology presented in this Manual is equally applicable to the nonautomated operation. Hopefully, it will ease the process of system development, no matter what the environment.

For ease of use, *System Development Guidelines: An ICAP Manual* has been divided into three parts.

Part 1, "The System Development Process: A Conceptual Framework," provides a comprehensive description of the process of system development establishing the conceptual phases involved in establishing any law enforcement information system. It is written for the nontechnical audience unfamiliar with data processing.

Part 2, "Tools and Techniques," introduces supplementary material for individuals interested in specific systems analysis and design approaches. While not highly technical, Part 2 is designed primarily for the analyst responsible for project implementation. It references Part 1 to clarify context.

Part 3, "Appendicies," is the technical reference section of the Manual and may be useful during various phases of the system development effort. In addition to the presentation of technical guidelines such as security and privacy standards, Part 3 also provides sample documents that may be used as a model or guide during the contract process. This part of the Manual, like Part 2, was designed so that the reader may pick and choose among the materials needed for any particular development phase without first having to have read previous sections.

PART 1

THE SYSTEM DEVELOPMENT PROCESS:
A CONCEPTUAL FRAMEWORK

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This part of the Manual provides an introduction to, and a comprehensive description of, the process underlying the system development effort. It provides a conceptual framework for a system development project, yet is written for a nontechnical audience unfamiliar with data processing. In this part the reader is introduced to the six phases of system development:

- Project Planning
- System Investigation and Analysis
- System Design
- Procurement Cycle
- System Development
- System Implementation and Evaluation

The successful implementation of an information system requires careful planning. It is an interative process of reevaluating agency goals, objectives, and operating procedures. While many administrators assume that automation is the only way to increase the utilization of information, efficiency must be realized within the manual operations of the agency. The process presented in this part, while geared toward the automated system, is equally applicable to the nonautomated operation.

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Chapter 1

PROJECT PLANNING

1. THE IMPORTANCE OF PLANNING

Every systems project, regardless of its complexity, requires thorough and reasonable planning: "thorough" in that each project phase is analyzed in advance to estimate budget and manpower requirements; "reasonable" because the resource limits associated with each phase strike an accurate compromise between best and worst possible cases.

As Philip Metzger states in his highly regarded book, *Managing A Programming Project*,

> Too many programming projects are treated like mystery novels. You're left hanging by your fingernails down to the last climactic moment when it's suddenly clear which manager was the villain.

The reason for the suspense is not a mystery: poor planning takes its toll again. Project plans are not carefully developed much less adhered to; completion schedules are slipped by weeks or months; commitments made to users or administrators are neglected entirely or altered dramatically. Users' confidence in the planned system becomes tarnished, while administrative support of the project team erodes with every missed milestone. Meanwhile, the increasingly frantic project manager often attempts to find a miracle cure for the project, which usually compounds the problem.

In almost all cases, poor planning plays a significant role in the kinds of project complications and/or failures mentioned here. Once a project receives startup approval, everyone involved wants to see results. Programmers want to program, managers want to see deliverables. No one really wants to plan yet, in regard to system success, literally weeks could be well spent on planning, depending upon the size and scope of the project.

2. THE SCOPE OF PLANNING

The concept of scope is essential in planning a system development effort. The following is a broad outline of the phases which must be accounted for by the project manager in the planning process, and which should result in some of the documents listed after each phase.

2.1 Investigation and Analysis Phase

Chapter 2 describes the objectives and activities involved in the Investigation and Analysis Phase of a systems project. Problems are identified and analyzed thoroughly. Needs are measured, prioritized, and documented. Alternatives are examined. Without giving proper attention to this phase, which when combined with the design phase can amount to one-fourth or even one-third of the total project duration, a systems endeavor risks unpleasant future surprises. Requirements could change midstream, as could problem statements and preferred alternatives. Comprehensive analyses during the Investigation and Analysis Phase should result in the early avoidance of these pitfalls.

The following types of documents should be produced at the end of this phase:

- Problem statement
- Report to management detailing the alternative solutions and other findings of the study team
- Design overview - preliminary notes

2.2 Design Phase

Chapter 3 presents techniques and concepts for good system design. Based upon the thorough analysis completed in the Investigation and Analysis Phase, the proposed new system should be conceptualized in as much detail as possible. Input from users should be utilized to ensure that a proper focus on the problem statement has been maintained throughout the design process. The final design specifications produced at the end of this phase should be sufficiently detailed to enable the programmer to develop coding specifications and begin coding in the next phase. If a computer procurement is required, the design specifications produced in this phase can also be used in the development of the Request for Proposal (RFP).

The kinds of documents which would be produced during this phase might include:

- Final Project Plan
- Design specifications summary for management approval (minimum detail)
- Design specifications for user approval (moderate detail)
- Design specifications for programmers (maximum detail)
- Draft Request for Proposal

2.3 Procurement Cycle

The Procurement Phase is another critically important process. When executed correctly, the set of procedures described in Chapter IV will enable an agency to procure equipment which fully satisfies its current and future information requirements at the lowest possible price. Because this phase usually results in contractual obligations for both the agency and the vendor, special attention must be paid to any documents produced. Whenever possible, legal counsel should be obtained for this purpose.

The following documents will usually be produced during the procurement phase:

- Final Request for Proposal

- Proposal Evaluation Criteria
- Contract(s)

2.4 System Development Phase

At the beginning of the System Development Phase (see Chapter 5), the programmers will take the detailed systems design specifications and convert them into coding specifications. The difference between the two documents is important to note. Design specifications describe exactly **what** a system or an individual program should do; coding specifications describe **how** they do it.

Although they are commonly neglected because many programmers code directly from the design specifications, coding specifications serve several very important functions. First, they provide an excellent vehicle for review and analysis by the rest of the programming team to ensure that the baseline system design has been thoroughly understood and followed by programmers with unit or module responsibility. Second, they serve as a backup in case a programmer is replaced mid-program; it is easier for the new programmer to pick up the logic of a program from coding specifications than from the design specifications. Finally, the coding specifications are a vital part of the overall documentation plan, which will be discussed later in this chapter.

The programmer will take the coding specifications and translate them into computer instructions which will then be tested in accordance with a specified plan and corrected or "debugged" as necessary.

Documents which should be developed during the System Development Phase would include:

- System Design Specifications
- Coding Specifications
- System Test Plan draft

2.4.1 System Testing

Once the programmers have finished coding the system, the System Development Phase shifts into system testing. The system test is often neglected by the development team in their eagerness to deliver the system to prospective users. By this time the project may be behind its scheduled completion date; users and project managers alike are anxious to see the system in final operation. The system test is important for one primary reason: the system may still have "bugs". Programs which run correctly by themselves often fail or generate errors when linked to other programs.

During system testing, a team of analysts and programmers should test the system for every possible transaction and/or condition with a temporary test file of data closely simulating live data. Many potentially embarrassing oversights can be identified during this phase, as well as more serious errors which would drastically complicate acceptance testing, the next test cycle. Only after several error-free test runs, when the system test team is reasonably confident that they have corrected all the problems they encountered, should user participation in the acceptance test begin. In order to facilitate Acceptance Testing, the User Manual should be completed in draft form.

The conclusion of system testing should be marked by the completion of the following documents:

- User Manual drafts
- Acceptance test plan

2.4.2 Acceptance Testing

During acceptance testing, the users have the opportunity to test the system and confirm to their satisfaction that it does what the analysts, planners, and programmers say it does. If a comprehensive system test was completed, the majority of the errors should have been eliminated. Any remaining errors should be identified and corrected during acceptance testing. Acceptance testing should follow a predetermined schedule until the users are fully satisfied, ie., until they "accept" the system.

Any required changes to the system design are not automatically the responsibility of the programming team. The programmers have fulfilled their obligation by coding a system which meets the design specifications approved during the Design Phase by the users. If changes to the design are needed, as they invariably are, they must be fully documented and negotiated according to the provisions of the Change Plan, which will be discussed later in this chapter. At the conclusion of Acceptance Testing, required changes should be made to the Users Manual in preparation for system implementation and evaluation.

Documents produced at the end of acceptance testing will include:

- Final user's manual
- Final system documentation

2.5 System Implementation and Evaluation Phase

Chapter 6 discusses many of the technical and physical details which should be considered during the Implementation and Evaluation Phase. Conversion of old data files to new formats may be required. Parallel operations should be considered where the old manual procedures are maintained for a specified length of time until the new automated system gains user confidence and performance credibility. Immediate, total replacement is also an option, depending on the type of new system (e.g., Computer Assisted Dispatch) and/or the quality of backup procedures.

An evaluation of the systems project should be completed during this phase. The evaluation should include an analysis of the project from a scheduling standpoint, noting problem areas and unexpected situations which arose. This hindsight will prove invaluable to the next project team, which may be able to avoid the same problems. In addition, the system itself should be briefly and objectively evaluated, assessing performance standards and gauging the degree to which the conditions contributing to the original problem statement have been reduced or eliminated by the new system.

The System Implementation and Evaluation Phase will be completed when the following documents have been produced:

- Project History - chronological listing of milestone dates
- Project Evaluation
- System Evaluation

3. THE PROJECT PLAN

Perhaps the single most important effort to be undertaken during the life of a system development or transfer project is the creation of the Project Plan. Without a comprehensive plan, the most rudimentary systems project can dissolve into unforeseen chaos.

Why is a Project Plan important? Because without defining the scope of the undertaking, the project reverts back to the "mystery novel" syndrome mentioned at the beginning of this chapter. Without thinking about possible problem areas, every setback will appear to be a crisis instead of a workable deviation. And finally, without making a reasonable attempt at scheduling, prioritizing, and estimating, the success of the project depends on one of the most elusive and undependable forces in life: luck.

3.1 Developing a Project Plan

There is no correct or incorrect method of developing a Project Plan--the only important thing is that it must be a written document rather than a verbal understanding or informal set of notes. It should be physically durable; three-ring binders are excellent since they easily accommodate revisions. The plan need not be excessively long and it should never be confidential. Quite the contrary, every member of the project team should have a copy. The entire purpose of the plan is to demystify the system development process and to familiarize management and team members with objectives and expectations.

Creation of the Project Plan forces project managers to estimate time and budget requirements. It is important to note here that the plan should include not only those estimates, but equally as important, the assumptions on which estimates are based. The latter is critical for a meaningful plan. You may estimate six man-months for programming, based on the assumption that the programmer will be available to the project full time. If, in fact, he/she is only available half-time, your original estimate will require revision. Without documenting assumptions, those types of necessary changes could be overlooked resulting in acutely backlogged projects. One other situation makes the estimate assumptions invaluable: the project manager quits or is dismissed. Without knowing how milestone dates were developed, the replacement project manager will suffer a difficult learning phase, or worse, may make commitments based upon a misinterpretation of facts.

The Project Plan is not impervious to revision or modification. Just the opposite should be true: the plan should be altered every time a significant change occurs in assumptions or circumstances. It should be a dynamic, utilitarian document. Parts of it will never require alteration, such as the provisions described below for making design changes. Other sections, such as timing estimates and task assignments, may undergo at least one revision.

The sections listed below indicate the degree of detail which should be considered during the early project planning stages. Project managers should structure the Plan to fit the style of their organization as well as the scope of the system development, transfer, or modification effort.

3.2 Organizing the Plan

Each section of the Project Plan should be organized similarly, including a summary, a brief narrative discussion of relevant issues or considerations affecting that section, and a detailed subplan in outline or list format. Charts, graphs, and tables should be included at the back of each section. Sections of the plan might include:

- Overview
- Phase Plan
- Organization Plan
- Procurement Plan
- Test Plan
- Change Control Plan
- Documentation Plan
- Training Plan
- Milestone Review and Reporting Plan

3.2.1 Overview

The Plan Overview should assume that the reader knows nothing about the prospective system. This, in fact, may often be the case, since new additions to staff or even new management will require project briefing.

The Overview should introduce the reader to the general scope of the project, including any historical background which is relevant to the current undertaking. It should then describe for the reader the different sections of the plan which follow.

3.2.2 Phase Plan

This is probably the most difficult plan section to develop and the most conspicuous. If no other attempt is made at planning beyond a detailed Phase Plan, the project will still have a reasonable chance of smooth execution. In this section, every phase of the project is defined, estimated, and as closely scheduled as possible, following the phase guidelines described in Section 2 of this chapter.

The Phase Plan should be concluded with a milestones or Gantt chart which applies dates to the projected milestones and deliverables. This section should also include all assumptions influencing time and budget estimations. The need for a durable format and fluid approach will be reflected by this section since it will probably undergo the greatest number of revisions and alterations. In the absence of unforeseen disasters, however, most events influencing a project's natural life cycle can be reasonably estimated, thus limiting necessary revisions to a bare minimum.

Estimating is probably the area where a nondata processing manager faces the greatest obstacles. Without firsthand experience, the novice must rely on the estimates of lead analysts and senior programmers to whom estimating responsibilities have been delegated. A word of consolation: even the most proficient data processing professionals have not developed a sure-fire estimation formula or guaranteed technique. Every project and every system is different.

Generally, it is much easier to estimate a project once the basic Design Specifications are completed. Once the complexity of the planned system has been defined, the tasks required to accomplish the project objectives will become obvious. System functions will be individually listed and prioritized. Programs which support those functions will logically fall into related groups or sections. And finally, the routines and subroutines required in each of the programs can be identified. All of these quantifiable tasks should be identified for, or by, the Project Manager. From there, a rudimentary assignment of time values can be applied.

Opinions vary on the number of lines of code a programmer can produce per day. On the average, however, it has been estimated that over the life of a typical system development or transfer project, a programmer will complete 10-15 lines of fully tested and documented code per day. The projection of this figure over time for a complicated programming effort can appear staggering. Nevertheless, if in doubt when estimating the Programming Phase, remember Murphy's Law and Corollary ("Whatever can go wrong, will, at the worst possible time" and "Murphy was an optimist") and multiply the estimated time by two.

3.2.3 Operation Plan

Try to visualize the overall Project Plan as a set of transparent overlays, with each section adding to the framework established in the section before. In this context, the Operation Plan assigns staff resources to the tasks which were defined in the Phase Plan. These assignments can be general (by department) or highly specific (by employee). Regardless, this section is very useful because it identifies the inevitable shift in primary responsibilities as each project phase is initiated. When applied to the approximate dates selected in the Phase Plan, user departments as well as programming and computer operations personnel can prepare for heavy time/equipment commitments. Clerical support can also be scheduled for the production of final reports, RFP's, design specifications, etc.

3.2.4 Procurement Plan

In the event that computer or consultant procurements are required during the system project, this section should briefly outline relevant policies and/or special procedures to be followed. Generally, the procurement cycle will not be initiated until the system design specifications have been fully developed. (Refer to Chapter 4.)

3.2.5 Test Plan

This section of the Project Plan describes the different types of tests which will be applied during the project, e.g., unit testing, system testing, and acceptance testing. Notation should be made of any special equipment, forms, or personnel which will be required during each type of test. In addition, the minimum number of required error-free test cycles should be identified in the Test Plan. This point, if established clearly in advance, will combat pressure usually encountered by the Project Manager from users and administrators to accelerate the testing phases in order to gain lost time. Whenever possible, test plans should not be altered or condensed.

3.2.6 Change Control Plan

It is very common to encounter changes in the basic system design during the project effort. These changes, if frequent and extensive, will add extra weeks or months to the project, depending on the extent to which the original specifications have been programmed and tested. Inadequate Analysis and Design Phases are the most common causes of this debilitating project ailment. Some design changes, however, will be the result of new insight and will not only be necessary but highly beneficial. Regardless of their cause, design changes must all be handled according to a set of procedures identified in the Change Control Plan. Every project manager should consult with user representatives during the development of this subsection. Without becoming excessively complicated, the change control process should be clearly defined addressing specifically the following questions:

- How will change requests be submitted?
- Who will investigate change requests?
- What types of changes can be excluded from the review process?
- Who will review the results of change requests investigations?
- Where does the final responsibility for change approval rest?
- When does the user have the right to override change decisions?
- What priority should changes receive?
- How will changes be documented?

3.2.7 Documentation Plan

Documentation is without a doubt one of the least popular project tasks; some programmers maintain that the need for extensive system documentation is overrated. Do not believe the latter claim for a second. Comprehensive documentation is vital for the success of the project as well as for the eventual maintenance and modification of the installed system. The Documentation Plan will serve to clarify responsibility and deadlines for documentation products.

Documentation need not be an overwhelming final burden to system analysts or programmers. In fact, a project which is properly organized can almost be self documenting to some degree: design specifications form the basis for general system documentation, while coding specifications should contain the basic information required for program documentation.

Resist the temptation or the pressure to modify your Documentation Plan regardless of time delays, and never consider the system operational unless it is fully documented. Programmers who know the system inside and out can change jobs or retire. If the only documentation is inside their heads, subsequent program modification becomes a difficult task. In extreme cases, entire modules/programs could require recoding because the existing undocumented code might be undecipherable to a new programmer.

The federal government, recognizing the importance of documentation, developed Federal Information Processing Standards - Publication 38 (FIPS PUB-38) to clarify documentation considerations. A copy of FIPS-PUB 38 is included in Part 3 and should be utilized during the development of the Documentation Plan.

3.2.8 Training Program

The scope and degree of necessary training should be identified in the Project Plan for every major user or system support group. Field officers will require orientation to new forms, as will clerical and data entry personnel. Computer operations staff must also be considered in the Training Plan.

A thorough Training Plan will designate the responsibility for training and will also identify required materials, equipment, etc. One point which is often forgotten is that training establishes attitudes as well as new routines. Haphazard training will result in inadequate data, poor habits, and bad attitudes. Users at the lowest level of the organization are often key elements in system success and/or failure. This should be kept in mind during the development of the Training Plan.

Depending upon the extent and complexity of the system training required, training sessions should be conducted in hour increments over an extended period of one or two weeks. All day sessions are usually disruptive to normal departmental routines. Consult with user management to determine optimum training group sizes, class hours, days of the week, etc.

3.2.9 Milestone Review and Reporting Plan

This section of the Project Plan is critical for the assessment of project progress, and is especially vital to the inexperienced Project Manager. This is the only way he/she will be able to identify problems, pitfalls, and potential disasters. For that reason, the Milestone Review and Reporting Plan deserves strict attention. It is linked closely to the Phase Plan because of the deliverables identified and scheduled in that section.

It is important to refrain from making every task a milestone. Metzger advises:

> ...pick out those points in your schedule at which something truly significant should have been completed and at which some decision is to be made, e.g., continue, replan, get more resources. Further, base each milestone on something measurable, otherwise you won't know when you get there.

Types of poor milestones include percentage assessments: "Programming 25% completed." You have no way of foretelling the future, and problems could set programming behind several months. Identify milestones which signify the end of a single or set of related activities, such as "Coding Specifications Completed for Module X".

Determine a reporting schedule and stick to it. Weekly reports are the most common, and should probably be the smallest interval required. Anything less, such as daily reports, generate meaningless volumes of paper. Develop a reporting format and insist upon it from everyone submitting reports. Topics which should be considered in addition to standard items such as "Accomplishments" would be "Current Problems", "Issues", "Questions", or "Potential Problems."

The Project Manager must make a concerted effort to monitor all system events, both positive and negative; the Milestone and Reporting Plan can

facilitate this endeavor. Identify who reports to whom. Programmers typically report to their first-line supervisors, who will then condense the comments and report to the Project Manager. **Caution:** Beware of the Supervisor who buries a smoldering problem in the hope that it will correct itself. Periodically request to see all reports, including those from bottom level programmers, analysts, and user representatives. There is no more rude shock than discovering after receiving "On Schedule" reports for weeks that the milestone is actually three weeks behind.

4. CONCLUSION

The ease with which a systems project is conducted relates directly to the amount of effort devoted to planning. Every project will encounter delays and difficulties; comprehensive planning will eliminate careless blunders and minimize the impact of unavoidable problems. Furthermore, when planning steps are documented, the need for an "after the fact" reconstruction of project materials is greatly reduced.

Finally, every systems project is, to varying degrees, a journey into the unknown. Even the most experienced data processing professional cannot predict sudden changes in the law, in available staff resources, in agency objectives, or in public sentiment. Any one of those changes could significantly impact a development or transfer effort. With proper planning, however, even an administrator new to data processing can rely on established alternatives and guide the project to a successful conclusion.

Chapter 2

SYSTEM INVESTIGATION AND ANALYSIS

1. INTRODUCTION

Criminal justice administrators experience a wide range of problems with their records systems. These problems can often present the most potentially damaging situation that an administrator must confront. This is because the records function has far reaching impact throughout the entire agency and beyond--into associated criminal justice agencies at the local, state and, Federal levels.

Such problems as excessive field reporting time, record room backlogs, tardiness in filing required state and federal reports, deficiencies in report data capture, missing report copies, and lack of thorough, timely information for effective decision-making are common. They all can have a direct effect on police management as well as on citizens, investigators, prosecuting attorneys, court administrators, and data processing personnel.

The administrator must recognize complaints in these areas as symptoms of specific deficiencies somewhere in the overall system. Because of the penetrating effect of records system problems on the entire organization, such evidence must be traced to its real cause to permit initiation of suitable remedies.

Any examination of records system problems should be carried out in a two-phased approach. The first step is a preliminary investigation of how the present system is working, the nature of the problems being experienced, and the need for and cost of a more extensive analysis. The second step, if necessary, involves the planning and undertaking of a detailed system analysis. This chapter discusses these first two steps for a records system project. Since this Manual addresses agencies of various sizes and degrees of complexity, not all of the material contained herein will apply in all cases. However, agency administrators should follow the general approach detailed in this chapter whether their need is to correct deficiencies in an established system, design a new system, transfer an existing system, consolidate with other agencies, or prepare for future automation. This approach permits the correct identification of problem areas and establishes the foundation for appropriate future action. In this context, "system" refers to the functional workings of a department or agency, not necessarily computerization.

2. THE PRELIMINARY INVESTIGATION

While administrators can easily recognize the symptoms of records processing problems, they may have greater difficulty identifying the actual source of those problems. In order to establish a proper perspective, they must first determine exactly how their present system works. The preliminary investigation is designed to:

- Develop full understanding of the present records system

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- Identify the true nature of the problems

At the end of a preliminary investigation, administrators should be able to determine:

- Whether the symptoms they observed or the complaints they heard accurately reflect the system problems
- The amount of time and money required for a detailed system analysis
- The benefits which should accrue to their agency, associated criminal justice agencies, and to the public if identified problems are solved and the records system is improved

2.1 Initiating the Preliminary Investigation

The administrator can initiate the preliminary investigation by either assigning a staff member or by hiring an outside consultant to undertake this task. Regardless of who is chosen to do the work, the administrator should take three actions preceding any activity by the assigned investigator.

1. Give written notice to all personnel that the investigation is to take place. This memorandum should explain the purpose, scope, and the identity of the individual(s) chosen for the project. If an outside consultant is hired, that person should be provided with a letter of authority to conduct the investigation.

2. Solicit cooperation from all personnel. Publicize the project as much as possible. MAKE YOUR PURPOSE KNOWN. By informing everyone of what to expect and by "demystifying" the investigation, you do much to allay the fears of employees who may misjudge the intention of the project.

3. Select a due date for a written report and, if deemed appropriate, a formal oral presentation of the findings by the investigator.

2.2 Conducting the Preliminary Investigation

The assigned analyst, with the approval of the agency administration, should determine the scope of the preliminary investigation and the resources required to accomplish the objectives of this phase. Major steps in the preliminary investigation include:

- Determining how the system works
- Locating key problems
- Determining need and cost of a detailed system analysis
- Reporting to management

2.2.1 Determining How the System Works

The system should be examined by direct observation and by interviews with key personnel. Only the main information flow should be examined at this time; analysis of subroutines and minor deviations should be kept to a minimum. Interviewing should be limited to personnel at the supervisory or management level who are knowledgeable about the operation of their respective units and who are aware of intraagency system requirements.

2.2.2 Locating Key Problems

The preliminary examination will reveal major system problems and will identify those work stations, personnel assignments, procedures, and system deficiencies which contribute to the identified problems.

2.2.3 Determining Need and Cost of a Detailed System Analysis

The analyst must decide whether the problems uncovered during the preliminary examination warrant the expense of a more detailed study. Any recommendation to proceed with a further study should be accompanied by a cost estimate of the personnel, equipment, and time required for the task.

2.2.4 Reporting to Management

A written preliminary investigation report should be presented to the criminal justice agency administration by the due date agreed upon. This report should include:

- The scope of the investigation
- A listing of personnel interviewed
- A description of the system
- An identification of major problems
- A recommendation whether or not to proceed with a detailed system analysis
- A cost estimate (if needed) to proceed with a second investigative phase

2.3 Management Decisions Based on the Preliminary Investigation

The administrator must be able to answer a major question at the end of the preliminary investigation: are the problems which have been identified severe enough to justify the cost of an extensive analysis of the system? This judgement may be made solely by the administrator or with the help of key advisors.

While the decision can be made strictly on the basis of the investigator's written report, it is usually more helpful to request an oral presentation of the findings and recommendations. In this way, questions can be asked, ambiguities clarified, and further information obtained.

In weighing the investigator's recommendations, the administrator should consider several factors:

- Investigative bias - If the investigator was an agency employee, the recommendations may be affected by his/her prior assignments, past work experience, or loyalties to personnel working in affected subunits. If the investigation was done by an outside consultant, bias may be created by a desire for additional work.

- Cost of detailed system analysis - The investigator's estimate of costs for conducting a more detailed study should be carefully analyzed. The benefits of spending money for this project must be weighed against other essential agency budgeted costs.

- Expected results - The anticipated results of a more detailed system study should be carefully considered in light of long-range benefits to the agency, to the criminal justice structure of which the agency is a part, and to the public.

When making a decision, the administrator should resist the temptation to resolve the immediate problems uncovered in the preliminary investigation, a practice commonly known as the "fire-fighting" approach. Such a procedure results in a patched system that does not consider the relationship of the problem to the total system and its progressive effect on extended systems. If the problems are troublesome enough, if the cost of making a more thorough investigation can be absorbed, and if the expected results will be a smoothly functioning system, approval should be given to conduct the detailed System Analysis.

3. PLANNING THE SYSTEM ANALYSIS PHASE

The purpose of the system analysis is to determine the extent to which problems affect system objectives, and to identify all feasible solutions to those problems. The analysis will build and expand upon the work done in the preliminary investigation phase. A successful analysis will result in a management report that discusses alternative solutions and recommends the best. Steps in planning the system analysis phase include:

- Forming a user's group
- Stating the purpose of the analysis
- Selecting an analyst
- Publicizing the project
- Requiring a management report

3.1 Forming a User's Group

An advisory group of system users should be formed to assist the analyst in investigating the system and to provide guidance during the subsequent phases of system design, development, implementation, and evaluation. A well-balanced user's group would include representatives of each major department within an agency as well as individuals from related agencies which provide input to or receive output from the system. Group members should be chosen for their interest in and knowledge of system objectives, resources, problem areas, and constraints. They should be dynamic individuals as the user's group will carry the project through to fruition. Sufficient time should be allotted for user group members to attend meetings, conduct research, and write necessary reports.

The importance of a user's group should not be underestimated. Generally speaking, information systems can be "made or broken" at the user level. Users are responsible for the integrity of system input, for important clerical functions, and for the smooth, cooperative daily operation of any manual or automated system. They are also an invaluable source of information regarding potential errors, bottlenecks, and combinations of conditions which could impact many processing steps. Without their support, the system analyst loses a vital ally. Through the creation of a productive user's group, important contributions can be made to either the improvement or development of an information system.

3.2 Stating the Purpose of the Analysis

The first task of the user's group is to define the basic purpose and objectives of the system analysis. This is necessary to provide both a sense of direction and a basis for reviewing the progress of the undertaking. Since the analysis is built on the work accomplished in the preliminary investigation, the findings of that earlier study can be the basis for stating the problem areas which must be investigated in greater depth. Examples of overall objectives would be to identify ways to: reduce clerical costs by improving the methods of data acquisition and processing, simplify the report flow with a higher degree of accessibility, and permit more timely decision-making by mid-level and upper-level management.

3.3 Selecting an Analyst

The analyst may be the same person who conducted the preliminary investigation, or another agency employee or outside consultant. Besides a knowledge of criminal justice information systems, analysts should be chosen for their ability to work harmoniously with a user's group and current system employees, and their ability to develop ideas for future developmental efforts.

3.4 Publicizing the Project

Once the membership of the user's group and the selection of the analyst has been determined, efforts must be made to publicize the project and familiarize agency employees with the goals and objectives of the study. The same steps taken at the start of the preliminary investigation (Section 2.1) must be repeated for the system analysis phase. Again, it is very important to explain the purpose of the analysis activities to everyone. A greater number of individuals will be affected in some way by the system analysis phase, and by neutralizing imaginary threats or fears the analysis can proceed in a relaxed, supportive atmosphere.

3.5 Requiring a Management Report

At the beginning of the system analysis phase, a date should be selected for the completion of a written report to management. In addition to the written report, the analyst should be permitted to make a formal presentation summarizing the work accomplished, the findings, and recommendations.

4. CONDUCTING THE SYSTEM ANALYSIS

When preliminary planning for the system analysis has been completed, the analyst and the user's group should determine the major tasks required to accomplish the objectives of this phase. In addition, a workchart should be prepared to facilitate the assignment of individual tasks and identify appropriate milestones. Major steps in the systems analysis include:

- Defining system objectives
- Determining present system capabilities and resources
- Analyzing needs
- Determining resource requirements
- Assessing procurement options
- Determining the best system
- Reporting to management

4.1 Defining System Objectives

The major goal of a good information system is to provide useful information to legitimate users in a timely and efficient manner. When defining specific system objectives, consideration should be given to the following:

- Identification of all system users - Criminal justice information is used by various subdivisions within an agency, agency administrators, research personnel, and by related criminal justice agencies at the local, state and federal levels.
- Cataloguing user needs and the various ways they utilize the information - This assessment includes the use of data for operations, crime analysis, management, statistics, and research. The listing should trace only essential information; data which are considered "nice to know" should be excluded at this point.
- External constraints on the system - A determination must be made of the retention and purging requirements, privacy and security regulations, and other constraints related to interfacing with other systems.

4.2 Determining Present System Capabilities and Resources

Once user needs have been established and the external system constraints have been identified, it is necessary to determine the capability of the present system to deliver the type and quality of service required. System capabilities can be determined by:

- Interviews
- Questionnaires
- Observing the system
- Flowcharting
- Gathering sample forms
- Gathering all system directives

4.2.1 Interviews

While interviews during the preliminary investigation phase were conducted at the management and supervisory level, interviews must now be conducted at the clerical level with paper processors, coding clerks, data entry operators, and report distributors. The purpose of these interviews is to obtain detailed information about the operation of the system from the people who make it run. Interviews should be well planned and scheduled. Information from the interviews must be carefully recorded, collated, and analyzed. Key points for effective interviewing success can be found in Part 2 of this Manual.

4.2.2 Questionnaires

Questionnaires may also be used to obtain necessary information. Since many criminal justice personnel work night shifts and weekends, it may be necessary to obtain information by the questionnaire approach. One of the most important tasks involved in this method of information gathering is the identification of desired data and the resultant wording of questions. It is imperative to know exactly what kind of information is sought so that the questions will be precise and unambiguous. Guidelines for success in questionnaire development and administration can be found in Part 2, Interviews, of this Manual.

4.2.3 Observing the System

The best way of finding out how a system works is to see for yourself. The flow of paper from input to output should be traced and documented. By doing this the analyst can identify each step in the process and the cost of each function. This task will be more successful if the anlayst considers the following:

- Decide on your purpose - It is impossible to observe everything. The analyst must decide in advance which procedures and tasks to monitor and which to exclude. In this way, attention will not be diverted to those tasks and procedures which are not pertinent to the analysis.
- Select times for observing which will reflect typical staff behavior - For example, the work of a law enforcement communication section differs radically if viewed at 11 p.m. on Friday night or at 6 a.m. on Sunday morning.
- Ensure objectivity - Attempt to be objective, impartial, responsive to new ideas, and free of prejudice concerning the events and individuals to be observed.
- Be unobtrusive - The work of the system must go on without undue disruption from the analyst. Workers should not be constantly distracted by having to answer questions. Key points for success in the system observation task can be found in Part 2, Interviews, of this Manual.

While studying the information flow throughout the department, watch specifically for "bootleg" records or files which the staff have unofficially established for their own use. These bootleg records and files, as well as the information acquired from meetings or phone calls, are not part of the official paper flow, but they often tell much about the true informational needs and capabilities of the department. Some of these unrecorded communications are just unnecessary duplication caused by mistrust of the records system, and may indicate severe deficiencies in the present system. A thorough study can often reveal opportunities for simplification, combination or even elimination of information that is being collected.

It is important when identifying potential functional applications for any new system to focus attention on necessary activities rather than on the organizational sections in which they occur. This will foster the development of a system that can withstand future organizational changes, such as dissolution of departments, restructuring of divisions, or the creation of new organizational sections.

4.2.4 Flowcharting

When the analyst has developed sufficient information about the current system, a series of flowcharts should be drawn to pictorially represent it.

Such flowcharts show the sequence of operations within each department, the tasks performed at each work station, and the movement of documents between departments.

4.2.5 Gathering Sample Forms

Copies of all forms used in the system should be obtained, together with pertinent information regarding their utility. Most of these forms can be obtained from the individuals who explain the system to the analyst. However, the forms gathered in this manner should be checked with the person or unit charged with the forms control responsibility. In this way, special use forms, temporary forms, newly designed forms not yet in the system, and duplicate forms can be added to the collection. Additional information which should be collected about forms includes: number of copies made, usage, reorder points, existing stock, originating point, and distribution.

All of the documents and forms used by the agency should be evaluated in terms of their content and usefulness. This can be accomplished in part by identifying those data elements necessary for effective operational and management decision-making within any division. You may find that some forms contain too much or too little information, inappropriate information for that department's needs, or duplicate data which may already be available on some other form. Consolidating forms and structuring their flow can often save an untold number of personnel hours.

4.2.6 Gathering All System Directives

A copy of all directives or procedures governing the current system should be obtained. These include agency orders, department or unit directives, training procedures, and shift supervisor's memos. All directives which affect the system are of particular interest, including personnel orders, forms control procedures, and equipment operating instructions.

Directives and procedures should be analyzed to determine whether they address all aspects of the system, if there are any conflicting, overlapping, or ambiguous instructions, and whether they are currently applied. All deficiencies in this area should be noted and included in the final report.

In addition to identifying current system capabilities, it is also helpful to determine the limits of present resources. These resources consist of:

- Personnel - Identify current staff by job category and percentage of time committed to existing services. Also consider special interests of employees; for instance, those individuals who might be interested in computers.
- Equipment - Determine how each piece of equipment is being utilized and the potential of each. Pay particular attention to production peaks and valleys as well as total utilization. It might be that certain

equipment is only utilized sixty percent of the time per month, but it is used eighty percent the first two weeks and twenty percent the last two.

- Facilities - Evaluate present floor space, power and environmental capacities, and the extent to which they are currently being utilized. Also consider any upcoming changes or the potential to change any facility.

- Support Services - Identify the current requirements for warehousing, phone services, clerical services, and supplies.

4.3 Analyzing Needs

Once objectives have been clearly identified and current system capabilities and resources have been assessed, a determination of current and future needs can be made. By comparing system objectives and existing capabilities, the following determinations can be made:

- Which Existing Functions Could be Replaced - If the implementation of a desired objective would eliminate all or part of an existing procedure, there would be an increase in current capabilities in direct proportion to the displaced service. For example, automating the UCR report function obviates the need for manual daily tallies and monthly recaps, thereby saving considerable clerical time.

- Which Existing Functions Could be Modified - When an objective affects current services, it will most likely change current capability requirements in a given area. For example, a change from keypunching to direct entry of crime reporting information eliminates the interim coding step while increasing the validity of the information.

- How Existing Resources Can Best be Utilized - Once you have an adjusted picture of current capabilities, you can determine how existing resources can best be utilized and what additional resources if any are required to attain all of the stated objectives.

- Which Resource is the Major Constraint - To formulate an accurate picture of the resource requirements, it is important to determine which type of resource represents the major constraint for any given objective. The constraint could be lack of sufficient personnel, current equipment limitations, lack of specialized equipment, or the implementation of a higher priority objective.

There is an important point that should be kept in mind while conducting the needs analysis: the concept of convenience vs. input/storage cost. The need for any given piece of information should be weighed against the cost of input and storage of that information. For example, if the information is needed in only 1 out of every 5,000 cases, it is impractical and uneconomical to enter it in the computer; it can be accessed manually. However, if immediate access to the information is critical to the safety of an officer, the urgency of need outweighs the frequency of use.

Several tools can be used to clarify system needs. Two different types of needs assessment charts should be produced. The first is a priority listing of all proposed objectives. The relative importance of each objective can be illustrated by listing them in order of priority, from highest to lowest. The second chart is a listing of all proposed objectives by capabilities. The list starts with those objectives which can be accomplished with present resources, the remaining objectives are listed in order according to the degree of additional resources required for their attainment, from minimum to maximum. Both charts should be utilized: it is not advisable to analyze objectives which have been ranked in resource order without also considering what level of priority they assume within the system. In addition, these charts should include those mandatory objectives which have been mandated by law or other regulations.

The development of the charts aids in the formulation of a comprehensive picture of the needs assessment, and can then be used for intelligent decision-making regarding an agency's priorities and resources. They also contribute to the implementation of objectives in a logical and reasonable sequence.

4.4 Determining Resource Requirements

Each functional objective identified in the system analysis should now be analyzed to determine the required resources including both developmental and operational personnel, equipment, facilities or overhead, and supplies. Although there probably will be interrelationships between two or more objectives and/or existing applications, each may have its own resource requirements. Specific dollar costs will fall basically into two categories: variable costs and fixed costs. Variable costs tend to react proportionally to volume changes and therefore are affected most by such things as crime volume. Fixed costs tend to be more stable and will only respond to significant volume changes over a long period of time.

Variable costs to consider include:

- Clerks - The cost of clerks should be based on the total annual productive hours necessary per application times an average hourly rate (plus fringe benefits).

- Clerk Supervision - A supervisor's salary should be included if the workload requires more than three clerks.

- Forms and Documents - These costs should be figured for each specific application as well as the additional costs incurred for new objectives or modifications to current procedures.

- Data Storage - The costs to consider here could be either file cabinet space or the cost of computer storage space to maintain the information on-line.

- Computer Processing - In an automated environment, this would be the annual cost of time utilizing the computer's control processing unit. This could be broken down into the entering, updating, and accessing the information, plus the costs associated with report production.

Fixed costs to consider include:

- Administration - The management personnel time necessary to accomplish each objective. Also included would be the cost of specific operational personnel necessary for each task.
- Training - The cost of training staff on new procedures or forms. Often this will be necessary for many new applications and the costs of personnel time and training could be divided among them.
- Travel - Any trips necessary for the implementation or transfer of new applications need to be considered.
- Office Equipment and Supplies - The initial cost of supplies and all equipment for the implementation of any objective.
- Hardware/software - Any costs associated with the procurement of automated data processing equipment and applications.
- Terminals and Lines - Any costs associated with the installation and purchase/lease of terminals, printers, and/or communication lines should be accounted for by application.
- Contractual Expenses - Any costs associated with the system study, procedures analysis, software design or modification, system transfer, or forms design which will be a direct result of the implementation or change of any application or objective must be accounted for.

4.4.1 Ranking Objectives

Once the necessary resources have been identified, the objectives should then be ranked in order of priority determined by the agency's needs. These needs can fall into four basic categories:

- Required - Where Federal, state, or local regulations require a new service or a modification to an existing service. An example of this would be a mandated change in Uniform Crime Reporting.
- Critical - Where inadequate procedures or the lack of automation is a serious detriment to the efficient functioning of the agency. This could be a dispatch system that is unable to handle peak workloads.
- Significant - Where the development or modification of an application would produce a significant improvement in an agency's functional capabilities. Examples of this might be better management information or crime analysis data.
- Desirable - Where the availability of automation or modification of an existing service would result in an improvement, but lack of action would not seriously affect the agency's overall operation. This could be the implementation of micrographics or an evidence control application.

4.4.2 Costing Concepts

When determining resource requirements and analyzing current capabilities, there are three important costing concepts that must be considered. These are:

- Cost avoidance - Where a new application or system results in increased efficiency or productivity without an increase in personnel and/or equipment under the present system. For example, due to an increasing workload it might be necessary to hire one additional clerk with supporting desk, chair, typewriter, etc., for the present system. With a change in the present system, the additional clerk might no longer be necessary, thereby avoiding the associated costs.
- Cost displacement - Where a current expenditure for personnel, equipment or office space will no longer be required due to the implementation of a program or application. An example of this would be the automation of local criminal history information which could decrease the need for 10 filing cabinets, associated floor space, and clerical support.
- Added value or opportunity - Where a dollar value is placed on less tangible benefits normally associated with improvements in service delivery, planning, forecasting, crime analysis, or response to volume fluctuations which were the result of the implementation of a new application or procedure. An example of this would be increased crime analysis due to less indexing and filing time required, or 15-second access to investigative information as opposed to the previous 15-minute access time.

Often it will be very difficult to assign fixed dollar amounts to these costing concepts. Not only is it extremely hard to segregate jobs into specific application areas, but it is also difficult to attach a dollar value to either increased service delivery or any specified reduction in crime or caseload. In fact, there are so many social factors unrelated to the justice process which will contribute to variations in crime trends, that it is rarely possible to relate changes directly to a specific program. Regardless, an attempt to apply the concepts identified in this study may, at the very least, result in an improved decision-making process and should provide a better base for postimplementation evaluation.

4.5 Assessing Procurement Options

Once the needs assessment has been accomplished and the results analyzed, it is necessary to consider what equipment or services should be procured, when that procurement should take place, and the anticipated costs involved.

4.5.1 Purpose and Scope of Anticipated Procurement

The first step in assessing procurement alternatives is the identification of the purpose and scope of the undertaking. The following are examples of procurement intent:

- Nonautomated - The agency considering acquisition of data processing services for the first time will have the most difficulty in conducting a procurement assessment due to its lack of (in-house) expertise. It is strongly recommended that any agency considering automation for the first time utilize the services of both an advisory committee and consulting group. Generally an advisory committee can be formed in part from the user's group that has been overseeing the project from the beginning in addition to voluntary management or administrative personnel from automated businesses and agencies in the immediate area. Consulting services are available from a variety of private and public sources. While this may initially seem like an unnecessary expense, it will generally be a sound investment.

- Partially Automated - An agency may already be purchasing some automated services or may have special purpose equipment and is considering significant expansion of automated activities. While there may be more in-house resources available in this instance compared to the nonautomated situation, the same basic rules should be applied. Avoid the tendency to rely on a vendor sales representative because he seems to know what he is talking about. He probably does, but the best interests of the agency and the vendor could differ.

- Mode Conversion - An agency with an existing automated system may propose a reorientation of current processing methods and techniques, e.g., batch to on-line processing, in-house to remote data entry, traditional file structure to data base management. It is difficult for administrators and governing boards to evaluate the true intent and actual benefits of such a conversion. Is it being done because it is a new technique that represents a technical challenge? Is it something someone saw with impressive results (but in a different environment)? Will the results exceed the needs (in the context of cost-effectiveness)? Again, an advisory committee and/or consultant service should be utilized to assist in the evalution.

- Computer System Conversion - This is the need to completely replace an existing computer system with a different computer system. Generally, the reasons for a system conversion are: the existing hardware will not perform the necessary functions in the required time; the cost of the existing system exceeds the requirements of the agency; the mode conversion requires it; and, poor or outdated applications design and/or programming. Prior to approving the procurement of a different computing system, administrators and governing boards should make every attempt to assure themselves that the existing computer system is, in fact, the cause of the problems.

  Note: Computer system in this context refers to the mainframe and all attached devices which make up the hardware configuration, not applications it processes.

- Limitation Problem - In this case a new or revised application may require hardware the current system does not have, or the lack of adequate throughput may necessitate faster devices, more storage, etc. Generally, this is almost a purely technical problem and can be analyzed and evaluated through a study of performance characteristics.

4.5.2 Acquisition Period

Once all of the above factors have been considered, a decision must be made regarding the acquisition period. This is the period of time during which the procurement process will obligate the contracting agency. In most instances, this will correspond to the time frames identified in either the needs assessment or departmental long-range planning. Generally speaking, purchases of equipment will be for a period of five to seven years, lease or lease/purchase should cover three to five years, and any short-term rental would only be from thirty days to one year.

There are, however, a number of factors that can be considered when determining the optimum acquisition period:

- Current Procurement Obligations - If there is existing equipment which requires either augmentation or replacement, the procurement acquisition period should correspond to the end of the existing obligation.

- Comprehensive Systems Analysis - Even well-developed plans are subject to change and any long-term commitment must provide flexibility. Often it is less expensive to acquire equipment which may be augmented at a later date than it is to purchase equipment intended to cover all contingencies.

- Anticipated Implementation Period - The longer the implementation period the greater the possibility of change. It is generally more cost effective to limit the implementation period to the time required to satisfy current needs and planned enhancements rather than to maintain an open-ended period for the life of the installation.

- Legal, Fiscal, or Policy Constraints - Purchase, lease, or rent restrictions may override what might otherwise appear to be the most sound approach for determining the acquisition period.
- Significant Pattern Changes - Any long-term acquisition periods should be considered with caution when there is the potential of significant instability in either growth or decline patterns for your agency.

Careful consideration of each of the above points should indicate the optimum acquisition period for individual circumstances. For example, if the application is going to be an on-going, long range requirement, such as an automated master name index or a Uniform Crime Reporting capability, then a purchase or long-term lease/purchase may be the most cost-effective. However, if the application is going to be temporary or involve new technology, such as micrographic plotters where the value of the application is uncertain, a short-term agreement would be the better approach.

4.5.3 Consideration of Anticipated Costs

In planning a data processing operation, cost discussions and decisions typically focus on computer hardware. However, other considerations such as software, location, staff, and types of services to be provided must enter into the cost decision. Each data processing situation must be analyzed individually, inasmuch as every additional system function requires that certain resources be available to perform the desired service.

The purchase of **Dedicated Equipment** for an upgrade of the present system could require expenditures for the following:

- Central Processing Unit (CPU) - This may be a microcomputer, minicomputer, or large mainframe.
- All peripheral equipment - This includes card readers, line printers, CRT keyboard displays, modems, etc.
- Additional operating staff, including benefits - This includes personnel who will actually operate the system who were not needed in the present system.
- Operating systems - The software or utility programs which control the operation of the machine.
- Applications programs - Programs written to perform all of the functions necessary for the agency.
- Supplies - This includes printer paper, extra disk packs, punch cards, etc.

Costs for the purchase of dedicated equipment can be offset by:

- Sale or trade-in of present hardware.
- Current system maintenance costs - These include all present costs, in personnel and equipment, that will no longer be necessary under the new system.

When considering a **Shared System**, the following costs should be anticipated:

- Hardware upgrade and/or expansion - It is usually necessary to replace or upgrade present hardware to increase the capacity, speed, and operational ability of the system sufficiently to handle the proposed additional workload of the criminal justice agency.
- Peripheral and communications equipment - Additional peripheral equipment is needed because of the distance between the user and shared computer. Telephone lines, modems, and other communications equipment are needed.
- Operational costs of system on a cost-incurred basis - The greater the usage (on a transaction volume basis) of the system's application, the greater the cost to each user. If the criminal justice agency anticipates that there will be a high volume of transactions, it might be more cost-effective to purchase a dedicated system.
- Personnel (Programmers/Analysts/Operators) - Additional staff might be required to operate the system on a 24-hour/day, 7-day/week basis. This additional staff should be knowledgeable about criminal justice concerns to ensure that necessary priorities, schedules and confidentiality matters are properly addressed.

Costs involved in a shared system can be offset by:

- Sale or trade-in of the current computer mainframe.
- The purchase of staff services required to establish, maintain and operate a computer operation from an existing organization. This results in a cost savings for recruitment, hiring, and training of personnel.
- Specialized services and facilities could be available from a large center with staff experienced in telecommunications and applications programs. This specialization is obtained at a lower cost than if purchased separately.
- Current system maintenance costs including all present costs, in personnel and equipment, which will no longer be necessary under the shared system.
- Floor space requirements as floor space is saved when the hardware and personnel are located elsewhere.

The **Lease** of a computer would involve the following costs:

- Cost of lease. For comparison purposes, a rule of thumb often used in approximating annual rental is to take one-third of the purchase price.
- The same software, supplies, and personnel costs that are required for a purchased dedicated system.

Costs for the lease of a computer can be offset by including maintenance costs in the lease.

4.6 Determining the Best System

The analyst, with the assistance of the user's/advisory group, should now have sufficient information to determine the best system alternative. This determination should be based on:

- Reviewing system objectives and capabilities
- Determining the accuracy and completeness of the needs assessment
- Reducing all possible alternatives to a few of the best
- Evaluating economic and noneconomic factors

4.6.1 Reviewing System Objectives and Capabilities

Stated system objectives must be reviewed to establish the proper focus on principal issues and goals. In a similar manner, statements about system capabilities must be reviewed for clarity. It is important that the user's group participate in this task to ensure that objectives have been set for organizational units within the agency as well as for the agency itself.

4.6.2 Determining the Accuracy and Completeness of the Needs Assessment

The review of the needs assessment should permit the analyst to answer the question: What are the system deficiencies and constraints, (external and internal) which prevent the current system from providing useful information to legitimate users in a timely and efficient manner? If this question cannot be fully answered at this point, the need for additional analysis is indicated.

4.6.3 Reducing all Possible Alternatives to a Few of the Best

At this time, the analyst and the user's group should list all possible alternative solutions to the problem. From this list, alternatives should be reduced to approximately two or three of the best which are technically feasible and fiscally attractive. These are the alternatives which will be examined in detail and which form the basis for the recommendation of the best system.

4.6.4 Evaluating Economic and Noneconomic Factors

When comparing alternatives, various considerations must be weighed. These can be divided for ease of analysis into economic and noneconomic criteria.

Economic Criteria - The evaluation of each alternative should include some cost estimates for each segment of the process. These estimates will answer such questions as:

- Are the relative monetary costs high for the information received or work done?
- Are there more cost-effective ways of accomplishing the same objectives?
- What are the costs going to be for the accomplishment of any new objectives?
- What are the costs for report taking and paper processing?
- What are the costs in supplies?
- What are the costs in floor space for personnel, files, machinery?
- What are the costs for the hardware and software?

After all of the costs have been determined, comparative tables of cost factors should be prepared showing the requirements of each system for manpower, space, time, and equipment.

Noneconomic Criteria - Noneconomic criteria can be applied to the alternatives to judge comparative performance potentials and adherence to external and internal constraints. Comparative tables should be prepared showing the extent to which each system meets the noneconomic criteria.

- **Performance:**

  Will the system provide the informational requirements of all users?

  Can the distribution of reports be expanded?

  Are special reports any easier to produce?

  Is the response time satisfactory?

Are needs for long-range planning being met?

- **External Constraints:**

  Does the system meet necessary privacy and security regulations?

  Does the system meet all state requirements (if any) for forms design?

  Does the system meet required retention and purge requirements?

  Does the system meet requirements for state and federal reporting?

  Does the system meet requirements for interfacing with regional, state, or Federal systems?

- **Internal Constraints:**

  Do budgetary restrictions limit the availability of personnel and equipment to do the job?

  Are there any reorganization plans that will affect the system?

  Are there any planned moves to new or larger quarters that will affect the system?

  Are there any plans to consolidate services with other agencies?

  Are there any plans to transfer functions to other agencies?

4.6.5 Selecting the Best Alternative

The methods of evaluating the various alternatives can vary depending on the money and time available to accomplish the task. Sometimes a review of all documentation (especially the comparative tables) will make the best choice obvious. In other cases, additional work is required to make an intelligent decision. A rating scale for more accurately assessing each criterion can be prepared. These are useful for judging criteria that cannot be measured objectively but are rather matters of informed judgment. Such a scale can use ratings of 1 to 5, from "least favorable" to "most favorable". One method in which these scales can be used effectively requires each member of the user's group to rate the criteria privately and then discuss the ratings as a group until a consensus is reached.

4.7 Reporting to Management

A written system analysis report should be presented to the criminal justice agency administrator by the due date agreed upon. This report should include:

- The scope of the analysis
- A brief review of the preliminary investigation which preceded this analysis
- A discussion of the needs assessment
- The advantages and disadvantages of alternatives
- Recommendation of the best system
- A minority opinion if the recommendation does not reflect a group consensus
- A listing of all problems that a new information system will not correct, along with suggestions for further research into certain recommendations

The administrator must decide at the end of the system analysis phase whether to accept the recommendation to proceed with the design of a new or upgraded system. While the decision can be made solely on the basis of the analyst's written report, the complexity of the issues and the potential costs involved certainly justify an oral presentation by the analyst in the presence of the user's group. In this way, questions can be asked, ambiguities clarified, further information obtained, and any political considerations reviewed.

If the agency administrator agrees that system deficiencies are seriously hampering efforts to maintain a smoothly functioning information system and that funds can be obtained for the necessary corrective measures, approval should be given to continue to the next step--System Design.

Chapter 3

SYSTEM DESIGN

1. INTRODUCTION

Once the system analysis has been completed and the best possible alternative selected, the next logical phase in the system project is the **system design.** It will now be necessary to direct attention toward the redesign and improvement of the existing system procedures or the development of new ones. This applies equally well to manual systems or to automated ones, with the major difference being the degree of consideration required for machine as opposed to manual processing.

Systems design is the process of devising methods and/or procedures for the processing of data. This can seldom be accomplished without imagination, creativity, and the awareness of what can be done to improve existing procedures. The completed analyses should have identified problems and difficulties inherent in the current system. The analyst must now consider how the system can be improved, the informational needs of management and operations personnel, and the availability of hardware that might provide an effective solution to the problem. It is not only necessary for the analyst to design a system that will correct current problems, he/she must also provide additional information as previously outlined in the planned objectives of the agency.

There are essentially four fundamentals to practical systems design: a knowledge of computer hardware and programming systems; a knowledge of criminal justice systems and procedures; a knowledge of how problems in the same applications area have been solved elsewhere; and, a knowledge of how to perform the systems design process efficiently. This chapter will discuss these fundamentals as they apply to the major components of the systems design process.

1.1 System Output

The first step in the design process is the identification of desired output. Output is that portion of the system that satisfies the informational needs of the agency -- the reason for the system. It is practically impossible to design the inputs or the processing that will occur within a system without first identifying what the desired output will be. The output design must be considered both from the standpoint of what information will be produced from the system and what the format of that information will be.

1.2 System Input

After the type and format of the output has been determined, the next step is the design of the system input. Considerations during this step are: the devices and input media to be used; a further analysis of data requirements; analysis of available source documents and/or redesign of source documents; and, the design of input records.

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1.3 Files and Processing

After the inputs and outputs of the system have been designed, the analyst must decide on the best file structures and most efficient processing methods for the system. This takes into consideration how the files are to be stored (e.g., magnetic tape or disk) and the methods of accessing these files.

2. DESIGNING THE SYSTEM OUTPUT

During the system analysis phase the analyst should have identified the types of output produced by the existing system. It must be decided whether any changes, either in the form of new reports or in the redesign of existing reports, are necessary. Finally, the decision must be made as to whether or not the elimination of some of the reports or copies would significantly affect the efficiency of the system being designed. The following steps should be undertaken when designing the system output:

- Review the types of output media that may be useful or are available in the new system
- Define the output requirements for each application in the revised or proposed system
- Define the specific data element content of all output reports along with any other information that must be produced
- Design all necessary output documents
- Consider any special methods and techniques for the disposition and handling of the output

2.1 Types of Output Media Available

The outputs from a computer system typically include printed reports, punched cards, magnetic tape, magnetic disk, and video screens. The Output Design step entails the designing of the specific types of output that will best meet the informational needs of the agency.

Historically, the printed report has been the most commonly used type of output. However, with newer types of input/output capabilities available today, the analyst should consider the other output types in addition to printed reports. Some of these other output possibilities will be discussed below.

2.1.1 Computer Output Microfilm (COM)

For those large organizations with enormous numbers of files, microfilm technology has been a tremendous aid. This technology reduces images such as printed reports from 20 to 90 times. By outputting information from the computer to microfilm, you cannot only reduce the physical size of the files, it can be done faster. Typically, output on microfilm is 10 to 30 times faster than a common line printer printing at 600 to 1,100 lines per minute.

2.1.2 Cathode Ray Tube (CRT) Terminals

The CRT is rapidly becoming the most popular form of output utilized. It is a television-like terminal in which the computer outputs are in the form of numbers, letters, and in some cases, line drawings displayed on the screen. Typical CRT systems will display 24 lines of information with 80 characters per line or a maximum of 1,920 characters at any one time. Although many terminals today can have an attached printer similar to a typewriter that can reproduce screen images, CRT's are most commonly used in inquiry types of applications where information is to be looked at but a permanent hard copy is not required.

2.1.3 Plotters

Plotters have commonly been associated with scientific and mathematical applications but have recently been introduced to the criminal justice environment. They can be used to make special charts and graphs for administrators or plot activity by locations or density for operational decision-making. There are many different types of plotters available. A common system operates by moving a pen-type mechanism, under computer control, in increments of 1/100 inch. The plotting would occur at a speed of up to 16 inches per second.

2.1.4 High-Speed Line Printers

The most widely used output from most computer systems are printed reports. Reports are generally printed on high-speed printers which often print at speeds of up to 3,000 lines per minute. However, for most small to medium sized agencies, a printer capable of 120 to 480 characters per second would suffice and be much more cost effective. Printers provide the most flexibility (e.g., different character sets or multiple copies) and probably have the widest acceptance among administrators.

2.1.5 Other Output Mediums

Other types of output to be considered are: punched cards, punched paper tape, magnetic tape, and magnetic disk. Although these methods can be used as output, they are more often considered as either inputs for other functions or for the storing of data not directly referenced by the user.

2.2 Defining Output Requirements

The primary concern in defining the output requirements of any new system is the determination of what information is needed as output to meet the needs of the agency. Often, the present system is producing much of the required information, therefore, the analyst should review all the documents obtained and produced during the systems analysis phase of the study. It is important to note, however, that the analyst does not merely want to redesign the old output reports for production on the computer but should also be concerned with providing valuable new information and eliminating unneeded or unused reports.

While defining the output requirements of the system, the analyst should question each item of output information produced by the present system or proposed for the new system. One approach used involves asking the following questions of potential users:

- Is the output report actually required?
- Is there unused information in the report that could be deleted?
- Is some of the information in the report contained in other reports?
- How often does the report need to be produced?
- How many copies of the report are really necessary and are being used?

Remember that the analyst does not establish the information requirements of the agency. The analyst's task is to relate the informational needs to equipment capabilities in order to achieve a much higher level of efficiency.

2.3 Defining Report Content

Once the output requirements of the system have been defined, the analyst must then decide on the specific content of each report. Here it is important to use both the reports produced by the existing system and consultation with management and operations personnel who will be using the information.

2.4 Designing Output Reports

Once the required output has been determined and the specific content of each report identified, it is necessary to design the exact format of the report as it will be prepared by the computer.

2.5 Disposition of Output

The disposition of output reports will often be determined by need or frequency of use. For example, most reports will be on a specific timetable such as daily, weekly, or monthly. However, another type of report, "ad hoc" reports, are produced only when specifically requested. In many agencies, the ad hoc report has been the most cost effective output approach. It saves the cost of producing many reports with questionable useage. It also allows for only the printing of those reports actually needed and in the format in which the requestor wishes to see the information portrayed. These reports lead to better understanding and utilization of information and more efficient operations. The analyst must determine which types of reports are required for the system, where the reports will be sent, how many copies of the report will be needed, and what other types of information might be requested in the future.

3. DESIGN OF SYSTEM INPUT

Once the determination is made as to what output will be produced from a system, it must then be decided on what data will be necessary to generate the required output. Again, it is necessary to analyze current operations for the who, what, where, when, and how of data entry. Utilizing this information, the analyst can attempt to design more efficient and improved methods of data handling and input into the proposed system. Consideration must be given to data entering the system, any source documents used, and the length and size of data fields.

There are essentially six basic steps in the input design phase as follows:

- Understanding data entry devices
- Determining input data requirements
- Determining the source of the input data needed
- Designing the input formats and source documents
- Designing of the input records, fields, and coding
- Determining the specific methods of data entry to be used

3.1 Types of Input Equipment

Historically, the punched card has been the most widely used form of input for computer systems. However, during the past decade many new data entry devices have become available and should be reviewed before determining the type of media used for the system being designed. When designing any data processing system, the analyst must consider the method of data entry that will provide the most efficient method of input preparation, sorting, and processing of data.

3.1.1 Card Punches and Verifiers

Card punches, or more commonly called keypunches, are the oldest and still probably the most widely used method of preparing data for input to the computer. The basic operation of the keypunch is to record, in the form of punched holes on an 80 or 96 column card, data which could be processed by machines. It is necessary to ensure the accuracy of the punching; therefore, a verifier is commonly used. The major problem with this is that it essentially entails keying the same information twice; once to punch and once to verify.

3.1.2 Key-to-Tape Systems

A key-to-tape system allows the entry of data via a keypunch-type keyboard and stores it directly onto magnetic tape. Magnetic tape, similar to recording tape, is coated on one side with metallic oxide on which data can be recorded in the form of magnetic spots. Unlike the punched card capacity of 80 or 96 columns, with magnetic tape there is no requirement for the records to be any particular length. Usually up to 1,600 bits can be stored on one inch of magnetic tape and it can be read into the computer much faster than punched cards.

3.1.3 Key-to-Disk Systems

Key-to-disk systems, which are also called "shared processor systems," provide the power of a minicomputer to format screens, edit data, set up file structures, sort indexes, and allow multiple data entry stations to input data simultaneously. The disk-based system can be interfaced directly to larger computer systems through data communications equipment, or the disk may be physically removed and used as input.

3.1.4 Terminals

With increasing frequency, agencies are beginning to utilize Cathode Ray Tube (CRT) terminals for remote entry of input data and the transmission of data to the computer. In many cases, the CRT's may have the capability of performing some processing internally, such as editing and validating data. This terminal "intelligence" relieves the main computer of some of the necessary steps in preparing the input data for processing.

3.2 Determining the Input Data Requirements

By defining the input requirements, the analyst is simply defining the data that are needed as input to the system to generate the required output. As part of the design of system output, the system was broken down into the names of the fields in any record, a description of the fields, and the number of characters in each of the fields. These concepts will be discussed further in section 4. However, it is important to point out that the analyst must ensure that essential data needed to produce the outputs are identified for input.

3.3 Determining the Source of Data Needed for Input

Once the input data requirements have been identified, the next task is to determine the source of the data needed. Data may originate primarily from four basic sources.

3.3.1 Data Originating from a Single Document

This is the easiest input design task the analyst will face. This occurs when all the data for an output report originate from a single source document. It is only necessary for the analyst to note what the source of the data is and how it will be used during the programming phase.

3.3.2 Data Originating in or Calculated by the Program

On many reports the data that appear could originate from source documents, constants within the program, or program calculations made as the input data were processed. The analyst has now begun to define some programming specifications needed in later phases of the development cycle.

3.3.3 Data Extracted from Several Sources

In some cases, the necessary data elements needed to produce an output must be extracted from either more than one source document, or from a source document and a separate file. In the latter case, the analyst is faced not only with the task of designing the input record and master file record, but must also design some method of integrating the two.

3.3.4 Data Originating from Tables

The use of tables often simplifies the input design process by eliminating the need for multiple input files. A table is simply a list of the variables for any given field. For example, an employee number could be used as input to the system instead of keying in the entire name. Then, when the output information is developed, a table of employees could be accessed, the number matched to a name, and the output report developed with the named employee for better understanding and ease of use. Tables can provide a means of condensing the data for input records and can be stored either as part of the computer program or on an external storage device and referenced as required.

3.4 Determining the Method of Data Entry

The method of data entry must be given serious consideration since once the input records are designed and the method of entry selected any future changes could be very costly. The analyst should decide on what type of data entry equipment will most efficiently handle the preparation of input and will often be limited by present capabilities such as batch processing. However, consideration of the following questions should be given when designing a new system:

- How are the data to enter the system?
- Is it possible to capture data at their source without excessive errors?

- What is the volume of input data that will be processed?
- Is this volume consistent or does it peak often?
- Is remote data entry needed or will batch processing suffice?
- How often do the data need to be processed?
- How current do the requested output reports need to be?

3.5 Designing the Input Data Format

This design step is one of the most important because the analyst is not only concerned with the design of each individual input record, but also any necessary redesign of existing source documents. The task of entering data from a source document to an input record is usually a manual process. Therefore, every consideration must be given to the simplification of the procedures which could lead to faster and more accurate operations.

Another consideration at this point is how the data are to be recorded on the source document and who will be doing the recording. It is imperative in source document design to ensure that all individuals filling out the form will do it in an identical way.

3.6 Design of Input Records

The design of the input records will usually be done at the same time as the design of the source documents. This is because the positioning of the fields in the input record will usually be decided by the source document design. If "on-line" data entry is utilized, however, input record positioning can be altered to suit your needs.

3.6.1 Record Length

In some cases the record length will be dictated by the physical characteristics of the input media. For example, punched cards have a maximum physical record length of either 80 or 96 characters, whereas magnetic tape or disk usually has no restriction on input record length. When a restricted record length is used it is possible that more than one physical record will be needed to form one logical record. However, when this occurs, a control field, such as employee number, must be on each physical record to be able to tie all of the physical records together forming one logical record. It is also desirable for this control field to be in the same place on every physical record.

3.6.2 Size of Fields

The size of any field on a record is the maximum number of characters that will be required for that field. This is best developed by reviewing historical records and other documents. Keep in mind that changing a field size later may be very expensive in reprogramming costs.

3.6.3 Coding of Input Data

A code is a brief label, either numbers or letters, used to identify an item of data. The advantage of codes is that they reduce the number of characters required on an input record and hence, the total storage capacity. Through programming, a table of codes may be referenced and the descriptive English name printed on output reports negating the need for users to decipher the codes. Good coding systems should have the following basic characteristics:

- The code should be as concise as possible
- The coding structure should be expandable
- The code developed should lend itself to sorting
- The coding structure should be simple to apply and use
- The coding structure should be as comprehensive as possible.

Coding should be approached as a conscious decision on the part of the analyst. It can be a time consuming effort frequently subject to errors and misunderstanding unless the coding can be structured and integrated into the system properly.

4. DESIGN AND PROCESSING OF SYSTEM FILES

After the input/output requirements have been determined, the last remaining major step is the design of the method by which the inputs will be processed to produce the required outputs. This step in the design phase can be broken down into two major portions. First, the analyst must define the characteristics of the files to be processed, and then define exactly how each of the files will be handled.

A file is simply a group of related records, e.g., crime or arrest reports. Although there are many different types of records, files can be broken down into two basic types: master files and transaction files. **Master files** contain the information that reflect the current status of the system. They will be periodically updated by **transaction files** which reflect the day-to-day activities of an agency. Processing transaction files against the master file will add to, delete from, or modify master file records resulting in a new, updated master file.

The design of system files and processing will cover essentially four distinct areas:

- File organization and retrieval
- Methods of file storage
- File design criteria
- System processing

4.1 Methods of File Storage

The best method of file storage would be in the central memory of the computer. This would allow immediate and direct access to any record in any file. However, primary storage of this type would be far too expensive for the permanent storage of files. Therefore, the analyst must consider alternate methods of record and file storage.

4.1.1 Punched Card Files

As previously mentioned in section 3.1.1, as an input and file storage device, the punched card was one of the earliest methods utilized with data processing equipment. It is still used to a large extent; however, when compared to newer technology it has many drawbacks, such as space required for card storage and equipment necessary to punch, sort, and translate cards.

4.1.2 Magnetic Tape Files

The need for more efficient methods of processing data has become evident as the growing volume of records and files to be processed becomes larger. The major appeal of magnetic tape is the fact that there are no restrictions on the length of physical or logical records. Most magnetic tape units can read or write data at a density of 800, 1,600, 3,200, even up to 9,600 bytes per inch and the information can be read into a computer system very rapidly.

4.1.3 Magnetic Disk Systems

There has been a growing need among criminal justice agencies to gain direct access to daily operational data. This has led to the increased use of magnetic disk systems as they are used in applications that require inquiry into files or where random access or retrieval of data is desired.

4.2 File Organization and Retrieval

In addition to being aware of the various types of storage devices available, the analyst must also be concerned with the different types of file organizations that can be utilized with the system. The three types that are most widely used are sequential, direct, and indexed sequential file organization methods.

4.2.1 Sequential File Organization

Sequential file organization is perhaps the most commonly used method today. The records are stored in sequence usually based on some type of **key.** A key is a data field located within each record, such as a suspect's name or number, which can be used to establish a sequence or order to the entire file of records. Sequential files can be stored on any type of storage medium previously discussed. Sequential files are most applicable in those cases where a master file is to be updated frequently and against which there are many transactions processed.

4.2.2 Direct File Organization

Files utilizing the direct file organization method can only be created on direct access storage devices because they need a "random access" feature. This allows the processing of any one record without the necessity of processing all of the records. Direct file organization is used primarily with on-line systems as it provides the fastest form of retrieval and does not require records to be in any sequence for loading or updating of the file.

4.2.3 Indexed Sequential File Organization

This type of file organization provides for both random and sequential processing. This is available through the use of an **index** to point to records stored on the file. An index is a pointer used by the access method to go to a specific disk location. From there, the records are read sequentially through the end of the group containing the same index.

4.3 File Design Criteria

When the analyst is determining the type of files to be designed he must first consider the type of hardware or media that should be used and second, the type of file organization that should be used. A few other relevant factors that must also be considered are discussed below.

4.3.1 File Accessibility

It is very important to consider the type of access the user will need in comparison to the information in the file. The two types of processing systems in use that will determine accessibility are batch processing and on-line processing. **Batch** processing is usually the least expensive and sequentially executes selection criteria against the master file. This type of processing is normally used for the formulation of weekly or monthly reports. **On-line** refers to the processing of individual records or transactions at the time the transaction occurs. These types of systems allow inquiry capability into the master file for the purpose of examining its contents.

4.3.2 File Activity

File activity refers to the number of transactions processed against a master file in any specified period of time. In batch processing, high activity files should be sequential files for better efficiency; however, low activity files should use another method to save the time of processing the entire master file for relatively few transactions. In an on-line environment, rapid access and fast processing is the most important consideration of the system and therefore would use either a direct file or index-sequential organization method.

4.3.3 File Capacity

This refers to the maximum capacity of the files that will exist on the system. While there are relatively few physical size limitations on magnetic tape or disk files, it would be impractical to keep very large files on punched cards. For example, if an organization had a file of 100,000 records on punched cards, the stack of cards would be 50 feet tall, yet only a matter of inches on wound magnetic tape.

4.3.4 File Processing Speed

File processing speed refers to the speed the file can be processed into and out of computer memory. Again, punched cards are the slowest form and direct access (Disk Storage) the fastest form of file processing. File processing speed must also be related to the type of processing, either batch or on-line, and to the file activity.

4.3.5 File Costs

There are many cost factors related to file structure which include: the cost of the storage device; the cost of processing the data (slower processing costs more in computer time); the cost of storing the cards, tapes, and disks; and, the cost of backup and reruns due to the unreliability of some of the forms of file storage.

4.4 System Processing

Up to this point, the discussion has focused on the design of the systems outputs, inputs, reports, and files. The analyst must now determine how the system will operate to produce all the desired results.

The basic tool used by the analyst to design the processing is the flowchart. Once the system flowcharts are completed they should show all of the program modules, their interrelationships, and identify each file and report. This will provide management with a means of reviewing the plans for the entire system.

Although the reader may reference Appendix 3, it is beyond the scope of this Manual to teach flowcharting and all the techniques involved. Therefore, this section will concentrate on providing the reader with a brief overview of the four basic processing steps. These steps are:

- Editing
- Sorting
- Updating
- Reporting

4.4.1 Editing Process

The edit process consists of reading input data into the system and performing some type of checking routines to ensure the validity of the data. In a batch mode, an edit run is performed and a list of the records (usually rejected) which contain errors is printed. In an on-line system, editing takes place while the data are being entered and the system will not accept the record until it has been corrected.

4.4.2 Sorting Process

Sorting is the process of placing the input data in some type of sequence before the update takes place. The analyst need only identify the files to be sorted and the sort sequence as there are usually utility sort programs available with a vendor's operating system.

4.4.3 Update Process

The update process consists of making additions, deletions, and modifications to records within the master file. This holds true for all update routines; however, the specifics of each type of processing should be considered separately for any variations in the routine.

4.4.4 Reporting Process

The reporting process is nonstandard as each different type of system requires its own type of reports. The requirements of the system under design should have been determined under the section on output design and should be related to the specific hardware available.

There are many other system processing concepts that an analyst has to consider in the design of a system. Many of them are only relevant to the specific hardware and software capabilities of the agency. However, the final consideration in the area of processing deals with both the backup of system files and the retention of data within the files. There are many requirements, not only at the local level but also at the state and Federal levels, which could affect the retention of data. The analyst must be aware of these issues along with the need for duplicating files to guard against loss.

Chapter 4

PROCUREMENT CYCLE

1. INTRODUCTION

Assuming that the project planning, system analysis and investigation, and system design activities mentioned in preceding chapters indicate a need to procure computer hardware/software, the procurement cycle now begins. If the prior studies and resultant documentation were properly completed, a great deal of the basic procurement documentation will already be near final condition.

Procurement demands a complete requirements package detailing exactly what you want to purchase; the earlier analyses should have thoroughly documented this. The procurement cycle melds these requirements with the necessary procurement and legal procedures to effect a procurement that satisfies all needs.

The procurement cycle is lengthy--start to completion could easily take six to twelve months, or longer. The cycle includes preparation of a Request for Proposal (RFP) or an Invitation for Bid (IFB), advertisement for or selection of prospective bidders, adequate time for vendors to prepare their responses, analysis of bid prices, evaluation and final selection of vendor proposals, and the award of the contract. The figure on the following page displays the Procurement Cycle. Each of these segments require a great deal of time and thorough preparation. Actual delivery of the hardware/software, after contract approval, could add at least three to six additional months to the procurement cycle.

The procurement time cycle is not an easy one to predict. Many variables enter into the total time determination. If you are starting from ground zero with no prior experience in procuring computer hardware/software, and the proposed system is a complex one which has not been installed anywhere else, you can expect the cycle to take a minimum of 12 months. However, if you are transferring a fully operational system from another agency, and require only minor modifications, your procurement cycle time could be greatly reduced by utilizing the donor agency's documentation, such as RFP, contract, etc., as a guide. This is why transfer is highly recommended. It saves time and money not only in the initial design phase, but also in the final procurement cycle.

2. COMPETITIVE PROCUREMENT

In general, Federal, state, and local ordinances require that all procurements be accomplished on a competitive basis. Under certain conditions, exceptions to this may be allowed. For example, in rare circumstances it is possible to justify "sole source" procurement on the basis that there is only one responsible vendor whose equipment will perform the required functions within the dictated time frame. Justification for sole source procurements should be carefully analyzed and documented to avoid the risk of subsequent protests and possible nullification of contracts. The agency's legal counsel should be consulted on the correct procedure for all such procurements and the

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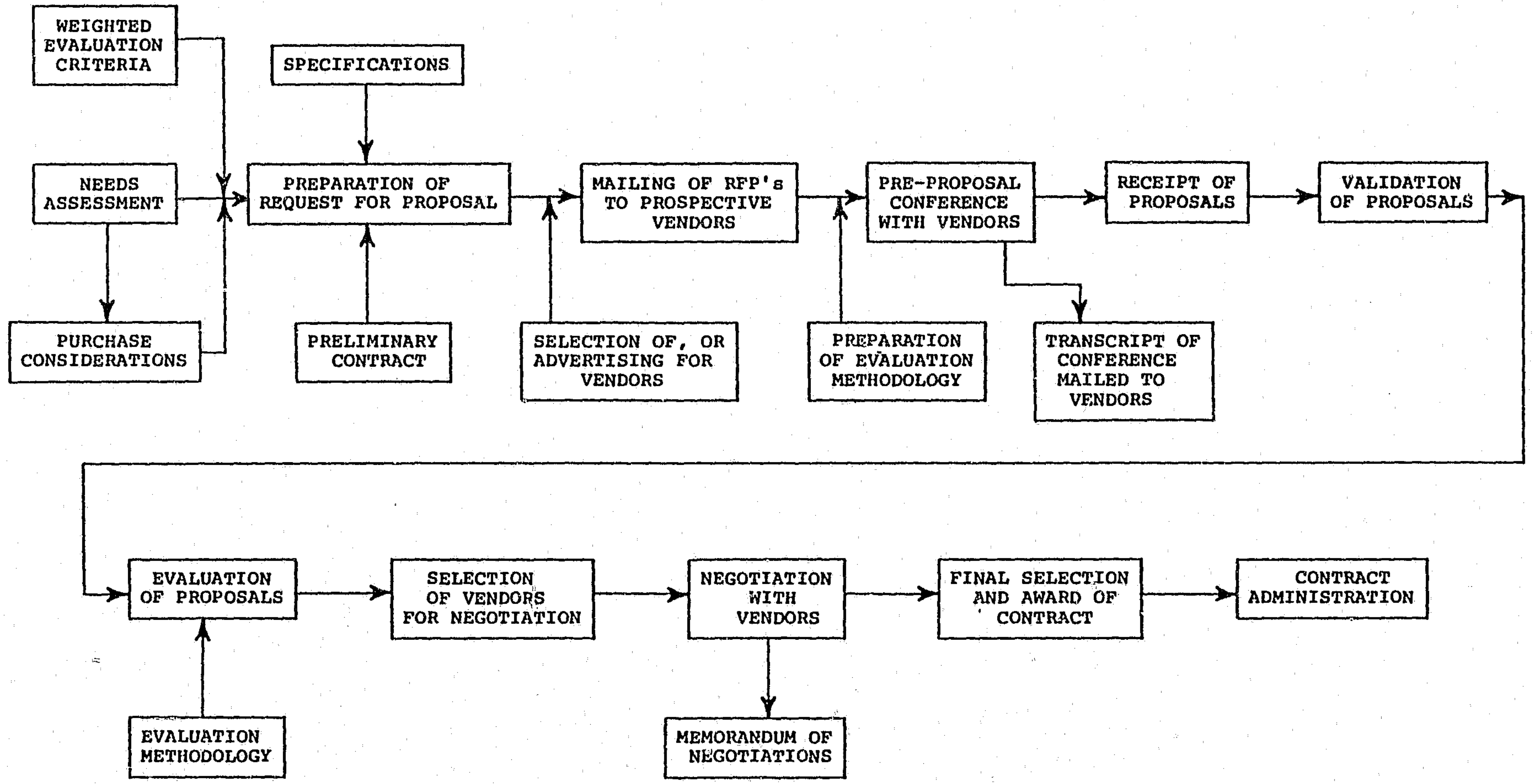
PROCUREMENT CYCLE
(Negotiated Process)


WEIGHTED EVALUATION CRITERIA
SPECIFICATIONS
NEEDS ASSESSMENT
PREPARATION OF REQUEST FOR PROPOSAL
MAILING OF RFP's TO PROSPECTIVE VENDORS
PRE-PROPOSAL CONFERENCE WITH VENDORS
RECEIPT OF PROPOSALS
VALIDATION OF PROPOSALS
PURCHASE CONSIDERATIONS
PRELIMINARY CONTRACT
SELECTION OF, OR ADVERTISING FOR VENDORS
PREPARATION OF EVALUATION METHODOLOGY
TRANSCRIPT OF CONFERENCE MAILED TO VENDORS
EVALUATION OF PROPOSALS
SELECTION OF VENDORS FOR NEGOTIATION
NEGOTIATION WITH VENDORS
FINAL SELECTION AND AWARD OF CONTRACT
CONTRACT ADMINISTRATION
EVALUATION METHODOLOGY
MEMORANDUM OF NEGOTIATIONS

necessary legal justifications. See Part 2, Contract Terms and Conditions, for the factors to be considered in sole source procurements.

There are two major forms of competitive procurement: **Bidding** and **Negotiation.** Each requires competition. The bidding, or Invitation for Bids (IFB) method is used for the procurement of standardized equipment or services at the lowest cost. The negotiation, or Request for Proposal (RFP) method is used for procurement of equipment or services where the terms, conditions, and costs are negotiable, and where unknowns and contingencies must be accommodated. Although the negotiated method will be used much more frequently for the purchase of computer hardware/software, the bidding method will also be discussed.

2.1 Bidding Method

The bidding method is utilized mainly to procure those standardized items which constitute the peripherals or support items of computer systems. Bidding involves the establishment of specifications to satisfy the organization's requirements, the public announcement or invitation for bids, the receipt of bids from qualified bidders, an analysis of the bids, and the award of a contract for the goods or services. The award is made on the basis of the lowest (cost) responsive bid submitted. Some basic principles in this process include:

- Invitation for Bids (IFB's) must provide a basis for full and fair competitive bidding among vendors on a common standard, free of restrictions which might tend to stifle competition. IFB's must be so specific and detailed as to provide an environment where all competitors are bidding on the same end objectives.

- To have a valid bid, the bidder must respond and conform to the IFB, including all of the documents incorporated and referenced therein. A bid which does not fully comply should be rejected as nonresponsive.

- A formal public bid opening should be announced and all interested parties allowed to attend.

- Public agencies usually have the express or implied right to reject any and all bids in the best interest of the public. Bids cannot, however, be selectively rejected without cause.

- Bids cannot be changed after the time designated for their receipt and opening.

- Bids cannot be accepted "in part" unless the IFB specifically permits such an award. No negotiation as to the scope of work, amount to be paid, or contractual terms is permitted.

- A contract entered into through the competitive bidding process cannot later be amended, unless the IFB includes a provision which allows such amendment.

Competitive bidding, in its normal context, is a relatively straightforward process of acquiring specific, predefined items or services at the lowest dollar amount bid by a responsive and qualified vendor. The process is ideally suited to the procurement of most standard items of equipment and for most construction projects. Federal, state, and local laws governing the competitive bidding process, and resultant procedures under which this process operates, are intended to preclude any attempt at collusion, favoritism, or fraud. Consequently, the process is inflexible and unresponsive to bids for alternative solutions. Competitive bidding does not allow any modification of bids already submitted, nor does the agency have the option of counter-proposing alternate solutions.

The principles of the bidding method do not allow those attributes usually desired for the procurement of complex computer hardware/software and related services. The very nature of data processing involves the assessment of various alternatives and the selection of that which is most appropriate. Data processing methods, equipment, and services to be employed in any specific situation are essentially trade-offs in the selection of alternatives—alternate concepts, alternate methods, and alternate equipment. There is no "one best way." Each alternative has cost and benefit ramifications which must be balanced against the rest. And, in the process, new alternatives may be developed and pursued. Innovative ideas should be sought and new techniques should be considered. The bidding process does not allow this flexibility. A negotiated procurement does allow an innovative approach and is therefore the method most frequently used for the purchase of complex computer systems (see sample IFB in Appendix 5).

2.2 Negotiation Method

As stated previously, if you want to have a choice of proposed alternatives to meet your computer requirements, the negotiated or Request for Proposal (RFP) method is the one you should choose for your procurement process. This method requires careful planning and organization of the sequential procedures to be followed, and must be fully understood by everyone involved in document preparation and decision-making. It is highly recommended that a scheduled event chart be prepared at the onset so that proper time periods can be allowed for each phase.

A team, consisting of data processing management, key technical staff, outside advisors, and others involved in the procurement and operation of the system, should be selected to prepare the RFP. The RFP should clearly state your evaluation criteria, hardware and software requirements, as well as support requirements necessary for conversion, training, installation, maintenance, benchmarking, etc. (see the sample RFP in Appendix 6.)

The prudent procurement requires that the RFP be sent to at least six, preferably more, qualified vendors who should be given at least 30 days to respond with their proposals. A definite time and place for submission of proposals should be specified in the RFP transmittal letter. Under no circumstances should the proposals be publicly opened as in the case of IFB's. If this happens, future negotiations will be compromised.

Shortly after the RFP is sent out, but before the proposals are due, it is highly recommended that you conduct a preproposal conference with the vendors. This allows the vendors to ask any questions they deem appropriate to clarify the RFP. The questions and your answers should be documented, and a complete transcript sent to all vendors (including those who did not attend the preproposal conference).

An initial evaluation of the proposals should screen out those vendors who were nonresponsive to the RFP, and oral discussions should be established with the remaining "validated" vendors. Vendors should be prepared to make all changes final, and everything the agency wishes to negotiate should be negotiated at this time.

You should not have to negotiate with all "responsive" offerors. If you have a few marginally responsive offerors and a number of "high graded" offerors, you will be wasting your time to negotiate with the marginal ones. For example:

OFFEROR	PROPOSAL GRADE	
A	94	Negotiate (hold oral discussions) only with these in the "competitive range"
B	93	
C	89	
D	76	Notify these that they were responsive but not within the competitive range
E	75	
F	73	
G	Nonresponsive	Notify these that they were nonresponsive
H	Nonresponsive	

The rule of thumb that should be used in the above example is to ask yourself, "As a result of oral discussions, could offeror 'D' upgrade his proposal to the level of those in the competitive range?" It is not very likely in this case, considering the wide discrepancy of scores.

Based upon the proposal grades, selection is normally made by an agency official to determine with whom negotiations will be conducted. Also, upon request, unsuccessful offerors should be briefed. Armed with the final evaluated proposals, the agency should then proceed to negotiate with the offeror(s) identified by the agency official.

During negotiations, a complete record called the "Memorandum of Negotiations" should be prepared and should identify who was in attendance, the date and time, the purpose of the negotiation, and what was proposed, counter-proposed, and finally agreed upon. This is useful because during most negotiations more information is exchanged and communicated than is reflected in the formal contract. A negotiation memorandum should be written in a narrative chronology after each session to ensure the proper sequence of discussions and understandings. These memoranda, including cost and price analyses, should all be included in the procurement file.

3. PROPOSAL EVALUATION

A proposal evaluation is a planned method for selecting the most satisfactory vendor/proposal from a number of qualified proposals. The evaluation methodology is separate and distinct from the initial validation process, which merely assures that all the proposals which reach the final phase for consideration (negotiation) meet all the basic requirements of the RFP. There are different degrees of satisfaction and different groups of people to be satisfied. The validation process only guarantees that a minimum level of basic RFP requirements have been met. In evaluation, higher levels of satisfaction are considered for the final selection.

Unless an evaluation methodology is fair and unbiased, the vendors may not spend the time and money necessary to submit a proposal. Or, if they have proposed but feel they have not been fairly evaluated, they may protest the selection. If upheld, a protest can lead to considerable delay and embarrassment for the procuring agency, and will require considerable time, effort, and dollars to resolve the issues. Therefore, the selection methodology must be completely fair and incontestable.

Weighted evaluation criteria should be stipulated in the RFP to give the vendors an opportunity to assess which areas are considered to be most important when responding with their proposals. The actual evaluation technique used in evaluating the proposals, although more detailed, must be in consonance with the overall weighted evaluation criteria stipulated in the RFP.

The evaluation technique should differentiate between mandatory requirements and other optional system requirements. The evaluation technique uses mandatory requirements as a determination of responsiveness; the other system requirements are used as the basis for actual evaluation. The technique must preestablish relative values for the optional system requirements, and these values should be established in weighted scores supported by meaningful rationale, and fully described in value matrices. The technique should consider all differentiating costs over the full stated system life, and assess appropriate values against proposals for those desirable items not offered at a cost. When all of these steps have been completed, the system which then reflects the highest score for meeting all requirements for the full system life cycle is selected.

Evaluators should refrain from utilizing purely subjective evaluations. The subjective approach tends to ignore most of the discriminating criteria delineated above. The more sophisticated evaluation methods will adhere to these criteria, and will more likely result in the most beneficial selection. See Part 2, Proposal Evaluation Methodology, for a detailed procedure to follow when evaluating proposals.

4. CONTRACTS

The final document produced in the procurement cycle is the contract. It is the binding document which obligates the vendor, as well as the procuring agency, to conform to all of the agreed upon terms, conditions, and requirements. Prior documents, such as the specifications or the work statement, are contractually binding only if they are included or referenced in the final signed contract. The verbal agreements or promises are likewise useless, unless they are written in the contract.

The initial draft of the contract should be prepared in conjunction with the RFP document. In order for the required and desired clauses to be included in the final contract, it is suggested that the agency include a copy of the contract in the RFP package. This does not mean that the initial contract cannot be modified, particularly during negotiations; rather, it affords both sides a common understanding of the major terms and conditions that a final contract will include. Each agency should use legal counsel to guarantee that the wording of each clause precisely reflects its requirements before the document is included in the bid package, and to ensure that all wording of the clauses meets the legal constraints of applicable Federal, state, and local ordinances. In IFB's, the IFB is the work statement portion of the contract or purchase order.

4.1 Contract Types

Part of the decision regarding what type of contract to execute is dependent upon the results of the needs assessment process and the conclusions reached when the RFP was constructed. The basic decision as to whether the equipment is to be rented, leased, or purchased will have a long-term effect on the procuring agency. All of the benefits and drawbacks of each type of contract must be weighed and considered with respect to the objectives which have been established in the needs assessment. The possibility of time-sharing a computer system should not be overlooked. If agency requirements allow, this could be a relatively inexpensive means of satisfying hardware needs.

The following sections describe the various types of contracts and reference a typical model contract.

4.1.1 Rental Contracts

These are the simplest types of contracts and represent the lowest risk but usually the highest cost. The function of a rental contract is to provide equipment to the organization for a short period of time, ranging from 30 days to one year. In this type of contract, the agency renting the equipment has made very little commitment for any significant duration of time and has no intention of owning the equipment. In many cases 30-day cancellation clauses are all that is required. Any accruals of rental payments against the purchase price are generally not significant on these types of contracts.

Flexibility should be the primary motivation for entering into a rental contract. If an agency is unsure of the long-term need for specific equipment, this type of contract could prove to be beneficial. The drawback of a rental contract is usually found in the higher cost of rental payments. Since there is little risk to the agency renting the equipment, the premium paid in rental payments covers the risk to the organization providing the equipment.

In many cases rental contracts are only provided by the original manufacturer who can afford to take the equipment back into inventory prior to placing it in another installation. If total flexibility is required and no long-term commitment is desired, a rental contract may prove to be the most desirable type of arrangement. However, it may be better to consider an "option to purchase" contract than a pure rental contract, since greater flexibility is afforded.

4.1.2 Lease Contract

A lease contract is not unlike a rental contract except that in a lease contract a commitment is made for a longer period of time. For this longer commitment, the lease rates will be less than rental rates since the risk of termination is considerably lessened. Lease contracts typically run for periods of one year to three years. The commitment over the lease period is firm, and a certain amount of flexibility is subsequently lost. Regardless, the savings in lease payments may justify a lease over a rental.

Under a lease contract, the agency which obtains the equipment does not intend to own it in the future but is primarily interested in lower payments during the specified period of time that the equipment will be useful. It should be noted that purchase accruals are usually available on lease contracts. If purchase is even a remote possibility, the accruals should be made part of the contract.

Lease contracts are usually available from the manufacturer and, in many cases, from leasing firms which specialize in computer equipment leasing. If a third party leasing firm is involved in a lease contract, the lessee should ensure that the equipment provided qualifies for a manufacturer's maintenance agreement and that all warranties applicable to the equipment are provided to the lessee.

In a lease contract, some vendors impose a penalty for early termination. If early termination is a possibility the total of the lease payments plus the penalty payment may equal or exceed the amount paid for the same period on a rental contract basis. This should be considered prior to making a decision to lease.

If a long-term commitment can be made and there is no thought of purchasing the equipment, a lease contract may prove to be the most beneficial arrangement. The agency must make certain that it is either obtaining sufficient capability to last for the duration of the contract, or that an upgrade option is available if the work load subsequently exceeds the original capacity. However, like the rental contract, there is more flexibility with an "option to purchase" type contract.

4.1.3 Lease with Option to Purchase Contract

Under this type of contract the agency may plan to eventually own the equipment. This lease is sometimes called a full payout lease in that the majority of the cost of the equipment will be paid during the lease period, and title will pass at the end of that time if the purchase option is exercised.

The purchase option must be voluntary and the lessee must be free to exercise it at any point in time during the contract period. Lease with option to purchase contracts typically run from three to seven years. The length of time selected is usually dependent upon the agency's desire for lower lease payments over a longer period versus making higher lease payments for a shorter period of time.

In a contract of this type a definite commitment is required to make the lease payments and to exercise the purchase option upon completion of the lease period. As with the lease contract, flexibility is not one of the major points of a lease with option to purchase contract. Lease with option to purchase contracts are usually available from the manufacturer, who in many cases will assign the contract to a leasing firm or financial institution.

It should also be noted that lease with option to purchase contracts may carry the same early termination penalties identified in the lease contract section. Manufacturers' maintenance agreements and warranties applicable to the equipment must also be considered.

Lease with option to purchase arrangements can be constructed to be a tax-exempt type of transaction for which interest income may be considered as tax-exempt to the lessor. If this type of lease payment can be arranged with the vendor, the lease payment for the lessee can be considerably less than a normal lease with option to purchase. As in the case of a lease contract, this type of contract is a long-term commitment. Careful consideration should be given to the capability of the equipment to be adequate over the life of the contract. See Part 2, Lease vs. Purchase, for the methodology used in comparing the total cost of lease vs. purchase.

4.1.4 Purchase Contract

The last major contract type is a purchase contract. The purpose of this arrangement is to acquire title as soon as the specified contract terms and conditions are successfully met. If funds are available, and if it is determined that both the equipment's useful life and the needs of the agency justify the purchase, this can be a beneficial arrangement. However, care must be exercised in any purchase arrangement because, although this type of contract normally has the least overall cost for an extended period of time, the risk is the highest.

Flexibility of management must be considered in a purchase decision since equipment purchase generally represents a long-term commitment. This decision requires long-range planning and must consider the equipment's potential obsolescence, its ability to handle required work loads, and many other factors which could potentially make purchase unattractive. If purchase is a desirable method, the purchaser should consider a purchase contract rather than a simple purchase order.

The terms and conditions which must be fulfilled by the seller prior to receiving payment must be completely defined as in any contract. The equipment purchased should be new equipment, if possible, and should qualify for a manufacturer's maintenance agreement in addition to a written warranty statement from the manufacturer. Training, installation, conversion, and many of the items normally considered in a lease must also be considered in a purchase agreement.

It may be preferable to enter into a purchase contract which actually is just a rental agreement for a brief initial period. After the agency is fully satisfied with the product, the purchase option is exercised.

4.1.5 Model Contract

An agency should be aware that the vendor will probably have a standard contract with which they would like agreement. Keep in mind that it will always be designed to favor the vendor and limit their responsibilities. For this reason, it is suggested that the agency draft its own contract, one which provides the necessary protection desired and identifies all responsibilities of both parties.

It is not possible to draft a model contract which would fit every situation and serve every potential hardware buyer. However, a model contract has been included in the Appendix of this Manual to give you an idea of the format and wording of a typical computer system procurement contract.

4.2 Statement of Work

This section of the contract need only make reference to either the technical requirements in the Request for Proposal or the technical description in the vendor's proposal. By incorporating these requirements "by reference," (see sample Reference Clause below) the size of the contract itself can be kept to a minimum. This will bind the vendor to those requirements just as if they were a part of the contract itself.

Sample Reference Clause:

"The technical description of the hardware capabilities detailed in the vendor's proposal are incorporated herein by reference with the same effect as if they had been reproduced in their entirety."

If reference is made to the technical requirements in the RFP, make sure that any changes resulting from the negotiations are duly noted in the contract. **Caution:** One word change can cost thousands of dollars in certain cases.

4.3 Contract Clause

There are certain clauses which need to be considered in the creation of the contract document. These clauses fall within three basic categories: (1) required, (2) elective (but highly recommended), and (3) discretionary. Clauses which fall in the "required" category are those which are necessary to adequately protect the agency from situations which might occur and could be costly or troublesome. The matrix on the following page lists these clauses and the recommended categorization for each.

4.4 Contract Administration

Contract administration involves monitoring and administering an established contract and finally closing it out when the contractor's work is completed to the satisfaction of the purchaser. Normally an agency administrator, such as a purchasing agent, is given the sole authority to award, amend, or modify a contract or take any action to change a contractual commitment on behalf of the procuring agency.

The purchasing agent is normally assisted by a project manager or contract monitor for individual contracts who ensures that administrative functions are performed to achieve the desired results and to protect the agency's interests. The purchasing agent is usually responsible for maintaining a complete file of documentation related to each contract, while the contract monitor is normally responsible for the technical and managerial aspects of the contract administration.

Upon completion of the contract work, the agency's objective should be to close out the contract as rapidly as possible and make prompt final payment to the contractor. Any unnecessary delays are usually costly and time consuming of agency personnel's time. To this end, the purchasing agent should ensure that cognizant project personnel inspect all work promptly after completion in sufficient depth to determine its acceptability.

5. PRECAUTIONS

The procurement cycle is normally the culmination of many months, or possibly years, of prior study, analysis, assessment, and detailed documentation. Do not attempt to skimp on this most important phase of computer system acquisition. Take the time to properly analyze your needs, keeping in mind the relative system costs, the probability of short term obsolescence, and your future requirements. What you buy now is what you will have to live with for a specified period of time. Make sure you delineate all of the terms, conditions, and requirements in your bids, RFP's, and contracts. Document all of the procurement proceedings, such as source selection, evaluation analyses, and negotiations and maintain these documents in a procurement file.

As a further note, the following is a list of precautions which should be exercised by each agency involved in a procurement process:

1. Every source solicited for a proposed procurement should be given equal opportunity to participate by being provided the same information. Special care is required to preserve the integrity of a procurement during the interval between the release of a solicitation and a contract award.

IMPORTANT CLAUSES FOR COMPUTER SYSTEM CONTRACTS

Clause	Required	Elective (Highly Recommended)	Discretionary
A. Cost Section			
1. Contract Terms	x		
2. Payment	x		
3. Price Protection/Price Changes	x		
4. Termination or Cancellation	x		
5. Nonfunding Termination	x		
6. Purchase Option (Lease Only)	x		
7. Taxes	x		
8. Overtime Usage (Leased Hardware)		x	
9. Maintenance	x		
10. Insurance	x		
11. Supplies		x	
12. Hold Back		x	
B. Delivery and Installation			
1. Delivery	x		
2. Site Preparation	x		
3. Installation	x		
4. Relocation		x	
5. Freight	x		
6. Acceptance	x		
C. Terms and Conditions			
1. Assignable Rights		x	
2. Patent Protection	x		
3. Standards of Performance	x		
4. Equipment Modification	x		
5. Component Cancellation/ Substitution	x		
6. Attachments	x		
7. Upgrading of Hardware/ Software			x
8. Manufacturer Interface	x		
9. Education and Training	x		
10. Key Personnel		x	
11. Latent Defects/Warranty	x		
D. Miscellaneous Clauses			
1. Conversion		x	
2. Notices	x		
3. Progress Reports			x
4. Equal Employment Opportunity	x		
5. Examination of Records	x		
6. Clean Air Act	x		
7. Disputes	x		

See Part 3, Procurement Standards, OMB Circular A-102, Attachment O for a complete listing of standards applicable to contracts using Federal grant funds.

2. Check with your attorney on the legality of disclosing any IFB offeror's cost breakdown, profit, overhead rates, trade secrets, or other confidential business information to any other offeror. This cannot be disclosed on negotiated procurements without compromising down-stream negotiations.

3. Agency employees should be aware of contractors who may employ or attempt to employ improper or unethical influence to obtain contracts.

4. No gratuities should be accepted by employees from existing or potential contractors.

5. All agency employees should be notified when an RFP has been issued to guide their response to seemingly harmless telephone inquiries or other requests for information.

6. The handling of responses to public advertisement and the mailing of RFP's must be coordinated and carried out with utmost accuracy.

7. Special handling is required for proposals received in response to an RFP.

8. A proposal received after the established time deadline should not be opened and should be returned to the sender with a note indicating that it was late and therefore unacceptable.

9. Weighted evaluation criteria for each procurement must be established and documented in the RFP.

10. A contract must be worded in very careful and precise language.

11. Exceptional planning must be exercised to obtain all necessary contract approvals prior to the desired contract start date.

12. All contract provisions, unless officially deleted, must be adhered to by both the contractor and the agency.

13. The Project Monitor must be especially wary when giving technical help or direction to a Contractor lest his "help" later be construed to have been a "constructive change order." This is a situation whereby a Contractor reacts in a manner other than that required by the contract because of a discussion with an agency representative. The contractor can later claim any additional costs incurred by complying with the Project Monitor. When in doubt, the Project Monitor should discuss with his superiors any prospective technical direction he intends to give to the Contractor which may border on a change to the contract.

14. Contractors who develop or draft specifications for a proposed procurement, using Federal funds, must be excluded from bidding for the award of such procurement. This is required to preclude possible conflicts of interest.

Chapter 5

SOFTWARE DEVELOPMENT

1. INTRODUCTION

The development of automated systems requires an understanding of computer software—the stored sequence of instructions which control a computer's operation. There are two basic types of software: (1) **systems software,** which serves as an interface between the user's programs and internal system functions, and (2) **applications software,** which controls specific user jobs such as payroll, booking, and crime analysis.

2. SYSTEM SOFTWARE

2.1 Operating Systems

Computer operating systems, or supervisory systems, control program operation and the assignment and use of machine resources. There are several operating system environments available to the user including: Batch, Real-time, On-line, and Timeshared. Reference Part 2, Requirements, for a detailed description of these operating systems.

2.2 Utility Programs

Utility programs are specialized programs, usually vendor supplied and independent of the operating system. When accessed by applications software they perform routine functions such as file search, record retrieval, report generation, and sorting of records.

2.3 Compilers and Language Processors

Compilers convert programs written in high-level, English-like user-oriented languages such as COBOL or FORTRAN into machine language instructions.

2.4 Programming Languages

All Federally funded criminal justice projects are mandated by LEAA Guideline M 4500.16 to utilize one of three higher level languages: COBOL, FORTRAN, or BASIC. The use of these languages must be in accordance with the latest version from the American National Standards Institute (ANSI). It is important to avoid using nonstandard language elements as they may jeopardize interchangeability of programs between agencies and future hardware upgrades within an agency.

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COBOL should generally be used in programming computer applications and programs that emphasize the manipulation of characters, records, files, and input/output processes as contrasted with those concerned primarily with computational problem solving.

FORTRAN and BASIC (ANSI x 3.9) can be used where scientific or highly computational usage is demanded and where the needs of a specific application cannot be achieved through Federal Standard COBOL (see FIPS 21-1 in Appendix 12.)

FIPS PUB 38, *Guidelines for Documentation of Computer Programs and Automated Data Systems* are to be utilized by Federally funded programs for software documentation. For more detailed explanation please refer to the source documents found in Part 3 of this Manual.

2.5 Data Base Management Systems

A Data Base Management System (DBMS) is a software system designed to assist a user in creating, organizing, and manipulating data files and records within those files. It facilitates the processing of large numbers of file update and retrieval transactions. It reduces unnecessary redundancy of files by establishing relationships between data elements within the data base. A desirable DBMS will include appropriate functions pertinent to the user's needs. Some of these functions consist of:

- Interactive processing
- Creating file structures
- Simplifying file maintenance
- Simplifying report generations
- Performing basic computations
- Handling multiple report requests
- Performing hardware device handling for the user
- Providing complete and understandable error diagnostics
- Processing inquiries and updates involving more than one file
- Making information accessible to nonprogramming individuals

2.6 Software Packages

Most software packages utilize callable subroutines which are sometimes incorporated into what could be called a "system." A system allows for easy program execution and file maintenance through menu processing concepts which allow the user to choose the task he/she wishes to execute. A set of routines without any systems incorporation relies heavily on the user to be able to write input-output functions around the routines. This is possible in many experienced data processing shops but is beyond the capabilities of most criminal justice agencies.

Statistical packages will perform many calculations that are tedious and repetitive, e.g., number of incidents in each district by day of week, shift, or hour. Frequency reports for desired meetings can be prepared on any time frame if the data are available. Histograms can be produced for easier recognition of differences among groups of data, e.g., age, race, sex, employment status groups, etc.

Some statistical packages handle complex filing procedures while others tend to consume many hours of programming time to coordinate the file structure. It is highly recommended that you observe the package running in a similar type agency before purchasing it. A technical person should also be available to monitor the running of the statistical package.

Plotting packages provide the ability to represent statistical information in a pictorial format. This often aids in the comprehension of the information being portrayed. The adage "a picture is worth a thousand words" holds true in police applications as it does in other disciplines.

3. APPLICATIONS SOFTWARE

Applications software represents modules that carry out the user's work. These modules should be able to stand alone on a microcomputer or alternately utilize a shared environment on a larger machine. The modules themselves can function independently or interact with a number of other modules. Some of the modules typically found in a law enforcement environment are identified in the following sections.

3.1 Incident Data Capture

The Incident file contains essential data arising from initial contact in the field. Since this is the primary source of statistical data for all levels of police planning, it is mandatory to have timely, accurate, and readable reports from the field. Incident reports gather information on location, victims, suspects, evidence, witnesses, multiple offenses, modus operandi, etc. Generally this report details crimes against persons, property, and vehicles.

3.2 Uniform Crime Reporting

These reports provide the department with the means to accurately report crime figures over a period of time. They include all Part I offenses, Part I and II arrests broken down by adult or juvenile, and stolen/recovered property by type of offense and descriptive category. Many agencies across the country have developed automated Uniform Crime Reporting programs that are available for transfer into similar criminal justice agencies.

3.3 Arrest

General arrest/summons information obtained from custody and summons forms (e.g., physical description of the individual, current place of residence, driver's license number, etc.) constitutes the basic data elements of an arrest module. Other pertinent arrest data variables include: type of charge, day of week, age of offender, sex, race, weapon, employment status, and location of arrest.

3.4 Property

Stolen Property segments of a system can be used to record and retrieve data concerning status, location, and type. Found property can be numbered and put into the module for easy retrieval by location in the evidence room.

3.5 Alpha File

Alpha files, commonly called Master Name Indexes, are files which contain the names of victims, arrested persons, witnesses, wanted persons, and field interview contacts. Each class of alpha entry should have specific purge criteria associated with it. Alpha files generally serve as a link to offender and incident report files.

3.6 Field Interview

Field contact reporting is an important investigative tool. Field interviews, generally conducted by patrol units, generate data that are reviewed by investigative personnel. See Part 2, Interviews, for a more indepth method of analysis.

3.7 Warrant

Pertinent warrant information should be included in an information system in two places: (1) the warrant file, and (2) the alpha file. When the warrant has been served or dismissed by the court, the purge process is performed at the warrant file level only. The alpha file is not deleted but it is designated as inactive and given a purge status as to the severity of the warrant. In this way, historical information is preserved for later reference.

3.8 Traffic Citation

The traffic citation module controls the input of significant data for the successful tracking of traffic violators. Input begins with the warning, summons, or citation information. Outputs are varied: (1) violators that have not paid fines; (2) formatted output that produces input, e.g., automobile description, time, and place information for crime analysis programs; and, (3) formatted output that inputs into the Department of Motor Vehicles system.

3.9 Jail Management

Jail Management techniques vary enormously with the number of inmates the facility accommodates. An effective jail management system can furnish jail personnel with court appearance dates, release dates, alphabetic inmate listings, the location of inmates in a facility, and more. Summary statistics can be produced that show population characteristics such as daily census, average confinement period by type of criminal charge, recidivism factors, age, sex, and race categories.

3.10 Gun Registration

This module would provide an agency with the cross-referencing capability needed to establish ownership of a weapon. Such a weapon could be easily verified as stolen property if registered via descriptors; e.g., Type, Color, Caliber, Serial Number, distinguishing markings, name, address, and phone number of owner.

3.11 Bicycle Registration

The manual process of registering bicycles, locating owners, and determining if a bike is "hot" can be a time-consuming procedure. The automation of these files can help both the staff assigned to bike registration and the field personnel in the recovery of stolen property. With an on-line system, multiple card indexes are not necessary for cross-referencing purposes. All necessary information such as serial number, year of bike, manufacturer, color, type, size, owner, and address can be extracted from one initial registration card.

3.12 Geoprocessing

The converting of an address to a readable coordinate parameter for input into a computer system can be very technically involved. The computer needs relative information points, stored in comparison to specific addresses or generalized streets, with a distance estimator for the exact address point. Many larger cities utilize zip codes, street labels, direction delineators, cross streets, and specific addresses as variables for input into the geoprocessing module. An inexpensive method of plotting incidents can be utilized by an agency with a digitizer pad and hard copy output unit. Each particular class of incidents can be digitized into hard copy output which is then overlaid for field use or planning purposes onto a skeleton map via a reproduction (Xerox) device. This technique, however, is less cost/effective for the large volume agency. It is best suited for the smaller and medium-sized agencies.

3.13 Crime Analysis

The plotting of crime incidents by police departments for crime analysis has been in existence for many years. In most jurisdictions, however, pin mapping is the most common technique utilized. Computer routines for plotting or mapping are currently available from many vendors and some are transferable from other criminal justice agencies.

When an application's informational and procedural requirements have been identified and functional specifications established, an agency should consider system transfer as an alternative to initiating a new developmental effort. Equivalent in many ways to a "make or buy" decision, system transfer may significantly reduce both implementation time and cost.

Effective system transfer involves locating suitable agency donors that have systems or application modules that are compatible with the previously specified requirements and specifications. This compatibility may include mode of operation (on-line versus batch), data elements, special features, operating procedures, hardware configurations, and programming language.

Since most system transfers involve some modifications to meet specific local needs, it is important that the donor system be well documented and fully operational. Communication with prospective donors and assistance from facilitative organizations can do much to assure successful transfer.

4. COMPUTER PROGRAMMING

Computer programming is a human activity. With the mystique placed on the manner in which individuals program, this subject has not received a great deal of investigation. Programming is a kind of writing; each individual has his/her own style. There are, however, at least four aspects of good programming which should be kept in mind.

4.1 Specifications

Specifications refer to the documented requirements or "blueprints" on which a computer program is based. If a program does not meet the specifications from which it was developed, the other aspects are unimportant.

4.2 Schedule Requirements

Schedule requirements are important considerations for a program. Programming schedules must take into account the productivity of the personnel involved, the availability of computer time for testing, the availability of approved specifications, and the review of and impact of suggested enhancements.

4.3 Adaptability

Almost all programs undergo some modification and enhancement over a period of time. To assure the success of such changes, programs should be coded according to some agreed upon set of standards. These standards will include structural requirements, labeling conventions, and necessary restrictions on mixed (high-level plus machine) code.

4.4 Efficiency

Most computer programmers attempt to make their programs execute as quickly as possible. This can be in direct conflict with making them modifiable. Each program, to be efficient, must make full use of the operating system, be specific to the application, and be coded to take maximum advantage of the machine on which it is to run. This is often done at the expense of a loss in adaptability. Whether your application will be utilized on another machine or not (as in a transfer situation), it behooves the wise programmer or manager to seek a middle of the road approach in matching adaptability and efficiency objectives.

4.5 Structured Programming

Programming by structured methods results, at least theoretically, in less time needed for problem testing, increased productivity, and increased readability of code. With structured methods the main program is called by the operating system as a module, and control returns to the operating system when the program is finished. At the next level, the program is broken down to subordinate level-1 modules, which are further broken down into level-2 submodules, etc., continuing until the submodules are broken down into building blocks that are easily and quickly coded. Each submodule is coded independently of each other module and can be tested without context being considered. The modules have a single entry and exit point.

The major advantages of this "top-down" coding are:

- Debugging is made easier
- Systems testing in the traditional method is eliminated
- Testing time is more uniformly distributed throughout the project
- Major problems are encountered first and trivial items are found later
- The users have a preliminary version of the system early in the project
- Programmer's morale is maintained as more and more of the program is finished and tested
- If slippage does occur, there exists a good chance a useable subset of the program will have been finished

4.6 Documentation Standards

The use of FIPS PUB 38, *Guideines for Documentation of Computer Programs and Automated Data Systems*, is a Federal requirement for all Federally funded projects. As a rule, the higher the cost, importance of the project, complexity of system design, and future transfer considerations will decide the ". . . formality, extent, and level of detail of the documentation." An addendum to FIPS PUB 38 (included in Part 3) provided by LEAA, addresses issues concerning Security and

Privacy Documentation and Minimum Documentation Requirements for Criminal Justice Systems. A predominant theme in the publication is: execute thorough documentation throughout the entire process rather than subsequently trying to document an operational system.

In general, complete documentation can be divided into three groups:

Preliminary documentation is used to specify user needs as an input to the design process. It includes Functional Requirement and Data Requirement documents.

Design and development documentation supports analysis, programming, and test activities by specifying internal system construction, operation, and data handling. This documentation may include System/Subsystem Specifications, Program and Data Base Specifications, and Test Plans.

Operational documentation provides the users and support staff with the information needed to effectively use, operate, and maintain the system. In addition, it provides certification of the systems operational readiness. This documentation may include Detailed System Flow Charts, Users Manuals, Operations and Program Maintenance Manuals, and Test Analysis Reports.

Systems testing procedures are provided for in FIPS PUB 38 and can be followed verbatim with minimal effort. This segment of the process is crucial, as it shows you whether or not the system functions as intended. The extra time taken to develop in-depth test criteria to determine "bugs" will pay for itself quickly, especially if a contractor is paid in full or in-house staff begin a new project.

Programmers do not necessarily make good documentors. To create high quality documentation a documentation specialist should work closely with a programmer. When a system is turned over to a programmer or user to maintain or learn it, the original documentor must assume that they will not know where to begin to learn about the system. The first page of the documentation, whether it be on-line or notebook format, should inform the reader about the "depth" of the system and its documentation.

Some helpful hints in improving the readability of a program would be to:

- Place a narrative paragraph at the top of the program to describe what it is used for
- Have a special section set aside for explaining all branches within the program logic
- Set off key words with underline or boldface type
- Rename all ambiguous variables
- Develop special areas for specific types of variables such as EXTERNAL, FLOAT, REAL, INTEGER, etc., to descriptively label what each one does
- List out potential ambiguities and describe them in greater detail

- Extract all complex conditional segments and create decision tables
- Strip out all confusing or technical expressions and show the formulas with and without data

Chapter 6

SYSTEM IMPLEMENTATION AND EVALUATION

1. INTRODUCTION

This chapter deals with the planning, delivery, and installation of the computer. By now a vendor has been selected, a contract has been signed, and a generalized implementation plan has been adopted. At this point a specific, detailed plan should be developed in order to ensure successful installation of the computer and provide for adequate future expansion. The general areas of concern addressed by this chapter are:

- Methods of File Conversion
- Site Planning and Location
- Electrical, Environmental, and Cabling Requirements
- Physical Security
- Delivery Schedule
- Hardware Installation
- Acceptance Tests
- Operating System Installation
- Application Programs Installation
- Backup Facilities
- Installation Evaluation
- Project Review and Master Plan Development

2. METHODS OF FILE CONVERSION

The term conversion is used to describe the process of changing from one way of doing things to another. In the context of a systems project, conversion might mean changing manual procedures into automated ones, reformatting data contained on magnetic tape for access on magnetic disk, or the upward transition of programs from one computer to a more powerful machine. Even though a system is well designed and properly planned, its initial success may depend on how well these types of conversions are executed. When a computer system untimely or incorrectly produces information, the users will invariably develop a skeptical attitude and a mistrust of the entire system. This attitude may remain long after all the problems have been resolved. In order to prevent this, the conversion process must be carefully planned, documented, and executed.

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2.1 Direct Conversion

This method involves curtailing all manual or computerized operations under the old method, and then as quickly as possible, beginning operations under the new. Direct conversion is relatively inexpensive but involves a high risk of failure. By relying totally on a system which is operationally untried, an agency runs the risk of a breakdown with no backup system to help. Generally, there are too many errors which could occur using this process to make it feasible for an agency.

2.2 Parallel Conversion

In this approach both the old and new systems operate simultaneously for a limited period of time; the results produced from each are compared and the differences reconciled. This method provides a high degree of protection against failure, but the costs of duplicating facilities and personnel in order to maintain the two systems can be high. For most conversions, however, a month of parallel operation is sufficient and is not prohibitively expensive. This method has gained widespread acceptance in spite of associated costs because of the confidence users will develop in the new system. By observing that it produces reliable outputs which match their needs and expectations, users are able to overcome their resistance to change and appreciate the enhancements offered by the new system.

3. SITE PLANNING AND LOCATION

The selection and layout of the computer site requires careful consideration since improvements will, in most cases, be necessary before the equipment can be installed. The relocation and rearrangement of a computer center represents a large and unnecessary cost and should be avoided in the future by adequate planning. Whenever possible, the assistance of architects, vendor site planning personnel, and industrial engineers should be utilized during this planning function to clarify both present and future requirements. In many data processing installations the future requirements have not been given adequate thought and have often resulted in expensive remodeling costs.

It is important to select the physical area which will not only house the computer in its present configuration but will also allow for future expansion. Care must be exercised to identify a location that is compatible with the type of computer you are installing. For example, if teleprocessing is to be a prominent part of your system, then a site should be selected which would minimize telephone line costs.

Other considerations in locating the computer facility are door size openings, elevator size, or other size factors which might cause problems when the equipment is delivered. It does not require much imagination to picture the frenzy of a Project Director who discovers on the day of delivery that the computer is six inches wider than the computer room door. These types of last minute problems, which always result in confusion, embarrassment, and delay, can easily be avoided by thorough preliminary planning.

Once the general area has been identified, the floor plan and work flow need to be considered. Work flow should be of prime importance when laying out the floor plan of a computer center. In most data processing centers the first step in job processing is the Control Section, which date stamps, prioritizes, and in turn passes work to the Data Entry Section. The completed data entry work is then passed to the computer room. After the computer processes the data, the output reports are decollated and burst. The completed work is then delivered back to the Control Section for validation, posting, etc., prior to being delivered to the user. This flow may not be typical of your installation, but is used here to point out that a work flow plan should be developed and made part of your site planning function. In the computer room itself, the floor plan should reflect the work flow, work assignments for operations personnel, accessibility of computer components for operations personnel, and equipment maintenance personnel. You must also plan adequate space for storage of forms, cards, magnetic tapes, magnetic disks, and other data processing supplies.

4. ELECTRICAL, ENVIRONMENTAL, AND CABLING REQUIREMENTS

Once the location has been determined and the physical floor plan completed, the next step is the identification of the power requirements for each computer component. In addition, the requirements for air conditioning, humidity, and other environmental factors involved in the operation of the system must be identified.

Electrical requirements will most probably require dedicated power lines with special termination connectors. The location of the power lines, circuit breakers, and types of wire all need to be established and added to the floor plan layout. Care should also be taken when planning the power supply to consider outside sources which could cause power irregularities. Emergency power backup may be required if the agency's computer system is supporting a critical function in an on-line environment.

Air conditioning is a critical factor with computer systems. Excessive heat or cold will cause a computer to malfunction and, in some cases, will physically damage the equipment. Hot spots should be identified and an air conditioning plan developed to deal with those areas.

Once the individual components of the system have been located on the floor plan the cabling required to connect them must be considered. Any unusual arrangement of the components may require nonstandard lengths of cable, which generally come in increments of fifty feet.

Due to the cabling of components, power lines, air conditioning, etc., raised flooring may be required to provide a functional physical layout. The equipment weights will be a factor in determining the type of raised floor and the associated height required to handle the cables. Again, when planning for power, environment, and cabling, it is advisable to utilize the services of vendor site planning specialists, architects, and industrial engineers if available. Also, any planning in this area should include future requirements since an upgrade of air conditioning and other environmental systems can be very expensive if not considered in the initial planning stages.

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5. PHYSICAL SECURITY

The key elements in achieving security in a computer installation are prevention, detection, and recovery. This part of the chapter discusses the establishment of a program that encompasses these elements, but is designed for computer processing with its particular demands. Security involves protecting both data and equipment.

It is recommended that agencies planning to implement a computer system identify an internal staff function called "security". The staff assigned to this function must be knowledgeable in the data processing field and should clearly understand the implications of various kinds of security breaches. The staff should also help design the security program, evaluate the threats to be encountered in terms of dollars and probability, determine what information must have the capability of being recovered, and be familiar with the different ways of protecting data and the computer center.

While each agency or organization views security in a different light, the following objectives have general validity:

- To ensure the integrity and accuracy of the data
- To provide for the privacy of personal, privileged, or otherwise sensitive data
- To protect agency assets from the hazards of fire, water, misapplication and vandalism
- To ensure the ability to survive hazards
- To protect employees from the temptation to default on their responsibilities
- To protect management from charges of failing to manage, if any security breaches occur

5.1 Site Selection

The location of a computer installation can itself be the means of achieving protection. The cost of protection, the ease with which it can be provided, the extent of damage which can be incurred by accidents or fires in adjacent areas, the ease of access to and surveillance of an installation, and the likelihood of external threats occurring are all directly related to the computer location.

In an established facility it may be possible to take advantage of security measures already in force. If there is some perimeter control, a degree of security exists which probably would not be justifiable in a separate, isolated facility.

There are at least two distinct advantages in maintaining a separate building for data processing: it is easier to control access, and there is less risk from water damage or from fire that may be caused by flammable or volatile products used by other components. But it must also be taken into consideration that a separate building might be more vulnerable to a deliberate attack. Someone intent on destruction might find it easier to identify the entrances, power sources, communication lines, and water supply. To offset this possibility, measures should be employed to make the building itself, or only critical elements, unidentifiable as to use. Power and communications lines should be placed underground and manhole covers locked.

Limiting the number of entrances is another important control measure. Two entrances should be sufficient; one for personnel, another for supplies. Emergency exit doors should be kept locked from the outside, opening from the inside only, and should activate an alarm if opened. External locks should be of high quality, hinges should be on the inside, and latches on exit-only doors should be covered by plates or designed to prevent forced entry.

There is a hazard in locating a computer center below ground level. More insurance claims from computer installations come from water damage and flooding than from any other cause. Backed-up sewer lines, broken water mains, heavy rains or rising streams, and flooding from putting out a fire on a floor above or in an adjacent area make up a sizable portion of the insurance claims.

Locations inside the building are preferred for computer placement over locations along outside walls because of the exposure to external hazards. If there is no choice but to have part or all of the installation on an outside wall, windows could be closed with masonry, or glass could be replaced with one of the new "impenetrable" plastic sheeting materials.

Many techniques are used for controlling access to a building or a room. Guarded entrances are probably the most popular. Because one person is unlikely to stop an attack by a group, the intent is actually to control normal access. This can be done by a secretary-receptionist who can challenge strangers and call for help if necessary. Procedures must be established so that the guard has instructions for all eventualities and assistance is close by. The guard must know when and how to summon help without causing a scene, and the help should be on varying levels to cope with problems of differing complexity. There should be advance planning for all situations which could be expected to arise.

5.2 Fire and Other Damage Control

Fire prevention begins with the structure. Ideally, it should be a separate, fireproof building. In the absence of this, however, the walls common to offices and the computer center should have at least one-hour fire ratings and effective firebreaks. Windows facing nearby buildings will permit fire to enter and should be replaced by masonry. This is not to suggest that the computer center alone should be protected from fire; the point is that fires are more likely to start in an office environment and spread to the data processing area.

In the computer center, all interior walls should extend from the slab to the structural ceiling, and all air conditioning ducts through these walls should have fire dampers. The facility should be fireproof, including the raised floor, suspended ceiling, and any partitioned areas for operators, job dispatching, or maintenance and work storage.

Cleanliness is vital to maintaining a noncombustible environment. Lint from moving paper and cards ignites easily and burns rapidly. The space under the raised floor collects lint and should be frequently cleaned.

The first line of defense against fires should be the small hand-held extinguishers. These should be placed around the computer area so that they are handy and visible, and every employee should be trained in their use. Computer room fires are infrequent, but those that do start can usually be put out quickly with a small hand-held extinguisher.

Electrical equipment fires are characterized by a breakdown in insulation and a resultant short circuit or arcing. The heat in the area of the breakdown can become quite intense, vaporizing material and generating smoke. But the fire will normally remain local, lasting only as long as the cause remains. The temperature of the room may not be elevated even with the air conditioning off. It is therefore recommended that the detectors be sensitive to smoke rather than temperature.

It is wise to set the threshold of the detectors low enough to detect equipment fires as early as possible. When quenching systems are used, it is important that the detectors not release a fire extinguishing agent immediately; it is wasteful and, in the case of CO_2, can be hazardous to the people in the area. The detector should trigger an audible alarm locally and at appropriate fire or guard stations, and the detectors should initiate a time delay. If this delay is allowed to run its course without intervention, the quenching agent will be released. This will cover the times when no one is in the area to intervene, such as holidays and weekends.

5.3 Sprinklers or Flooding Systems

In the past, local building and fire codes have dictated the use of sprinkler systems, which are well suited for extinguishing fires in building materials and paper products but are ill suited for fires in electrical equipment. There are several disadvantages to such a system in a computer room. A fire would be well advanced before the ceiling temperature reached 160°F in a room with forced air cooling and it would have already caused extensive damage. The water that is discharged would cause severe problems; it would rarely reach the fire inside the equipment cabinet. At best, the equipment would have to be dried thoroughly before being repowered and used again. At worst, the water from the charged lines could contain conductive sediments and could induce additional short-circuit paths. Also, the exposed sprinkler heads could be struck accidentally which poses the problem of discharging water into equipment which is fully powered and operating.

There is a recent trend toward gas flooding systems which are effective for building and office materials and ideal for equipment and storage media. The gas is dispersed so as to reach any fire, and causes no residual damage. Except for damage from the fire itself, equipment is usable immediately after use of the extinguishing agent.

Until recently the only extinguishing agent used in flooding systems was carbon dioxide. The major drawback to CO_2 has been that it is dangerous to personnel.

The concentration needed to extinguish a fire with CO_2 can incapacitate and suffocate. Where CO_2 flooding systems are used, personnel should be alerted to the dangers and trained to work in pairs.

The dangers of CO_2 have spurred the development of other extinguishing agents which do not extinguish a fire by displacing oxygen but has a chemical action on the combustion process itself so that there is no further burning. It is important that the gas be used in the proper concentrations; therefore, the discharge systems must be correctly engineered and installed.

5.4 Protecting Tapes, Disk, and Microfilm

While data processing equipment will not sustain combustion, most storage media will. Magnetic tape, tape reels, tape and disk canisters, and microfilm can warp and burn under heat. Because these materials become distorted and unreadable if subjected to temperatures above 150°F, it is vital that they be kept separate and well insulated from other flammable, high-temperature environments. The walls, ceilings, floors, and doors to a data storage area should have a two-hour fire rating. Vaults designed for data storage are available as prefabricated units built to several different fire ratings.

5.5 Protecting Supplies

Paper products are the most combustible materials in a data processing installation. It is advisable to store as few of these as possible in the computer room. A storage area for larger quantities of supplies should be located some distance from valuable equipment and data. Two-hour rated protection is recommended for the walls. Water is the standard quenching agent for paper products, but it may cause punched cards, printer paper, and other supplies to be unusable.

6. DELIVERY SCHEDULE

After all of the physical site planning has been completed, the next step is to develop a schedule which identifies all of the events necessary to prepare the installation and establishes appropriate dates for the start and completion of each event. Once this is finished, you will be ready to either confirm the delivery date of the system or reschedule it.

The delivery date becomes critical to the other major areas of operating system generation, analyst and operations staff training, and work assignments. By planning site preparation and delivery schedules, you will not be accepting and paying for a system until you are ready to use it. At all times, the establishment of the delivery date must be stipulated in the agency's contract and must be adhered to by the vendor.

7. HARDWARE INSTALLATION

When the system is delivered, the physical installation of the equipment can begin. In most instances the installation will be handled by the vendor's personnel and should be so stipulated in the contract in addition to the preestablished installation time frames. The individuals responsible for the installation should schedule adequate personnel to handle the task. If they are not available, or they are called out to handle breakdowns for other customers, the installation of your equipment may be delayed to the point of being unacceptable, which could in turn impact other important project milestones. If you have completed your obligations on site preparation, insist that the vendors complete their obligation or provide for an acceptable alternative.

8. ACCEPTANCE TESTS

After the physical installation of the computer has been completed, but prior to turning the system over to the agency, the vendor must be required to perform acceptance tests demonstrating a functional system. Provisions for acceptance testing should be included in the contract. These tests vary from a simple requirement stating that a hardware component must operate without error for a specific period of time to a full-blown test of the entire system, including its operating system and user application programs.

The magnitude of these acceptance tests is dependent upon the functions stipulated in the RFP and contract. No payment should be made to the vendor until the acceptance test has been completed. Once payment has been made, an agency has little recourse against a vendor who does not perform the installation and checkout procedures properly.

9. OPERATING SYSTEM INSTALLATION

When developing the overall installation schedule for the equipment, consider the installation schedule for the operating system. Adequate time should be provided to the systems programmers to finish operating system generation and testing so that the completion of this task coincides with the completion of the equipment acceptance test. Since this is a highly technical undertaking, the use of vendor personnel to assist in the development of the operating system implementation schedule should be encouraged if at all possible.

10. APPLICATION PROGRAMS INSTALLATION

The last major component of the total system is the development of the application programs. Conversion or modification of current programs may be required if the system being installed is replacing an existing system; new programs may be needed if it is an original development effort. In either case, to ensure proper installation of the system, the schedule for completion of application programs must be considered along with the equipment and operating system installation schedule.

11. BACKUP FACILITIES

Another item which must be considered in the equipment area is the availability of backup facilities in case the computer installation is drastically delayed or there is a breakdown of the equipment later during the life of the system. In most instances moving to a backup facility would be a difficult and cumbersome task, especially for batch applications. Nevertheless, alternate facilities which could handle critical applications should be identified, and arrangements for emergency use negotiated. The development of an emergency plan to cover these types of circumstances would be very helpful.

One source to use in identifying backup facilities is the equipment manufacturer, who can provide names and locations of agencies using compatible equipment. Another source might be local users groups and consortiums. Even if your agency feels that its applications might not be critical, consider what action would be required if the entire system was destroyed. How long could you afford not to do any processing of necessary applications?

12. INSTALLATION EVALUATION

After the computer system has been installed and is considered to be operational, an evaluation should be conducted to determine if the vendor has supplied all items or services which were contracted for and, from the agency's standpoint, if the capabilities identified in the needs assessment process were, in fact, achieved. All statistics and narrative documentation produced as a result of the different types of evaluations described below should be saved for a final presentation to management.

12.1 Equipment Evaluation

In the area of equipment, the evaluation should deal with performance achieved versus promised. Records should be maintained which identify all hardware malfunctions, the time required for the vendor to respond, and the time it takes to fix the malfunctions.

If the vendor's performance does not meet the level specified in the contract or you are experiencing poor hardware performance, the vendor should be notified of the malfunctions and/or a plan should be established to improve the service. At that point, if no noticeable improvement is made, action should be taken to enforce the vendor's contractual obligations. These actions could go as far as contract cancellation or filing of claims for damages due to nonperformance.

12.2 Software Evaluation

As in the case of hardware, this evaluation should deal with the levels of performance achieved, down time record, maintenance record, and tuning. This evaluation is best performed by technical software people under criteria established by data processing management.

12.3 Application Programs Evaluation

This is the most important part of the evaluation since the result of the procurement process should be the implementation of a system which resolves the problems identified in the needs assessment. Review sessions with the users are critical here to determine if they are satisfied with system products and to ascertain if future modifications are necessary. These reviews should be formal and should be documented.

13. PROJECT REVIEW AND MASTER PLAN DEVELOPMENT

Before the system project can be concluded, an important final review process must be undertaken. This review should include management, in addition to the principals involved in the project. The purpose of this review is twofold: to determine the degree to which the objectives identified at the beginning of the project have been achieved, and to outline a master plan for the future operation and/or enhancement of the system. Depending on the complexity of the system, the review should not be conducted for at least six months. This delay is intended to eliminate any installation and implementation problems which might distort the review findings.

Program development and implementation, whether in a manual or automated mode, is an iterative process. Continual reassessment of an agencies objectives and effectiveness will most likely identify areas for future improvement. The guidelines set forth in this Manual should be very useful every time a project is analyzed.

The project review should be followed by an annual audit of the agency's master plan. During the audit, the system and its procedures are evaluated to determine the extent to which the system continues to meet the objectives of the agency. All audit findings should be added to the system documentation package.

In order for a computer system to operate effectively over an extended period of time, an agency must have some type of overall plan. A master plan of short and long-range goals and general guidelines for the achievement of stated objectives is a necessity. The master plan will provide direction to an agency and will decrease the sense of uncertainty about future enhancements or modifications. By being watchful and following the guidelines set forth in this Manual, an agency can help ensure that its computer system will be successful.

TOOLS AND TECHNIQUES

PART 2

This section of the Manual is designed to supplement the conceptual information presented in Part 1 with practical techniques and procedures. The material in Part 2 follows the topical organization of the preceding chapters, and is referenced in the Table of Contents back to the appropriate Part 1 text. Although Part 2 may be read by the more technically-oriented criminal justice information system administrator, it is directed primarily towards systems personnel tasked with the responsibility for designing and developing these systems.

For the individual new to the system analysis and design process, the checklists and sample data collection forms should be especially useful. For the experienced analyst, the suggested techniques and methods of data organization may offer a fresh point of view and provide an opportunity to review current practices.

Keep in mind that not all of the procedures and techniques may be needed during a particular project phase. The nature of the study or design effort may require the user to make modifications in approach as necessary.

PART 2

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1. INTERVIEWS

1.1 Purpose and Approach

The interview process is probably one of the most important elements of information gathering for a systems development project. An effective user interview provides insight and direction, user involvement in the process, and serves as a source of important information.

In advance of the interviews consideration of the purpose for the interviews should encompass at least four considerations. What approach or approaches should be taken with the interviewees? What kind of questions should be asked or information exchanged? What form of interview should be conducted? What kinds of available material should be reviewed prior to the interview?

The approach taken in an interview determines the type of communicative relationship established between the participants. Choice of approach, in any particular criminal justice agency, will depend not only upon the nature and scope of the project, but also upon the personalities involved, the organizational relationship between the interviewer and the interviewee, and the likelihood of creating a positive, informative environment. Guidelines for several approaches are provided here.

Approach 1: User Oriented Interview

1. In this type of interview, encourage the interviewee to describe problems, needs, and information requirements from their point of view.

2. Accept their description as the only legitimate frame of reference for the interview.

3. Keep the interview informal to establish a relaxed atmosphere.

4. Be supportive. Encourage the user to elaborate on problem definition and needs, and to propose possible directions for system improvement and data collection.

5. Avoid making specific suggestions or recommendations. Ideas with respect to procedural changes, system alternatives, or additional requirements should be presented in a very tentative manner.

6. In order to maintain the necessary perspective, the interviewer must gain some understanding of the problems before the interview. Never go into this type of interview "cold".

7. Use the comparison between steps 1, 2, and 6 as a basis for strengthening and refining your perspective of the project scope and content.

Approach 2: Interviewer/User Confrontation

1. Thorough advance preparation for the interview is essential.

2. Take nothing the interviewee says for granted. Have the interviewee support problem identification and stated requirements with facts and examples.

3. Probe for reasons, motives, objectives, causes, and reactions. Challenge the interviewee's thinking regarding assumptions, potential value and use of data, and possible alternatives.

4. Be prepared to present facts, but present your own perspective and thinking in a nonthreatening way.

5. Gather needed information as a byproduct of assisting the interviewee in clarifying his/her understanding of the problems and project.

Approach 3: Interviewer/User Environmental Acceptance

1. Emphasis is on nonjudgmental insight into problem areas, and the interaction of the interviewee with the project environment. This approach is particularly applicable when the project is to be conducted in a low-morale environment.

2. The interviewer tries to understand the problem, project environment, information requirements, and feelings without necessarily accepting them as a frame of reference for project development.

3. Restate the user's feelings and concerns wherever possible to emphasize awareness and supportiveness.

4. Don't agree or disagree. Make the users feel that they have an important interest in the success of the project and that their presentation of the problems and requirements will contribute positively to the project effort.

Generally, each of the approaches listed above applies to different circumstances surrounding the fact-finding effort. If conditions are particularly hostile or conflicting in terms of opinion, Approach No. 2 is recommended. Approach No. 3 applies in a situation where user morale is low, while approach No. 1 is standard for an uncomplicated interview effort.

The kinds of questions which should be asked or the type of information which needs to be exchanged will be a function of the nature of the project. The following guidelines, however, should be kept in mind.

1. If information requirements form a part of the interview scope, the questions asked should also focus upon:

   - How the information will be used and in what format

   - The sources of the information
   - The needed reliability
   - The differences between existing information capabilities and the desired capabilities
   - Potential difficulties in satisfying the requirements
   - Response requirements

   The higher the level of interview, the more the emphasis should be placed upon the kinds of information and the information usage.

2. If problem definition is a part of the scope, develop questions that explore areas of concern from many different points of view. Remember that there is always the danger of focusing on symptoms rather than the actual problems.

3. If system improvement is of major concern, be sure to include an exploration of the way in which different parts of the department interact with each other and with external elements. These relationships are usually quite sensitive to system changes. The interviewer should also be prepared to explore the ways in which system performance is currently evaluated and how improvements will be evaluated. Be sure to explore the need for system improvement as perceived by the interviewee.

Once an interview approach has been selected, the interviewer should also identify the best form, which may vary from user to user or from multiple interviews with the same interviewee.

An **informal** interview is desirable when a set of previously prepared questions would be inappropriate. It may be used when dealing with management users to explore general concerns about system performance and problems, as part of preliminary investigations, and to discuss possible needs currently not being met.

In a **topical** interview the major areas of concern have been identified and outlined, but a detailed set of questions is not prepared in advance. In the topical, and in the informal interview, considerable attention must be given to developing accurate notes.

A **structured** interview involves the development of a detailed series of questions. These may be distributed to interviewees in advance of the meeting, reviewed prior to the meeting and then discussed at the meeting. Alternatively, the questions may be raised at the meeting. While the interviewer should attempt to cover all of the relevant questions, he or she should be prepared to follow other promising leads that may be developed in the interview.

1.2 Review Available Material

The selection of material for review prior to interviews is a function of both the purpose of the interviews and the user's function within the organization.

Interviews involving technical personnel will require the review of appropriately detailed technical information. Material reviewed prior to managerial interviews should highlight organizational structure and experiential data. Operational information should be reviewed with an emphasis on purpose and performance. The purpose of reviewing available material prior to interviews is to assure that the maximum amount of useful information will be elicited. Material reviewed should provide:

- A familiarity with terminology.
- An understanding of the environment in which the project is being undertaken.
- A clear picture of the organizational structure and the personnel involved.
- Exposure to past activities, experiences, and problems that are likely to impact the success of the interview and the project.
- An understanding of the existing baseline systems, operations, performance and utilization.
- The identification of previous related efforts.

Depending upon the nature of the project, materials to be reviewed would include such things as:

- Technical reports
- Organizational charts
- Planning documents
- Flow charts
- Job descriptions

1.3 Prepare Interview Documents

With regard to the structured form of interviews, there are two major types of interview documents. These are the **questionnaire** and the **interview record.** The questionnaire provides the basis for a more thorough, thoughtful response to questions than might be obtained in an initial interview. In almost all cases the response to the questionnaire should be used as the basis for additional interview material. A sample questionnaire used in an information requirements analysis is shown on the following page.

The second interview document that needs to be prepared is the interview record. This is generally a summary document which organizes interview material so that it can be merged or compared with material from other interviews. A sample interview form follows the sample questionnaire.

MANAGEMENT INFORMATION SYSTEM
QUESTIONNAIRE

1. What specific objectives would you like to see achieved as a result of having an operational Management Information System?

2. How would you rank these Management Information System objectives in order of priority?

3. How would you evaluate the quality, timeliness, and usefulness of the information you presently receive?

4. What other kinds of information would you find helpful?

5. What are the most important types of decisions you make and actions you take?

6. What are the most frequent types of decisions you make and actions you take? How often do you make these decisions?

7. In your opinion, what are the major obstacles to your receiving accurate, timely, and useful information?

8. What kinds of applications do you feel are important candidates for inclusion in the Management Information System, and how would you rank them in order of priority?

Date Completed

Name: ____________________

Title: ____________________

PAGE:
DATE:
COMPLETED BY:

PROJECT:

INTERVIEW SHEET (Page 1)

PURPOSE OF INTERVIEW

NAME

TITLE

DEPARTMENT

REPORTS TO

OBJECTIVES & PRIORITIES

INFORMATION REQUIREMENTS & EFFECTS

INFORMATION SOURCES & RELIABILITY

PAGE:
DATE:
COMPLETED BY:

PROJECT:

INTERVIEW SHEET (Page 2)

NAME

DOCUMENTS RECEIVED, SOURCES & FREQUENCY

RESPONSE TIME (REQUIREMENTS & ACTUAL)

DOCUMENTS GENERATED & RECIPIENTS

OBSERVATIONS AND COMMENTS

1.4 Notify Interviewees

It is important to notify the users well in advance regarding the time and scope of the scheduled fact finding interviews. Often it is very helpful to send a letter which establishes the significance of the exercise and the intent of the project. When developing such a letter, make sure that it:

- Is from a ranking officer
- Is sent as early as possible
- Establishes the date, time, and location
- Establishes the purpose of the interview
- Describes the intent of the system effort
- Requests interviewee preparation if necessary

A sample interview notification memorandum may be found on the following page.

1.5 Conduct Interviews

Some suggestions for conducting interviews are:

- Interviews of from 45-90 minutes are usually the most productive.
- If possible, use interview teams consisting of one system specialist and one experienced officer.
- The most effective interviews are usually those in which there are the fewest interruptions or distractions.
- If a team is used, one member should document while the other member is questioning the interviewee. Alternating these roles is useful.
- Notes should be reviewed immediately following an interview and any additional thoughts or observations recorded.
- Don't be afraid to ask a question more than once, paraphrasing if necessary, to assure that it is understood.

1.6 Collection and Analysis of Data

If they are well done, feasibility studies, requirements analyses, and design and development efforts produce large amounts of useful data. Effective collection and analysis of data gathered during interviews and through preparatory studies should focus on several system aspects. These include:

SAMPLE INTERVIEW NOTIFICATION MEMORANDUM

TO:
FROM:
SUBJECT: M.I.S. Interview scheduled for ....
at ....

At the scheduled interview we are planning to discuss with you some aspects of the Management Information System now under development. We are interested in exploring two major areas with you at that time.

the first is concerned with the type and quality of information you are presently obtaining, the extent to which it meets your needs, and the degree to which it supports your decision making. At the time of the interview, it would also be helpful if you could have your secretary assemble for us a set of samples of those documents (computer reports, forms, etc.) on which you currently receive information.

The second area involves a determination of the ways in which a Management Information System can be of greatest value to you and your organization. We would appreciate you giving some thought to significant objectives that you would like your organization to achieve as a result of the Management Information System becoming operational. In identifying these "Management Information System Objectives", think in terms of practical levels of achievement, the parts of the organization that would be most directly affected, those individuals that would have the responsibility of achieving the objectives, and the relationships of these objectives to long-range plans.

Attached is a short questionnaire which we would like you to complete as frankly and completely as possible and return to us in advance of the interview.

We appreciate your cooperation and look forward to meeting with you.

1. The documentation of "baseline" or current system characteristics:
   - The **flow** of information - sources, users, frequency, volume, timing, and importance
   - The **use** of information - decision making, operational applications, planning
   - The **structure** of information flow - file structures, documents, quantities of information, accuracy
   - The **economics** of information - costs of acquisition, manipulation, and reporting; benefits; information value
2. The impact of modifications and additions to the "baseline" system.
3. The evaluation of the "baseline" system in both qualitative and quantitative terms.

Experience has shown that considerable insight can be obtained by organizing data to emphasize the above aspects. The following analytical formats are useful:

Flow Diagrams

Standard flowcharting may be used. To make the diagrams more useful, they should be structured to show the movement of information from one organizational element to another, or from one functional area to another. An example flowchart follows. Refer to Appendix 3 for simplified flowcharting techniques.

Input/Output Charts

In a more summarized form than the flow diagrams, an Input/Output Chart shows the flow of documents. An Input/Output chart can take many forms. One example, shown below, indicates which departments a document is Ouput from and Input to.

Data Matrices

Charts of matrices that relate the relevant documents to the data elements they contain can reveal considerable information concerning areas of similarity and areas of potentially undesirable redundancy. An example of a data matrix can be found following the sample Input/Output Chart.

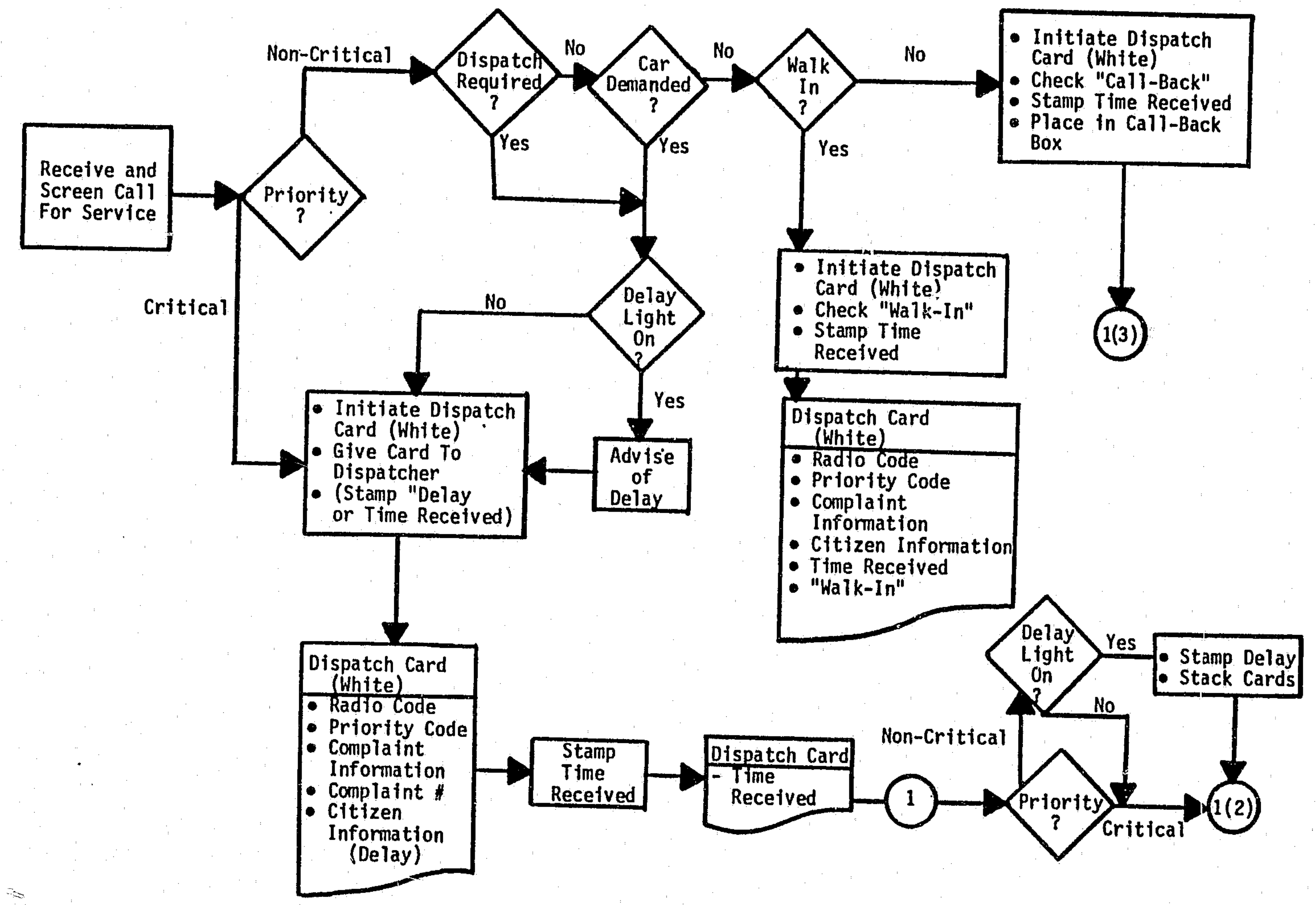
2. SYSTEM STUDY

2.1 Define Objectives

Whatever the nature of the project, it is important to establish one or more objectives that the department would like to see achieved as a result of the

CALL FOR SERVICE PROCEDURE

Example of Flowchart


Receive and Screen Call For Service
Priority ?
Non-Critical
Critical
Dispatch Required ?
No
Yes
Car Demanded ?
No
Yes
Walk In ?
No
Yes
• Initiate Dispatch Card (White)
• Check "Call-Back"
• Stamp Time Received
• Place in Call-Back Box
1(3)
Delay Light On ?
No
Yes
• Initiate Dispatch Card (White)
• Check "Walk-In"
• Stamp Time Received
Dispatch Card (White)
• Radio Code
• Priority Code
• Complaint Information
• Citizen Information
• Time Received
• "Walk-In"
• Initiate Dispatch Card (White)
• Give Card To Dispatcher
• (Stamp "Delay or Time Received)
Advise of Delay
Dispatch Card (White)
• Radio Code
• Priority Code
• Complaint Information
• Complaint #
• Citizen Information (Delay)
Stamp Time Received
Dispatch Card - Time Received
1
Priority ?
Non-Critical
Critical
Delay Light On ?
Yes
No
• Stamp Delay
• Stack Cards
1(2)

EXAMPLE OF INPUT/OUTPUT CHART

	DEPARTMENT							
DOCUMENT	COMMUNICATIONS	CRIME ANALYSIS	INVESTIGATIONS	IDENTIFICATION	JAIL	PATROL	ADMINISTRATION	RECORDS
DISPATCH CARD	O/I	I						I
INCIDENT REPORT		I	I			O/I		I
ARREST REPORT		I	O/I		I	O/I	I	I
SUPPLEMENTARY REPORT		I	O/I			O/I	I	I
MASTER INDEX CARD								O/I
BOOKING SHEET		I		I	O/I		I	I
FINGERPRINT CARD				O/I				I
FIELD INFORMATION CARD		I	I			O/I	I	I
SHIFT REPORT		I	I			O/I	I	I

I = INPUT TO O = OUTPUT FROM

EXAMPLE OF DATA MATRIX

	DATA ELEMENTS											
	COMPLAINT CODE	LOCATION	STATUS CODE	DISPOSITION CODE	COMPLAINT NO.	DATE	OFFICER NAME	DEFENDANT NAME	VICTIM NAME	CHARGES	CRIME TYPE	D.O.B.
DISPATCH CARD	X	X	X	X	X							
INCIDENT REPORT	X	X		X	X	X	X		X		X	
ARREST REPORT		X			X		X	X	X	X	X	X
SUPPLEMENTARY REPORT	X	X		X	X	X	X		X		X	
MASTER INDEX CARD		X				X		X	X	X		X
BOOKING SHEET		X				X	X	X		X		X
FINGERPRINT CARD		X				X		X		X		X
FIELD INFORMATION CARD		X				X	X					

project. This is an essential prelude to any system evaluation. The objectives, if properly stated, provide the basis for determining the extent to which the new system or improved system performs as expected.

To be most effective, the objectives must satisfy at least three conditions:

- They must be **specific,** explicitly as quantitative as possible.
- They must be **restrictive,** explicitly identifying the areas of concern that will be the subject of the effort.
- They must be **resolvable,** translatable into lower level objectives that apply at other points within the department.

Formulation of the objectives will require the active involvement of department heads and top management. Objectives must be agreed upon and carefully documented.

2.2 Identify Study Areas

Identification of the most obvious areas to be analyzed occurs when:

- users report disatisfaction with a system's performance
- new requirements are established which cannot immediately be met with existing systems
- normal growth of a system or changes in its operating environment threaten to obsolete the system

Depending upon the number of system users, the complexity of the system, and the extent of interactions with other systems, multiple application areas may be identified for further analysis.

It is unusual to encounter an information system project with unlimited resources. In most cases, project personnel, time, and effort must be carefully directed to those specific application areas which will produce the most important results. But what is meant by "important" in this context? In the absence of a clearly defined problem area, several viewpoints may be adopted.

From a technical point of view, a set of priorities may be established based upon factors such as cost/benefit ratios. But other nontechnical factors must also be considered. Initial consideration must be given to those applications areas which provide information required by state, Federal, or local law. Applications areas which provide information or operational capability necessary to the operation of the criminal justice facility would be, broadly speaking, next in line for consideration. Areas which involve the provision of new capabilities should be considered at this point.

When further selection of areas is necessary, a relative assessment of potential applications by agency users or managers will help to incorporate an additional set of viewpoints. There are many ways of accomplishing this assessment. Perhaps the simplest way is to:

1. List all of the potential areas and have each participant in the decision rank them from highest = 1 to lowest = N, where N is the number of areas being considered.
2. For each potential area, form the sum of the rankings.
3. Form a new list in which the potential applications areas are placed in increasing order of their sums. The higher an application is on this list, the higher the assessment priority it should be given.

2.3 Establish Priorities

All system improvements and modifications for both automated and manual systems should be assessed with respect to the following elements. Priorities can be assigned according to the number and degree of appropriateness of the elements.

- Complexity
- Cost/Benefit
- Availability of data
- Probability of success
- Availability of new personnel
- Importance of new information availability
- Extent of interdependency on other systems

2.4 Review Information Requirements

An effective information requirements review is a complex process. The emphasis is normally upon matching stated requirements with the "baseline" capabilities of a system in order to assess the changes required. Under these circumstances, the higher the level of interview or the more preliminary the study, the more condensed will be the categorization of information. As a study becomes more detailed, attention will be directed to individual elements of data/information. When this happens, each element should be reviewed and documented.

The most difficult aspect of such a review is the examination of stated requirements without reference to a "baseline" system. While the project team is not always in a position to distinquish between "stated" needs and "actual" needs, it should work closely with the user's to jointly explore how particular kinds of information would be used.

2.5 Document Analysis

Document Analysis can be undertaken from two points of view - that of the user and that of the contents.

The primary intent of the Document Analysis from the user's point of view is to determine the manner in which the document is received and how it is used. It is also important to note the way in which a document's utility is viewed by the user. The sample Document Analysis (User) form identifies some of the most important aspects of this analysis.

Document Analysis (Content) elements are shown in the sample form. While the elements are not all-inclusive, they do provide some direction. Actual samples of completed documents should be gathered and assembled as part of the documentation wherever possible during the data collection process.

The Document Analysis is a convenient point at which to review Input/Output charts to identify document flows that appear unnecessary. It is also the point at which to analyze any data matrices to identify areas where duplicate data elements may be involved.

The document analysis is used as an input to the system design or evaluation process. Considerable care, however, must be exercised in interpreting the data obtained. Information that seems to suggest the elimination of a document, or a potential change in document format, must be reviewed in terms of the degree of control that the document provides and the impact on the system's operation.

Instead, the analysis may indicate the need in which specific individuals receive their information. If the degree of data redundancy is a factor in potential document elimination, special consideration must be given to the underlying reasons for the redundancy. Adequate controls may suggest the desirability of such redundancy; adequate backup, should part of the system break-down, may require it.

3. FILE ANALYSIS

3.1 Estimate Information Volume

Criminal justice files represent an important resource. The objectives of a project, the time, and the manpower resources available will determine the scope of their examination. However, a comprehensive file analysis includes an evaluation of contents, format, physical storage, utilization, and economic factors. The following items may be included in specific file analyses.

Content

- Data Elements - definitions, value ranges, and units
- Amount of Information - average and maximum number of characters per record

PROJECT:

PAGE:
DATE:
COMPLETED BY:

DOCUMENT ANALYSIS (USER)

USER

DOCUMENT NAME

IDENTIFICATION NUMBER

SOURCE

FREQUENCY

NUMBER RECEIVED

NUMBER FORWARDED

ACTION/DECISION VALUE

REPORTING DELAY

ACCURACY & VERIFICATION

DOCUMENT ELEMENTS UTILIZED

REDUNDANCY WITH RESPECT TO OTHER DOCUMENTS RECEIVED

DISPOSITION:

FORWARDED ___ FILED ___ HELD ___

FORWARDED WITH MODIFICATIONS ___ DESTROYED ___

FORM OF REPORTING:

MONITORING ___ TRIGGERED ___

DEMAND ___ PLANNING ___

OBSERVATIONS AND COMMENTS

PAGE:
DATE:
PROJECT: COMPLETED BY:

DOCUMENT ANALYSIS (CONTENT)

DOCUMENT NAME IDENTIFICATION NUMBER

SOURCE INPUT ___ BASIC RECORD ___ INTERMEDIATE ___ FINAL ___

FREQUENCY AVERAGE NO. OF PAGES ___ NO. OF COPIES GENERATED AVE. ___ PK. ___

HOW IS DOCUMENT USED?

DOCUMENTS ORIGINATING FROM AND UPDATED BY THIS DOCUMENT

RETENTION CHARACTERISTICS

DOCUMENT FILING SEQUENCE

MEDIA: NO. OF CHARACTERS OF INFORMATION MAX ___ AVG ___

- Number of records
- Duplication of data elements with other files
- Identification of data elements that serve as retrieval keys or linkages with other files and records

Formats

- File structure and organizational characteristics (in the case of automated records)
- Storage media (in the case of manual records)

Physical Storage

- Space occupied by a file
- Physical layout - for manual records this would include file drawers, shelf storage, etc.

Utilization

- Sources of updating information
- Users
- Frequency and number of accesses for purpose of retrieval and/or update
- File growth rate
- Historical changes in access frequency and volume
- Reliability of file data
- Access times
- Purging characteristics
- Access controls
- Efficiency measures such as recall/relevance ratio and scanning ratio.

Economics

- Cost of personnel and equipment associated with file maintenance including access and quality control
- Cost of space
- Incremental access costs

- Cost of file reorganizagion and/or periodic purging
- Cost of access control
- Cost of file analysis
- Data conversion costs
- File consolidation costs

When looking at manual files, the easiest procedure for estimating volume of information is simply to calculate:

Volume =

records in file 1 x average #characters of information in a file 1 record

Plus

records in file 2 x average #characters of information in a file 2 record

Plus

.
.
.

records in file N x average #characters of information in a file N record

The resulting figure must usually be reduced by some fraction representing the anticipated reduction in file sizes resulting from a purging of the files. When analyzing automated files, a similar computation may be carried out. The resulting figure may also have to be increased by a fraction which represents "overhead" - information which is stored for the purpose of linking records to one another or for the purpose of indexing the computerized records.

3.2 Estimate Space Requirements

Space requirement estimates should always incorporate anticipated growth rates. Generally:

- One may assume that space requirements will increase at a rate at least equal to that experienced up to the time of the file analysis.
- Space requirements should be calculated over an interval of time equal to the Value Period of the Cost/Benefit analysis (see Section 6).
- In the case of manual files, an ample growth rate can be extrapolated based upon current file volumes, past growth rates, and, for example, current crime rate and population trends.
- In the case of automated files, because of (a) the likelihood that additional data elements may be added at a later time, and (b) the effect of file "overhead", a compound growth rate should be used. The resulting figures may then be adjusted downwards to reflect purging and reorganization of files. The computation could be shown as:

Volume in N years =

$$\text{Current Volume} \times (1 + \text{overhead factor}) \times (1 + \text{growth rate})^N$$

e.g. current volume = 600
overhead = 5%
annual growth rate = 5%

Estimated Volume in 3 years desired

$$= 600 \times (1 + .05) \times (1 + .05)^3$$
$$= 600 \times 1.05 \times 1.22$$
$$= 769$$

Physical space requirements for manual files also needs to be estimated.

3.3 Estimate File Accuracy

It is always a sound idea to reestimate the accuracy of your files as a part of a system redesign or improvement effort. It is not difficult, but should be done carefully. Generally the procedures involve:

1. Establishing criteria for determining that a particular record is accurate. For example, what reference will be used? How will missing data be treated? Will all data elements be considered or only selected elements?
2. Decide how many records will be examined. This usually depends upon staff and time available.
3. Establish a procedure for selecting records to be examined. If, for example, the records are numbered sequentially, you may want to select records randomly, using a random number table.
4. When the record examination is completed, calculate the estimated accuracy. For example,

$$\textbf{Percent Accuracy} = \frac{\text{No. of Records Found Accurate}}{\text{No. of Records Examined}} \times 100$$

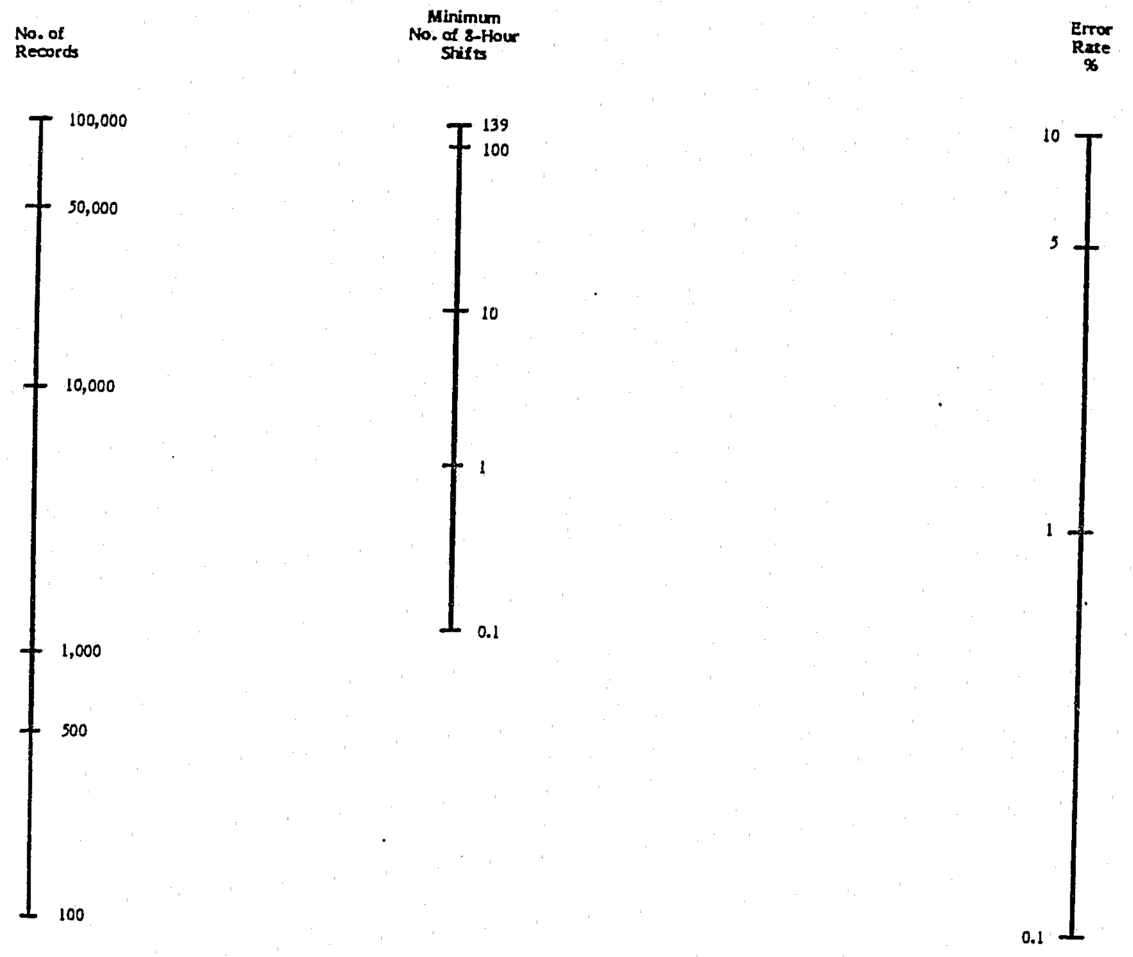
The chart on the following page provides a method for estimating the number of shifts required for record correction.

4. SYSTEM FLOW ANALYSIS

4.1 Diagrams

System flow diagrams are useful in a number of ways. They can be used to isolate particular system problems, to explore potential changes to the CJIS, and they can be used as the basis for a variety of system calculations.

Record Correction Chart



To estimate the minimum number of shifts required for one person to correct errors in file records:

Connect the number of records in the first column with the estimated error rate in the third column with a straight edge. Read number of shifts on the second column.

In attempting to isolate system problems, be especially alert to:

- Response times that appear unreasonably large. These may indicate areas of unnecessary flow or excessive processing delays
- The same data moving back and forth between the same functions or departments
- Information that appears to pass through more than one "nonprocessing" activity before reaching the intended users
- Redundant flows of information that do not exist for control or backup purposes

When using the flow diagrams to consider potential system changes:

- Clearly identify those information flows as procedures that are mandatory
- Identify necessary control functions
- Be sensitive to managerial and political considerations which might affect the acceptibility of alternate flows. Some of these considerations include responsibility for accuracy of data, control of files, effect of changes in elected positions on acceptability of activities, sharing of costs, and effect of system changes on systems external to that under study

4.2 Response Time

In analyzing system flow data, we are always particularly concerned with response times - the intervals of time measured from data input or availability to actual user receipt of information. Defined in this way, response time incorporates components of time attributable to:

- Data collection and recording
- Decision/control points
- Data transmission
- Data conversion
- Data processing
- Report delivery
- Quality control

and other system activities.

If we are concerned with specific information reflected on the flow diagram and we have recorded the number of transactions per unit time and the average time for each of those transactions, we can calculate a useful measure of response time for the system or portion of the system under study.

We calculate the average time per transaction as:

Number of Samples	Elapsed Time for Transaction
1	22
2	20
3	19
4	16
5	15
6	14
N =	106

$$\textbf{Average Time per Transaction} = \frac{\text{Total Time}}{\text{Number in Sample}} = \frac{106}{6} = 17.67$$

5. RELIABILITY ANALYSIS

5.1 Information

In the context of an information system, reliability can be thought of as the probability that information generated by the system is accurate. In fact, information can be presumed to be generated by each step in the operation of the system. This process can occur in any direction. For example, the following is one possible path for information flowing into the system, destined for the appropriate files.

incident ⟶ communications ⟶ investigations ⟶ DP ⟶ Files

The overall reliability, as measured by the accuracy of the files, is a function of the reliability of each of the steps. These component reliabilities, in turn, are a function of the inputs to and outputs from the components.

5.2 Configuration

Reliability of hardware within a criminal justice system can be considered as the probability that the hardware is actually available for use when needed. Reliability analysis can be applied to any hardware - reproduction equipment, microfilming equipment, and computer systems. In the present analysis we are assuming that the system of interest is a computer system.

In technical terms, hardware reliability may be expressed in terms of expected failure rates. A simpler approach may be used, however, that also reflects availability for use when needed. It requires that a careful operating log be kept. This log should indicate, for all of the equipment components:

T = the total shift time

t_s = the scheduled shift maintenance or test time, and

t_a = the actual time available per shift.

Taking into account scheduled maintenance or test time, unscheduled maintenance or test time, and unscheduled down time for each piece of equipment, we can calculate reliability as:

$$R_{\text{EQUIP}} = \frac{t_a}{T - t_s}$$

For example, on a given eight hour shift a printer underwent ten minutes of scheduled maintenance. Later in the shift a malfunction led to its being unavailable for another twenty minutes. In this case:

$T = 8$ hr.;

$t_s = 0.167$ hr.;

$t_a = 8 - 0.167 - .333 = 7.5$

$.957 = \frac{7.5}{8 - .167}$

Then, $R_{\text{PRINTER}} = .957$

To find the overall reliability of a series of components, such as the data communications device, the computer, and the printer, we multiply the component reliabilities together. Thus,

$$R_{\text{OVERALL}} = R_1 \times R_2 \times R_3$$

Acceptable reliability factors will vary depending on the importance of the system. For example, an on-line Computer Assisted Dispatch system should have a factor of at least .990 to be considered reliable, while an off-line batch reporting system could go as low as .950 before being considered unreliable.

6. COST/BENEFIT ANALYSIS

A criminal justice information system requires a substantial commitment of resources over time. Approval of such a system should depend, in part, upon sufficient evidence that the benefits justify the expenditure. For an agency with a limited budget, any information system project should compete with other potential needs for funding. A cost/benefit analysis provides the basis for making such a comparison. Closely related to project objectives, benefit/cost data also serve as yardsticks for measuring the extent to which a system achieves the original expectations. The following guidelines should assist you in developing the necessary cost/benefit data:

6.1 Establish Cost and Value Periods

Reasonable cost and value periods must be established to assure that a realistic Cost/Benefit Ratio is obtained. Where there is more than one agency involved in the project, mutual agreement should be reached on both the value and cost periods.

The **Value Period** is equivalent to an assumed Life Cycle interval - the period of time over which the developed system is expected to function. This period is frequently set equal to the time cycle of the organization's long range planning cycle.

The **Cost Period** can be set equal to the Value Period in the case of manual systems. When dealing with computer systems, the cost period is usually set equal to the period over which the equipment costs can be amortized.

6.2 Identify Benefits

Benefits generally fall into three categories:

- Benefits related to program achievements
- Benefits related to process or operational improvements
- Benefits related to informational capabilities

Typical examples would be:

Program achievements

- Improved use of resources - personnel, supplies, space, data processing
- Improved scope - number and type of user agencies
- Effect of changes in organizational structure

Operational improvements

- Increased efficiency
- Improved response
- Increased accuracy and reliability of outputs

- Effect of better, more timely information
- Elimination of redundancies in processing steps
- Improved service levels
- Effect of new information capabilities
- Increased confidence in systems
- Report flexibility

Informational capabilities

- Effect of better data standards
- More efficient file structuring
- Elimination of redundant information
- Better protection of data

6.3 Translate Benefits Into Equivalent Dollars

Most Cost/Benefit analyses will involve a consideration of both quantitative and qualitative benefits. For example, the former might include reduced cost of generating reports; the latter might include improved service.

In order to incorporate qualitative benefits into the analysis, they must be converted into **equivalent dollars** by relating them to other factors that are more easily considered on a quantitative basis. For example, suppose improved service in a particular agency refers to the ability of Records to provide Modus Operandi data more quickly than was possible previously by manual files within CID. Specific assumptions might be made relating this improved service to a percentage increase in personnel efficiency which, in turn, could be translated into equivalent labor dollars saved, into an assumed increase in the number of cases cleared, and finally, into equivalent dollars of stolen property recovered, etc.

It is most important that all such assumptions be carefully documented. Sample summary sheets are shown on the following pages.

6.4 Identify Costs

For purposes of Cost/Benefit analysis, costs are generally identified as:

- Recurring vs. Nonrecurring - where recurring costs are a function of the number of cycles of occurence within the selected cost period, and the nonrecurring costs are considered as being amortized over the cost period.

PAGE:
DATE:
COMPLETED BY:
PROJECT:

COST/BENEFIT EVALUATION (I)

Application/Functional Area ______________________

Cost Period __________ Value Period __________

Assumptions ______________________

____

____

Cost Estimation

#	Item	R/NR	Estimation	$
			Total	______

Benefit Estimation

#	Item	QN/QL	Estimation	$
			Total	______

PAGE:
DATE:
PROJECT:
COMPLETED BY:

COST/BENEFIT EVALUATION (II)

Cost Period __________ Value Period __________

Application/Functional Area	Cost Est.	Benefit Est.	B/C

Totals			

- Replaceable vs. Nonreplaceable - where replaceable costs are those completely eliminated as a result of the new system or system modifications. Nonreplaceable costs are those that continue into the new or revised system.

One significant conversion or improvement cost that deserves special consideration is that cost associated with correcting file records that are found to be in error. In many cases, correction involves comparing a given record with other data sources and altering a piece of data or filling in a missing data element. The amount of time required to scan the file records that are in error and take corrective action (and hence the related costs) is a function of the size of the file (number of records) and the estimated error rate.

6.5 Calculate Cost/Benefit Ratios

The ratio of Total Benefit, expressed as the sum of quantitative benefit dollars and qualitative equivalent dollars, to Total Cost, over their respective Value and Cost Periods, is a useful measure of worth. Where there is more than one application component to a system, a Cost/Benefit Ratio (C/B) can be calculated for each application and used as an input to priority setting and relative assessment.

Since a Cost-Benefit ratio is interpretable in much the same way as a "return on investment" figure; it may be used as a basis for assignment of resources or for recommending that an application not be included in a particular project. Unless other mitigating factors exist, applications for which the Cost-Benefit Ratio is greater than one should be avoided.

7. PROCUREMENT REQUEST PREPARATION

The Request for Proposal (RFP) or Invitation for Bid (IFB) is the document used to describe the computer system requirements of the agency to the vendors. It is also the solicitation document for bids or proposals from the vendors for systems that will meet the agency's requirements. A sample RFP and a sample IFB are presented in the Appendix 3 and 4.

7.1 Uniform Response

The key function of the request document is instruction to the vendors on how to respond to the request. This is important in public agencies since each vendor will respond differently unless instructed to respond in a uniform manner. It makes it difficult, if not impossible, to compare responses if each vendor is permitted free form in his response, and considerable time and effort are wasted in attempting to develop comparisons.

7.2 Pricing Instructions

A critical part of the instructions to vendors is how to respond to the pricing instructions. Pricing information contained in the proposals serves several purposes. Unit prices are required for every component, software, and support items. The monthly, yearly, and total costs for the system under each of the various procurement plans are also required. Unit prices are necessary for contract administration and accounting purposes. Total costs are required for evaluation purposes. Pricing instructions must specify which prices are sought when and where. For instance, if residual value is to be considered in comparing the expenditures associated with a lease or rented system to those for a purchased system, the formula for determining residual value must be given. If other than monthly pricing is required, such as quarterly or yearly, the vendor must be so instructed to comply. Any special formats (charts, tables, etc.) required for cost must be provided along with samples for the vendor to respond properly.

7.3 Uniform Contractual Terms and Conditions

One of the most important functions of the request is to establish the contractual terms and conditions to which the vendors must agree in order to respond to the request. A more detailed discussion of terms and conditions is contained in Chapter 4 of Part 1 and in Part 2, Contract Terms and Conditions. No two vendors' prices are based on the same terms and conditions. Unless uniform terms and conditions are required, it is meaningless to compare prices since there will be no uniform basis for comparison.

7.4 Specifications

The essential part of any Request for Proposal or Invitation for Bid is the section on the agency's system specifications and requirements. These specifications delineate what the agency is asking in terms of a computer system.

An essential part of the specifications is the designation of any limitation which will be imposed on any proposed computer system. These limitations must be classified as either mandatory requirements or desirable features. Mandatory requirements are used to define those conditions which must be met by the vendor and must be provided exactly as defined. If a vendor system cannot meet any of these mandatory requirements, then the system cannot be considered for selection. It is always better to set mandatory requirements in the broadest terms rather than in many levels of detail. Functional requirements for the new system should be expressed in terms of application systems, representative programs, or job mixes rather than a specification for a particular type of hardware device. Often vendors can meet the functional requirements but not the specific requirements indicated by hardware limitations or capabilities.

Desirable features are those items which the vendor could provide but which can be done without or which can be obtained in some other way. If a given vendor proposal does not include some desirable feature, the agency would continue to consider that vendor's proposal even though the failure to provide that desirable feature would invoke some penalty on the proposal. In most cases, if the vendor can meet the desirable features he will provide them, unless his cost to provide them exceeds the assessment to be imposed on him for failure to so provide.

7.5 Detailed Support Information

The Request for Proposal or Invitation for Bid should also specify response sections where the vendor makes presentations on his system. The vendor should also be instructed to submit detailed technical descriptions of the hardware and software of his bid system, environmental specifications, and detailed results of any benchmark demonstrations. A dictionary of terms and complete details on how requirements will be met must be furnished.

7.6 Turnaround Document

The solicitation document should serve as a turnaround document. In other words, the document should be incorporated into the vendor's proposal and should become a part of the contract.

7.7 Evaluation Criteria

The overall weighted evaluation criteria should be delineated in the RFP. This will allow the vendors an opportunity to assess which areas are considered to be most important in responding with their proposals.

7.8 Summary

The RFP or IFB, if properly prepared, should serve many varied functions. It should be developed in such a way that it serves as a turnaround document with its sections suited for enclosure in the vendor's proposal and contract. It will ensure a standard formatted response from all vendors with particular attention given to pricing instructions. It must contain the system specifications with a positive statement of the mandatory and desired features. Finally, it must provide response sections in which the vendor is to provide detailed supporting information.

8. PROPOSAL EVALUATION METHODOLOGY

8.1 Introduction

An effective evaluation methodology must have the following criteria:

- Consider those items or features desirable, but not mandatory
- Cover all of the items or features desired

- Facilitate the establishment of meaningful and understandable value between the desired items
- Require establishment of the desired items and their relative values before the solicitation document is completed
- Permit disclosure of the desired items and their overall relative values to the vendors by including the evaluation criteria in the RFP
- Incorporate the least total expected cost for the system life cycle

The evaluation technique should be consistent with the needs assessment as defined by the procuring agency, as well as the terms and conditions of the request. The criteria should be reviewed by an independent party such as an advisory committee. The individuals who will make the evaluation should be defined at least as to position within the procuring agency or as to their positions within an outside organization.

There are two basic evaluation methodologies, with several variations of each, which permit the evaluator to consider desirable features and establish the relative value of the desirable items. The approaches fall under either "weighted-scoring" schemes or "cost-value" based approaches. Brief descriptions of each of these approaches follow.

8.2 Utility Assessment Technique

Under this system, the prospective user preassigns varying quantities of points (or percentages) to all items considered important and then selects the system earning the most points. The technique is applied in three stages. First, criteria are selected and weighted in a way which takes into account trade-offs and priorities. Then a systematic procedure is developed which calculates raw scores with respect to each of the criteria. Finally, the raw scores are multiplied by the criteria weights and the products summed to arrive at a weighted score for each proposal.

Utility Assessment

Goal:

> To analyze proposals in a consistent, orderly fashion and to determine the extent to which each proposal meets a set of predetermined and weighted criteria.

Overview:

> This method provides a framework for analysis which effectively measures both the qualitative and quantitative aspects of a proposal. Criteria with quantitative values or limits will be rated similarly by every member of the review team, thus providing a high degree of uniformity independent of personal preference or experience. Qualitative criteria will be evaluated subjectively against an established scale.

Process:

1. Calculation of Raw Score for all Quantitative Criteria

   A. Upper Limit Constraints

   - Dollars ("not to exceed ________ dollars")
   - Numerical ("no more than ________ days")

     1. Divide proposal value by constraint value
     2. Multiply by 100
     3. Subtract product from 100
     4. Result is raw score

   B. No Upper Limit Given

   - Dollars
   - Numerical ("A minimum of ________ transactions")

     1. Divide proposal value by constraint value
     2. Multiply by 100
     3. Product is raw score

Process:

2. Calculation of Raw Score for All Qualitative Criteria

Criteria such as company reputation, prior experience in a related field, etc., may be important in the evaluation process but must be rated on a subjective scale. For each qualitative criterion, establish a scale of 0 to 100 and rate each proposal accordingly. It would be helpful to provide each member with a scoring guide in order to maintain some degree of uniformity.

For example:
0 - 25 poor
26 - 50 average
51 - 75 above average
76 - 100 outstanding

The resulting value is raw score for that criterion.

Process:

3. Calculation of Final Weighted Score for All Criteria: Proposal Ranking

   A. Multiply raw score by the weighting factor for each criterion. The product is the weighted score or "utility" for every criterion.

   B. Total all weighted values to determine the final score for every proposal.

   C. Rank the proposals from high to low score. The highest score satisfies the criteria to the greatest extent.

A sample worksheet to summarize this process is on the following page.

8.3 Criteria Weighting Technique

Method of Successive Approximations

Goal:

To ensure that the relative importance of all evaluation criteria is accurately reflected in their assigned weights.

Overview:

This method of assigning weight values to a list of criteria is a useful preparatory step which must be completed prior to the opening of the proposals. By systematically comparing the criteria against one another, trade-offs and priorities become apparent which might not have been considered otherwise. See Tables 1-5 on the following pages for sample Criteria Weighting.

Process:

1. Assignment of Initial Criterion Values

   A. Rank criteria in order of importance.

   B. Assign an arbitrary value to each criteria (the total need not add up to 100).

   Considerations

   - Compare the value of Criterion #1 to the sum of all the other criteria.

     1. Is it greater in importance than all the rest? Equally important? Not as important?
     2. Adjust the value of #1 to reflect its perceived importance.

PROPOSAL EVALUATION CRITERIA

Worksheet

CRITERIA	CRITERIA CONSTRAINTS	CRITERIA WEIGHTS	PROPOSALS					
			1		2		3	
			Raw	Wht	Raw	Wht	Raw	Wht
	SUM OF WEIGHTED SCORES (UTILITY)							
	PROPOSAL RANKING #							

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- Drop, successively, the last criterion from consideration, the next to the last, etc. and make comparisons until the first criterion is compared to only two others.
    1. If criterion #1 could not be satisfied, but the (decreasing group of) others could, would that be satisfactory?
    2. Adjust #1 to reflect its importance.
- Compare criterion #2 to the sum of the remaining criteria (excluding #1).
    1. Is #2 more important, of equal importance, or less importance than the remaining group of criteria?
    2. Adjust #2 to reflect its importance.
- Continue the descending comparison of every criteria against the sum of the remaining criteria. Make value adjustments accordingly; do not attempt to make the values add up to 100 or 1000.

Process:

2. Normalizing Final Criteria Values: Percentage Calculation

- Add the values for all the criteria.
- Divide each individual value by the sum produced in step #1 above.
- Multiply each by 100.
- Resulting values are the percentage weight for each criterion.

TABLE 1

CRITERIA WEIGHTING

INITIAL VALUE ASSIGNMENT

CRITERIA	INITIAL WEIGHT
A. COST	40
B. DELIVERY DATE	25
C. QUERY CAPABILITY	20
D. STORAGE	15
E. MAINTENANCE	5

TABLE 2

CONSIDERATION #1

FUNDING FIXED; MUST TAKE PRECEDENCE OVER ALL OTHER CRITERIA COMBINED

	ADJUSTMENT
A. COST	70
B. DELIVERY DATE	25
C. QUERY CAPABILITY	20
D. STORAGE	15
E. MAINTENANCE	5

TABLE 3

CONSIDERATION #2

DELIVERY DATE COULD BE SLIPPED IF QUERY CAPABILITY, STORAGE, AND RELIABILITY CRITERIA ARE SATISFIED

WEIGHTS REMAIN THE SAME, SINCE THE SUM OF C, D, & E ARE GREATER THAN B.

A. COST	70
B. DELIVERY DATE	25
C. QUERY CAPABILITY	20
D. STORAGE	15
E. MAINTENANCE	5

TABLE 4

CONSIDERATION #3

IF FACED WITH ALTERNATIVE OF MEETING BOTH QUERY CAPABILITY (C) AND STORAGE (D) OR MAINTENANCE (E), THE GROUP FEELS THE LATTER MUST BE AT LEAST EQUAL TO THE OTHER TWO

	FINAL ADJUSTMENT
A. COST	100
B. DELIVERY DATE	25
C. QUERY CAPABILITY	20
D. STORAGE	15
E. MAINTENANCE	35
TOTAL	195

TABLE 5

FINAL WEIGHT CALCULATION

- DIVIDE EACH VALUE BY THE SUM OF THE VALUES (195)
- MULTIPLY BY 100 TO DETERMINE FINAL WEIGHTED PERCENT

A. COST	51%
B. DELIVERY DATE	13%
C. QUERY CAPABILITY	10%
D. STORAGE	8%
E. MAINTENANCE	18%

8.4 Cost-Based Techniques

8.4.1 Cost-Effectiveness Ratio

This evaluation methodology is really only a subcategory of the Criteria Weighting Technique, except that here, by dividing the total system cost by the sum of the points scored in the other desirable categories (collectively called the effectiveness category), the prospective user can select the system with the lowest ratio of cost to effectiveness. But, such a division of points is not sufficient to establish a meaningful relationship between cost and effectiveness.

8.4.2 Cost-Value Technique

None of the previous evaluation techniques proves very satisfactory under intensive investigation. Therefore, a more advanced evaluation method, the Cost-Value Technique, has been developed. This technique combines the simplicity of a Cost-Only Technique (lowest proposal cost is selected) with the realism of the Criteria Weighting Technique. The result is a technique superior to both. It is better than the Cost-Only Technique because it considers some items in a computer system to be of value in addition to the system's cost and its compliance with the mandatory requirements. It is superior to the Criteria Weighting Technique in that it establishes a meaningful relationship between the items of value and the system's cost, while at the same time incorporating system's life costing.

Under this procedure, a dollar value to the procuring agency is established for every desirable feature sought. If a vendor offers that item, the difference between the vendor's charge for the item and its preestablished dollar value is deducted from the cost of the proposal. If the desired item is not offered, or if its costs exceed its value, no value is deducted from the vendor's cost. The evaluation consists of nothing more than summing all costs associated with each system and deducting any values earned. The system having the lowest overall total cost (cost minus values) is the system selected.

8.4.3 Least Total Cost

This technique is conceptually the same as the Cost-Value Technique, only under this approach a vendor is assessed a preestablished dollar value or worth for any desirable feature not offered (or offered at a cost that exceeds its worth) by the vendor in his proposal, or if the vendor offers the feature, but at some charge, the vendor is assessed that charge. The system is the one having the lowest overall total cost, including not only the cost of the vendor's hardware, software, and services, but also other costs for items such as staffing, power and air conditioning, etc., and assessments for features not offered. An example of Least Total Cost is shown on the following page.

AN EVALUATION USING LEAST TOTAL COST

Evaluation Items	Vendor Cost A	 B	 C
Mandatory Costs:			
Hardware	$ 1,328,100	$ 1,048,180	$ 1,234,034
Software	62,400	28,800	-0-
Training	7,500	24,000	27,000
Other Costs:			
Site Preparation	148,000	161,000	193,000
Systems Analysis	147,800	56,000	78,000
Conversion -- User Personnel (200 Programs)	-0-	200,800	312,000
Parallel Option and Preinstallation Testing	16,827	107,200	194,600
Applications Development	-0-	310,000	420,000
Operations	435,000	513,000	487,000
Other*	17,300	15,000	17,800
TOTAL SYSTEM LIFE COST	$ 2,161,927	$ 2,463,980	$ 2,963,434

*Examples of additional "other costs" are:

Backup
Estimated Communications (Nonvendor Equipment)
Terms and Conditions
Maintenance
Environmental Software

The Cost-Value Technique and the Least Total Cost Technique are essentially identical and they prove exceptionally satisfactory once the dollar values of the desirable features are established. Both of these techniques meet all the criteria listed as essential for a superior evaluation methodology and both have been used with great success and vendor acceptance. Since the Least Total Cost Technique is a revision of the Cost-Value Technique, and is today more widely used, it will be discussed in detail below.

With the Least Total Cost Technique the items listed as essential to the completion of the agency's mission, called "mandatory requirements" or "vendor requirements", are not evaluated. The vendors' abilities to satisfy those requirements are validated and if any vendor fails to satisfy those "mandatory requirements", his proposal is removed from any further consideration. The items evaluated are those items called desired items, features, or "other system requirements", which are items sought by the procuring agency unless they are too costly. These "other system requirements" are normally items required for the user's system, but are items which could be obtained from other sources, or which could be accomplished in-house or which could be done without, at some sacrifice to the procuring agency. In all cases, the failure of a vendor to supply the "other system requirements" indicates additional expenditures to the procuring agency to compensate for the absence of the feature(s). The predetermination of the "additional expenditures" represents the worth or value of the items to the procuring activity.

The necessity for establishing a dollar worth or value for all "other system requirements" gives the Least Total Cost Technique the advantage that dollars become the common denominator between all the evaluated items and the system's life cost. While it is easy to say that a "115 nanosecond add time" would be desirable, it may be totally impossible to determine a realistic dollar worth for that same feature. The inability to place a dollar value on an item indicates that the wrong feature is being considered.

For example, the "115 nanosecond add time" is not the important consideration. The important consideration is more likely to be the total time required to run a representative program (consisting of a large number of adds), together with a number of other representative programs, since that time, extended by an appropriate preestablished factor, results in the number of hours per month required by each bid system. However, even that time, by itself, is not appropriate in determining a dollar value. The important time, and the one to which a dollar value can be assigned, is the time remaining (per month) after all the known and represented work load has been processed. The time remaining is the time available for expansion. The value of the expansion capability can be determined by considering the nature of the work load, the probability of the work load exceeding the time available to do it, the probable cost of equipment or rented service necessary to do the additional work load, etc.

Similarly, the value of a software program offered by the vendor can be determined by considering the cost that can be avoided if the using agency does not have to write the program, buy it elsewhere, or operate without it. It is important to note that the value of an item should be the lowest cost alternative available to the using activity. Thus, if the cost of manually flow charting is $45,000, and the cost of writing a flow charting program would be $32,000, but a flow charting program could be bought for $15,000, the value of the item is $15,000.

Not only is it necessary to predetermine the dollar value for every "other system requirement" to be used in the evaluation, it is also necessary to understand how the established dollar value(s) vary with time. Is it $X per month or a one-time expenditure of $Y and, if so, when is that expenditure made? With the capability offered (if the flow charting program offered by a vendor is not as powerful as the one desired) would you: not consider it; or use it and do some conventional flow charting on Y+% of your programs; or etc.? The preestablishment of these variables is contained in a value or assessment matrix. A matrix should be established for every "other system requirement" used in the selection. These matrices, showing the time value of all desired items, should be disclosed to the vendors to help them bid.

The most important and most difficult item to be considered in the evaluation is the cost. Cost, for evaluation purposes, must include all differentiating cost between vendors over the full system's life. This means that not only are lease, purchase, and lease-with-purchase option costs of all equipment considered for the stated life of the system (normally from five to seven years), but all other vendor costs such as mandatory maintenance, software, support, etc., are also considered. Further, several additional differentiating "other costs", such as staffing, power, air conditioning, space, supplies, etc., are also considered over the full life of the system. And, since the dollar expenditures for the system are being made over time, appropriate cost-of-money factors may be used to adjust payments made in the later years. This may require some detailed financial analysis.

The Least Total Cost Technique considers not only the cost of the mandatory items, but also the cost of all requirements sought by the using agency. First, full system life costing is done on all the mandatory equipment, software, support, etc. Then the "other costs" for expenses like power, staffing, etc., are calculated. Finally, assessments are made for the "other system requirements." For example, if a vendor does not offer a desired item (or offers it at too high a cost), the value of that item is assessed against the vendor's proposal as a cost item. Or if he does provide an item, but at some cost which is less than its computed value, that lesser cost -- the price at which it is offered -- is assessed against his proposal.

In this manner all costs of meeting all the requirements over the entire stated system life are considered in the evaluation. The system having the Least Total (expected) Cost over the entire system life is the system that is selected.

8.5 Summary

The selection plan is a preestablished road map. Like any plan it should be approved before it is implemented. The selection plan should set forth the proposed methods of validating the claims contained in the vendors' proposals and the procedure to be used in evaluating those validated claims to select the winning proposal. The selection plan must also state the system life to be used for evaluation purposes within the selection.

The examples presented here are based on the procurement of a complete system for a given system life cycle. The same technique would apply for acquisition of individual system elements such as plug-compatible direct access devices or for the acquisition of software packages. Even with individual system components, there are considerations in addition to the component price. Power requirements may differ and site prerequisites could cause expenditures over and above the amounts required for just the hardware. Software or operating system changes could prove to be costly and thus reduce the cost advantage. These costs should be evaluated over the system life cycle of the individual component or software package.

9. CONTRACT TERMS AND CONDITIONS

9.1 Introduction

This section of the Manual deals with the contract document itself. It assumes that the needs assessment has been completed, and the bid document is being developed. In order for the required and desired clauses to be included in the final contract, it is suggested that the agency include a copy of the contract document in the bid package. The purpose of this section is to identify those clauses which should be included in each contract to ensure that the agency will be adequately protected and its rights clearly defined. However, each agency should use legal counsel to have the wording of each clause written to reflect its requirements before the document is finally included in the bid package and to ensure that all wording of the clauses meets the legal constraints of the specific buying agency. An explanation of the purpose of each clause is included in this section.

Part of the decision as to what type of contract to be executed is dependent upon the result of the needs assessment process and the decisions reached when the Request for Proposal was constructed. The basic decision as to whether the equipment is to be rented, leased, or purchased will have a long-term effect on the agency obtaining the equipment. All of the benefits and drawbacks of each type of contract must be weighed and considered with respect to the objectives which have been established in the needs assessment.

Hardware contracts are typically available from three different types of vendors. These include the original equipment manufacturer, third party suppliers, and financial institutions engaged in leasing activities. Contractual obligations, terms, and payment amounts will vary considerably depending upon whether the procurement is lease or purchase, as well as the duration of the contract. Special discounts are available from some vendors to public agencies. Combinations of purchase and lease may prove to be practical. Also, multiple vendors, each providing a component of the total system, may also provide the best total system. See Part 1, Chapter 4, for a discussion of the various types of contracts.

9.2 Model Contract

An agency should be aware that the vendor will probably have a standard contract on which they would like agreement; however, it will be designed to favor the vendor and limit his responsibilities. For this reason, it is suggested that the agency draft its own contract which will provide the necessary protection desired and identify all responsibilities of both parties.

It is not possible to draft a model contract which would fit every situation and serve every kind of potential buyer of hardware. A sample contract, however, which was actually used in the procurement of a complex computer system may be found in Appendix 7.

9.3 Statement of Work

This subsection need only make reference to the technical requirements in the Request for Proposal (bid) or the technical description in the vendor's proposal. By incorporating these requirements by reference, the size of the contract itself can be kept to a minimum. This will bind the vendor to those requirements just as if they were a part of the contract itself. A sample reference clause is as follows:

"The technical description of the hardware capabilities detailed in the vendor's proposal are incorporated herein by reference with the same effect as if they had been reproduced in their entirety."

9.4 Contract Clauses

These individual contract clauses are defined in detail in the subsections which follow, and are listed in Part 1, Chapter 4.

9.4.1 Cost Section

This subsection contains a description of each of the clauses which relate to cost, i.e., the who, what, when, where, and how. It provides the clauses which define both the vendor's and contractor's obligations for payment of various kinds of costs and is essential to limit the agency's obligation. The clauses are listed below followed by a brief explanation.

- Contract Terms

  This clause defines the type of contract, (i.e. fixed price or rental) and the period of time (if a lease). If the contract is a rental contract, the cancellation notice period will be stated. This clause is required for the contract to be complete since it also states when and how invoicing will be accomplished.

- Payment

  The payment clause in a contract will vary slightly according to whether or not the contract is for the purchase or lease of hardware. However, the payment clause for either should be specific as to what events are to take place before payment becomes an obligation on the part of the agency. Discounts, late payment charges, due dates, and method of payment (check, cash, services), should be well defined in the clause. The payment plan is generally negotiable since without an agreement on it no contract can take place. A key factor to keep in mind in the payment clause is the passing of title in the case of a purchase or lease with option to purchase. This clause is a requirement in any contract.

- Price Protection/Price Changes

  The buyer should protect himself to ensure that he gets the best price offered by the vendor in the time frame in which the hardware is being procured and installed. This would limit the cost in the case of a price increase after the time of order and allow the agency to benefit from a price reduction which might occur between the order date and installation date. This clause is highly recommended.

- Termination or Cancellation (Lease)

  The rights of the agency to terminate a contract for leased hardware due to nonperformance of the vendor or the vendor's hardware or software should be spelled out in the contract. Both parties desire that the clause will never be invoked, however, it should clearly define for both parties under what circumstances it can be invoked. It is primarily a clause to protect the agency. It generally addresses hardware performance in accordance with predetermined standards. It should also address the failure of the vendor to act in a prescribed time and manner to satisfy his obligations. This is a required clause.

- Nonfunding Termination

  Governmental agencies are dependent upon funds which are budgeted and approved annually; therefore, they are restricted from making obligations which exceed one year's funding. Any contract commitment for more than a year must include a clause which clearly states this limitation. This is a required clause.

- Purchase Option (Lease Only)

  If during the needs assessment it is determined that a lease arrangement is desired but the agency would also like to provide a way to apply all or some of the lease payments toward the purchase of the leased hardware, the details to accomplish this must be spelled out in this clause. The formula used to determine the amount of lease payments which can be credited as a reduction in the purchase price should be clearly stated. In addition, the procedure to be followed to terminate the lease payments should be spelled out. Include in this clause the purchase price, the date of purchase or the date when the option must be exercised, how payment will be made, when title will pass, and any references to other clauses which are in the lease contract and apply under the purchase option. This clause is required only in a lease with option to purchase contract.

- Taxes

  The liability for the payment of all taxes must clearly be defined. These taxes should include state and local, property, excise, use, and any other taxes which might be applied to the hardware. Any possibility of a tax credit pass through should be thoroughly investigated and terms should spell out who will receive the credit. This is a required clause.

- Overtime Usage (Leased Hardware)

  The vendor may charge extra if the leased equipment is used beyond a specific number of hours in a given billing period (usually a month). If this is the case, the extra charge amount should be defined along with how it is to be calculated. This clause is only required where there is an overtime charge.

- Maintenance

  Keeping the leased or purchased hardware up and running is a must; therefore, the obligations of both parties regarding maintenance should clearly be defined. The agency must agree to setting up a schedule for allowing the vendor to perform preventative maintenance. In addition, the buyer's rights to have the latest changes in engineering incorporated in the hardware, drawings, parts lists, and maintenance documents should be clearly defined. Additional items which should be considered in this clause are the vendor's responsibility for maintenance if the agency subsequently sells the purchased equipment. In addition to spelling out obligations for maintenance of hardware, the vendor's obligations for maintenance of any system software which is provided should be spelled out. This is a required clause.

- Insurance

  Responsibility for insuring the hardware against loss or damage must be clearly defined. This will relate to loss during delivery as well as after installation. Who holds title to the equipment and when title passes from vendor to buyer is an important factor which must be addressed in this clause. There are other types of insurance, such as liability and performance, which should be considered in drafting this clause. The extent of insurance to be included in this clause will depend upon the need for protection. This is a required clause.

- Supplies

  A clause should be included which defines who is responsible for providing any supplies, particularly those of a nonstandard nature. Provision for access to all sources of supply should also be reserved by the agency. This is a highly desirable clause.

- Hold Back

  Hold back of specific payments until certain deliveries are made, or until certain milestones are satisfactorily completed, such as acceptance testing, is added assurance to the procuring agency that the vendor will perform his obligations in a timely manner.

9.4.2 Delivery and Installation

This subsection deals with the question of who is responsible for what regarding the delivery and installation of the hardware. It includes dates, site preparation, acceptance, etc.

- Delivery

  To be sure there is no misunderstanding, there should be a clear distinction made between delivery and installation. The delivery date should be agreed upon at the time the contract is signed and not later on. This may not be possible, however, if the buyer is doing a conversion or installing a large configuration of hardware. If a delivery date cannot be established, the contract clause must make provision for the buyer to set the date and the contractor to deliver within a specified time after the date has been set. The method of delivery and the consequences of late or early delivery must be spelled out. The responsibility for payment of delivery charges, if not defined in the cost or payment clause, should also be included in this clause. This is a required clause.

- Site Preparation

  The agency needs to know specifically what it is required to provide in the way of power, air conditioning, and physical plant; therefore, this clause should include a complete set of specifications for site preparation.

- Installation

  The installation of hardware is a crucial time for the agency. This is true whether or not the hardware is in addition to or replacement of existing hardware or a new installation. All of the buyer's plans for use of the hardware depend upon the installation being successfully completed by a specific date. This date plus the time allowed for a testing period should be clearly stated in this clause. If time is of the essence, any liquidated damages, penalties, or rights to cancel the contract should also be addressed in the clause. When the delivery date is not included in the contract, the installation date should be made to read a certain number of days or weeks after the delivery. This is a required clause.

- Relocation

  If hardware is leased, it is important to the agency that it have the right to relocate the hardware at its discretion. The responsibility of both the vendor and agency regarding liability for loss or damage to property should also be included in this clause. In addition the details of who pays for transportation, packing and unpacking, and any requirements for giving notice to the vendor should also be included.

- Freight

  If in the delivery clause or relocation clause you do not address the responsibility for payment of freight on hardware delivery, this clause is required.

- Acceptance

  The agency should make certain that the hardware is operating and performing as it is contracted to perform. To do this, standards of performance should be agreed to and formula developed to measure the acceptability of the hardware. The obligation of the vendor to have the hardware accepted by a specific date might be desirable if time is of the essence. Penalties for not performing in the prescribed acceptable manner should be a part of this required clause.

9.4.3 Terms and Conditions

This subsection contains various clauses which further define and limit the responsibilities of each party to the contract. They are clauses which all relate to the hardware but do not fall into the cost or delivery category. Some of these clauses are not absolutely necessary but are highly recommended to handle potential situations which can arise and cause a great deal of trouble in trying to arrive at a solution.

- Assignable Rights

  The provision for the agency to assign its rights to another party should be made in case the agency should decide to sell the equipment or discontinue using it. In this manner, the vendor is tied to the equipment and not to the agency. This clause, while not required, is highly recommended.

- Patent Protection

  To protect the buyer from being sued by an inventor or patent holder for patent infringement, this clause should be included to limit the liability to the vendor. This is a required clause.

- Standards of Performance

  The standards of performance addressed in the clause "Acceptance" is not sufficient to cover the ongoing operation of the hardware after it has been installed and accepted. The agency has a right to expect the hardware to perform in accordance with minimum standards which need to be clearly defined in this clause. The formula for monitoring performance should be described and the obligation of the vendor to keep the hardware operating above the minimum requirements must be agreed to. Any right to cancel the agreement due to nonperformance of the hardware plus any damages, costs of freight, or any other costs associated with the removal and replacement of the hardware should be spelled out. This is a required clause.

- Equipment Modification

  Any alterations to equipment not covered in the maintenance clause should be covered in this clause. There are basically three types of alterations which should be covered: safety, design, and improvement. Safety alterations should be made by the vendor regardless of whether the equipment was purchased or leased and they should be made as soon as possible at the vendor's expense. Design alternatives are made to correct errors in the original design and should be treated much the same as a safety alteration. Alterations which improve performance require an agreement on who pays to have them incorporated and whether or not the buyer must incorporate the change into the hardware. This is a required clause.

- Component Cancellation/Substitution

  In this day of rapid advancement in technology, it is quite likely that new, cheaper, and better components of computer systems will be marketed after your hardware is installed. To provide a way for you to take advantage of the changes, this clause is highly recommended. The procedure to cancel a portion of the contract hardware and the right to replace the hardware with other hardware should be reserved by the agency.

- Attachments

  All attachments to the contract should be identified, and if considered a part of the agreement, should be so specified. Those which are attached for reference only also should be identified as reference clauses.

- Upgrading of Hardware/Software

  Any guarantees or claims made by the vendor regarding upgrading of the hardware or software should be included in this clause. The penalty for not being able to comply with the terms of this clause should also be included.

- Manufacturer Interface

  If another manufacturer's hardware is attached to the original vendor's hardware, the original vendor may disclaim any obligations agreed to elsewhere in the contract unless a clause is included which allows the buyer to attach "foreign" hardware. This clause is highly desirable to allow flexibility to take advantage of price.

- Education and Training

  The vendor's responsibility for maintaining generalized and specialized training programs for the agency's benefit should be clearly stated. Training materials, and frequency of training all should be addressed in this highly desirable clause.

- Key Personnel

  If certain of the vendor's key personnel are considered essential to the successful operation of the installed system, the names of these key personnel should be listed as those the vendor will assign to do these specific tasks.

- Latent Defects/Warranty

  After satisfactory acceptance testing, there may be certain latent defects which will surface downstream. As part of the warranty, a specific time period should be stipulated to make the vendor liable for those latent defects.

9.4.4 Miscellaneous Clauses

This subsection contains clauses which may not be directly applicable to the hardware being procured but relate to the contract itself as a legal document. They define more the rights of the parties in connection with the contract itself.

- Conversion

  If hardware is being installed to replace existing hardware, the entire conversion process should be included to require the vendor to research the procedures necessary to complete the conversion. Any requirements for "backup" equipment should be agreed to along with the period when payment is to begin. Many times the vendor will provide the hardware for a free rental period to allow for adequate testing and data conversion to be completed.

- Notices

  To preclude any arguments, a clause should be included which states that all notices must be made in writing. The addresses and positions of the persons to be notified should be included in the clause.

- Progress Reports

  To assure that the vendor is performing his responsibilities in a timely manner, he should prepare and submit periodic (weekly or monthly) progress reports. This is desirable to preclude any conflict in commitment dates required as part of the total coordination of the entire system.

9.4.5 Equal Employment Opportunity

All contracts awarded by grantees and their contractors or subgrantees having a value of more than $10,000 shall contain a provision requiring compliance with Executive Order 11246, entitled "Equal Employment Opportunity," as amended by Executive Order 11375, and as supplemented in Department of Labor Regulations (41 CFR Chapter 60).

9.4.6 Examination of Records

All negotiated contracts (except those of $10,000 or less) awarded by grantees shall include a provision to the effect that the grantee, the Federal grantor agency, the Comptroller General of the United States, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the contractor which are directly pertinent to a specific grant program for the purpose of making audit, examination, excerpts, and transcriptions.

9.4.7 Clean Air Act

Contracts and subgrants of amounts in excess of $100,000 shall contain a provision which requires the recipient to agree to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act of

1970. Violations shall be reported to the grantor agency and the Regional Office of the Environmental Protection Agency.

9.4.8 Disputes

Contracts under Federal grants or subgrants will normally include provisions addressing disputes, appeals, and remedies. Unless the funding agency is to be involved through existing Federal Law or Executive Order, the grantee is the responsible authority without recourse to the grantor agency on all contractual and administrative questions arising out of these minimum standards as well as requirements such as, but not limited to, disputes, claims, and such other matters of a contractual nature as may otherwise be within the applicable legal and contracting authority of the grantee. However, matters concerning violation of law or regulation are to be referred to such local, state, or Federal authority as may have legal or administrative responsibility.

9.5 Noncompetitive Procurements

Requests for approval of sole source procurements should be sent to the appropriate Federal fund source.

9.5.1 Factors to Consider in Preparing Requests for Approval

Each request should reflect the degree of consideration given to other sources in the field, and the reasons why such sources lack the capability, which the proposed contractor evidences. The following illustrations represent factors that should be considered, as appropriate, in preparing the request:

- What capability does the proposed contractor have that is important to the specific effort and makes him clearly unique in comparison to another contractor in the same general field?
- What prior experience of a highly specialized nature does he have that is vital to the proposed effort?
- What facilities and equipment does he have that are specialized and vital to the effort?
- Does he have a substantial investment of some kind that would have to be duplicated at the grantee's expense by another source entering the field?
- If schedules are involved, why are they critical and why can the proposed contractor best meet them?
- If lack of drawings or specifications is a guiding factor, why is the proposed contractor best able to perform under these con

ditions? Why are drawings and specifications lacking? What is the leadtime required to get drawings and specifications suitable for competition?

- Is the effort to be a continuation of a previous effort performed by the proposed contractor?
- Is competition precluded because of the existence of patent rights, copyrights, or secret processes?
- Are parts or components being procured as replacement parts in support of equipment specially designed by a manufacturer? Are the data available adequate to assure that another contractor's components will perform the same function in the equipment as those components being replaced?

9.5.2 Avoiding Future Noncompetitive Procurements

When a proposed procurement appears to be noncompetitive (i.e., sole source), the grantee (or subgrantee) is responsible not only for assuring that competitive procurement is not feasible but also for acting whenever possible to avoid the need for subsequent noncompetitive procurements. This action should include both examination of the reasons for the procurement being noncompetitive and steps to foster competitive conditions for subsequent procurements, particularly as to the availability of complete and accurate data, reasonableness of delivery requirements, and possible breakout of components for competitive procurement.

10. REQUIREMENTS

10.1 Operating System

Batch processing involves handling groups of records, e.g., updating the existing master file with corrections, new entries, and deletions, or generating a monthly report that necessitates a complete sequential pass through the file. On-line processing refers to processes under the direction of the Central Processing Unit (CPU). This contrasts with batch processing which involves off-line procedures and is usually less expensive per transaction.

A real-time system usually involves on-line processing where the system senses the beginning of the action, monitors the action, determines what corrections are needed for successful conclusion of the action, and executes the corrections. This is all accomplished within the continuous real-time period.

Timesharing simulates dedicated service from a Central Processor, when in reality each user is receiving a piece of processing time on a shared basis from the CPU. The cost of a timesharing machine is high but generally, in terms of multiple transactions by several users, the cost is low. The CPU Supervisor, which controls the polling of the network among other things, can set higher priority for terminal users that necessitate immediate feedback versus those users tolerating longer delays, etc. Most users of timeshared operations are in remote locations requiring network development.

Choosing the most beneficial type of operating system can be a difficult task for the layman. One alternative is to outline the tasks the computer will perform and then rely on the vendors to present you with an operating system that meets your needs. Most computer firms have different operating systems to better serve the demands of their customers.

10.2 Compilers and Languages

If you are receiving a package from a vendor or agency and you plan to make changes in the future to the programs, you must have operational copies of the source programs. Object code will "lock" you into an undesirable position of having to deal exclusively with a specific vendor's equipment in the future.

The different higher level languages are adaptive to varying disciplines: **FORTRAN** (FORmula TRANslation) was written to be used in the solution of mathematical problems. The majority of plotting and special function routines are also written in FORTRAN. Its usefulness as a file manipulator or powerfulness for formatting output is weak in comparison to **COBOL** (COmmon Business Oriented Language). COBOL excels in tape and disc file control, character manipulation, and output formatting. COBOL is the most universal and transferable language available and is recommended for applications which do not involve complex mathematical calculations and equations.

As the use of minicomputers and microcomputers continues to expand, **BASIC** has gained widespread popularity in small agencies as a tool for developing in-house software in the least amount of time. Although it does not have the file manipulation abilities of COBOL and FORTRAN, BASIC is easily learned and the programming effort required to accomplish immediate results is typically minimal. In Appendix 12 of this Manual FIPS PUB 21-1 gives the Federal requirements for the COBOL programming languages.

10.3 Data Communications

This section will generally impact agencies where terminals will be more than 1,000 feet from the central processor. Communications imply some type of message transmittal from one source, via a medium, to another source.

Communication theory has defined "information" as any organized signal. This can mean numerous characters, a group of tones, a series of pictures, or the sound of a siren; these all comprise the message. In order for these messages to be understood, they must be spelled correctly, punctuated properly, and pronounced with meticulous enunciation. The same level of detail is necessary for computer systems, but utilizing machines helps control the variability of the communication process.

In communications, any signal that interferes with the message being sent is called "noise." This noise is undesirable in a message medium, such as a telephone line or microwave transmission. Noise can occur from many sources and can have serious effects on network transmissions. Sometimes after the common carrier has set up your lines, noise drifts in and out, resulting in a subsequent search process to find a clearer channel for your network. Half-duplex channels are sometimes prone to noise as both units try to transmit at the same time; the signal can only go one way at a time.

Line speed is a function of the number of binary digits (bits) that can be sent in one second. This is referred to as the "baud" rate. If the baud rate is 300bps (300 bits per second), the transmission of characters across the communication line is 30 cps (30 characters per second) on an asynchronous line. This can be generalized to a specific application. For example, if the city had a computer center and wanted to install a terminal and printer remote from the center, it would be important to know how fast a line would be required to maintain a desirable speed to and from the CRT and printer. In addition, the terminal and printer must be able to perform at the required speed.

In asynchronous situations like these, the data bit stream for each character contains a start and stop bit to transfer 8 bits of data. This is where the bits per second is divided by 10 to get the characters per second; i.e., 1200 bps ÷ 10 = 120 cps. Not all facilities are the same, however, and each network analysis demands specific attention.

Some telegraph channels perform at speeds up to 75 baud. In certain instances, a DC current modulation technique is used to transmit data. Utilizing this type of channel, but adding a **MODEM** (MOdulator-DEModulator) can increase the data rate to 300 baud. A modem is a piece of hardware that converts digital information to analog transmissions and vice versa. Since the nationwide telephone network was developed with voice communication in mind, there needs to be a conversion of impulses by modems to get information from a computer, across a telephone line, into a terminal, and back again.

Voice-grade channels are available for data transmission ranging from 300-9600 baud. Proper conditioning of the line is necessary for the higher speeds. Performing at maximum, a full screen on a CRT can be filled in two seconds, a very fast rate for a remote site. As the line speed increases, the costs will rise significantly as special conditioning of the line, high speed modems, and a private leased line, among other factors, influence the price.

Wide-Band channels are facilities that provide data transfer speeds ranging from 19,200 to the one million baud region. Availability of these facilities are limited to specific geographical areas depending on the common carrier's equipment.

The absence of a full duplex situation (a half-duplex) on a data communication line could impact the response time for data retrieval, etc. With half-duplex situations when Terminal A is sending an inquiry to the computer, the line is closed to all terminal traffic from the computer, etc., utilizing that line. In a full duplex situation, simultaneous transmissions in both directions are possible. When configuring more than one terminal or printer, etc., on the same line, consider the restrictions of half duplex transmission and the impact on the specific application.

When considering network analysis for your department, five general areas of concern should be addressed:

- Throughput
- Response Time
- System Sensitivity
- System Reliability
- Cost

System throughput specifications should be met without serious adverse affects on the other four areas of concern. Response times to critical applications such as dispatching, emergency services, or strike force teams should not vary significantly from the original tolerances.

System sensitivity to variations within projected hourly, daily, and monthly traffic volumes should be low. For example, a bad design exists if a small variation in the traffic produces high degradation in system performance.

As more redundant units are provided for backups, system reliability tends to increase. Specific reliabilities can be specified under performance contracts, however, and if they are not met the contractor must subsequently provide a workable system.

Given that the first four requirements are configured to specifications, system costs need to be minimized. If the planned network crosses any common carrier, e.g., phone line, a modem is a necessary piece of communications hardware. As stated previously, a modem converts analog transmission to digital impulses and vice-versa. Modems are available through the carriers or from communication vendors. Closely examine the difference between leasing and purchasing modems, considering speed of replacement procedure, the length of time they will be used, and maintenance contracts.

Multiplexors are used to save line and modem costs for multiple terminal usage at remote sites. A multiplexor will effect the baud rate by the number of separate peripheral paths utilized. For example, a 9600 baud transmission will be split respectively into 2-4800, 4-2400, or 8-1200 baud lines.

The polling of terminals in a network is the computer's method of determining which terminal information it will ask for next. Usually a computer will have an internal polling list of device addresses to interrogate. Certain priority terminals can have their addresses on the list more than once, thus giving that terminal at least twice the access availability on the network. It is apparent that polling order might impact a dispatch terminal if it is addressed only once in a large network, as opposed to a terminal in a small planning unit being addressed three times.

10.4 Data Base Management

Raw data elements entered into a Data Base Management System consist of a specified number of characters called a record. Numerous records constitute a data file; as records are added, the file size increases. This file size can expand from a factor of 2:1 to 10:1 or more depending on the complexity of relationships and the overhead of the DBMS itself. One way around this storage problem is the usage of a data compression algorithm. These techniques are very complex and can only be developed by an experienced programmer; they are included in relatively expensive DBMS Packages.

Data elements, files, individual bases, and cross-referencing descriptions are handled by a data dictionary module. Nearly all DBMS Packages have a dictionary option available that describes qualities such as: alphanumeric, alpha, or numeric status; length of field; decimal point locations; data base description; purpose of base; and, what files are contained therein.

In a multiuser setting utilizing a DBMS, specific security controls must be implemented to insure that an "unauthorized" person or program does not access, modify, or damage restricted data. These controls vary from very low security such as a password, to extremely complex procedures for high security utilizing a combination of (1) an application routine, (2) a DBMS routine, and (3) privacy locks found on some operating systems. The extent to which this level of security is applied varies with the risk of damage and the result of a security breach. The privacy procedures can be specific to a data item, record, section of related records, entire file, or access to a total data base.

The costs of a DBMS range from a few thousand dollars to over a hundred thousand. It is highly recommended that any agency contemplating the purchase or usage of a DBMS view and discuss with police personnel the advantages, restrictions, and security areas of the package used.

10.5 File Size and Access

Preparing for a new computer system or application entails determining the size of the file. This can be ascertained by the following:

- Determine what items are absolutely necessary for the desired output
- Count the characters needed for those items, comprising a record
- Determine the number of incoming records by historical experience
- Determine the quantity of the backlog data you desire to be entered
- Estimate any suspected increase due to automation
- Count the length of items that will be used as keys to the file

After the above data are collected, an analysis of the file length can be estimated:

INCIDENT RECORD 158 Characters

16,000	Incident reports yearly
+ 320	Increase due to automation
+ 1,330	Backlog entered
17,650	Total incidents, increase & backlog
x 158	Character length
2,788,700	**Characters of Incident file storage**
17,650	Incidents, increase & backlog
x 7	Character key
123,550	**Characters for Key**
2,912,250	**Total Characters for Incident File & Key**

The figures would take into account the incident file only. All space must be examined in detail including: permanent files, working files, temporary scratch files, output files, application programs, systems utilities, and operating system overhead. Some of this allocated space will be explained by the vendor. In addition to figuring current levels of need for disc space, try to envision the future and allow for computer expansion corresponding with the projected increase in departmental activity.

When the estimated disk storage is computed, a decision is required regarding the necessity of one large disc drive or several smaller drives. If on-line files, application programs, and the operating system all reside on the same disk unit, substantial contention for space can occur. It is better, in most designs, to utilize a number of smaller units rather than a single large unit. This design technique will increase the throughput of the system and, if one unit fails, boost the reliability by having whole or partial responsibility taken over by another unit.

10.6 Data Access

Speed of data access, relevant to software development, is an indicator of systems performance which is directly related to system design. The type of access method used will reflect the speed of response to on-line inquiries. Three different access methods will be discussed: Sequential, Index-sequential, and direct addressing.

Sequential access implies "one right after the other" or "in sequence." This access method can be demonstrated in a manual setting. For example, a Master Name File has 40,000 cards in its drawers, filed alphabetically. Given that the card desired was Smith, James R., instead of going to the "S" drawer, a sequential process would start at the beginning of the "A" drawer and read every card until it finds Smith, James R. Using this type of access method for on-line applications is very time consuming and should be avoided. Sequential access is appropriate where a monthly or weekly report is generated, or where an entire pass through the file is necessitated.

Index-sequential files search an index rather than a file. It is similar to the practice in a library, where a person uses the card file to locate a book's catalogue number, which shows generally the location by shelf where a book will be found. Once the shelf is located, a sequential search is initiated. On larger files, however, it is beneficial to utilize several indexes which index the indexes. This procedure consumes some storage space but saves time in processing on-line requests, as it points to the general location where the desired information will be found.

Direct addressing schemes provide the fastest means of addressing available. With this procedure, there is no need for file searches or index preparations; the inquiry itself contains the machine address. Almost as fast as direct address inquiring, and used quite often, is an algorithm to convert the key to the machine address. This technique is used where the input item is not compatible with the machine address initially or, as an alternative entry procedure when the address is not known.

10.7 In-house vs. Turnkey

With an in-house effort there exists continuing staff costs, personnel problems such as sick time, time off, turn-over, and personal factors, all possibly interferring with initial timing of milestone accomplishments. However, if you treat your in-house personnel as you would a contractor with reasonable due dates, expectations of high quality work, competitive salaries, and dismissal of personnel not performing up to standards, the resulting product will reflect your efforts.

In-house developments generally reflect an abundance of personnel at the beginning of a project, increasing in the middle, and stabilizing too high at the end. This observed phenomena exists because of changes in direction of the project midstream and maintenance of usually poor documented systems by "key" individuals who wrote the system. These problems can be overcome by insisting that once the "final plan" is agreed upon and signed off by administrators, that you proceed with blinders to the completion of the project. Once a system is up and running, changes or modification plans for the future can be discussed. Document each module completely before proceeding on to the next module. The person that says "don't worry about documentation, I'll be here forever" will leave, or just as bad, his memory will fade.

Turnkey system development can be accomplished faster, with less bother, is inexpensive by comparison, and lower in risk factors. Expanding on these items, a development by trained professionals who work with information systems on a day-to-day basis is hard to compete with. Very little guesswork is involved with the successful software vendor. He knows how long it will take to accomplish an end goal because the life blood of his business depends on that estimate being close to reality.

With a turnkey development the user is not plagued with the day-to-day troubles of maintaining a large staff. Staff requirements necessary for a turnkey system generally reflect the amount of maintenance and modification required in the software. Once a basic system is working correctly, adding bells and whistles to

it can be done at a slower pace by limited in-house staff. Expense factors must be weighed in comparison to what an "identical" development would cost if an in-house effort was attempted. Some of these items include: extra personnel assigned to the project; loss of efficiency while those personnel are involved in the project; loss of efficiency by field personnel if a lag exists in development of tools that would increase their productivity; and, ongoing costs of data processing staff.

Risk factors of receiving a product that does not meet your needs relies on your ability to select and inform a software contractor in writing what it is you want from a system. Monitor the progress continuously in order to make sure you are getting what you asked for from the vendor. Within the RFP, write in monetary penalties for delayed delivery of an operational and fullydocumented system. Keep penalties low enough so as not to exclude otherwise potentially good proposals, but high enough to show the vendor you are very serious about delivery times.

Probably a good procedure for a criminal justice agency to follow, where its staff is not experienced in data processing, would be to contract out the basic system and hire limited staff to maintain and enhance it. One other alternative exists: transfer an existing operational system or part of a system into your agency.

11. APPLICATION MODULES

11.1 Incident Module

As previously discussed in Part 1 of this Manual, the incident report captures the initial data from the field. Management reports showing changes in calls for service levels by month of year, day of week, time of day, type of incident, and location of the city are important to higher levels of administration.

Field command personnel require more detailed information from this file, not only whether there is an increase in criminal activity but specifically type, time, and location. This level of detail enables analyses of shift loads, response times, case time by type of incident, and many other management combinations. Besides the daily reports received for routine information purposes, field personnel will require very detailed information concerning their particular area.

11.2 Plotting

The plotting of crime incidents by police departments has been in existence for many years. In most jurisdictions, however, pin mapping is the most common technique utilized. Computer routines for plotting or mapping are available currently from many vendors and some are transferable from other criminal justice agencies. The use of computers to plot crime locations or produce density maps can assist both field officers and supervisors.

Field personnel can utilize maps that are restricted to specific time frames, area of coverage, and type of offense activity. For example, a District 5 officer is given four maps that are divided into two-hour segments showing only District 5 burglaries. During an eight-hour shift, that officer can focus some attention to directed burglary patrol activity. As the activity changes with time (2 hour segments) during the shift, the officer can adjust his patrol emphasis within the district. This concept can be expanded upon, contrasting activity maps, allowing the officer to decide which area of preventive emphasis is needed at a specific time in the shift.

Supervisors can utilize specific maps to assign patrol emphasis teams or to oversee crime trends across the city. Plotting programs vary in complexity, some generating 3-Dimensional representations while others produce simple gray shaded area density maps. When creating crime mappings via offense report data, an essential element to consider is the coordinate system used by the department to represent areas. Each incident must be coded for location. The detail allowed by the department geocoding system and computer program will reflect on the degree of exactness or generalization of the mappings.

11.3 Uniform Crime Reporting

UCR modules gather statistics on crime, arrest, and property. An overview is presented in Part 1 of this Manual. Preferred output for a UCR module includes duplicating the exact format of the Federal forms. In some states, generation of a magnetic tape to be processed by state UCR staff is acceptable from automated agencies. Your state agency will give you the specifics of formatting, etc.

Pitfalls to watch out for during programming include a clearance designator for past and present offenses, and a special condition flag showing whether the incident was entirely composed of juveniles or influenced by an adult. These conditions will be necessary to produce accurate reports reflecting appropriate clearances in the month they occur with the corresponding offense category. Flags must be set for property recovered on a previous month's case in order to show proper recovered dollar amounts and categories. In larger agencies, however, UCR work files would probably be desirable so complete passes through the master file are not necessary. A considerable computer time savings would be noticed utilizing this method.

11.4 Alpha File

As previously mentioned in Part 1 of this Manual, purging and entry criteria are very important to the integrity of this file. On an information system, the name entries usually "point" to other files so information can be stored more effectively. Similar to a manual system, just the necessary information is held in the alpha file.

Field interview (FI) card information should be matched with existing master name entries to see if previous contact has been made. If a positive match is found then the master name card should be updated to reflect that contact has indeed been made and a list of these updates should be generated so a human verification of the entry can be made. If no previous contact has been made, the card entry should be given a FI purge status, which should be short in duration.

Specifically, these files would be accessed in times where an officer requests a name search from the field, e.g., when a car stop is made, or suspicious person is encountered. Investigators use this file when researching cases for leads based on witnesses naming possible suspects to obtain more background information on the person.

11.5 Field Investigation Analysis

One method of FI analysis involves analyzing the current FI data for time and place, extracting those FI's conducted in a specified area at a particular time. The area parameters examined should not be limited to the immediate area of a reported crime; rather, it should reflect an expanded area. The time zones should also be flexible as to assume nonaccurate reporting times by citizens, although rigid enough to minimize the amount of irrelevant data retrieved.

One data element desirable for automation includes some process of geocoding so as to reflect positive and negative values as positions vary up or down and left to right. Another element is a 24-hour clock procedure so as to easily identify time measure and the computing of varied amounts of time tolerance for different types of crimes or times of day. For example, a burglary was known to have occurred between 1300 and 1500 hours and was in Grid 0321. The FI times examined might include 1100 to 1700 hours and the grids would include an expanded sized radius, around 0321; the number would depend on the size of the grids. If there is traffic citation information available, this is also a good source of investigative material utilizing the same process as FI's.

Time and place are just two variables to utilize, and depending on volume FI contact area is probably a good index parameter by which to store information. In addition, sequential access will also be desirable in some situations and file entry procedures would have to accommodate this. All items, except the narrative, must be accessible by search parameters such as: an inquiry of the system for all males over six feet with black hair would respond back with all correct FI's including the narrative portion entered.

APPENDICIES

PART 3

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This part of the Manual presents a series of technical references which may be useful during various phases of the system development effort. In addition to the presentation of technical guidelines, such as security and privacy standards, this part also provides sample documents that may be used as a model or guide in the contract process.

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APPENDIX 1

LIST OF REFERENCES

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I. LIST OF REFERENCES

The citations that follow are references that were used in the process of developing this Manual. They represent either materials from which concepts were taken while developing portions of the Manual, or references from which forms and examples were taken. The reader is directed to these general sources for futher information about the process of developing information systems.

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APPENDIX 2

GLOSSARY

2. GLOSSARY

Access: The manner in which files or data sets are referred to by the computer. Examples could be serial, random, or index-sequential access methods.

Access Time: The time interval between the instant at which an instruction initiates a call for data and the instant at which delivery of the data is completed.

Add Time: The time required for one addition, not including the time required to get the quantities from storage and return them to storage.

Algorithm: A set of well-defined rules for the solution of a problem in a finite number of steps.

Alphanumeric: A character set that contains both letters and digits and may contain control characters, special characters, and the space character.

Analyst: A person who defines problems and develops methods and procedures for their solution. Systems Analyst - The architect of the system of procedures which will accomplish a given task.

Application Program: A program written for or by a user that applies to a particular application. In data communication, a program used to connect and communicate with terminals in a network, enabling users to perform application-oriented activities.

Assembler Language: A source language that includes symbolic machine language statements in which there is a one-to-one correspondence with the instruction formats and data formats of the computer.

Asynchronous: Without regular time relationships; unexpected or unpredictable with respect to the execution of a program's instructions.

Background Processing: The execution of lower priority computer programs when higher priority programs are not using the system resources.

BASIC (Beginner's All-purpose Symbolic Instruction Code): A programming language with a small repertoire of commands and a simple syntax, primarily designed for numerical applications.

Batch Processing: Data processing in which a number of similar input data items are grouped together and processed during a single machine run within the same program for operating convenience and efficiency.

Baud: A unit of signaling speed equal to the number of discrete conditions or signal events per second. In asynchronous transmission, the unit of modulation rate corresponding to one unit interval per second.

Binary Code: A code that makes use of exactly two distinct characters, usually 0 and 1.

Bit: Synonymous with binary digit; in the pure binary numeration system, either of the digits 0 and 1. Also used to refer to the doughnut-shaped pieces of iron comprising the core of the central processing unit.

Block: A string of records, a string of words, or a character string formed for technical or logic reasons to be treated as an entity.

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Buffer: A routine or storage used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transferring data from one device to another.

Bundling: Degree to which a computer manufacturer supports its customers with hardware engineers, software packages, programs, system conversion advice, and training.

Bus: A conductor, or group of conductors, serving as a common connection for two or more circuits.

Byte: A binary character operated upon as a unit and usually shorter than a computer word. Generally, eight bits equal a byte.

Calculator: A data processor, especially suitable for performing arithmetical operations, that requires frequent intervention by a human operator.

Cathode Ray Tube (CRT): An electronic vacuum tube, such as a television picture tube, that can be used to display graphic images.

Central Processing Unit (CPU): A unit of a computer that includes circuits controlling the interpretation and execution of all computations and instructions.

Chip: A minute piece of semiconductive material used in the manufacture of electronic components. An integrated circuit on a piece of semiconductive material.

COBOL (COmmon Business-Oriented Language): An English-like programming language designed for business data processing applications.

Code: A set of unambiguous rules specifying the manner in which data may be represented in a discrete form. A set of items, such as abbreviations, representing the members of another set. Loosely, one or more computer programs, or part of a computer program. To write a routine.

Compile: To translate a computer program expressed in a problem-oriented language into a computer-oriented language.

Computer: A data processor that can perform substantial computation, including numerous arithmetic or logic operations, without intervention by a human operator during the run. This device usually consists of input and output devices, storage, arithmetic and logic units, and a control unit. Usually an automatic, stored-program machine is implied.

Core: The configuration of magnetic material within the Central Processing Unit on which data are stored and through which electronic pulses are carried to perform computations and execute instructions.

Cursor: In video terminals, a moveable indicator which denotes where the next character entered (from keyboard or computer) will be positioned on the screen. The cursor may be a blinking character, a reverse video image, underline, or even be unobservable on some terminals.

Data: The basic elements of facts, concepts, or instructions represented by numeric, alphabetic, or special characters which are for communication, interpretation, or processing by humans or automatic means.

Data Base: A set of data, part of the whole of another set of data, and consisting of at least one file, that is sufficient for a given purpose or for a given data processing system. A collection of interrelated data stored together controlling redundancy to serve one or more applications.

Data Base Management: The collection of software required for using a data base.

Data Processing: The execution of a systematic sequence of operations performed upon data, e.g., handling, merging, sorting, computing.

Debug: To detect, to trace, and to eliminate mistakes in computer programs or in other software.

Decollate: To separate the plies of a multipart form or paper stock.

Digital Computer: A computer in which discrete representation of data is mainly used, e.g., using numbers rather than physical quantities.

DIP: Acronym for "Dual In-line Package", the most common form for an integrated circuit which has two rows of pins for connectors.

Direct Access: The facility to obtain data from a storage device, or to enter data into a storage device in such a way that the process depends only on the location of those data and not on a reference to data previously accessed.

Disc (Disk): A flat, circular plate with a magnetic surface on which data can be stored and retrieved in a random manner.

Diskette: A thin, flexible magnetic disk and a semirigid protective jacket, in which the disk is permanently enclosed.

Downtime: The time interval during which a functional unit is inoperable due to a fault.

Dump: To write the contents of a storage, or of part of a storage, usually from an internal storage to an external medium, for a specific purpose such as to allow other use of the storage, as a safeguard against faults or errors, or in connection with debugging.

Edit: To prepare data for a later operation. May include the rearrangement or the addition of data, the deletion of unwanted data, format control, code conversion, and the application of standard processes such as zero suppression.

EDP: Electronic data processing.

Fault: A physical state or condition that may cause a failure of a functional unit.

Field: In a record, a specified area used for a particular category of data, e.g., a group of card columns in which a wage rate is recorded.

File: A set of related records treated as a unit.

File Layout: The arrangement and structure of data or words in a file, including the order and size of the components of the file.

Firmware: Refers to the execution of programs from read-only memory, or programmable forms of read-only memory, so that programs seem as much a function of hardware as of software.

Fixed-length Record: A record having the same length as all other records with which it is logically or physically associated.

Flowchart: A graphical representation for the definition, analysis, or method of solution of a problem in which symbols are used to represent operations, data, flow, equipment, etc.

Foreground: In multiprogramming, the environment in which high-priority programs are executed. Foreground processing is the execution of a computer program that preempts the use of computer facilities.

Formatted Display: On a display device, a display in which the attributes of one or more display fields have been defined by the user.

FORTRAN (FORmula TRANslation): A programming language useful for scientific, engineering, or financial problem-solving where mathematical formulas are utilized.

Functional Design: The specification of the working relationships among the parts of a data processing system.

Hard Copy: A printed copy of machine output in a visually readable form; e.g., printed reports, listings, documents, and summaries.

Hardware: Physical equipment used in data processing, as opposed to computer programs, procedures, rules, and associated documentation.

High-level Language: A programming language that does not reflect the structure of any one given computer or that of any given class of computers.

Indexed Sequential Access Method: An access method used in one form to directly retrieve or update particular blocks of a data set on a direct access device, using an index to locate the data set. The index is stored in direct access storage along with the data set. Other forms of this method can be used to store or retrieve, in a continuous sequence, blocks of the same data set.

Information: Data that have been processed to obtain results of relationships are called information. It increases knowledge of the recipient.

Input: Information or instructions to the computer--the data to be processed. Pertaining to a device process, or channel involved in an input process, or to the data or states involved in an input process.

Input/Output Controller: A functional unit in a data processing system that controls one or more units of peripheral equipment.

Inquiry: A request for information from storage.

Instruction: In a programming language, a meaningful expression that specifies one operation and identifies its operands, if any.

Integrated Circuit (IC): A combination of interconnected circuit elements inseparably associated on or within a continuous substrate.

Interactive: Pertaining to an application in which each entry calls forth a response from a system or program, as in an inquiry system. An interactive system may also be conversational, implying a continuous dialogue between the user and the system.

Interface: An interface might be a hardware component to link two devices or it might be a portion of storage or registers accessed by two or more computer programs.

Interpreter: A program that executes each source language expression before translating and executing into the next one, without first translating the source program into machine language. Interpreters are slower in execution, but provide greater interaction.

I/O: Input/Output. Input or Output, or both. The process of moving information into a computer from external devices, such as tapes, disks, printers, terminals, etc.

Line Printer: A device that prints a line of characters as a unit. Contrast with character printer, page printer.

List: An ordered set of items of data. To print or otherwise display items of data that meet specified criteria.

Load: In computer programming, to enter data into storage or working registers.

Local Terminal: A terminal connected by a cable rather than by a data link.

Magnetic Core: A piece of magnetic material, usually doughnut shaped, used for storage.

Magnetic Disk Storage: A magnetic storage in which data are stored by magnetic recording on the flat surface of one or more disks that rotate.

Magnetic Tape: A tape with a magnetizable surface layer on which data can be stored by magnetic recording.

Magnetic Tape Cassette: A container holding magnetic tape that can be processed without separating it from the container.

Maintenance: Any activity, such as tests, measurements, replacements, adjustments, and repairs intended to eliminate faults or to keep a functional unit in a specified state.

Management Information System (MIS): The specific type of data processing system that is designed to furnish management with information designed to aid in the performance of management functions and decision-making.

Mask: A pattern of characters that is used to control the retention or elimination of portions of another pattern of characters.

Mass Storage: Storage having a very large storage capacity. The storage of a large amount of data which is also readily accessible to the processing unit of a computer.

Master File: A file that is used as an authority in a given job and that is relatively permanent, even though its contents may change.

Matrix Printer: A printer in which each character is represented by a pattern of dots.

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Merge: To combine the items of two or more sets that are each in the same given order into one set in that order.

Message Switching: The process of routing messages by receiving, storing, and forwarding complete messages within a data network. A telecommunication application in which a message received by a central system from one terminal is sent to one or more other terminals.

Microfiche: Microform whose medium is film, in the form of sheets that contain microimages arranged in a grid pattern.

Microfilm: Microform whose medium is film, in the form of rolls, that contains microimages arranged sequentially.

Modem (MOdulator-DEModulator): A functional unit that modulates and demodulates signals. One of the functions of a modem is to enable digital data to be transmitted over analog transmission facilities.

Module: A program unit that is discrete and identifiable with respect to compiling, combining with other units, and loading, e.g., the input to, or output from, an assembler, compiler, linkage editor, or executive routine. A packaged functional hardware unit designed for use with other components.

Monitor Program: A computer program that observes, regulates, controls, or verifies the operations of a data processing system.

Multiplexer: A device capable of interleaving the events of two or more activities or capable of distributing the events of an interleaved sequence to the respective activities.

Multiprocessing: A mode of operation that provides for parallel processing by two or more processors of a multiprocessor. Pertaining to the simultaneous execution of two or more computer programs or sequences of instructions by a computer or computer network.

Multitasking: Multiprogramming that provides for the concurrent performance, or interleaved execution, of two or more tasks.

Object Code: Output from a compiler or assembler which is itself executable machine code or is suitable for processing to produce executable machine code.

Offline: Pertaining to equipment or devices not under direct control of the central processing unit. Sometimes used to indicate batch processing.

Online: Pertaining to equipment or devices under direct control of the central processing unit. The term "online" is also used to describe a user's access to a computer via a terminal.

Operating System: Software that controls the execution of computer programs and that may provide scheduling, debugging, input/output control, accounting, compilation, storage assignment, data management, and related services.

Output: Pertaining to a device, process, or channel involved in an output process, or to the data or states involved in an output process.

Peripheral Equipment: In a data processing system, any equipment, distinct from the central processing unit, that may provide the system with outside communication or additional facilities.

Physical Record: A record whose characteristics depend on the manner or form in which it is stored, retrieved, or moved. A physical record may consist of all or part of a logical record, or several logical records.

Polling: Interrogation of devices for purposes such as to avoid contention, to determine operational status, or to determine readiness to send or receive data.

Process: A systematic sequence of operations to produce a specified result.

Program: A series of actions designed to achieve a certain result. A set of instructions to the computer to tell it what to do and how to do it. Also known as "software".

Programmer: A person who designs, writes, and tests computer programs.

Prompting: A function that helps a terminal user by requesting him to supply operands necessary to continue processing.

Query: In data communication, the process by which a master station asks a slave station to identify itself and to give its status. In interactive systems, an operation at a terminal that elicits a response from the system.

Random Access: An access mode in which specific logical records are obtained from or placed into a mass storage file in a nonsequential manner.

Read: To acquire or interpret data from a storage device, medium, or other source.

Read-Only-Memory (Read-Only Storage): A storage device that stores data not alterable by computer instructions; for example, magnetic core storage with a lockout feature and certain kinds of semiconductor (integrated circuit) memory on which the contents are created at the time of manufacture. (Synonymous with "nonerasable storage", "permanent storage", and "fixed storage".)

Realtime: Pertaining to the processing of data by a computer in connection with another process outside the computer according to time requirements imposed by the outside process. The term "realtime" is also used to describe systems operating in conversational mode and processes that can be influenced by human intervention while they are in progress.

Record: A collection of related data or words, treated as a unit, e.g., all the data elements in a single crime/incident report.

Record layout: The arrangement and structure of data or fields in a record, including the order and size of the components of the record.

Reentrant: The attribute of a program or routine that allows the same copy of the program or routine to be used concurrently by two or more tasks.

Relative address: An address expressed as a difference with respect to a base address.

Reliability: The ability of a functional unit to perform its intended function under stated conditions, for a stated period of time.

Relocate: To move a computer program or part of a computer program, and to adjust the necessary address references so that the computer program can be executed after being moved.

Remote: In data communication, pertaining to devices that are connected to a data processing system through a data link.

Remote Job Entry (RJE): Submission of a job through an input unit that has access to a computer through a data link.

Report generation: A technique for producing complete machine reports from information that describes the input file and the format and content of the output report.

Response time: The elapsed time between the end of an inquiry or demand on a data processing system and the beginning of the response, e.g., the length of time between an indication of the end of an inquiry and the display of the first character of the response at a user terminal.

Routine: An ordered set of instructions that may have some general or frequent use.

Satellite computer: A computer that is under the control of another computer and performs subsidiary operations.

Scratch file: A file used as a work area.

Seek time: The time that is needed to position the access mechanism of a direct access storage device at a specified position.

Sequential access: An access mode in which records are obtained from, or placed into, a file in such a way that each successive access to the file refers to the next subsequent record in the file. The order of the records is established by the programmer when creating the file.

Software: Computer programs, procedures, rules, and possibly associated documentation concerned with the operation of a data processing system.

Sort: To segregate items into groups according to specified criteria. Sorting involves ordering, but need not involve, sequencing, for the groups may be arranged in an arbitrary order.

Source program: A computer program expressed in a language from which statements are translated. Contrast with object program.

Storage: A device or portion of a device that is capable of receiving data, retaining it for an indefinite period of time, and supplying it on command.

Structured Programming: A technique for organizing and coding programs that reduces complexity, improves clarity, and makes them easier to debug and modify. Typically, a structured program is a hierarchy of modules that each have a single entry point and a single exit point; control is passed downward through the structure without unconditional branches to higher levels of the structure.

Subroutine: A sequenced set of statements that may be used in one or more computer programs and at one or more points in a computer program.

Syntax: The relationship among characters or groups of characters, independent of their meanings or the manner of their interpretation and use. The structure of expressions in a language. The rules governing the structure of a language.

System: An assembly of procedures, processes, methods, routines, techniques, or equipment united by some form of regulated interaction to form an organized whole.

Table: A collection of data in which each item is uniquely identified by a label, by its position relative to other items, or by some other means.

Task: A basic unit of work to be accomplished by a computer. The task is usually specified to a control program in a multiprogramming or multiprocessing environment.

Telecommunication: Communication over a distance, as by telegraph or telephone. Data transmission between a computing system and remotely located devices via a unit that performs the necessary format conversion and controls the rate of transmission.

Teleprocessing: A type of information processing wherein communication facilities are utilized.

Terminal: A point in a system or communication network at which data can either enter or leave. A device, usually equipped with a keyboard and some kind of display, capable of sending and receiving information over a communication channel.

Throughput: A measure of the amount of work performed by a computer system over a given period of time, e.g., jobs per day.

Timesharing: The use of a central processor for two or more purposes during the same overall time interval. Timesharing is done by interspersing in time the actions of the peripheral units and the central processor.

Top-down Programming: The design and coding of computer programs using a hierarchical structure in which related functions are performed at each level of the structure.

Track: The path or one of the set of paths, parallel to the reference edge on a data medium, associated with a single reading or writing component as the data medium moves past the component. The portion of a moving data medium, such as a drum, tape or disk, that is accessible to a given reading head position.

Transaction: In batch or remote batch entry, a job or job step. In systems with time sharing, an exchange between a terminal and another device that accomplishes a particular action or result, e.g., the entry of a customer's deposit and the updating of the customer's balance.

Transfer: To send data from one place and to receive the data at another place.

Translator: A computer program that translates from one language into another language and in particular from one programming language into another programming language.

Transparent: In data communication, pertaining to information that is not recognized by the receiving program or device as transmission control characters.

Troubleshoot: To detect, locate, and eliminate errors in computer programs or faults in hardware.

Undefined Record: A record having an unspecified or unknown length.

Utility Program: A computer program in general support of the processes of a computer; for instance, a diagnostic program, a trace program, a sort program. A program designed to perform an everyday task such as copying data from one storage device to another.

Validation: The checking of data for correctness, or compliance with applicable standards, rules, and conventions.

Variable-length Record: A record having a length independent of the length of other records with which it is logically or physically associated.

Verify: To determine whether a transcription of data or other operation has been accomplished accurately. To check the results of keypunching.

Virtual Storage: The storage space that may be regarded as addressable main storage by the user of a computer system in which virtual addresses are mapped into real addresses. The size of vitual storage is limited by the addressing scheme of the computing system and by the amount of auxiliary storage available, and not by the actual number of main storage locations.

Word: A character string or a binary element string that it is convenient for some purpose to consider as an entity.

Work File: A file used to provide storage space for data that are needed only for the duration of a job. In sorting, an intermediate file used for temporary storage of data between phases.

Write: To make a permanent or transient recording of data in a storage device or on a data medium.

Zero Suppression: The elimination from a numeral of zeros that have no significance in the numeral.

APPENDIX 3

SIMPLIFIED FLOWCHARTING

3. SIMPLIFIED FLOWCHARTING

1972

GENERAL SERVICES ADMINISTRATION
NATIONAL ARCHIVES and RECORDS SERVICE
OFFICE OF RECORDS MANAGEMENT

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WHO SHOULD PREPARE FLOWCHARTS?

- All employees who are involved in evaluating, analyzing, designing, or supervising paperwork operations should make systematic use of these techniques.
- Every supervisor wishing to know work processing steps involved in his operations, particularly where systems improvements are desired or needed.
- Any person responsible for writing desk manuals or operating procedures. Flowcharts frequently are used to supplement written instructions. In some cases, they are used in lieu of them.
- Top echelon personnel who are required to make presentations on work accomplished by their organization.
- Auditors for recording facts and in the analysis and development of proposed improvements.
- Management analysts engaged in systems studies.

WHEN SHOULD FLOWCHARTS BE USED?

- When major changes are being considered, procedural flowcharting should be a part of the review and analysis.
- When making formal presentations where present and proposed procedures will be discussed.
- Often, a flowchart will serve as a selling device for an idea to improve an operation.

WHY USE A FLOWCHART?

- It helps the analyst develop his plan and to determine where action should begin and end. It helps decide what should be done and who should do it.
- It provides an effective means of comparing existing and proposed systems and facilitates analyses leading to improvements.
- It enables management to see the entire plan, or any part, at a glance. It puts specific operations into focus. It presents a plan more clearly and helps management make the necessary decisions.
- It serves to identify bottlenecks and poor workflow.

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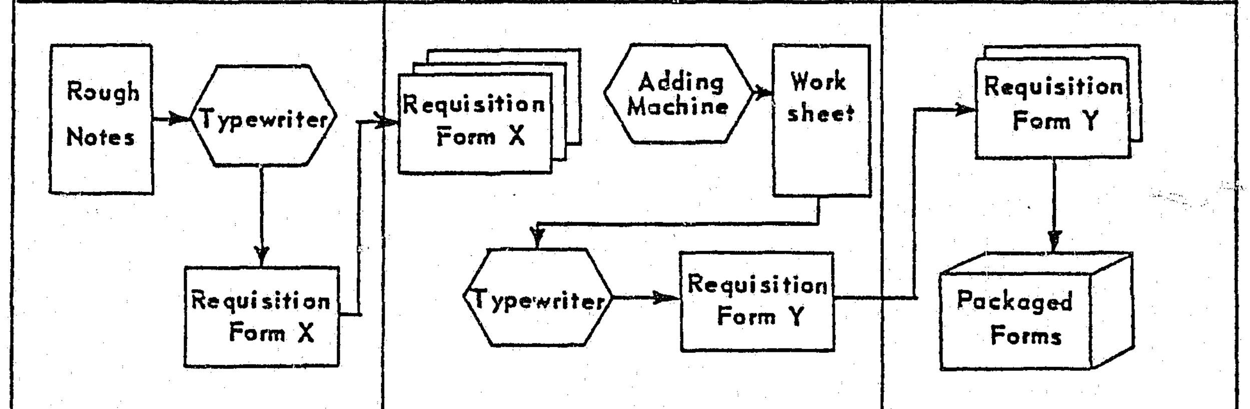
What is a flowchart ?

It is a word-and-symbol picture of the major steps involved in a workflow procedure.
For example:

PROCESSING REQUISITIONS FOR FORMS


Rough Notes
Typewriter
Requisition Form X
Requisition Form X
Adding Machine
Work sheet
Typewriter
Requisition Form Y
Requisition Form Y
Packaged Forms

2000 FIELD OFFICES	10 REGIONAL OFFICES	WAREHOUSE WASHINGTON, D.C.
From rough notes on forms in short supply, a "Request for forms" (Form X) is typed. Typing and proofing require an average of 15 minutes. 12 requisitions submitted annually. 6,000 manhours per year.	Similar items are grouped, totaled from worksheets. "Consolidated Requisition" (Form Y) is typed and forwarded. Average time to complete operation - 40 hours per month. 4,800 manhours per year.	Stocks of forms pulled, packaged and mailed to regional offices in accordance with Form Y requisitions. Average time to complete operation - 80 hours per month. 960 manhours per year.

The flowchart shows what jobs are being performed, where, how, and by whom.

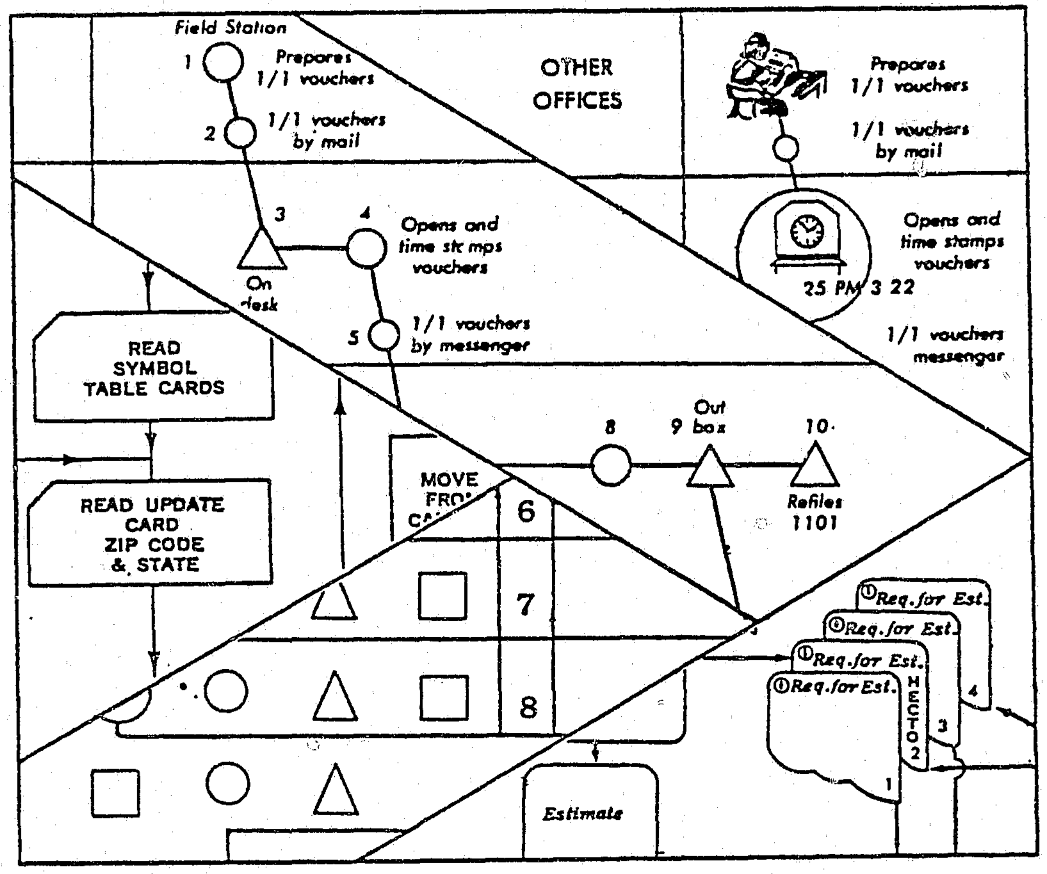
It identifies all documents, forms, and reports in a procedure.

It identifies the equipment used and the output of the equipment.

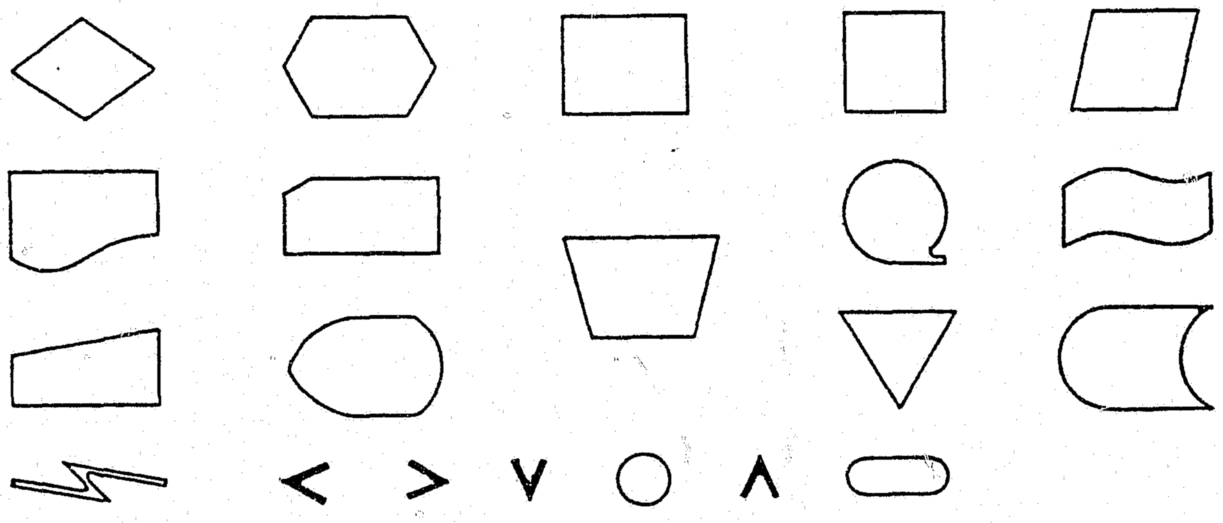
It records every action required to produce the final product.

It provides statistical data such as volumes, manhour costs, and numbers of offices involved.

There are all kinds of charts

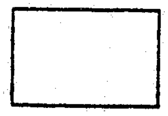

Field Station
1
Prepares 1/1 vouchers
2
1/1 vouchers by mail
3
On desk
4
Opens and time stamps vouchers
5
1/1 vouchers by messenger
OTHER OFFICES
Prepares 1/1 vouchers
1/1 vouchers by mail
Opens and time stamps vouchers
25 PM 3 22
1/1 vouchers messenger
READ SYMBOL TABLE CARDS
READ UPDATE CARD ZIP CODE & STATE
MOVE FRO
6
7
8
8
9 Out box
10
Refiles 1101
Req. for Est.
Req. for Est.
Req. for Est.
Req. for Est.
HECTO
1
2
3
4
Estimate

and a multitude of symbols

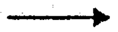


But for the sake of simplicity

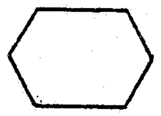
We use these symbols



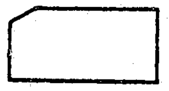
This symbol is used for any manually prepared document such as on a standard or electric typewriter. It might represent a letter, a form, a report, etc. Identify its meaning in the box, such as Form X, Annual Report, Building Drawing, etc.



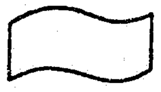
Action symbol indicating workflow or the movement of items or operations from one place to another. Draw the symbol with a dotted line to show an alternate direction of flow.



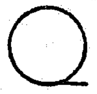
This symbol represents a machine. Identify it as a typewriter, keypunch, computer, etc.



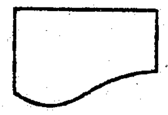
Tab card. If it has a form number, identify it. If it is a special type of card such as mark sense, dual purpose or port-a-punch, the type should be shown in the narrative explanation of the procedure. The symbol can also represent a magnetic card.



Punched paper tape.



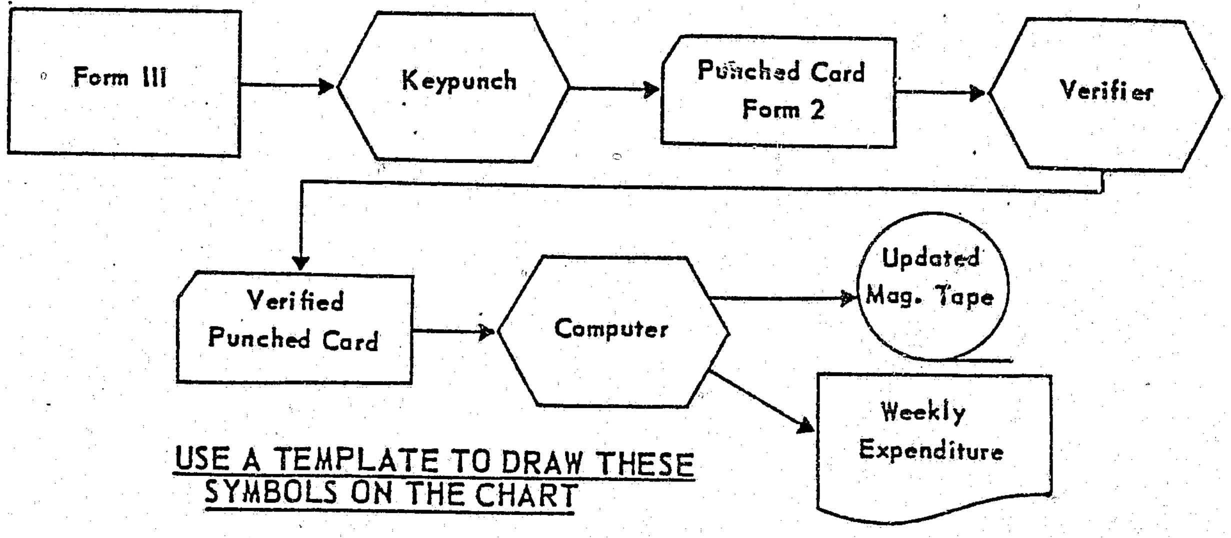
Magnetic tape.



Any document automatically produced from a machine, such as an automatic typewriter or high speed printer. Identify whatever it represents.

WHY IDENTIFY SYMBOLS?

Because the same symbol may appear a number of times on your flowchart. For example:



USE A TEMPLATE TO DRAW THESE SYMBOLS ON THE CHART

How are flowcharts prepared ?

Only a few basic rules are involved in preparing flowcharts:

TITLE The chart should be headed with a title that clearly states the name of the unit being surveyed and the process under investigation. The columnar headings of the chart should show the office or work unit involved.

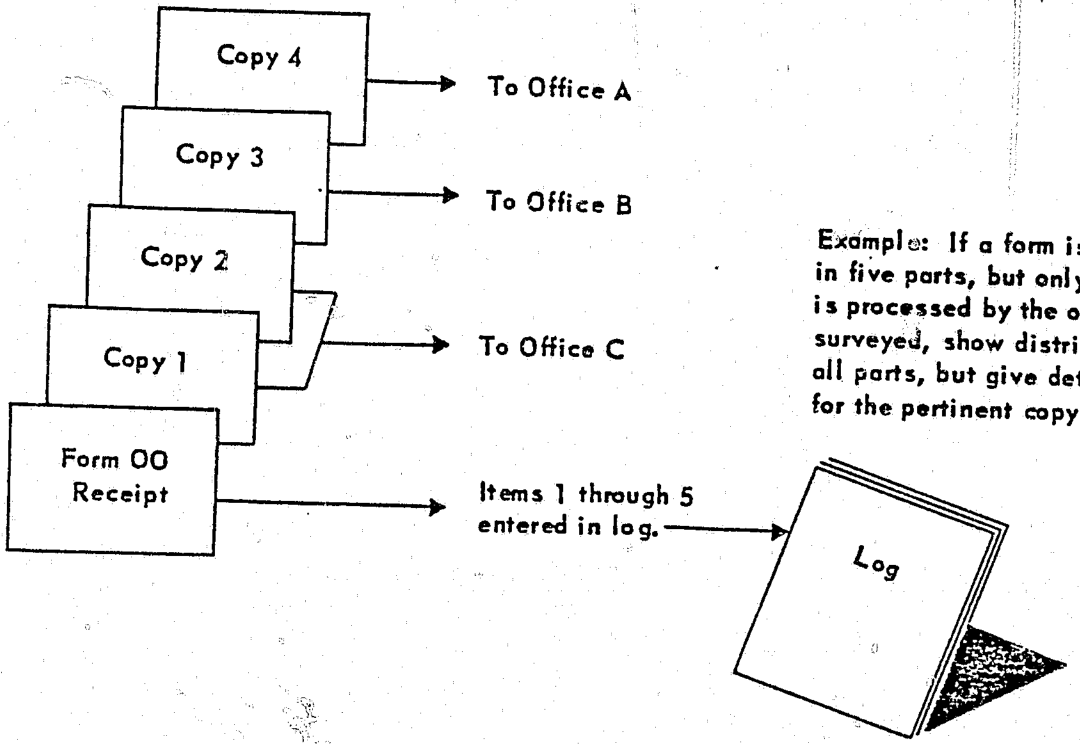
SYMBOL IDENTIFICATION Don't force the reader to guess at the meanings of any symbol. Show inside of them what they represent.

ACCURACY A flowchart should show exactly how a job is done or how it is proposed to be done. It is the analyst's duty to picture the work exactly as he sees it - or proposes it - based on careful observation and analysis.

BREVITY Don't worry about rules of grammar. Just make certain that explanations are brief, clear, and to the point. Use the explanations to make understandable the procedural steps covered by the symbols.

ELIMINATE BACKTRACKING Have continuous flow. If a document flows back to an office later in the procedure, make a new column on the chart for that step.

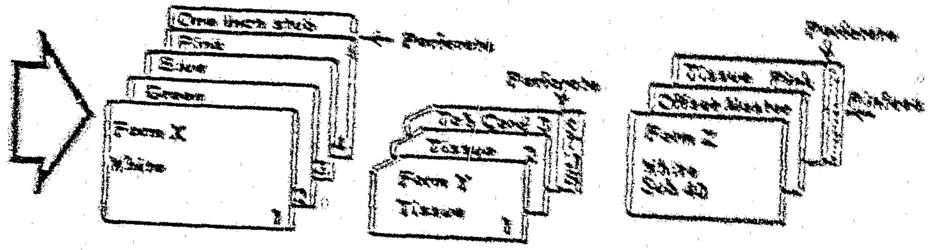
ELIMINATE MINUTIAE Don't go into elaborate details unless they are vital to your explanations.



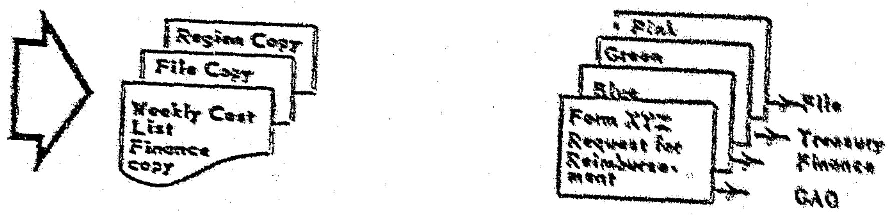
Example: If a form is prepared in five parts, but only one part is processed by the office being surveyed, show distribution of all parts, but give details only for the pertinent copy.

Use your template to illustrate:

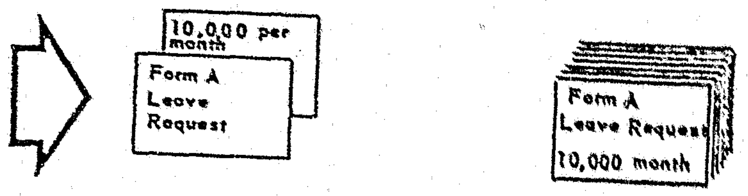
Construction
of form sets


One inch stub
Pink
Blue
Green
Form X
White
Perforate
Perforate
Carbon
Tissue
Form Y
Tissue
Perforate
Tissue Pink
Offset Master
Pinfeed
Form Z
White
Sub 40

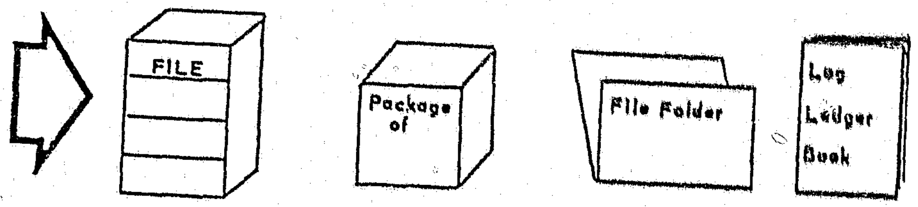
Number and
distribution
of copies


Region Copy
File Copy
Weekly Cost
List
Finance
copy
Pink
Green
Blue
Form XYZ
Request for
Reimbursement
File
Treasury
Finance
GAO

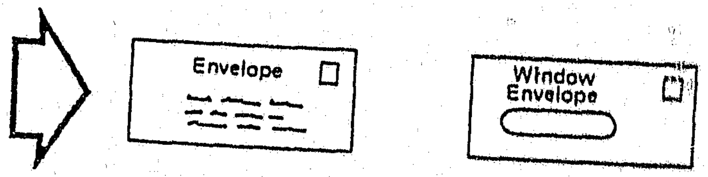
Volume
of papers


10,000 per month
Form A
Leave
Request
Form A
Leave Request
10,000 month

Three-
dimensional
objects


FILE
Package of
File Folder
Log
Ledger
Book

To highlight
improved
practices


Envelope
Window
Envelope

Developing an idea for improving a paperwork system

When you have located a target for improvement, get your ideas down on paper. The flowchart provides a tool for organizing information collected on present procedures so that they can be analyzed.

Challenge the entire system before examining the units that make up the system. Often entire systems can be completely eliminated. If the system cannot be eliminated, examine each segment carefully. Challenge the need, the volume, the timing, the place, the effort involved, the sequence of worksteps in the existing system.

Be sure to get all the facts. Check and recheck them. Never recommend a change unless it will improve operations in terms of service, effort, costs, and-or other immediate or long-range efficiencies.

When you are sure of your facts and proposed recommendations, talk them over with others. Discussion will reveal strengths and weaknesses in your idea and sometimes the need for additional information. It will give others the feeling that they are participating in improvement of the procedures and their resistance to change will be minimized. Valuable ideas for further improvements often result.

Where do you start ?

STEP ONE

GATHER THE FACTS

First you must gather data for your flowchart. Write down, step by step, every operation involved in the procedures in question. Where possible, obtain statistical data such as *time required to process, number of transactions* processed daily, weekly, etc., *number of persons performing identical tasks, number of edits, etc.*

Talk to people. By discussing a situation with others you win their confidence. They are more cooperative and they often contribute ideas for improvements.

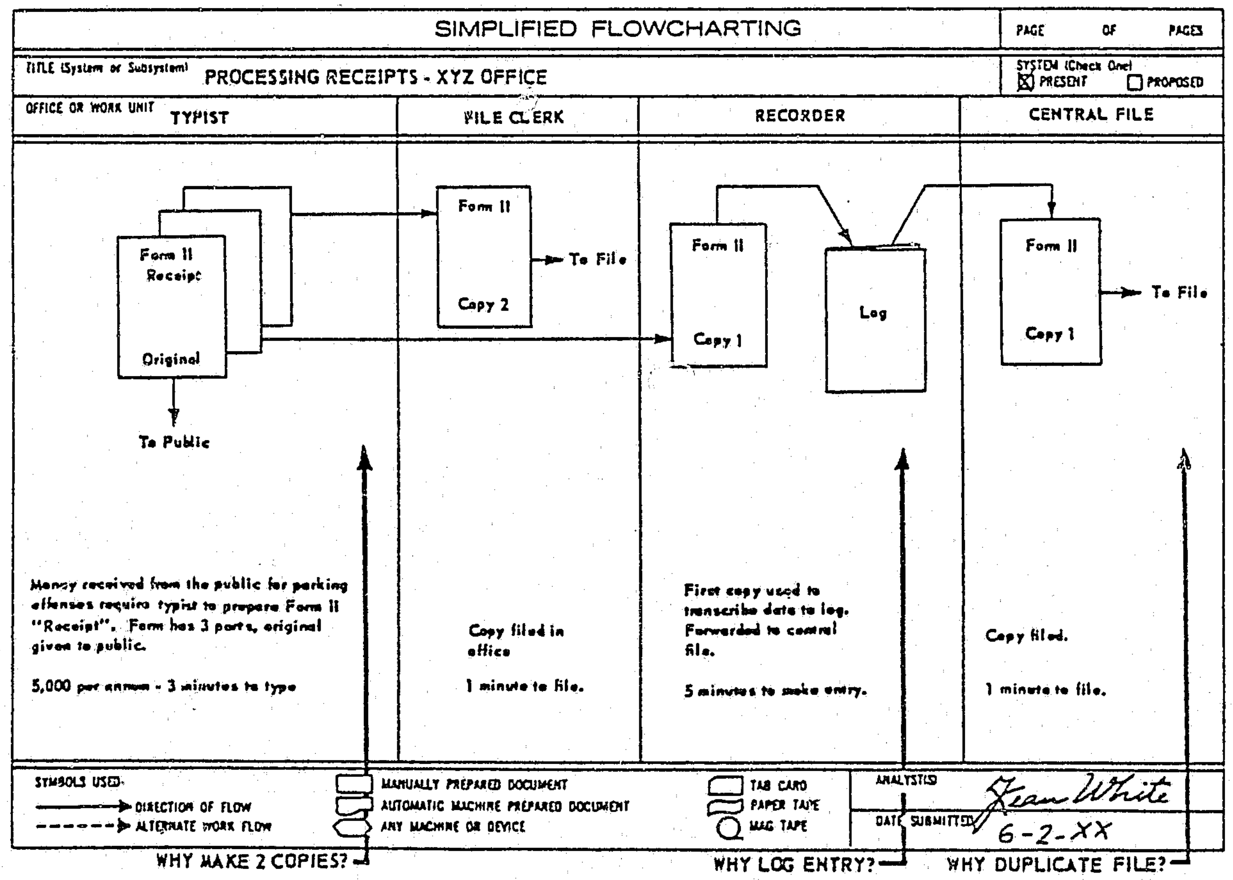
STEP TWO

ANALYZE THE FACTS

After you have the procedures roughed out draft a preliminary flowchart. There will be some areas which can obviously be improved. Duplicated efforts, bottlenecks, too many reviews, overlapping duties, unnecessary worksteps, etc., are often revealed when you can visualize the procedures shown on the preliminary flowcharts.

EXAMPLE OF PINPOINTING AREAS FOR IMPROVEMENT

Ask yourself "WHY" to every operation shown. (See next page for checklist of questions which will help you.)


SIMPLIFIED FLOWCHARTING

PAGE OF PAGES

TITLE (System or Subsystem) PROCESSING RECEIPTS - XYZ OFFICE

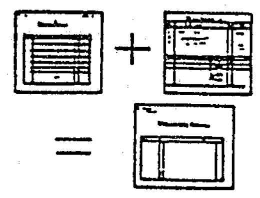
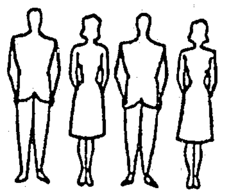
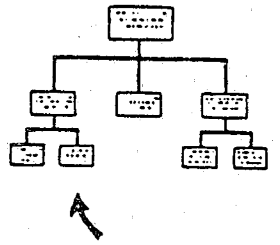
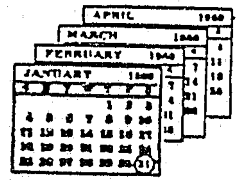
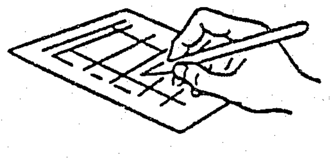
SYSTEM (Check One) ☒ PRESENT ☐ PROPOSED

OFFICE OR WORK UNIT TYPIST	FILE CLERK	RECORDER	CENTRAL FILE
Money received from the public for parking offenses require typist to prepare Form II "Receipt". Form has 3 parts, original given to public. 5,000 per annum - 3 minutes to type	Copy filed in office 1 minute to file.	First copy used to transcribe data to log. Forwarded to central file. 5 minutes to make entry.	Copy filed. 1 minute to file.

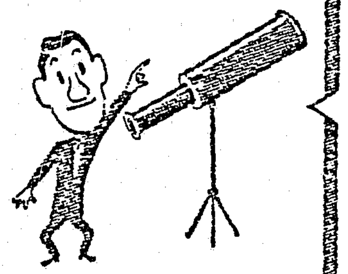
ANALYST(S) Jean White

DATE SUBMITTED 6-2-XX

WHY—The key to all good analysis

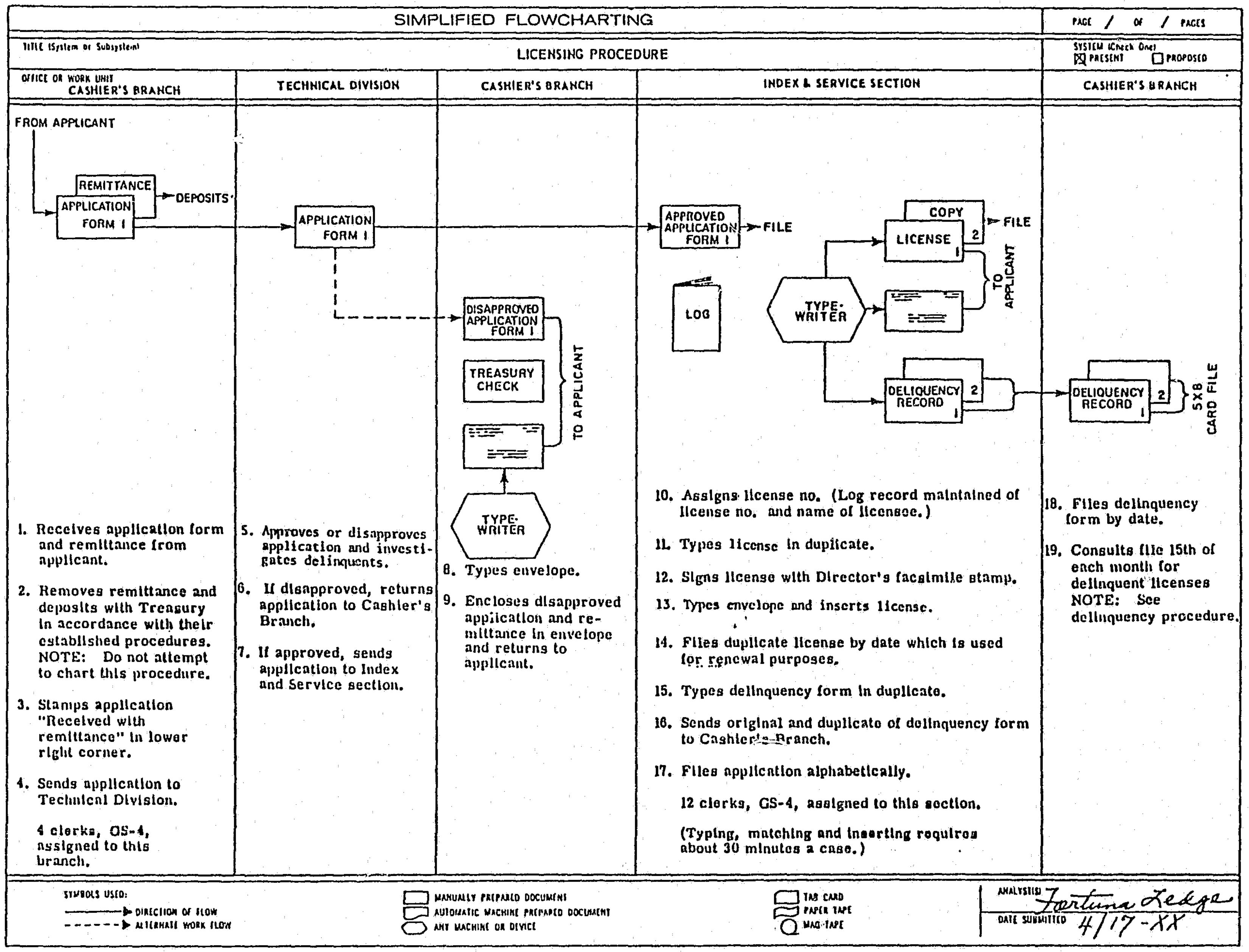
To get the facts - ASK:	ASK—WHY?	To make improvements - ASK:
NEED What offices and what people receive the information? What recipients use the information? What procedures describe the origin, distribution and use of the information?	 WHY this need?	**NEED** How is the information used? Is it absolutely essential? How much does it cost? Is it worth the cost? Is there another source for all or a portion of this data?
PEOPLE Who requires this data? Who enters information on the basic document? Who extracts or manipulates data from the source document? Who analyzes the data? Who makes the decisions?	 WHY by these people?	**PEOPLE** Can the work be done by someone else? Can some or all of it be done by machine? Can any of it be done cooperatively? Do employees know their procedures? Is work performed at the right grade level? Are duties related or varied.? Are supervision and training adequate?
PLACE Where is the source document prepared? How many copies are made? Where are completed documents sent? How are they transmitted? Where is the information used? Where is the information summarized and published?	 WHY here?	**PLACE** Is this the best place to prepare the source document? Is it closest to the source of information? Is it best equipped to do the job? Is equipment utilized for a variety of jobs, or just used for source data jobs? Could another office do it as well or better? Would another location speed transmission and use?
TIME What is the time schedule for obtaining the data? What are the deadlines for the final products? How much time is allotted to each process?	 WHY at this time?	**TIME** Is the time factor critical? Can peakloads be leveled by doing the job at a different time? Is the time factor realistic? Should frequency be altered? Can timing of related events be changed ?
METHOD How is the source document prepared? What machines or tools are used? How is the information processed? Are there quality or production standards? Are production and quality controlled?	 WHY this method?	**METHOD** Is there a better or faster way for entering data on the source document? Can data on the source document be prepared in a machine language? Are processing steps taken in a logical order? Can any processing steps be eliminated? Can parallel processing be substituted for serial processing ?

Watch for these conditions — they indicate a need for improvement



- Peaks and valleys in workloads
- Logs
- Multiple controls
- Difficulties in filing and locating documents
- Overtime
- Inadequate forms
- Numerous copies of reports distributed
- Errors
- Bottlenecks
- Numerous file cabinets
- Numerous edits and retyping operations
- Backlogs
- Costly composition -printing and visuals

Example of Flowchart of Present System


FROM APPLICANT
REMITTANCE
APPLICATION FORM 1
DEPOSITS
APPLICATION FORM 1
DISAPPROVED APPLICATION FORM 1
TREASURY CHECK
TO APPLICANT
TYPE-WRITER
APPROVED APPLICATION FORM 1
FILE
LOG
TYPE-WRITER
COPY
LICENSE
2
1
FILE
TO APPLICANT
DELIQUENCY RECORD
2
1
DELIQUENCY RECORD
2
1
5X8 CARD FILE

SIMPLIFIED FLOWCHARTING

PAGE / OF / PAGES

TITLE (System or Subsystem) LICENSING PROCEDURE

SYSTEM (Check One) ☒ PRESENT ☐ PROPOSED

OFFICE OR WORK UNIT CASHIER'S BRANCH

1. Receives application form and remittance from applicant.
2. Removes remittance and deposits with Treasury in accordance with their established procedures. NOTE: Do not attempt to chart this procedure.
3. Stamps application "Received with remittance" in lower right corner.
4. Sends application to Technical Division.

4 clerks, GS-4, assigned to this branch.

TECHNICAL DIVISION

5. Approves or disapproves application and investigates delinquents.
6. If disapproved, returns application to Cashier's Branch.
7. If approved, sends application to Index and Service section.

CASHIER'S BRANCH

8. Types envelope.
9. Encloses disapproved application and remittance in envelope and returns to applicant.

INDEX & SERVICE SECTION

10. Assigns license no. (Log record maintained of license no. and name of licensee.)
11. Types license in duplicate.
12. Signs license with Director's facsimile stamp.
13. Types envelope and inserts license.
14. Files duplicate license by date which is used for renewal purposes.
15. Types delinquency form in duplicate.
16. Sends original and duplicate of delinquency form to Cashier's Branch.
17. Files application alphabetically.

12 clerks, GS-4, assigned to this section.

(Typing, matching and inserting requires about 30 minutes a case.)

CASHIER'S BRANCH

18. Files delinquency form by date.
19. Consults file 15th of each month for delinquent licenses NOTE: See delinquency procedure.

SYMBOLS USED:

——▶ DIRECTION OF FLOW

- - - -▶ ALTERNATE WORK FLOW

MANUALLY PREPARED DOCUMENT

AUTOMATIC MACHINE PREPARED DOCUMENT

ANY MACHINE OR DEVICE

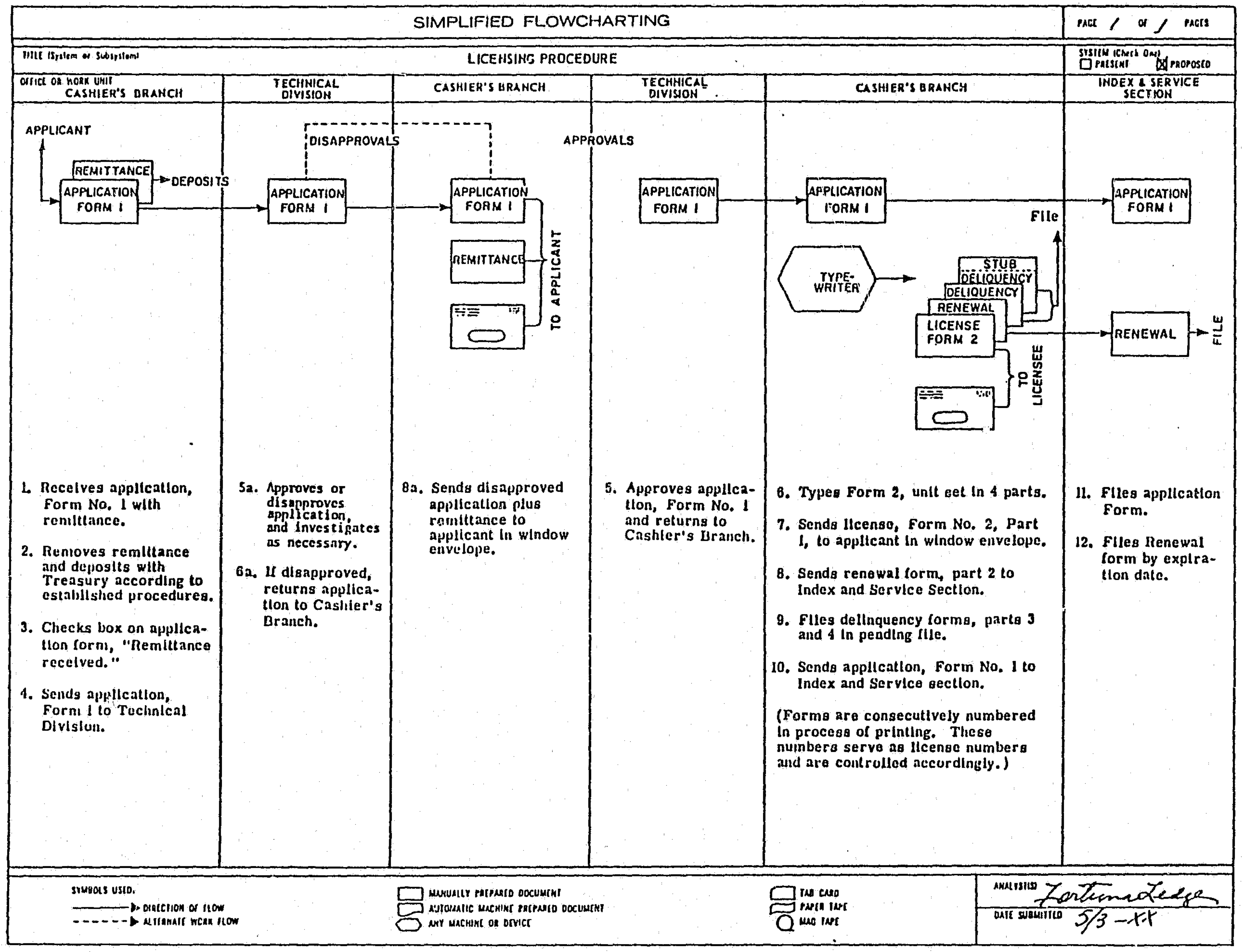
TAB CARD

PAPER TAPE

MAG-TAPE

ANALYST(S) Fortuna Ledge

DATE SUBMITTED 4/17-XX


APPLICANT
REMITTANCE
APPLICATION FORM 1
DEPOSITS
DISAPPROVALS
APPROVALS
APPLICATION FORM 1
REMITTANCE
TO APPLICANT
APPLICATION FORM 1
APPLICATION FORM 1
TYPE-WRITER
STUB
DELIQUENCY
DELIQUENCY
RENEWAL
LICENSE FORM 2
File
TO LICENSEE
APPLICATION FORM 1
RENEWAL
FILE

SIMPLIFIED FLOWCHARTING

PAGE 1 OF 1 PAGES

TITLE (System or Subsystem) LICENSING PROCEDURE

SYSTEM (Check One) ☐ PRESENT ☒ PROPOSED

OFFICE OR WORK UNIT

CASHIER'S BRANCH

1. Receives application, Form No. 1 with remittance.
2. Removes remittance and deposits with Treasury according to established procedures.
3. Checks box on application form, "Remittance received."
4. Sends application, Form 1 to Technical Division.

TECHNICAL DIVISION

5a. Approves or disapproves application, and investigates as necessary.

6a. If disapproved, returns application to Cashier's Branch.

CASHIER'S BRANCH

8a. Sends disapproved application plus remittance to applicant in window envelope.

TECHNICAL DIVISION

5. Approves application, Form No. 1 and returns to Cashier's Branch.

CASHIER'S BRANCH

6. Types Form 2, unit set in 4 parts.
7. Sends license, Form No. 2, Part 1, to applicant in window envelope.
8. Sends renewal form, part 2 to Index and Service Section.
9. Files delinquency forms, parts 3 and 4 in pending file.
10. Sends application, Form No. 1 to Index and Service section.

(Forms are consecutively numbered in process of printing. These numbers serve as license numbers and are controlled accordingly.)

INDEX & SERVICE SECTION

11. Files application Form.
12. Files Renewal form by expiration date.

SYMBOLS USED:

- ——▶ DIRECTION OF FLOW
- - - - -▶ ALTERNATE WORK FLOW
- ▭ MANUALLY PREPARED DOCUMENT
- ▭ AUTOMATIC MACHINE PREPARED DOCUMENT
- ⬭ ANY MACHINE OR DEVICE
- ▭ TAB CARD
- ▭ PAPER TAPE
- ○ MAG TAPE

ANALYST(S) Fortune Ledge

DATE SUBMITTED 5/3 -XX

Example of Flowchart of Improved System

APPENDIX 4

PROCUREMENT STANDARDS

4. PROCUREMENT STANDARDS

September 12, 1977 OMB Circular A-102, Attachment O

A. This attachment provides standards for use by grantees in establishing procedures for the procurement of supplies, equipment, construction, and other services with Federal grant funds. These standards are furnished to ensure that such materials and services are obtained in an effective manner and in compliance with the provisions of applicable Federal law and Executive orders. No additional requirements shall be imposed by the Federal agencies upon the grantees unless specifically required by Federal law or Executive orders.

B. The standards in this attachment do not relieve the grantee of the contractual responsibilities arising under its contracts. The grantee is the responsible authority, without recourse to the grantor agency regarding the settlement and satisfaction of all contractual and administrative issues arising out of procurements entered into, in support of a grant. This includes, but is not limited to: disputes, claims, protests of award, source evaluation, or other matters of a contractual nature. Matters concerning violation of law are to be referred to such local, state, or Federal authority as may have proper jurisdiction.

C. Grantees may use their own procurement regulations which reflect applicable state and local law, rules, and regulations provided that procurements made with Federal grant funds adhere to the standards set forth as follows:

1. The grantee shall maintain a code or standards of conduct which shall govern the performance of its officers, employees, or agents in contracting with and expending Federal grant funds. Grantee's officers, employees, or agents shall neither solicit or accept gratuities, favors, or anything of monetary value from contractors or potential contractors. To the extent permissible by state or local law, rules, or regulations, such standards shall provide for penalties, sanctions, or other disciplinary actions to be applied for violations of such standards by either the grantee's officers, employees, or agents, or by contractors or their agents.

2. All procurement transactions, regardless of whether negotiated or advertised and without regard to dollar value, shall be conducted in a manner that provides maximum open and free competition. The grantee should be alert to organizational conflicts of interest or noncompetitive practices among contractors which may restrict or eliminate competition or otherwise restrain trade.

3. The grantee shall establish procurement procedures which provide for, as a minimum, the following procedural requirements:

   (a) Proposed procurement actions shall be reviewed by grantee officials to avoid purchasing unnecessary or duplicative items. Where appropriate, an analysis shall be made of lease and purchase alternatives to determine which would be the most economical, practical procurement.

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(b) Invitations for bids or requests for proposals shall be based upon a clear and accurate description of the technical requirements for the material, product, or service to be procured. Such description shall not, in competitive procurements, contain features which unduly restrict competition. "Brand name or equal" descriptions may be used to define the performance or other salient requirements of a procurement, and when so used the specific features of the named brand which must be met by offerors should be clearly specified.

(c) Positive efforts shall be made by the grantees to utilize small business and minority-owned business sources of supplies and services. Such efforts should allow these sources the maximum feasible opportunity to compete for contracts to be performed utilizing Federal grant funds.

(d) The type of procuring instruments used; i.e., fixed-price contracts, cost-reimbursement contracts, purchase orders, incentive contracts, etc., shall be appropriate for the particular procurement and for promoting the best interest of the grant program involved. The "cost-plus-a-percentage-of-cost" method of contracting shall not be used.

(e) Formal advertising, with adequate purchase description, sealed bids, and public openings shall be the required method of procurement unless negotiation prusuant to paragraph (f) is necessary to accomplish sound procurement. However, procurements of $10,000 or less need not be so advertised unless otherwise required by state or local law or regulations. Where such advertised bids are obtained, the award shall be made to the responsible bidder whose bid is responsive to the invitation and is most advantageous to the grantee, price, and other factors considered. (Factors such as discounts, transportation costs, and taxes may be considered in determining the lowest bid) Invitations for bids shall clearly set forth all requirements which the bidder must fulfill in order for his bid to be evaluated by the grantee. Any or all bids may be rejected when it is in the grantee's interest to do so and such rejections are in accordance with applicable state and local laws, rules, and regulations.

(f) Procurements may be negotiated if it is impracticable and unfeasible to use formal advertising. Generally, procurements may be negotiated by the grantee if:

(1) The public exigency will not permit the delay incident to advertising;

(2) The material or service to be procured is available from only one person or firm (All contemplated sole source procurements where the aggregate expenditure is expected to exceed $5,000 shall be referred to the grantor agency for prior approval);

(3) The aggregate amount involved does not exceed $10,000;

(4) The contract is for personal or professional services or for any service to be rendered by a university, college, or other educational institution;

(5) The material or services are to be procured and used outside the limits of the United States and its possessions;

(6) No acceptable bids have been received after formal advertising;

(7) The purchases are for highly perishable materials or medical supplies, for material or services where the prices are established by law, for technical items or equipment requiring standardization and interchangeability of parts with existing equipment, for experimental, developmental, or research work, for supplies purchased for authorized resale, or for technical or specialized supplies requiring substantial initial investment for manufacture; or,

(8) The procurements are otherwise authorized by law, rules, or regulations.

Notwithstanding the existence of circumstances justifying negotiation, competition shall be obtained to the maximum extent practicable.

(g) Contracts shall be made only with responsible contractors who possess the potential ability to perform successfully under the terms and conditions of a proposed procurement. Consideration shall be given to such matters as contractor integrity, record of past performance, financial and technical resources, or accessibility to other necessary resources.

(h) Procurement records or files for purchases in amounts in excess of $10,000 shall provide at least the following pertinent information: justification for the use of negotiation in lieu of advertising, contractor selection, and the basis for the cost or price negotiated.

(i) A system for contract administration shall be maintained to ensure contractor conformance with terms, conditions, and specifications of the contract or order and to ensure adequate and timely followup of all purchases.

D. The grantee shall include, in addition to provisions to define a sound and complete agreement, the following provisions in all contracts and subgrants:

1. Contracts shall contain such contractual provisions or conditions which will allow for administrative, contractual, or legal remedies in instances in which contractors violate or breach contract terms and provide for such sanctions and penalties as may be appropriate.

2. All contracts, amounts for which are in excess of $10,000, shall contain suitable provisions for termination by the grantee, including the manner by which it will be effected and the basis for settlement. In addition, such contracts shall describe conditions under which the contract may be terminated for default as well as conditions by which the contract may be terminated because of circumstances beyond the control of the contractor.

3. [illegible]

4. [illegible]

5. [illegible] contracts [illegible] include a provision for compliance [illegible] CFR, Part 5). Under this act, contractors [illegible] laborers and mechanics at a rate [illegible] in a wage determination made [illegible] contractors shall be required to pay wages [illegible] The grantee shall place a copy [illegible] issued by the Department of Labor [illegible] contract shall be conditioned [illegible] tion. The grantee shall report all [illegible] grantor agency.

6. Where applicable, all contracts awarded by grantees and subgrantees in excess of $2,000 for construction contracts and in excess of $2,500 for other contracts which involve the employment of mechanics or laborers shall include a provision for compliance with sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330) as supplemented by Department of Labor regulations (29 CFR Part 5). Under section 103 of the act, each contractor shall be required to compute the wages of every mechanic and laborer on the basis of a standard workday of 8 hours and a standard workweek of 40 hours. Work in excess of the standard workday or workweek is permissible provided that the worker is compensated at a rate of not less than 1-1/2 times the basic rate of pay for all hours worked in excess of 8 hours in any calendar day or 40 hours in the workweek. Section 107 of the act is applicable to construction work and provides that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction, safety, and health standards promulgated by the Secretary of Labor. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

7. Contracts or agreements, the principal purpose of which is to create, develop, or improve products, processes, or methods; or for exploration into fields which directly concern public health, safety, or welfare; or contracts in the field of science or technology in which there has been little significant experience outside of work funded by Federal assistance, shall contain a notice to the effect that matters regarding rights to inventions and materials generated under the contract or agreement are subject to the regulations issued by the Federal grantor agency and the grantee. The contractor shall be advised as to the source of additional information regarding these matters.

8. All negotiated contracts (except those of $10,000 or less) awarded by grantees shall include a provision to the effect that the grantee, the Federal grantor agency, the Comptroller General of the United States, or any of their duly authorized representatives, shall have access to any books, documents, papers, and records of the contractor which are directly pertinent to a specific grant program for the purposes of making audit, examination, excerpts, and transcriptions.

9. Contracts and subgrants of amounts in excess of $100,000 shall contain a provision which requires the recipient to agree to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act of 1970. Violations shall be reported to the grantor agency and the Regional Office of the Environmental Protection Agency.

DOJ-1975-12

APPENDIX 5

SAMPLE INVITATION FOR BID

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The Sample Invitation For Bid is included herewith as an example of how one particular agency documented their bid requirements, terms, and conditions.

It should be noted that the IFB's are for the procurement of standardized products where the final selection is based on the lowest bid, provided all requirements are met. This methods does not allow for negotiations.

5. SAMPLE INVITATION FOR BID (IFB)

May 26, 1977

Gentlemen:

Agency A invites you to submit a bid for a small scale minicomputer system that meets the following specifications:

1. CPU with a minimum of 32K bytes usable memory (available for application programs).
2. Two disk drives, at least one of which must be removable. The minimum total capacity must be 2.5 megabyte usable storage available for application programs and data files.
3. Hardcopy printer with a minimum speed of 165 cps, pin feed platen, 132 character width capable of handling multipart forms.
4. One CRT with keyboard, upper case ASCII character set and display of at least 24 lines of 80 characters each.
5. An operating system having the capability to support multiterminal applications.
6. ANS COBOL and FORTRAN IV shall be provided, and the system shall be capable of supporting BASIC. Sort and copy utilities must be included also.
7. System installation cannot require special environmental considerations.
8. Delivery schedule cannot exceed 120 days from date of order acceptance.
9. Total system price must not exceed $35,000.
10. In submitting a bid, the offerors agree that all bids shall have full factory approval and that the prices quoted shall remain valid for a period of 30 days following the closing date for submission of bids.

In addition to the minimum specifications as presented, information should be included explaining the capability of the proposed configuration to support or be expanded to support simultaneous foreground/background operations; simultaneous operation of application programs in COBOL and FORTRAN using multiple terminals; development (compiling) of COBOL programs with simultaneous operations on FORTRAN application programs; and development (compiling) of FORTRAN programs with simultaneous operations on COBOL application programs. The cost factors involved with meeting these desirables should be included.

The quoted price should be itemized to reflect the cost of each item or subsystem in the quoted system. Agency A reserves the right to accept other than the lowest bid, as well as the right to purchase only portions of the quoted system.

In support of your bid, please provide full technical documentation of system hardware and software, including user's manuals where appropriate. Please include a description of your service capabilities in the Northern California area as well as your national service capabilities.

Bids and supporting documentation must be received by Agency A no later than 4:00 p.m. PDT June 24, 1981. Bids should be addressed to:

Agency A
1234 Main Street
Anytown, CA 99091

Attention: IFB #81-01

Agency A believes that this project is an important demonstration of small computing systems in the area of criminal justice. There is a considerable potential market for this category of system and it is with this in mind that we welcome your interest in participating in this project. If you are not interested, please feel free to forward this request to a systems house that incorporates your equipment in their products.

Sincerely,

s/Executive Director

APPENDIX 6

SAMPLE REQUEST FOR PROPOSAL

The Sample RFP is included to demonstrate how one agency documented their requirements, in an RFP, for a switching system.

It is offered as a guide for the preparation of an RFP that is intended to procure any type of computer system. Needless to say, your particular RFP should be tailored to fit your specific needs, and your legal counsel should be consulted in determining the fitting language, conditions, and terms which would most protect your interests. Unlike the IFB method, the RFP allows you to negotiate the best requirements commensurate with the best price.

6. SAMPLE REQUEST FOR PROPOSAL (RFP)

Interested Proponents:

The County Sheriff's Department is planning to install a message switching computer to serve the needs of law enforcement agencies within the County. Specifications for this system are outlined in the attached Request for Proposal. Funding for the project is available under a grant by LEAA and by matching funds of this County. Due to time limitations on funding, the time schedule within the Request for Posposal will have to be strictly adhered to.

We are hereby inviting you to submit a proposal for consideration by the Sheriff's Department. Please notice that a Letter of Intent to Submit a Proposal is required by August 15, 19XX, and failure to submit this letter can disqualify your firm from further consideration. Any procedural questions can be answered at any time by the period named within the Request for Proposal.

COUNTY
COMMUNICATIONS NETWORK
MESSAGE SWITCHING SYSTEM

A

REQUEST FOR PROPOSAL

ISSUED BY:

SHERIFF'S DEPARTMENT

July 30, 19XX

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*The contract is not included in this sample, although in the actual transmittal of the RFP it was included. See Section 7 of the Appendix for a sample contract.

I. ADMINISTRATIVE AND CONTRACTUAL INFORMATION

PURPOSE OF DOCUMENT

The County Sheriff's Department is planning to provide a law enforcement data communication system. This system will service the teleprocessing needs between various law enforcement agencies within the County and the California Law Enforcement Teletype Service (CLETS), the Police Information Network System (PIN) in Alameda County and the County Sheriff's Information System. Interface with National Crime Information Center (NCIC), Criminal Justice Information System (CJIS), and Automated Management Information System (AMIS, DMV) is made through CLETS.

The concept being pursued, and what this Request For Proposal (RFP) is concerned with, is the utilization of a data communication system, herein referred to as message switcher, to provide the common communications interface between the law enforcement users within the County and the National, State and County crime information files and State vehicle registration and driver information files. Further, the message switcher must provide the facility for storing criminal information of interest to law enforcement users within the County.

Part II and Part III of this Request For Proposal describes the hardware and software specifications for the System.

Interested vendors may respond with a proposal that covers the total system as described including both hardware and software. However, proposals to supply only the hardware or only the software will be accepted and considered.

1. Standard Terminology

The terms consultant, consulting firm, contractor, or bidder are all referred to as vendor for the purpose of this document.

The term message switcher refers to that function that provides for data communication processing and includes stand alone, store, and forward capability and message reformatting.

2. Issuing Agency

This Request For Proposal is issued by the Sheriff's Department. The issuing agency is the sole point of contact in the County for this selection process.

3. Intent to File a Proposal

Vendors who plan to submit a proposal as a result of this RFP must reply with a letter of intent indicating that a proposal will be submitted. The letter of intent must be in the hands of the person and address listed in Part 6 below by the close of business 8/15/XX.

4. Clarification of Specifications and Questions

If additional information is necessary to enable the vendor to make an interpretation of specifications in this RFP, written questions of this type will be accepted until the close of business 8/22/XX. Questions of this type from all vendors and responses will be consolidated and mailed on or about 8/31/XX to all vendors who submitted a letter of intent to respond.

Procedural questions will be answered at any time.

All questions must be submitted to:

Name
Department
Address
Phone Number

5. Response Preparation and Proposal Format

Each proposal must be in the same format and sequence as the details presented in Part II and Part III of RFP. The requirements stated herein are mandatory unless otherwise stated. It should be understood that failure to respond to a specific requirement may be the basis for a vendor being eliminated from consideration during comparative evaluation. The County reserves the right to accept or reject any or all proposals.

When a complete package proposal is made for a package price only those services or items included in the price can be referenced in the proposal. Optional equipment or services can only be described in an addendum.

6. Response Submission

To facilitate the evaluation process, eight (8) copies of each proposal are required. All proposals must be sealed in a package showing the following information on the outside:

1. County Sheriff's Department
2. Vendor's name and address
3. Proposal due date

The proposal package must be delivered or sent by certified mail to:

Name
Department
Address
Telephone Number

All proposals must be received by the issuing agency no later than the close of business 9/14/XX. Vendors mailing their proposals must allow sufficient mail delivery time to ensure timely receipt of their proposals by the time specified. Late proposals will not be accepted.

7. Incurring Costs

The County is not liable for any cost incurred by a vendor replying to this RFP.

8. Multiple Proposals

Multiple proposals involving the various methods of meeting the objectives may be submitted by each vendor. However, if more than one proposal is submitted, each must be complete in every respect and marked as Proposal No. 1, Proposal No. 2, on the cover page.

9. Oral Presentations

Vendors shall make oral presentations to supplement proposals if requested by the issuing agency. These presentations will be held subsequent to the receipt of the proposals to provide the vendor with an opportunity to clarify his proposal. The issuing agency will schedule a time and location for each oral presentation which it requests. Recording may be made of all oral presentations for further study and analysis. Should a vendor refuse to honor the request for oral presentation, it may result in the rejection of the proposal by the issuing agency.

10. Proprietary Information

Any restructions on the use of data contained within a proposal must be clearly stated in the proposal itself. Proprietary information submitted in response to this request for proposal will be handled in accordance with applicable County and/or Federal procurement regulations.

11. News Releases

News releases pertaining to this procurement or any part of the project shall not be made without prior approval of the issuing agency.

12. Bid Bond

Each proposal must be accompanied by a deposit in the amount of 10% of the total bid. Bid bond must be in the form of a cashier's check, certified check, or bid bond payable to the County.

13. Annual Report of Company

If a proposal is submitted, vendor will include one copy of the latest published Annual Report or submit satisfactory written evidence of the financial stability of the organization.

14. Selection Process

All proposals submitted as a result of this RFP will be evaluated by a technical committee composed of employees of County Data Processing, and the Sheriff's staff. The evaluation will cover:

a. Whether a proposal meets all mandatory requirements. If it does not, no further consideration will be given to the proposal.

b. The extent and effectiveness to which a proposal meets desirable and mandatory features.

If a proposal meets all mandatory requirements, it will be evaluated on the basis of a uniform selection and weighting technique. Point values have been assigned to each category of this RFP. At the completion of the evaluation, a total point value will be compiled for each proposal.

Cost will be evaluated according to benefits and comparable price for each system proposed.

15. Price

All proposals must include a pricing section which should contain the following price elements:

1. Total purchase price of the system.
2. Unit purchase price of each hardware component.
3. Price for each software task such as design, programming, documentation, and installation.
4. Additional charges such as shipping or installation.
5. Price of monthly service contract for total system maintenance based on each type of service when the vendor can perform.
6. Price of maintaining each individual component.

If lease of the hardware or software is available the price of the lease must be broken down in the same way as the purchase price. Lease rates should be shown based on 1 year, 3 year, 5 year lease periods. Services such as maintenance that are included in monthly lease rates must be defined in a statement to that effect.

If the lease plan provides for a conversion to purchase based on lease payments the exact terms of conversion must be explained.

16. No proposal will be considered with a contract delivery date later than 5/1/XX. Delivery of the total system is desired as soon as possible. The vendor must state earliest possible delivery date.

17. Acceptance of Proposal Content

The contents of the proposal of the successful vendor will become contractual obligations if acquisition action ensues. Failure of successful vendor to accept these obligations in the contractual agreement may result in cancellation of the award. The County reserves the right to accept any part of a proposal and not be obligated in any way to accept those parts that do not meet with the approval of the selection committee.

18. Standard Contract

The County reserves the right to incorporate standard State or County contractual provisions into any contract negotiated as a result of any proposal submitted in response to this Request for Proposal.

19. Prime Contractor Responsibilities

The selected vendor(s) will be required to assume responsibility for delivery, installation, and maintenance of all equipment and contracted services whether or not he is the original supplier. Further, the County will consider the selected vendor(s) to be the sole point of contact with regard to contractual matters, including the performance of services and the payment of any and all charges resulting frm contract obligations, except communication lines, modems, and terminal equipment which will be obtained from a common carrier and/or from other vendors unless the selected vendor also supplies these services.

The selected vendor(s) must commit to this project a professional staff assigned on-site for a reasonable period of time during installation and implementation. The selected vendor(s) must provide an on-site project manager who will be responsible to the Project Coordinator of the issuing agency.

20. Standard of Acceptance

The selected vendor(s) shall certify in writing to the issuing agency when the system is installed and, therefore, ready for use. The acceptance period of ninety (90) consecutive days shall commence on the first day following receipt of notification of installation to the issuing agency, at which time operational control becomes the responsibility of the issuing agency. The acceptance period for hardware will not begin prior to the delivery of the software unless the County contracts for the purchase of hardware separate from the software. The County reserves the right to make the final acceptance. In the event that equipment is procured on a monthly rental agreement the rental period will begin on date of acceptance by the County. It is not required that one ninety-day (90) period expire in order for another performance period to begin. To meet the issuing agency standard of acceptance, the system must operate at an average level of effectiveness of not less than 96% for a period of ninety (90) consecutive days. The average effectiveness level shall be determined by:

$$\text{Effectiveness} = \frac{\text{Total Productive Operational Use Time}}{\text{Total Scheduled Operational Use Time}}$$

Total productive operational use is defined as the total that the system is capable of operating without failure. Failure of redundant components or components not scheduled for use at the time of failure will not effect the productive operational use time. Total scheduled operational use time will be 24 hours per day, 7 days per week. This time will be reduced only by failure of external systems which are not caused by the system. Examples of external systems failures which will effect this are:

Power failures, Telephone line failures, PIN, CLETS, or other computer failures.

All associated down time during the acceptance period must be documented and submitted to the agency Project Coordinator.

21. Warranty

The vendor shall provide a copy of any warranty - guarantee provisions he offers for the Communications System Hardware. The vendor shall warrant and guarantee that all work and materials furnished under this specification shall be free from defects of material and workmanship for a period of one year from the date of acceptance. The vendor further agrees to repair or replace, at his own expense, all such defective work which becomes defective during the term of this warranty.

It is also noted that a one year guarantee shall be required for all vendor supplied software and this guarantee will begin on the date of acceptance.

In addition to the warranty the vendor shall state the availability of personnel to service this warranty and the maximum response time which will be provided when this service is requested.

22. Progress Reports

The selected vendor(s) must submit progress reports as requested by the agency Project Coordinator. A progress report will be submitted in writing at least once per month.

23. Permits and Licenses

The vendor(s) shall be responsible for obtaining any necessary construction and installation permits and licenses and shall comply with all local codes and ordinances without cost to the County.

24. Liability

Vendor(s) shall be responsible for all proper insurances (including workmen's compensation) on personnel and equipment provided by them.

25. Bid Prices

All bid prices shall hold firm for at least ninety (90) days from date of bid opening.

26. Payment

Payment schedule will be negotiated with vendor(s) at time of award.

27. Schedule of Activities*

Date	Activity
7/31/XX	RFP mailed.
8/15/XX	Closing date for filing letter of intention to submit a proposal.
8/22/XX	Due date for written questions on specifications.
8/31/XX	Mailing of all questions and responses.
9/14/XX	Closing date and time for receipt of proposals.
10/15/XX	Selection to be made on or before this date.
10/26/XX	Contract awarded on or before this date.
5/1/XX	Delivery made on or before this date.

*Vendors who have filed letters of intent will be informed in writing of any data change.

II. MESSAGE SWITCHER HARDWARE SPECIFICATION

PURPOSE OF HARDWARE

The County law enforcement communications network will be controlled by a programmable communications processor. The primary function of this system is message switching. Basically there are three types of message traffic to be processed. They are 1) point to point administrative text both within this system and to points outside of the system, 2) inquiry to a data base which requires a response to complete the transaction, and 3) data input to update these data bases.

The data base systems which this message switcher will be communicating with are:

a. The Criminal Justice Information System (CJIS) provided by the State of California Department of Justice (DOJ), accessed via CLETS.

b. The Automated Management Information System (AMIS) provided by the State of California Department of Motor Vehicles (DMV), accessed via CLETS.

c. The National Crime Information Center (NCIC) provided by the Federal Bureau of Investigation (FBI), accessed via CLETS.

d. The Police Information Network (PIN), provided by the County of Alameda.

e. The County Sheriff's Information System provided by the County data processing division.

In addition to providing message switching for the users of these data base systems the hardware must provide the ability to store messages for delayed delivery in a store and forward mode. A desired feature of this system will be to reduce the difference in input formats for similar transactions to different data bases.

Therefore, the vendor must propose a system to support these functions for the network as defined in this document. Only that equipment which the vendor has available for general sale and is fully operational at the time of proposal should be submitted for bid. In addition to the narrative portion of the proposal all questions in Attachment 1 (Hardware Questionnaire) must be answered. Some questions require a yes or no answer. When possible and practical, "no" answers should be explained by a brief narrative statement.

The message switcher proposed must handle all messages at line speed. On a single transmission a message may be sent to one terminal, multiple terminals, a predetermined group of terminals, or all terminals. Terminals will be polled prior to sending and will be addressed prior to receiving a message. Each terminal will send and receive but not simultaneously.

The message switcher will receive, edit, log, and retransmit each message. The message traffic must not be degraded on the remainder of the system, if any line or data base becomes inoperative.

1. Performance Requirements

Daily activity

650	data entry transaction to the County system.
3500	inquiry and response transaction with County system. Average input 100 bytes output 500 bytes.
900	original entry and inquiry to CLETS.
300	original entry and inquiry to PIN.

The peak loading in any one hour would be 30% of the total daily estimate.

The processing and switching capability of the system must be able to support double the initial traffic loading.

2. Configuration

The message switcher should be configured to include a magnetic tape unit for message logging. The system must have sufficient auxilliary storage (disk or drum) to queue up the administrative messages for all terminals during a 24 hour period. In addition, there should be enough storage to queue all messages for 50% of the terminals for 72 hours.

The system should include a paper tape reader and punch capable of reading and punching both 5 level and 8 level teletype paper tape. A high speed printer will be required for use in the system. Any other peripheral required to perform system generation or software assembly within a reasonable time frame should be included with the system. The line interface requirements will be:

a. 3 1200 baud asynchronous private leased lines to the County computer.

b. 1 1200 baud asynchronous private leased line to CLETS in Sacramento, California.

c. 1 1200 baud asynchronous private leased line to PIN System in Oakland, California.

d. 8 1200 baud asynchronous private leased line in multidrop configuration with 5 terminals per each line.

e. 6 1200 baud dial access 202C type ports.

All the above lines will operate using a poll and select mode. The interface to these lines should have program controlled speed selection.

3. Redundancy Requirement

The system that is proposed must contain duplicate modules or subsystems to insure reliable service. The tape unit that is used for logging of messages should be duplicated. The mass storage should be configured so that the total storage is divided into two independent subsystems. Any redundancy in the system will be limited to the switcher and not extend to the telephone lines or line interfaces. Part of the acceptance test will be run on the redundant modules to insure that the capability to switch over can in fact handle the service. It is most desirable to make use of the duplicate components during normal operation so that the availability to switch over is always apparent. The vendor must describe in detail the procedure used to accomplish manual switchover, describe operation involvement, and state the minimum and maximum switchover times.

4. System Expandability

We anticipate that the communications network will experience an increase in the number of terminals and volume of messages. Therefore, the message switcher must be modular in design. The vendor must list in detail additional hardware components required to support a configuration double the size of the initial requirements stated above, excluding the CLETS, PINS, and County circuits. The processing power in the initial units should be capable of handling twice the initial workload. Include a statement describing the impact on the system while changes are being made. Each proposal will be evaluated on how well this requirement is met.

It is also important that this system be able to respond to the new and changing communication needs of initial and future users of the system. One of the future needs will be to communicate using synchronous transmission technique. The ease with which the proposed system components can accommodate these changing needs will be an important factor in proposal evaluation. The vendor must indicate what line speeds and terminals are presently supported by their hardware and how these characteristics are supported.

5. Service Requirements

This message switcher is required to be operational 24 hours per day 365 days per year. In order to insure reliable up time the system should have the ability to self test through both hardware and software upon request. In addition, the data communication interface should have the ability to detect modem and/or line failures.

The system should be configured in such a manner as to allow maintenance on the duplicate components while the network is operating. Further, no line, computer system, or terminal being inoperative, should impare the service to the remainder of the system.

With the exception of entering the time and date each day there should be no requirement for a computer operator to attend the message switcher system.

6. Site Assistance

The vendor should specify the vendor's policy and cost for site assistance by systems engineers. This statement should include, but need not be limited to the following:

- Site Preparation Requirements
- Installation and maintenance of vendor supplied applications software
- Minimum number of vendor personnel to be made available; the earliest date that these personnel will be available; and the length of time that these personnel will remain on the installation site. The names and brief resume of each person who will be assigned to this project should be provided. Also indicate the current project the person is working on and the precise duty that he would fill in this project.
- The personnel who will be responsible to assist us after installation is completed and accepted.

The vendor should specify vendor's policy and transportation costs of equipment delivery if any, cost incurred for installation if any, and the total installation time for the proposed configuration.

7. Training

Specify the vendor's training policy for County employees or the location of the nearest training facility if on-site training is not provided. The vendor should also specify the duration of training and related costs. An abstract of each course should be included as well as a recommendation of those courses which the County should consider.

8. Maintenance Policy

The vendors are requested to include vendor's policy and costs in providing the following types of maintenance service:

- On-call maintenance personnel where the maximum elapsed time between notification of hardware malfunction and arrival of competent maintenance personnel may not exceed two (2) hours.

- On-call maintenance personnel where the maximum elapsed time between notification of hardware malfunction and arrival of competent maintenance personnel may not exceed eight (8) hours.
- Specify any other maximum elapsed time that the vendor is capable of supporting and the related costs.
- On-site maintenance personnel on prime shift basis, plus on-call 24 hours per day, 7 days per week.

The vendor should also specify for the proposed system the required number of hours per day and/or week needed for scheduled preventive maintenance. In addition, the vendor should specify the location of the spare parts depot which would service this installation. Explain the vendor's policy concerning backup support for service personnel including time limits and chain of contact for additional assistance.

The vendor should include a statement on policy concerning maintenance support in conjunction with maintenance personnel of other vendors while working on joint or common problems.

9. Documentation Policy

Specify the vendors policy and costs for distribution and updating of the system's documentation. Include as a minimum, hardware and software manuals, operating manuals, and other available user aids. Detailed fault isolation procedures must be included in the system documentation.

10. Related Systems Experience

The vendor should describe any similar message switching applications in which the proposed hardware has been used. Vendors should also provide the name, title, address, and telephone number of a person to contact in each installation. The County will contact each installation listed in the proposal.

III. MESSAGE SWITCHER SOFTWARE REQUIREMENTS

The objective of the County in soliciting and evaluating proposals is to insure that the selection of software is adequate in all respects to process the System workload. The vendor should be certain to state all costs and clearly describe how he intends to meet all software requirements. The proposal must be written in the sequence of this RFP.

We anticipate that the communications network will experience a steady increase in the number of terminals and volume of messages. Therefore, this software must be modular in design and easily modifiable. To meet this criteria it is desirable to use a table driven system rather than hard coded formats and configuration decriptions.

The vendor's proposal should include a general flow chart of the three basic types of transactions the system will process. Total core requirements must be included and indicate overlays required.

Any experience by the vendor in data communications should be described. Include any references that can be contacted. The vendor must indicate what percentage of the proposed software is operational elsewhere. State when installed and where.

All proposals received will be evaluated first to insure that mandatory requirements are met. Next they will be evaluated on how effectively the requirements are met.

Message Switcher software will include the message handling code and an operating system to control the message switcher specified in Part II of this Request for Proposal.

If the proposal is being made only on the software then the vendor must specify the exact equipment and configuration that he intends to develop the software to operate on. The vendor may specify more than one type of system that he will provide the software for.

The software proposed must be fully tested and in an operational status by the start of the acceptance period. Refer to Part II of this Request for Proposal for start of acceptance date and for the standards of acceptance.

In addition to the narrative portions of the proposal, all questions in Attachment 2 - Software Questionnaire, must be answered. Most questions have been prepared to require a "Yes" or "No" answer. For a "No" answer the vendor must supply a brief narrative clarifying the negative response. Where questions appear not-applicable or information is unavailable, enter "N/A" or "U/A" respectively. The narrative must contain the same question number and appear in the same sequence as the questionnaire. All questions must be answered on the questionnaire form and submitted with your narrative proposal. If alternate methods are proposed, submit data for each proposal separately.

The System must handle three types of messages: Criminal information file update, administrative messages, and data base inquiry. Criminal information file messages are those messages that create, update, or clear records from any of the data bases that this system interfaces with. Administrative messages are those messages transmitted between terminals, or remote computers. Inquiries are those messages that traditionally have both an input and response of data. The software must provide a level of service consistent with the message switcher performance requirements as outlined in the hardware specifications.

Following is a description of the System software requirements which are divided into four parts: The operating system, the data communications software, interface requirement, and vendor support. Proposals will be evaluated on the degree and effectiveness with which these software requirements are met. The vendor must describe in detail how the proposal will meet each requirement.

1. Operating System Software

The system must have a complete operating system that is fully tested and operational. The vendor must also supply an assembler whereby coding is performed at the instruction level and a higher level language compiler such as FORTRAN, COBOL, or BASIC. The vendor must provide a complete description of the assembler and other system support programs.

The operating system must include but need not be limited to the following capabilities:

- Resident monitoring of interrupts to provide completely automatic operation in the multiprogramming environment. Operator intervention must be held to an absolute minimum.
- Ability to detect and record equipment malfunctions, effect recovery procedures, and notify the operator of the nature of the malfunction.
- Provision for systematic classifying, identifying, storing, cataloging, and retrieving of all data and programs which are processed by the operation system.
- Priority processing providing scheduling among several levels of interrupt routines.
- Ability to allocate storage space in auxiliary storage under user request and protection of areas already allocated to existing files.
- The ability to support multiprogramming in at least a fixed partition foreground/background mode. Variable size realtime multiprogramming is desirable.
- The ability to load or dump data between the disk and magnetic tape without disturbing the communication program.

2. Data Communication Software

A complete software system must be fully tested and operational when delivered for acceptance testing. To give the vendor as much latitude in software design and creatability this software specification will list very few mandatory requirements. In place of mandatory requirements many desired features and functions are listed and the vendor is invited to address himself to each of these items. The proposal will be evaluated on how many and how well these desired features are proposed. It is not the intention of this request to dictate the software design technique except in the area that will affect maintenance and expandability.

A. GENERAL CONCEPT OF TERMINAL OPERATION

All terminals are in idle mode being polled by the system.

1. Operator requests an inquiry screen by use of a function key or single character transmission.
   a. The system displays a standard fill-in-the-blanks inquiry screen.
   b. Actual inquiry information is transmitted to the switcher system.
   c. The switcher software edits the inquiry according to the type and destination of the inquiry.

d. The message is formatted for the destination, written on the log tape, and placed in the output queue for the destination.

e. The message is taken from the output queue when polled by the destination and sent to the destination computer. Transmission is also noted on the log tape at this time.

f. Reply is received, written on log tape, and stored in output queue for original inquiry station.

g. When normal sequence of poll/select for the original terminal occurs the first page of the reply will be displayed on the terminal.

h. Delivery of response is noted on the log tape.

i. The terminal operator may elect to print the reply under local control.

The operator has several options available when using the inquiry screen.

a. Operator can request alternate terminal delivery for the reply.

b. Operator can request that the response be automatically printed.

c. Operator can request that this inquiry is batch mode.

If the terminal is operating in inquiry batch mode as requested by the operator then several steps in the inquiry operation will change. When the response is received by the message switcher it will not be sent to the original terminal. Instead a message indicating that a response is waiting will be sent to the terminal. The terminal operator will then have to request the reply be displayed before the message can be transmitted.

2. Operator requests administrative message screen.

a. Screen for administrative message is displayed.

b. Message is entered and transmitted to switcher.

c. Switcher logs message on tape and places message in output queue for destination.

d. Message is sent to destination and transmission is logged.

3. Operator requests data entry screen for Sheriff's system.

a. Terminal will be placed in a hold mode for all output except replies from the data base which are requested.

b. System will display initial screen to be filled in according to the type of request.

c. Additional screens and replies will come from the data base. All entries go to data base as destination assumed.

d. Terminal operator can request new screen to start over.

e. Terminal operator will ask for idle mode.

f. Any messages being held will cause notification to terminal at this time.

4. Operator can request "Out of Service."

a. Terminal is considered out of service. All messages will queue up and sender is advised of out of service condition.

b. Terminal continues to be polled every 5 minutes to determine if a request for "In Service" is present.

5. Operator requests unattended service.

a. All output messages are printed by the system after transmitting. No notification is sent of message waiting.

b. Terminal is placed in slow poll sequence.

c. Terminal remains in unattended mode until request for attended operation is received.

6. Operator requests permanent inquiry batch mode.

a. All responses will be held until the operator requests delivery of the message. The operator will not have to indicate batch inquiry with each transmission.

7. Operator requests print mode.

a. If this terminal is equipped with a printer all output messages will be automatically printed after transmission.

8. Operator enters an inquiry unformatted.

a. The terminal operator formats an inquiry according to the specifications of the destination.

b. The message is transmitted to the message switcher.

c. The switcher writes the message on the log tape and places the message in the output queue for the destination.

d. The handling of this inquiry then proceeds as if the inquiry was generated by a fill-in screen.

B. FEATURES AND FUNCTIONS

1. The software must assemble all messages in entirety either in core memory or in auxilliary memory before altering the message or initiating retrans-

mission to the destination. This technique will make it easier to add new features to the software system.

2. The previous message sent to the terminal will be retained by the software so that it can be recalled for display, printing, or redistribution.

3. Any message on the terminal screen can be transmitted to another terminal within this system as an administrative message. The software may permit the terminal operator to insert a comment before the redistribution takes place.

4. The terminal operator should have the capability to request multiple terminal distribution for a response to an inquiry. This feature would provide a method to operate mobile printing equipment in the future.

5. The input formats should be table driven to provide flexibility and an unlimited variety. It is desirable to have a few well designed screens to serve many purposes, however, the possibility of many formats must be provided. The table of formats should be loaded on command of the system control console while the system is operating.

6. A desirable adjunct to use of fill-in screens is a capability to request prompting instructions on how to enter the major fields.

7. The system control console should be capable of performing the following tasks:

   a. Take any terminal out of poll sequence or place one in a poll sequence.

   b. Place a given line out of service or put the line back in service.

   c. Change the time and date.

   d. Start a trace on any line.

   e. Direct a message log tape switchover or closeout.

   f. Request a destructive or nondestructive printout of all queued messages for a given terminal.

   g. Request a listing on the printer that shows complete system status.

8. The software should date and time stamp all messages.

9. The software must maintain a log of all transactions that pass through the system. This log will be maintained on magnetic tape although the log records may be built on disk to simplify blocking. All transactions written on the log tape must contain time and date. Those messages or events which must be logged are:

   a. All input messages or inquiries accepted from a terminal for retransmission.

   b. All output messages to a terminal.

   c. All actions of the system control console.

10. The software should allow for several types of message addressing.

    a. Point to Point

    b. Point to multiple Points (up to 6)

    c. Point to designated groups (up to 10 in a group, group ID used in place of terminal ID)

11. The software should contain the capability to direct a single inquiry to several data base systems. When an inquiry for vehicle registration is made using a license number, that same vehicle should be checked versus NCIC and PIN without the need for separate inquiries by the terminal operator. Likewise an inquiry for criminal history should trigger an inquiry to the warrant files. The software can generate the extra records to make these automatic inquiries. The extra inquiries would be indicated by extra fields within the inquiring or by defining the level of the inquiry.

12. The software should provide a trace function which can be initiated by the system control console. This function will cause every action on a specified line to be noted on the line printer. With each action such as poll, select, transmit, etc., a status word and time will be noted. This function is intended to provide a tool for line problem analysis.

13. The system software should log all line and modem errors and report to the system control console those which exceed a preset error limit.

14. There will be three basic levels of priority associated with the terminals. Priority A, the highest priority, will be assigned to those terminals that are located in radio dispatch areas and are used to support officers in the field. Priority B, the mid-level priority, will be assigned to those terminals that are located in other operational sections of law enforcement departments. The lowest level priority C, is for those terminals used by other justice administration services.

15. The software must allow the system control console to restrict specified terminals from using some transaction and accessing specified data bases.

16. The software must provide the capability of attaching terminals through dial access modems. This type of line will have only 1 terminal on the line and will use the poll discipline. Special security procedures will apply to granting access to this type of terminal.

17. The software must verify the hardware terminal address versus the use agency table for security purposes.

18. The software must provide a restart and recovery function that will insure that no message is lost without notifying the sender of that loss. This means that a transmitted message that is not complete when power fails will be lost. However when the system is restarted the originating terminal will be notified that the message must be retransmitted.

19. The software must provide the ability to direct inquiries to a specified data base to be punched on paper tape in a format readable on a model 33 ASR. In addition, the software should attempt to read the paper tape reader at least once per minute. Replies received via TTY will be punched on paper tape and entered to the message Switcher for retransmission.

C. INTERFACE REQUIREMENTS

The software must provide the interface to be compatible with CLETS service through one line initially and up to four lines eventually. The main requirements of interfacing to this service are:

a. We must be able to accept messages when CLETS is ready to send.

b. We must be able to accept messages of unlimited length.

c. Access will be made via 1200 baud asynchronous private leased line.

The software must provide the interface to PIN system in Alameda County. This data base is essentially a warrant system and is limited in the type of transactions possible. Basic requirements for this interface include:

a. This system must be able to accept messages before sending warrant inquiries.

b. PIN can be used as an alternate communication route to CLETS by affixing a code to the message.

c. The line discipline is a poll and select method over 1200 baud asynchronous private leased lines.

The software must provide an interface for 3 lines to the County Sheriff's Information System. This system is expected to handle as much if not more than all others combined. Therefore, the message load should be balanced across the 3 lines. Some of the interface requirements for this system are:

a. The communication lines will be 1800 Baud asynchronous leased lines.

b. Only one message can be sent to the County system over a single line without receiving a reply.

c. The line discipline will be a contention method.

D. VENDOR SUPPORT

1. Documentation

The communication software must be documented by the vendor when presented for acceptance by the County. This documentation must include but is not limited to the following:

a. General flowchart

b. Detailed flowchart

c. Narrative description of all major subroutines

d. Complete program assembly listings including a cross reference of data, names, and tables

e. Instruction on system generation

f. Instruction manual for the system controls console

g. Instruction manual for the terminal user

h. Fault isolation instruction manual.

2. Software Maintenance

Describe your software maintenance policy in detail. This should cover vendor enhancements, user defined improvements, and problem correction. Any additional charges over the basic software cost should be spelled out in detail.

3. Training

Training on the communication software programs should be provided by the vendor to persons in the County Data Processing and Sheriff's Department. Please state the time and cost considerations of this type of training.

ATTACHMENT 1 - HARDWARE QUESTIONNAIRE

1. Processor Features:

   a. Model Number

   b. Date of announcement

   c. Date of first installation

   d. Total number installed to date

   e. Normal delivery time (in days)

   f. Does the proposed configuration have the following built-in features:

      - Index Registers - how many, in core or integrated circuitry?
      - Character (byte) addressing capability?

   g. List all memory addressing modes and indicate what combinations, if any, may be used (i.e., base, relative, indirect)

   h. Number of general purpose registers

   i. Are hardware main memory protect features available?

   j. What is the basic machine cycle time?

   k. Total number of hardware registers

   l. Number of hardware interrupt levels

   m. Total number of instructions

   n. Number and type of direct memory access channels which can be attached per processor

   o. Total number of services per channel

   p. Describe the operator's console included in proposed configuration

   q. Does processor have byte instructions vs. word instructions?

   r. Hardware multiply and divide included or available

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2. Main Memory - Provide the following information separately for each processor proposed.

   a. Capacity of proposed system

   b. Maximum Memory size

   d. Number of bits per character

   e. Size of Memory banks

   f. Memory bank references overlapped?

   g. Is parity checking performed?

   h. Number of bits per basic instruction

   i. Memory Access:

      - How many bits accessed?
      - Memory cycle time
      - Average instruction execution time
      - Level of addressing byte/word
      - Range of address entire memory or module and base

3. Mass Storage Device - For each variety of mass storage device proposed, provide the following:

   a. Type of device (i.e., fixed head, moving head)

   b. Model number of device

   c. Date of announcement of device

   d. Date of first installation and number installed

   e. Model number of device controller

   f. Date of announcement of device controller

   g. Total capacity in alphanumeric characters per controller

   h. If the proposed device is of the replacable type (changeable cartridge, removable packs, etc.) provide the total character capacity per unit

   i. Does the proposed device have Write Check capability?

   j. Does the proposed device have cyclic redundancy check capability?

   k. What is the maximum/minimum access times?

   l. What is the average access time?

   m. Provide the maximum number of alphanumeric characters available per mechanical movement

   n. What is the maximum latency time of this device?

   o. What is the data transfer rate of this device expressed in alphanumeric characters per second?

   p. Does this device require a fixed record size?

   q. What is maximum record size in alphanumeric characters?

   r. What is the maximum number of individually addressable records per unit?

   s. What is the maximum number of individually addressable records per controller?

   t. What is the length of the address word in alphanumeric characters?

4. Communications Interface - For each variety of communications interface proposed, provide the following:

   a. Model number of device

   b. Date of announcement of device

   c. Date of first installation and number of installations

   d. Type of adapter

   e. Number of lines per unit

   f. Number of controllers per channel

   g. Is there a hardware buffer associated with this device? If so, how many characters per buffer?

   h. Does each character generate an interrupt which must be serviced by software?

i. What line mix, if any, is available on this device? ______

j. Is a channel connection to other computers available? ______

k. Does line interface provide full RS232C or RS232B compatibility? ______

5. Line Printer

a. Model number of the printer ______

b. Date of announcement of device ______

c. Date of first installation ______

d. Number of lines per minute ______

e. Number of characters per line ______

f. Number of graphics printable ______

g. Input code, i.e., ASCII, EBCDIC, BCD ______

h. Fully buffered ______

i. Out of forms detect ______

j. Vertical format control available ______

6. Expansion Capabilities

Core

a. What is the maximum core offered? ______

b. How many increments are there between the minimum and maximum core size? ______

c. Does any increment addition necessitate hardware replacement? ______

d. What is the estimated downtime necessary to effect expansion? ______

e. What is the price per increment? ______

Peripherals

f. What is the maximum number of devices of each type supportable? ______

g. What is the maximum mass storage device capacity that can be supported? ______

Communications

h. What is the maximum number of lines which can be attached to the system? ______

7. Physical Environmental Requirements - Specify range of environmental requirements for proper operation of the proposed system. These questions summarize the accompanying chart of individual system components which must also be completed.

a. Electrical

(1) KVA ______

(2) Line Voltage ______

(3) AC or DC ______

(4) Phase ______

(5) Cycle ______

(6) Voltage Fluctuations Tolerances ______

(7) Ground ______

b. Space and Weight

(1) Floor area required in square feet, including service requirements ______

(2) Floor loading weight ______

(3) Indicate preference for raised floor or dropped ceiling for cable sums ______

c. Supply auxiliary power supply requirements ______

d. Air conditioning at 100% use

(1) BTU dissipation per hour ______

(2) Temperature range and recommended level for reliable and safe operation ______

(3) Humidity at minimum and maximum percent ______

ATTACHMENT 2 - SOFTWARE QUESTIONNAIRE

	Operating System	Data Commun. Software
1. Identification		
a. Name the Operating System proposed and its current update level.		
b. When was this system first released?		
c. How many times has the system been updated?		
2. Systems Preparation, Maintenance, and Operation		
a. Is a systems generation run required to prepare the system for use after it is received?		
b. Does the reference manual for the operating system contain a complete list of system generation options?		
c. Is a complete systems generation required when:		
• the Operating System is updated?		
• the remote terminal configuration is permanently changed?		
d. Do all or part of the user libraries have to be recreated when the system is regenerated?		
e. Are special techniques necessary to avoid recreating the user libraries?		
f. Can the operator inform the system that a specific I/O unit or channel cannot be used?		
g. Can the operator inform the system that a specific area of memory cannot be used?		
h. Can the system operate if the operator's console is inoperable?		
i. Does the system require a printer?		
j. Name the peripheral equipment necessary to perform a timely systems generation.		

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	Operating System	Data Commun. Software
3. Multiprogramming		
a. Indicate the number of on-line programs allowed to operate simultaneously in a multiprogramming environment.		
b. Does the system have a Real-Time Executive?		
c. Does the system have a Scheduler?		
d. Does the system have a dynamic memory allocation scheme?		
4. Operations Log		
a. Is a file kept of the system's activity?		
b. What occurrences or conditions cause an entry to be made on the file?		
c. List and briefly define the data fields that appear in each record.		
d. On what device is the file kept?		
e. What action does the operating system take when the file becomes full? Describe briefly.		
f. Is any warning provided that the file is nearing its capacity?		
g. Are there provisions to allow user-written routines to be added to the standard logging routines?		
5. Space Requirements		
Show all space requirements in the units ordinarily used to describe the machine's storage capacity and identify the units used. Include any unused space that may be necessary to provide full memory protection for the system.		
a. Show the operating system basic memory requirements for each of the following categories:		
• Fixed portion (reserved storage for registers, interrupt, etc., used by the operating system and primary control program memory always occupied regardless of the functions performed by the operating system)?		

	Operating System	Data Commun. Software
• Variable portion (control program options including job and task management, interrupt, handling, task supervision and time supervision)?		
• Transitory portion (dynamic storage used by many routines)?		
• I/O supervision fixed (resident portion always in memory and not dependent upon the number and types of devices)?		
b. What is the total operating system memory requirement?		
c. Show the mass storage device space requirements for each of the following functions. In addition to the word or character sizes, show the requirements in device terms, i.e., tracks, cylinders, etc. Also, show any requirements for the residence of any of these areas on the same or on different devices.		
• Storage of the basic operating system itself		
• Storage of the language compilers or assemblers (list by language)		
• Storage of utility programs		
• Working storage for program compilations (list by language)		
d. Specify the memory requirements for the assembler		
6. System Support Programs		
List all system programs currently operating that perform the following functions:		
a. Operating system creation		
b. Operating system maintenance		
c. User program library creation and maintenance		

	Operating System	Data Commun. Software
d. Mass storage device file maintenance		
• generation		
• copy		
• dump (specify data representation used)		
• reorganization		
e. Complete system memory dump (specify data representation used)		
f. Program memory dump (specify data representation used)		
g. List or reference any other utilities		
h. Link Edit		
i. Loaders		

APPENDIX 7

SAMPLE COMPUTER CONTRACT

The Sample Computer Contract is included herewith as an example of how one particular agency documented their contractural requirements, terms, and conditions. It is offered as a guide for the preparation of a contract that is intended to procure a rather large, complex computer system. Needless to say, your particular contract should be tailored to fit your specific needs, and your legal counsel should be consulted in determining the fitting language and terms which would most protect your interests.

Not all of the attachments to the contract have been included, as the total number of pages exceeds 400. However, the table of contents, in conjunction with the Articles of the Contract, list all of the appendices and schedules attached to the original contract. The names of the Procuring Agency (Purchaser) and contractor have been changed to protect their privacy.

7. SAMPLE COMPUTER CONTRACT

COMPUTER CONTRACT

between the Criminal Justice Agency
and the ABC Corporation

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ARTICLE I

Parties and Contract Documents

A. Parties

The parties to this contract are the Criminal Justice Agency (Purchaser) and the ABC Corporation (Vendor).

B. Contract

The contract consists of:

1. This document (as defined in the Table of Contents).
2. Specification:
   - a. Solicitation for Bids and Request for Proposal of June 22, 1977, as amended ("RFP"), attached as Appendix D.
   - b. Clarification of Bids of September 26, 1976 ("Clarification"), attached as Appendix E.
   - c. ABC Corporation Proposal of August 11, 1977, and all clarifications, appendices, addenda and supplements thereto ("Proposal") attached as Appendix F.
   - d. Letter of November 17, 1977 ("11/17 Letter") attached as Appendix G.
   - e. Statement of ABC Corporation concerning ANSI COBOL, attached as Appendix H.

ARTICLE II

Purpose

This contract is entered into for the purchase, installation and support of computer hardware and supporting systems and services as described in the Purchaser's "Solicitation for Bids" and "Request for Proposal" of June 22, 1977 as amended and its "Clarification of Bids" of September 26, 1977.

ARTICLE III

Applicable Law

Funds for the purchase under this contract are available in part through grant or grants by the Law Enforcement Assistance Administration of the United States Department of Justice under provisions of the Omnibus Crime Control and Safe Streets Act of 1968, as amended. The parties accordingly agree that the terms of this contract and its execution shall conform to all applicable Federal laws, Executive Orders and Regula-

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tions with the effect of law including but not limited to Office of Management and Budget Circular No. A102, Attachment O (Appendix I) and Bureau of the Budget Circular No. A87, (Appendix J) May 9, 1968. The parties further agree that as to all matters where Federal statutes, Executive Orders or Regulations do not apply, this contract shall be governed by the laws of the State of the Criminal Justice Agency.

ARTICLE IV

Performance and Warranty

A. Definitions:

Central Site Hardware:

Item No.		Model & Description	Quantity
1.	ABC-123	Computer Sys.	2
	ABC-125	524KB Memory -	2
		4KB Cache Memory -	2
	ABC-127	Console Display -	2
	ABC-128	Console Control	2
2.	ABC-130	1100 LPM Printer -	2
	ABC-132	Printer Control -	2
3.	ABC-135	Tape Drive	
		(120KB-9ch-Pe/NRZ)	2
	ABC-136	Tape Drive Control	2
	ABC-150	Master Electronics Exchange	2
4.	ABC-152	Dual Disk Drive and Controller	4
	ABC-153	Disk Pack Control	2
5.	ABC-160	A/N Display	10
	ABC-161	Source Data Keyboard	
	ABC-162	TDI Connector	
	ABC-163	Data Set Cable	
6.	ABC-170		5
	ABC-171	2500-9600BPS	
	ABC-173	Synchronous	
	ABC-175	Multi-Point	
	ABC-176	256 Char. Buffer	
	ABC-177	Media Present Detector	
	ABC-179	Cassette and Self Scan	
		Cable Ctlr.	
7.	ABC-190	Multi-Line Controller	2
	ABC-198	Multi-Line Extension	2
8.	ABC-180	Sync Data Sets	20
9.	ABC-183	Disk Pack	24

Components Acceptance Test: The test procedure by which each of the components of Hardware and System Software are tested to ensure compliance with their respective Specification. The Purchaser's requirements are attached hereto as Appendix C.

Components Acceptance Date: For each component of Hardware or Systems Software, the first day after successful completion of the Components Acceptance Test.

Systems Software:

Ref. No.	Program Product/ Installation Support/ Training Identification	Quantity
842	ABC-1000-MCP	1
639		
639	ABC-1000-COBOL	1
949	ABC-1000-GEMCOS	1
	ABC-1000-SORT	1
	ABC-1000-UTILITIES	1
683	ABC-1000-NDL	1
421	ABC-1000-DMS II	1
227	ABC-1000-TEXT EDITOR	1
763	ABC-1000-CANDE	1
349	REPORTER	1
528	ABC-1000-NETCOM	1
691	GEMCOS	1

Computer System: The Hardware and Systems Software identified in Schedules A and B, as they may be expanded within the scope of the Specification.

Installation Date: The date on which the Central Site Hardware and Systems Software are installed in place and are certified in writing by the Vendor to be ready to commence the performance period.

Revised Installation Date: The date on which the replaced, supplemented or upgraded item or items of Hardware or Systems Software is installed in place and certified by the Vendor to be ready to commence the performance period.

Replacement Option: Purchaser's right to direct Vendor to (at Vendor's option) replace, supplement or upgrade any item of Hardware or System Software which failed or caused the failure of the Components Acceptance Test (Article IV B5) at no additional cost to the Purchaser.

B. Acceptance Testing

1. The Components Acceptance Test establishes a standard of performance which must be met before the Purchaser shall accept the Hardware and System Software.

2. Prior to installation, the Vendor shall certify in writing to the Purchaser that the sites meet all the Vendor's installation requirements and are ready to receive the equipment.

3. The test period shall commence on the Installation Date and shall end when the requirements of the Components Acceptance Test have been met for a period of thirty (30) consecutive days. The Purchaser may delay the start of the performance period for up to thirty (30) days after the Installation Date should such a delay be necessary for any reason.

4. In the event any component does not meet the Components Acceptance Test during the initial thirty (30) consecutive days, the performance period shall continue on a day to day basis until the Components Acceptance Test has been met for a total of thirty (30) consecutive days.

5. (i) If the equipment fails to meet the standard of performance after one hundred twenty (120) calendar days from the Installation Date or start of the performance period, whichever is later, the Purchaser may, at its option, terminate this contract or elect the Replacement Option. (ii) If the Purchaser elects the Replacement Option, such replacement, supplement or upgrade shall be installed in place within 30 days of Purchaser's election. If the Components Acceptance Test is not passed within sixty (60) calendar days of the Revised Installation date, the Purchaser shall have the right to terminate this contract.

6. If the Vendor does not install the Hardware and Systems Software in accordance with the Specification and as set forth in the delivery schedule in Article XIII then liquidated damages for each day of noninstallation shall be paid by the Vendor to the Purchaser at the rate of the greater of (i) $500 per day or (ii) 1/30th of the monthly equipment charge of the uninstalled items. The monthly equipment charge shall be calculated as if the equipment had been leased on a 360-day year. Liquidated damages shall also be paid with respect to any item delivered or installed but rendered unuseable due to nondelivery or noninstallation of another item or items. Liquidated damages for late installation shall not accrue for more than 180 days from the scheduled Installation Date pursuant to Article XIII with respect to any item. Installation of substitute equipment, acceptable to the Purchaser, shall terminate the accrual of liquidated damages as to any item for which the substitute equipment was accepted. In the event that the Central Site Hardware and the Systems Software are not installed within 180 days from the scheduled Installation Date pursuant to Article XIII, this paragraph, Article IV B6, shall not apply.

C. Performance Bond:

1. Upon execution of this agreement the Vendor shall furnish to the Purchaser a performance bond in the amount of $10,000 plus 50% of the amount by which the contract price exceeds $10,000.

D. Vendor shall not remove items to be replaced under the Replacement Option until the replacement item or items are installed.

E. Warranty of Performance

The Vendor expressly warrants that the Computer System will perform according to the specifications as set forth in Article Ib above for a period of five years from the effective date of this agreement, provided the system is continuously maintained by Vendor pursuant to a written agreement.

ARTICLE V

Payment and Acceptance

Upon acceptance by the purchaser of any or all of the items in Schedules A and B, and subject to appropriation and receipt of appropriate Federal and state funds, the Purchaser agrees to pay the Vendor the sums identified for such items in Schedules A and B. Acceptance by the Purchaser, which shall not be unreasonably withheld, shall be made after successful Components Acceptance Testing provided for in Appendix C.

ARTICLE VI

Taxes

Federal, State, and Local Taxes

A. Except as may be otherwise provided in this contract the contract price includes all applicable Federal, state, and local taxes and duties.

B. Nevertheless, with respect to any Federal excise tax or duty on the transactions or property covered by this contract, if a statute, court decision, written ruling, or regulation takes effect after the contract date, and

1. Results in the Vendor being required to pay or bear the burden of any such Federal excise tax or duty or increase in the rate thereof which would not otherwise have been payable on such transactions or property, the contract price shall be increased by the amount of such tax or duty or rate increase: Provided, that the Vendor if requested by the Purchaser, warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price as a contingency reserve or otherwise; or

2. Results in the Vendor not being required to pay or bear the burden of, or in his obtaining a refund or drawback of, any such Federal excise tax or duty which would otherwise have been payable on such transactions or property or which was the basis of an increase in the contract price, the contract price shall be decreased by the amount of the relief, refund, or drawback, or that amount shall be paid to the Government, as directed by the Purchaser.

3. The Vendor shall promptly notify the Purchaser of matters which will result in either an increase or decrease in the contract price, and shall cooperate

with Purchaser with respect to any such matter including permitting the filing of a protest in the name of Vendor, as requested by the Purchaser.

State and Local Taxes

4. Notwithstanding the provisions of paragraphs a through f above, the contract price excludes all state and local taxes levied on or measured by the contract or sales price of the services or completed supplies furnished under this contract. Taxes so excluded from the contract price pursuant to the preceding sentence shall be separately stated on the Vendor's invoices and the Purchaser agrees either to pay to the Vendor amounts covering such taxes or to provide evidence necessary to sustain an exemption therefrom.

5. After payment as provided, Purchaser shall have the sole responsibility of contesting any determination of the taxing authority which requires payment of taxes by Purchaser. Vendor agrees to cooperate with Purchaser in any such contest by providing any documentation within its control for the purpose of such contest, and Vendor agrees to refund to Purchaser any amounts paid to Vendor by Purchaser which are recovered as a result of such protest.

ARTICLE VII

Termination for Convenience of the Purchaser

A. The performance of work under this contract may be terminated by the Purchaser in accordance with this Article in whole, or from time to time in part, whenever the Purchaser shall determine that such termination is in the best interest of the Purchaser. Any such termination shall be effected by delivery to the Vendor of a Notice of Termination specifying the extent to which performance of work under the contract is terminated, and the date upon which such termination becomes effective, which date shall be at least ten (10) working days after receipt by the Vendor of such Notice.

B. After receipt of a Notice of Termination, and except as otherwise directed by the Purchaser, the Vendor shall:

1. Stop work under the contract on the date and to the extent specified in the Notice of Termination.

2. Place no further orders or subcontracts for materials, services, or facilities, except as may be necessary for completion of such portion of the work under the contract as is not terminated;

3. Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the Notice of Termination.

4. Assign to the Purchaser, in the manner at the times, and to the extent directed by the Purchaser, all of the right, title, and interest of the Vendor.

5. Complete performance of such part of the work as has not been terminated by the Notice of Termination; and,

6. Take such action as may be necessary, or as the Purchaser may reasonably direct, for the protection and preservation of the property related to this contract which is in the possession of the Vendor and in which the Purchaser has or may acquire an interest.

C. After receipt of a Notice of Termination, the Vendor shall submit to the Purchaser his termination claim. Such claim shall be submitted promptly but in no event later than 1 year from the effective date of termination, unless one or more extensions in writing are granted by the Purchaser upon request of the Vendor made in writing within such 1 year period or authorized extension thereof. However, the Purchaser may receive and act upon any such termination claim at any time after such 1 year period or any extension thereof.

D. Subject to the provisions of paragraph "c" and subject to any review required by the Purchaser's procedures in effect as of the date of execution of this contract, the Vendor and the Purchaser may agree upon the whole or any part of the amount or amounts to be paid to the Vendor by reason of the total or partial termination of work pursuant to this Article; Provided, for Hardware or Software herein, that such agreed amount or amounts exclusive of settlement costs, shall not exceed the total contract price as reduced by the amount of payments otherwise made and as further reduced by the contract price of work not terminated.

E. Costs claimed, agreed to, or determined pursuant to paragraphs "c" and "d", of this Article shall be in accordance with the standardized cost allocation and allowability principles prescribed for all contracts under Federal grant-in-aid programs in Bureau of the Budget Circular No. A87 if required by law in effect on the date of this contract.

F. In arriving at the amount due the Vendor under this Article there shall be deducted any claim which the Purchaser may have against the Vendor in connection with this contract, and the agreed price for, or the proceeds of sale of, any materials, supplies, or other things acquired by the Vendor or sold, pursuant to this contract and not otherwise recovered by or credited to the Purchaser.

G. If the termination hereunder be partial, prior to the settlement of the terminated portion of this contract, the Vendor may file with the Purchaser a request in writing for an equitable adjustment of the price or prices specified in the contract relating to the continued portion of the contract (the portion not terminated by the Notice of Termination), and such equitable adjustment as may be agreed upon shall be made in such price or prices.

H. The Purchaser may from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by the Vendor in connection with the terminated portion of this contract whenever in the opinion of the Purchaser the aggregate of such payments shall be within the amount to which the Vendor will be entitled hereunder.

I. Unless otherwise provided for in this contract, or by applicable laws and regulations, the Vendor from the effective date of termination and for a period of three years after final settlement under this contract, shall preserve and make available to the Purchaser at all reasonable times at the office of the Vendor but without direct charge to the Purchaser, all his books, records, documents, and other evidence bearing on the costs and expenses of the Vendor under this contract and relating to the work terminated hereunder, or to the extent approved by the Purchaser, photographs, microphotographs, or other authentic reproductions thereof.

J. This Termination for Convenience Clause shall not be applied to any item which has been delivered and passed the Components Acceptance Test.

ARTICLE VIII

Default by Failure to Perform

A. The Purchaser may, subject to the provisions of paragraph "b" below, by written notice of default to the Vendor, terminate the whole or any part of this contract in any one of the following circumstances:

1. If the Vendor fails to make delivery of the supplies or to perform the services within the time specified herein or any extension thereof; or,

2. If the Vendor fails to perform any of the other provisions of this contract, or so fails to make progress as to endanger performance of this contract in accordance with its terms, and in either of these two circumstances does not cure such failure within a period of 30 days (or such longer period as the Purchaser may authorize in writing) after receipt of notice from the Purchaser specifying such failure.

B. Except with respect to defaults of subcontractors, the Vendor shall not be liable for any excess costs if the failure to perform the contract arises out of causes beyond the control and without the fault or negligence of the Vendor. Such causes may include, but are not restricted to, acts of God or of the public enemy, acts of the Purchaser, acts of the Government in its sovereign capacity, lawsuits, protests, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and usually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the Vendor. If the failure to perform is caused by the default of a subcontractor, and if such default arises out of cause beyond the control of both the Vendor and subcontractor, and without the fault or negligence of either of them, the Vendor shall not be liable for any excess costs for failure to perform, unless the supplies or services to be furnished by the subcontractor were obtainable from other sources in sufficient time to perfmit the Vendor to meet the required delivery schedule.

C. As used in paragraph "B" of this clause, the terms "subcontractor" and "subcontractors" mean subcontractor(s) at any tier.

D. In the event of termination for default, the remedies available to the party not in default shall be those available under the Uniform Commercial Code in effect in the Purchaser's State unless remedies are specifically provided for under this Agreement.

ARTICLE IX

Disputes

A. In the event of any dispute hereunder, the parties shall negotiate in good faith to resolve such a dispute. If after such negotiation a dispute remains unresolved, the dispute shall be resubmitted to the Criminal Justice Agency's state legal counsel or its duly authorized agent or representative, which shall issue its written opinion with respect to such matters. Such opinion shall be final and conclusive unless, within 90 days, either party brings an action at law or in equity before a court of competent jurisdiction. Either party shall be entitled to be heard and to submit evidence in any matter submitted to the Criminal Justice Agency's state legal counsel.

B. Any matter submitted to a court of competent jurisdiction shall be tried de novo. Admission against interest in any evidence or testimony made by either party during a prior hearing or negotiation of such a dispute shall not be admissable unless such evidence or testimony is admissable under the rules of evidence of the court of competent jurisdiction hearing the case de novo.

C. Pending final decision of a dispute hereunder, both parties shall proceed diligently with the performance of their obligations under this contract to the extent not made impossible by the failure to resolve the dispute.

ARTICLE X

Title and Risk of Loss

A. Title to supplies and equipment covered by this contract shall pass to the Purchaser upon formal acceptance as provided in Article V, above, regardless of when or where the Purchaser takes physical possession.

B. Risk of loss or damage to supplies and equipment covered by this contract shall remain with the Vendor until delivered to Purchaser's site. Site is defined as the room or portion of room in which the equipment is to be installed.

ARTICLE XI

Patent Indemnity

A. Vendor shall defend or settle any suit or proceeding brought against Purchaser based on a claim that any equipment or software made to Vendor's design, constitutes an infringement of any existing United States patent, copyright or trade secret, provided Vendor is notified promptly in writing and is given complete authority and information required for the defense, and Vendor shall pay all damages and costs awarded therein against Purchaser, but shall not be responsible for any cost, expense or compromise incurred or made by Purchaser without Vendor's prior written consent which shall not be unreasonably withheld.

B. If any equipment or software is, in Vendor's opinion, likely to or does become the subject of a claim for infringement, of any existing United States patent copyright or trade secret Vendor may at its option and expense procure for Purchaser the right to continue using the equipment, or modify it to become non-infringing, but if Vendor is not reasonably able to modify or otherwise procure for Purchaser the right to continue using it, Vendor will remove the equipment and refund to Purchaser the amount paid in excess of a reasonable rental for past use.

C. Vendor shall not be liable for any infringement or claim thereof based upon use of the equipment in combination ith other equipment or with software not supplied by Vendor, or with modification made by Purchaser.

D. When the activities conducted by the Criminal Justice Agency under a grant from Law Enforcement Asistance Administration ("LEAA") and supported by the efforts of Vendor's technical and programming personnel produce original, innovative reports, records, graphs, charts, computer programs, and works of a similar nature which works are first produced by the Purchaser and/or Vendor in response to specifications from the Purchaser, as long as such works including computer programs do not include Vendor's Program Products or further do not include the output of Vendor's generative Program Products, the Purchaser, and in turn the Federal Government, shall have the right to use, duplicate, disclose to others, and license in any manner for governmental purposes to any law enforcement agency which is able to qualify under 42 USC 3701 et seq. If the work is copyrightable, Vendor may copyright such material, but the Purchaser and the Federal Government shall have and do hereby have a royalty-free, nonexclusive and irrevocable license to reproduce, publish and use such works, and to authorize others to do so. Vendor shall not have any right or title to programs produced by Purchaser which programs do not incorporate Vendor's specifications, programs, or the output of Vendor's generative program products.

E. The foregoing states the entire liability of Vendor to Purchaser arising from patent infringement.

ARTICLE XII

Examination and Retention of Records

A. The vendor agrees that the Purchaser or any of its duly authorized representatives shall, until expiration of 3 (three) years after final payment under this contract, have access to and the right to examine any directly peritnent books, documents, papers, and records of the Vendor required for compliance with state and Federal laws.

B. The Vendor agrees that the Purchaser's right under this provision will extend to the authorized representatives of the Comptroller General of the United States, and the Law Enforcement Assistance Administration.

ARTICLE XIII

Delivery and Installation

A. Items 1, 2, 3, 4, 7 and 9 of Schedule A; all items of Schedule B; and 10 of the components of Item 5, 5 of item 6, and 10 of item 8 of Schedule A shall be

delivered to the Purchaser, installed by the Vendor in the space designated by the Purchaser and made ready for testing of operating programs no later than 45 days after the effective date of this contract.

B. The remaining components of items 5, 6, and 8 of Schedule A will be delivered and installed by the Vendor as directed by the Purchaser's RFP.

C. The Vendor will perform the installation during its normal working hours at no cost to the Purchaser above the total payment to be made under this contract as set forth in Article V above; except that should the Vendor be precluded from performance of this provision by local law, union agreement or otherwise, the Vendor will supervise installation insofar as allowed by such local law, union agreement, or other restriction, and the Purchaser will bear any additional costs caused thereby.

D. The Purchaser agrees to prepare the sites for installation according to the Vendor's specifications and have them ready to receive equipment not less than 30 days prior to the date set for acceptance testing. The Purchaser further agrees to provide adequate working space within a reasonable distance of the site for installation of equipment for the use of the Vendor's personnel.

E. The Purchaser shall assume responsibility for the qualification of its personnel who operate the equipment.

ARTICLE XIV

Program Products License and Service Agreement

A. DEFINITIONS

1. Program Products shall collectively mean the Licensed Program(s), System Software, and Related Materials which Program Products are identified in Schedule B and those ordered from time to time by Purchaser subject to written acceptance by Vendor.

2. Licensed Program shall mean the program material in machine-readable or interpreted form, and shall include, where appropriate, listings of either machine code or source code.

3. System Software shall mean the current Vendor release of programs and routines which enable Purchaser to operate a leased or purchased hardware system including, for example, a control program or operating system including, for example, a control program or operating system, and if provided, appropriate utility routines, conversion programs, and language processors including compilers, assemblers and translators for the Designated Computer System.

4. Related Materials shall mean all material other than the Licensed Program or System Software furnished by Vendor in conjunction with such Licensed Program and System Software and including, for example, operating instructions, input information or format specifications, instructional and other documentation including all guides and manuals, and further shall include all permitted copies of Program Product material made by Purchaser.

5. Designated Computer System shall mean the system configuration including processing units designated by type and serial number and those associated units which have the capacity to utilize or call into use the Licensed program whether or not processing takes place on the designated processing units. All of the Hardware initially provided under this contract shall be considered one Designated Computer System, including Replacement Hardware redesignated pursuant to paragraph H1.

6. Installation Support shall include hardware orientation services and application Program Product services defined by Vendor specification for such services, and further shall include consultation and guidance support requested by Purchaser and agreed to be supplied by Vendor at its then current rates.

7. Training shall include Vendor's current published training courses for hardware, software, programming languages, and system management at the then current rates.

B. LICENSE

1. Vendor grants to Purchaser and Purchaser hereby accepts, subject to the limitations in Paragraphs 9 and 10 of this License, a personal, nonexclusive, nontransferable right and license to use the Program product(s) on the Designated Computer System and to use the Related Materials in conjunction therewith.

2. A separate license is required for each Designated Computer System into which the Licensed Program or any portion thereof is read in machine-readable form for operation on such System; PROVIDED, HOWEVER, this License may be temporarily transferred to a back-up system if the Designated Computer System is inoperative because of conditions beyond Purchaser's control.

C. DELIVERY OF PROGRAMS

1. Vendor shall furnish Purchaser on the estimated delivery date specified in Article XIII the then current version of the Program product(s) in a medium suitable for use on the Designated Computer System.

2. Application Program product(s) licensed hereunder and classified in Category "A" or "B" shall be made available throughout the implementation period.

3. The implementation period shall begin upon delivery of the Licensed Program by Vendor and will end upon the Components Acceptance Date as defined in Article IV. Monthly license fees specified on Schedule B hereof shall begin upon the end of the implementation period, or as otherwise agreed for a staged installation.

D. TERM

1. Each license shall commence upon receipt by Purchaser of any Program Product material and shall remain in effect for each respective Program Product as follows:

2. If a monthly license fee is applicable, until terminated by Purchaser upon one month's prior written notice or cancelled by Vendor as provided in Paragraph L or P.

3. If no monthly license fee is applicable, until Purchaser ceases using the Program Product on the Designated Computer System or on a Redesignated Computer System.

E. CHARGES

1. Purchaser agrees to pay Vendor within thirty (30) days of receipt of an invoice for the Program Product(s), Installation Support, Training and for all other charges listed on the face thereof in accordance with the charges in Schedule B.

2. Purchaser agrees to pay a nonrefundable initial charge upon acceptance for all Program Products having an initial charge specified in the Schedule. An initial charge, when applicable, shall be due for each license of the same Program Product.

3. Vendor may be ninety (90) days prior written notice to Purchaser increase or decrease the monthly license fees, and Vendor shall designate in such notice the date on which the new license fee shall become effective, except that the monthly fee shall not be increased until after December 31, 1979. If the monthly fee is increased, Purchaser may terminate this License as to any or all Program Products upon thirty (30) days prior written notice to Vendor. All additional licenses and services shall be invoiced at the charges in effect at the time of acceptance of an order thereof.

4. Purchaser agrees to pay Vendor a media and/or processing charge for preparing such media with the code requested by the Purchaser, and if such media are shipped, to pay destination area shipping charges for such shipment. If Purchaser furnishes the media upon order for its preparation, only processing and shipping charges will be invoiced.

F. CLASSIFICATION OF PROGRAMMING SERVICES

1. Each Program Product and each release of a Licensed Program will be classified by Vendor in Category "A", "B", "C", as defined below. Vendor reserves the right to alter, modify or change the design specifications and category (except that System Software shall not be changed from category "A" for a period of five (5) years), of each release of a Licensed Program or Program Product upon the notice as set forth in Paragraph 7.2.

   a. Category A (System Software and Supported License Program). Vendor will maintain and support the then current version of System Software and all Category A Programs for the Designated Computer System and will make available to Purchaser all revisions thereof released by Vendor during the term of this License as long as such Licensed Program remains classified by Vendor in Category "A". Vendor will maintain all Category A Program product(s) to be compatible with the then current unaltered released System Software used

2. If a monthly license fee is applicable, until terminated by Purchaser upon one month's prior written notice or cancelled by Vendor as provided in Paragraph L or P.

3. If no monthly license fee is applicable, until Purchaser ceases using the Program Product on the Designated Computer System or on a Redesignated Computer System.

E. CHARGES

1. Purchaser agrees to pay Vendor within thirty (30) days of receipt of an invoice for the Program Product(s), Installation Support, Training and for all other charges listed on the face thereof in accordance with the charges in Schedule B.

2. Purchaser agrees to pay a nonrefundable initial charge upon acceptance for all Program Products having an initial charge specified in the Schedule. An initial charge, when applicable, shall be due for each license of the same Program Product.

3. Vendor may be ninety (90) days prior written notice to Purchaser increase or decrease the monthly license fees, and Vendor shall designate in such notice the date on which the new license fee shall become effective, except that the monthly fee shall not be increased until after December 31, 1979. If the monthly fee is increased, Purchaser may terminate this License as to any or all Program Products upon thirty (30) days prior written notice to Vendor. All additional licenses and services shall be invoiced at the charges in effect at the time of acceptance of an order thereof.

4. Purchaser agrees to pay Vendor a media and/or processing charge for preparing such media with the code requested by the Purchaser, and if such media are shipped, to pay destination area shipping charges for such shipment. If Purchaser furnishes the media upon order for its preparation, only processing and shipping charges will be invoiced.

F. CLASSIFICATION OF PROGRAMMING SERVICES

1. Each Program Product and each release of a Licensed Program will be classified by Vendor in Category "A", "B", "C", as defined below. Vendor reserves the right to alter, modify or change the design specifications and category (except that System Software shall not be changed from category "A" for a period of five (5) years), of each release of a Licensed Program or Program Product upon the notice as set forth in Paragraph 7.2.

   a. Category A (System Software and Supported License Program). Vendor will maintain and support the then current version of System Software and all Category A Programs for the Designated Computer System and will make available to Purchaser all revisions thereof released by Vendor during the term of this License as long as such Licensed Program remains classified by Vendor in Category "A". Vendor will maintain all Category A Program product(s) to be compatible with the then current unaltered released System Software used on the Designated Computer System. Upon request, Vendor will provide programming services to make a prompt and reasonable attempt to provide Purchaser with a program patch to correct or program around any error or malfunction. Vendor may make available to Purchaser a revised program to correct such error or malfunction.

   b. Category B (Limited Support Licensed Program). Vendor will maintain all Category B Program Product(s) to be compatible with the then current unaltered released System Software used on Designated Computer System. Upon request, Vendor will provide programming services to make a prompt and reasonable attempt to provide Purchaser with a progrm patch to correct or program around any error or malfunction. Vendor may make available to Purchaser a revised program to correct such error or malfunction.

   c. Category C (Nonsupported Licensed Program). Vendor delivers Category "C" programs on an "as is" basis and therefore does not provide programming services for Category "C" programs other than for programs originally issued in Categories "A" or "B" and where a notice of error or malfunction has been given by Purchaser to Vendor prior to the effective date of reclassification to Category "C".

   d. Any programming service or assistance requested by Purchaser not set forth in Paragraphs 6.1.1 through 6.1.3 or in Article XV, or which go beyond the scope of Vendor's commitments under this contract will be provided at Vendor's standard rates then in effect.

2. Purchaser agrees to advise Vendor in writing (if so requested by Vendor and to the extent possible) of the precise nature of any suspected error or malfunction. Vendor does not represent or warrant that all specific errors or malfunctions will be corrected.

3. Purchaser agrees to assist Vendor in remedying any suspected error or malfunction or making any changes requested by Purchaser and agreed to by Vendor. Subject to Purchaser's security and other reasonable restrictions, Purchaser shall provide Vendor with all information and documentation available to attempt to perform such remedy or change.

4. If it is determined that the error or malfunction was directly caused by factors within Purchaser's control, Purchaser agrees to pay for all time and material expended by Vendor in attempting to correct such suspected error or malfunction.

5. To the extent that Vendor requires the use of Purchaser's Computer System in order to reproduce the environment in which the Program Products operate, Purchaser shall provide Vendor with reasonable access to Purchaser's Computer System at mutually agreed times.

6. Vendor has no obligation to maintain, support, or provide programming services for any Licensed Program beyond the specification of the current version of the Program Product, as such may be enhanced by subsequent revisions.

G. CHANGE IN CATEGORY

1. Vendor may at its sole discretion change the category of any Program product(s) and/or release of a License Program (except System Software) for a period of five (5) years) hereafter without liability to Purchaser. The services to be provided after such change shall be as set forth in the newly designated category.

2. Any change in category from either Category "A" or "B" to Category "C" shall be made only upon at least ninety (90) days prior to notice to the then licensed users of such Program Product(s). In the event of such change to Category "B" or "C", Purchaser shall have the right to terminate the license without further payment obligation hereunder upon one (1) month's prior written notice.

3. Subject to the termination provisions of paragraph E3 in the event the Category of a Program Product is changed with ninety (90) days prior notice, the Monthly License Fee thereafter for such Program Product shall be the then current standard price for such Program product.

H. LICENSE REDESIGNATION

1. Purchaser by written notice to Vendor may redesignate the Designated Computer System on which the Program Products are licensed for use hereunder. The redesignation will be effective in accordance with an Addendum to this License to be furnished to Purchaser by Vendor subject to the terms, conditions and charges then in effect.

2. The right of Purchaser to redesignate such Designated Computer System does not apply to System Software outside the ABC-123 line or to Computer Systems other than those initially ordered hereunder.

I. PERMISSION TO COPY, MODIFY AND USE

1. Any Program Product furnished by Vendor in machine-readable form may be copied in whole or in part by Purchaser for use with the Designated Computer System, PROVIDED, HOWEVER, that only the number of copies required to service Purchaser's actual need for the Designated Computer System shall be made. Purchaser agrees that the original copy of all Program Products furnished by Vendor and all copies thereof made by Purchaser are and shall remain the sole property of Vendor.

2. An original or a copy of the Program Product(s) may be kept in storage at a location separate from that of the Designated Computer System. Purchaser agrees to notify Vendor immediately in writing of the location of such backup and safekeeping originals or copy, upon request by Vendor.

3. Purchaser shall have the right to modify any Application Program Products supplied by Vendor for Purchaser's use under this License, and may combine such with other programs or material to form an updated work, PROVIDED, HOWEVER, upon discontinuance or termination of rights granted under this License, the Licensed Program supplied by Vendor shall be completely removed from the updated work and all of such Licensed programs, copies thereof (in whole or in part) and Related Materials shall be returned to Vendor or disposed of in accordance with written instructions from Vendor.

4. Purchaser expressly agrees to include Vendor's copyright notice and proprietary notice on all copies, in whole or in part, in any form including machine language made by Purchaser in accordance with this License.

J. PROTECTION AND SECURITY

Purchaser agrees not to disclose, publish, release, transfer or otherwise make available any program Product(s), in any form, to any person other than Purchaser's or Vendor's employees without prior written consent from Vendor except during the period any such person is on Purchaser's premises for purposes specifically related to Purchaser's use of the Program Product(s). Purchaser also agrees that the Program Product(s) are the property of and proprietary to Vendor and further agrees to use its best efforts to protect the Program Product(s) or any part thereof from unauthroized disclosure by its agents, employees or customers.

K. WARRANTY

1. Each licensed Program Product classified in Category "A" or "B" is warranted to conform to the design specification for that release as designated in the Program product specification or similar applicable release issued by Vendor. EACH RELEASE OF A PROGRAM PRODUCT INITIALLY CLASSIFIED IN CATEGORY "C" IS LICENSED ON AN "AS IS" BASIS WITHOUT ANY WARRANTY.

2. This warranty is applicable for each unaltered release of the Licensed Program commencing on the date of its delivery to the Purchaser and terminating one year from the date of such delivery. Thereafter the warranty shall continue until ninety (90) days after the date on which Vendor releases a revision thereof or upon termination of the license, whichever is earlier.

3. Purchaser agrees that its sole and exclusive remedy and Vendor sole obligation, if a Licensed program warranted hereunder fails to conform to the applicable design specifications and Purchaser advised Vendor of such failure in writing during the term of the warranty, is for Vendor to provide programming services to attempt to correct any defect. For purposes of this Agreement, nonconformance to design specification and the term "defect" shall mean only significant deviations from the design specifications for such current release of the Licensed Program. Nothing in this paragraph (K) shall relieve Vendor from its performance obligations as set forth in Article IV.

4. EXCEPT AS SPECIFICALLY PROVIDED IN THIS CONTRACT THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

L. PATENT AND COPYRIGHT INDEMNITY

1. In the event any suit or proceeding is brought or in Vendor's opinion is likely to be brought against Vendor or Purchaser based on a claim that any Program Product(s) constitutes an infringement of a patent, trade secret, or copyright, the provisions of Article XI shall apply.

M. RESPONSIBILITY OF THE PURCHASER

Vendor shall not be responsible for the supervision, management and control of Purchaser's use of the Licensed Programs, including but not limited to: (1) assuring proper machine configuration, program installation, audit controls and operating methods, (2) establishing adequate backup plans, including, for example, alternate procedures and access to qualified technical personnel to aid in diagnosis and to assist in repair of Licensed Program defects in the event of error, defect or malfunction and, (3) implementing sufficient procedures to satisfy its requirements for security and accuracy of input and output as well as restart and recovery in the event of a malfunction.

N. RISK OF LOSS

Vendor agrees to replace, without additional charge to Purchaser, any Licensed Program or Related Material lost or damaged in shipment to Purchaser. If Purchaser through no fault of Vendor loses or damages any Licensed Program or Related Material, Vendor will replace them, if available, at a reasonable additional charge.

O. CPU SERIAL NUMBER

In the event the serial numbers of the CPUs are not known at the time this License is executed, the serial numbers will be inserted by Vendor in its copy of this License and such serial number shall be the CPU serial numbers of the Designated Computer System when Purchaser receives notification of any such insertion. If no serial number is designated in this License at the time of execution, or as otherwise provided herein, then the serial numbers of the CPUs on which the Program Product is first used shall be deemed to be the CPU serial numbers of the Designated Computer System.

P. CANCELLATION ON DEFAULT

This License Agreement may be cancelled by either party upon default by the other party of any covenant of this License if such default is not corrected within two (2) months after receipt of written notice thereof. Said notice must set forth particulars of the alleged fault. The remedies provided in this License Agreement (Article XIV) shall not be deemed exclusive but shall be cumulative and shall be in addition to and shall not be limited to other remedies provided in this contract (Articles I-XXX) and in law and equity. No delay or omission in the exercise of any remedy herein provided or otherwide available to other party shall impair or affect either party's right to exercise the same. Any written extension or indulgence shall not otherwise alter or affect either party's rights or obligations or be deemed a waiver thereof.

Q. RETURN ON TERMINATION

Within one hundred twenty (120) days after the revision of a Licensed Program terminated by Purchaser under Paragraph G2 hereof or ninety (90) days after the termination or cancellation for any other reason, of a license granted hereunder, Purchaser shall deliver to Vendor the Licensed Program and Related Materials related to such Licensed Program and all copies thereof in whichever form, including partial copies which may have been modified by Purchaser or Vendor or a Certificate of Discontinuance so certifying.

Upon prior written authorization from Vendor, Purchaser may be permitted for a specific period thereafter to retain one copy of each Program Product for record purposes.

ARTICLE XV

Vendor Support

A. Concurrent with the execution of this Agreement Vendor agrees to assign a member of its staff as technical engineer to devote substantially all of his/her normal full-time working hours to assist in equipment installation, implementation of application software, and operation of the system from the effective date of this contract for a period of fifteen (15) calendar months, or one (1) calendar year from the Components Acceptance Date, whichever is later.

   With respect to such technical engineer, Purchaser may request that Vendor remove such technical engineer for cause (including but not limited to incompetence or breach of fiduciary obligations) and Vendor will not unreasonably deny such request. In the event of a lapse in the continuous availability of such technical engineer, the time for such support shall be extended by the length of the lapse.

B. The assignment in paragraph "A" above, shall be at no additional cost to the Purchaser.

C. In addition to the support provided for in paragraphs "A" and "B" above, the Vendor agrees to provide support as described in its proposal, including training, at the rates of payment, where payment is required, as set forth in its proposal.

D. Further, the Vendor agrees to assign its local Commercial Branch Manager to serve as agent representative of the Vendor in matters related to performance of this contract.

ARTICLE XVI

Transportation

The Vendor will arrange for transportation and drayage to the sites of the Purchaser at which the equipment under this contract is to be installed. Transportation costs shall be billed directly to and paid by the Purchaser, but the Purchaser shall not be liable for any charges for packing, boxing, crating, or storage in excess of the contract price. The risk of loss under this Article is governed by the provisions of Article X above.

ARTICLE XVII

Clean Air Act

The Vendor and all subcontractors under this contract shall be subject to the provisions of the Clean Air Act, 42 U.S.C. 1857, et seq., as amended by P.L. 19604; and Executive Order 11602.

ARTICLE XVIII

Equal Employment Opportunity

During performance of this contract the Vendor will comply with all provisions set forth in Appendix A, which is incorporated herein by reference.

The Vendor will comply with the provisions of the State's Code of Fair Practices, Executive Order No. 23, dated July 20, 1970, and of Chapter 151B, as amended of the nondiscrimination laws of the State which are herein incorporated by reference and made a part of this Contract.

The Vendor has filed the Equal Employment Opportunity Employer Information Report EEO-1 with the Joint Reporting Committee of the Equal Employment Commission, Office of Federal Contract Compliance, in June, 1977 and hereby permits the foregoing agencies to inspect said filed report.

ARTICLE XIX

Liability

The Vendor shall indemnify the Purchaser for damages arising out of any personal injury (including death) or damage to tangible property which is caused by the negligence of Vendor, its employees, subcontractors or agenct, while acting in the scope of their employment in the performance of this contract, provided the Purchaser shall give timely notice of the facts and circumstances of any occurrence of any claim hereunder and authority to control the defense of any claim or action; provided, however, that Vendor shall not be liable for any cost, expense or compromise incurred or made by Purchaser without Vendor's prior written concent.

ARTICLE XX

Right of Assignment

Neither party shall assign, subcontract or in any way transfer any interest in this contract without prior written consent of the other, which consent shall not be unreasonably withheld. Such assignment prohibition shall also include any equipment maintenance contract(s) required for this equipment.

The Purchaser reserves the right of assignment of this contract in its entirety to an individual or office designated by the Justices of the Supreme Judicial Court of the state, provided said individual or office is a legal entity of the state.

ARTICLE XXI

Severability

The provisions of this contract are severable, and if any provision shall be held invalid by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the reamining provisions.

ARTICLE XXII

Effective Date and Term of Contract

This contract shall be effective on the date when written notice is received by the Vendor after prior execution by the authorized representatives of the parties including all approvals provided for on the signature page hereof and shall continue in effect until terminated according to its terms.

ARTICLE XXIII

Other Warranties

Vendor further warrants that: (a) no applicable statute, regulation or ordinance of the United States or any state has been violated in the manufacture and sale of the equipment; (b) Vendor has title to the equipment and the right to sell it; and (c) for a period of one (1) year from installation, the equipment delivered under this contract shall be free from defects in material and workmanship under normal use and service.

Written notice and an explanation of circumstances concerning any claim that the equipment has proved defective in material or workmanship shall be given promptly by Purchaser to Vendor. Purchaser's sole and exclusive remedy in the event of such a defect is expressly limited to the correction of the defect by adjustment, repair or replacement, at Vendor's election and sole expense, except that there shall be no obligation to replace or repair items which by their nature are expendable such as light bulbs, print ribbons and the like.

No representation or other affirmation of fact, including but not limited to statements regarding capacity, suitability for use, or performance of the equipment shall be or be deemed to be a warranty by Vendor for any purpose, nor give rise to any liability or obligation of Vendor whatsoever, other than that under the Warrany of Performance granted to Purchaser in Article IV.

Vendor warrants that replacement parts for each item of equipment will be available seven (7) years following the Acceptance Date of the Central Site Hardware.

Vendor represents and warrants that the Hardware shall be of new and original manufacture, unless Vendor notifies Purchaser otherwise, in which event such Hardware shall be warranted the same as new equipment.

EXCEPT AS SPECIFICALLY PROVIDED IN THIS CONTRACT, THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO,

CONTINUED

3 OF 5

ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In the event of employment by Purchaser of any non-Vendor attachment, feature, or device on the equipment, or any part thereof, furnished by Vendor hereunder, which has not been approved in writing by Vendor, Vendor shall not be liable under this warranty for such non-Vendor supplied equipment to the extent such non-Vendor attachment, feature, or device adversely affects the performance of Vendor's equipment. The approval of the use of any non-Vendor attachment, feature, or device shall not be deemed to be a representation, warranty or understanding by Vendor regarding that non-Vendor equipment including its performance in conjunction with the Vendor's equipment.

IN NO EVENT SHALL VENDOR BE LIABLE FOR LOSS OF PROFITS, INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF ANY BREACH OF THE CONTRACT OR OBLIGATIONS UNDER THE CONTRACT, EXCEPT AS MAY BE INCLUDED IN LIQUIDATED DAMAGES EXPRESSLY PROVIDED FOR IN THIS CONTRACT.

EXCEPT AS OTHERWISE PROVIDED HEREIN, VENDOR SHALL NOT BE LIABLE FOR ANY DAMAGES CAUSED BY DELAY IN DELIVERY, DELAY IN INSTALLATION OR DELAY IN FURNISHING OF THE EQUIPMENT OR SERVICES UNDER THE AGREEMENT.

The performance required does not extend to equipment not listed on Schedules A and B.

Purchaser shall maintain the operating environment of the equipment to the standards set forth in the Specifications.

ARTICLE XXIV

Additional Equipment

A. Purchaser may order additional component(s) for its system(s) as initially listed in Schedule A or order additional system(s). These additions may be effected by the issuance of a written order by Purchaser subject to acceptance by Vendor. Prices shall be those in effect when the order is placed (except those items listed in Article XXVII B), and the order shall refer to and be subject to the terms and conditions of this contract.

B. The Vendor agrees to hold the following prices firm to the Purchaser until 12/31/79 (although the following items are not purchased under this contract): ABC-1002 Primary Storage Module high-speed disk drive $34,000 purchase, ABC-10005 Add-on Storage Module $28,000 purchase, and the ABC-223 System, Communications Processor and option as described in the New Product Announcement Price List Attachment A of 2/28/77 signed by Group Executive Vice President of ABC Corporation., (Appendix K).

ARTICLE XXV

Convenant Against Contingent Fees

The Vendor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Vendor for the purpose of securing business. For breach or violation of this warranty the Purchaser shall have the right to terminate this contract without liability or in its discretion to deduct from the contract price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XXVI

General

A. This Contract constitues the entire agreement, understanding and representations express or implied, between Vendor and Purchaser with respect to the equipment and services ordered hereunder, and supersedes all prior communications not expressly incorporated herein. No modification or amendment to this Contract and no waiver of any provision shall be valid unless in writing and signed by duly authorized representatives of the parties. For the purpose of executing this Contract or any modifications thereto by Vendor, the authorized representative is a Vice-President-Marketing, or a supervisor thereof.

B. Neither party shall publicly disclose by news release or other means any information pertaining to this contract without prior approval of the other party.

C. A waiver of a breach or default under this contract shall not be a waiver of any other or subsequent default.

ARTICLE XXVII

Maintenance Agreement

A. The Vendor agrees to maintain the equipment in good operating condition by performing equipment maintenance service, and the Purchaser agrees to pay the Vendor the amounts designated as monthly maintenance charges, as set forth in Appendix F. The parties agree to be bound by the following terms.

B. The "basic period" of service coverage shall be twenty-four (24) hours per day from 1 a.m. Monday to 12 midnight Saturday. Equipment maintenance service hereunder covers periodic preventive maintenance (including testing, cleaning, lubricating and adjusting), and the replacement of unserviceable parts (the replaced parts becoming the property of Vendor). In addition to preventive maintenance, emergency call service shall be provided during the "basic period".

Preventive maintenance needs will be determined by and provided to the extent possible during Vendor's regular business hours (excluding Vendor's recognized local holidays) or at a time mutually agreeable to both parties. Equipment included in this agreement will be designated by the maintenance agreement addendum showing applicable current rates. Such addendum will become part of this agreement. If additional machines or components are added to the equipment listed on the addendum and are to be maintained hereunder such additions will be accepted by Vendor at the current maintenance agreement rates. Billing will be prorated and payable within 30 days of receipt of invoice. Whenever equipment is regularly used outside of the "basic period", the Purchaser may elect to purchase coverage for such "extended use period" at rates and policies then in effect. Emergency call service will be provided at no additional cost during agreed upon "extended use period" coverage. Once established, an "extended use period" shall continue for a minimum of three (3) months. Service requests outside of coverage purchased will be rendered subject to the availability of field engineers at the then current man-hour rate computed to the nearest one half (1/2) hour with a minimum of one hour per call per person during Vendor's regular business hours or two (2) hours minimum outside of such hours. Travel time to and from the Purchaser's premises will be included in this computation. Equipment maintenance charges do not include the furnishing of supplies (such as ribbons, cards, paper tape, paper forms or magnetic tape). Only those supplies are to be used which meet Vendor's specifications in all cases where the performance of the equipment may be affected. Vendor's specifications shall be supplied to Purchaser upon request and vendor approval of supplies shall not be unreasonably withheld.

C. In the event Purchaser employs additional attachments, features or devices not sold or manufactured by the Vendor, Vendor shall not be liable under it maintenance obligations and warranties to the extent the addition of such non-Vendor attachments, features, or devices adversely affect the Vendor's ability to maintain the equipment or to the extent such attachments, features, or devices adversely affects the performance of the equipment.

D. Vendor shall furnish maintenance services to the Purchaser without charge until 30 days before the equipment is accepted by the Purchaser under the provisions of Article V. Thereafter, such services shall be billed to the Purchaser at the rates listed in the Vendor's Proposal (Appendix F).

E. In consideration of Purchaser's execution of the maintenance agreement, Vendor agrees that the rates for maintenance services that are charged to Purchaser shall not be increased until after December 31, 1979. Thereafter maintenance rates shall not exceed Vendor's published maintenance rates then in effect.

F. For a period of five (5) years the Vendor shall not terminate its obligations under this maintenance agreement except for the failure of the Purchaser to perform its obligations hereunder, and in any event, not before the end of the calendar month which is three months from the date notice of termination with reasons therefore is received by the Purchaser.

G. The following is the standard of performance under this maintenance agreement. Failure of the Vendor to maintain the equipment covered hereunder according to such standard shall result in the payment of liquidated damages by the Vendor to the Purchaser or at Purchaser's option, credited towards the current monthly maintenance charges. Liquidated damages shall be the monthly lease purchase charges including maintenance had the equipment been leased, as such charges are specified in Appendix B to Vendor's clarified proposal of October 14, 1977 (Appendix F to this contract) divided by six hundred (600) for each weighted hour during a calendar month that the standard of performance is not met. Liquidated damages shall not accrue for downtime other than: (1) Central Site: 9 a.m. to 9 p.m. Mondays through Fridays and 9 a.m. to 1 p.m. Saturdays; (2) Remote Sites: 9 a.m. to 6 p.m. Mondays through Fridays. The standard of performance shall be met when the equipment "downtime" is less than or equal to seven (7) weighted hours during the calendar month. "Downtime" shall mean that time in which an item of equipment is not operating according to specifications, but shall not include: (1) scheduled preventive maintenance, (2) equipment or service unavailability which is directly related to "External Causes", (3) maximum travel times of two (2) hours to remote sites and Central Site terminals and one (1) hour to Central Site Hardware other than terminals. "External Causes" are defined as:

1. Telephone and electric service fluctuations or failures;
2. Floods, wind-storms or other acts of God;
3. Accident, negligence, improper equipment operation or abuse by the Purchaser, including failure to maintain the Vendor's specified environmental conditions;
4. Acts of third parties which prevent the Vendor's performance of its obligations hereunder;
5. Errors or malfunctions in software other than in software provided by the Vendor under Article XIV;
6. Any other reason not within control of Vendor.

Actual "Downtime" shall be calculated according to the weighting table below:

WEIGHTING TABLE

Central Site	Both	One
CPU	1.0	.3
Disk	1.0	.3
Tape	.5	.1
Printer	.5	.1
Remote and Central Site		
Terminals	For each terminal: 1 ÷ No. of Terminals	

For example: If both CPU's are down for four (4) hours, the weighted Downtime is four (4) hours. If one CPU if down for four (4) hours, the weighted Downtime is 1.20 hours (.3 x 4). If one terminal is down for 5 hours, and there are 100 terminals in the Computer System the weighted Downtime is .01 x 5 or .05 hours. Downtime shall be cumulative up to a weighting factor of 1.0.

The Purchaser will provide adequate working space, if required, within reasonable distance of the equipment for use of Vendor's field engineering personnel. The Purchaser shall also provide, upon request and at Vendor's risk, adequate facilities and equipment for storage of test equipment and spare parts. Vendor's personnel are to have full access to the equipment to be maintained, subject to the Purchaser's security rules and other reasonable restrictions. Environmental conditions, electrical requirements and site facilities shall be maintained in accordance with the Vendor's installation specifications. The equipment must be in good operating condition on the effective date of this agreement. The Purchaser is not to make alterations in the equipment nor participate in the maintenance of the equipment without the consent of the Vendor, which shall not be unreasonably withheld.

Vendor's furnishing of equipment maintenance does not include the assumption by the Vendor of liability for: (1) any damage or physical loss caused by delays in the rendering of equipment maintenance hereunder for any reason, except as provided in Article XXX (G) and Article IV, or (2) for damage or physical loss due to nuclear radiation or radioactive material, (3) labor, expense and material necessary to repair damage to the equipment directly caused by (i) accident, negligence or abuse by Purchaser including failure to maintain environmental conditions or arising from acts of third persons, (ii) causes external to the equipment, such as electrical power fluctuations and failures, (iii) floods, windstorms and other acts of God, or (iv) attachment of non-Vendor equipment or alteration of the equipment by the Purchaser. Such repair or alteration will be rendered only upon special order by Purchaser, and after approval by Purchaser of the estimated additional charge therefore.

IN WITNESS WHEREOF, the Purchaser and the Vendor have executed this Contract as of the date indicated below.

THE CRIMINAL JUSTICE AGENCY	THE ABC CORPORATION
By:____________________ John Doe Executive Secretary Purchaser	By:____________________ Jane Doe Vice President -Marketing Vendor (Clerk's Certificate Attached)

APPROVED AS TO FORM:

____
Office of the Attorney General   Dated: ________________

____
Committee on Criminal Justice   Dated: ________________

AUTHORIZATION CERTIFICATE

I, John Jones, do hereby certify that I am the duly qualified Assistant Secretary of the corporation named herein as CONTRACTOR: that Jane Doe who signed this Contract on behalf of the CONTRACTOR, was on that date Vice President - Marketing, Northeast Region of said corporation; that this Contract was duly signed for and in behalf of said corporation by authority of its governing body, and is within the scope of its corporate powers.

IN WITNESS WHEREOF, I have hereunto affixed my hand and seal of ABC Corporation, on the 28th day of June, 1978.

Signature: ________________________

PARTIES IN INTEREST

Gentlemen:

I hereby certify under the penalties of perjury that the following sets forth the names and addresses of all persons having a financial interest in this Contract in accordance with the provisions of State General Laws, Chapter 7, Section 14A, as inserted by Chapter 844 of the Acts of 1963.

Names	Addresses

Signature:______________________________

Title:______________________________

Firm Name:______________________________

Date:______________________________

QUALIFICATION CERTIFICATE

Gentlemen:

I hereby certify under penalties of perjury that the following sets forth a resume of my qualifications as they relate to my ability to perform the work described in this Contract, in accordance with the "Rules Governing Employment and Compensation for Consultants" promulgated by the State Commissioner of Administration and Finance, as amended

Date:__________________ Signature:__________________

Contract No:________________ Dated:__________________

GOVERNMENT CONTRACTS LIST

Gentlemen:

I hereby certify under penalties of perjury that the following sets forth a statement listing of all other contracts of income derived from the State or any political subdivision thereof in accordance with the "Rules Governing Employment and Compensation of Consultants" promulgated by the State Commissioner of Administration and Finance, as amended.

Date:____________________ Signature:____________________

Contract No:______________ Dated:______________________

SECURITY AND PRIVACY NOTIFICATION

This will serve to notify the vendor that all vendor personnel are subject to the provisions of State General laws governing the storage and dissemination of criminal offender record information. Such laws include, but are not limited to, chapter 6 sections 167 through 178 inclusive. The vendor will take note of the following language within section 178:

> Any person who willfully requests, obtains or seeks to obtain criminal offender record information under false pretenses, or who willfully communicates or seeks to communicate criminal offender record information to any agency or person except in accordance with the provisions of sections one hundred and sixty-eight to one hundred and seventy-five, inclusive, or any member, officer, employee or agency of the board, the advisory committee, the council or any participating agency, or any person connected with any authorized research program, who willfully falsifies criminal offender record information, or any records relating thereto, shall for each offense be fined not more than five thousand dollars, or imprisoned in a jail or house of correction for not more than one year, or both. Added by St. 1972, c.805 section 1

All vendor personnel including the systems engineers, field engineers, repair technicians and others who have access to central site or remote computer equipment and/or applications programers will be required to pass a security clearance prior to their assignment by the vendor to maintain or work with equipment or software supplied under this contract. The purchaser will provide security certification forms to vendor personnel who shall agree to complete such forms and pass a security clearance prior to assignment.

APPENDIX 8

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8. REGULATIONS FOR CRIMINAL HISTORY RECORDS

The Law Enforcement Assistance Administration, on March 19, 1976, adopted its regulations for the collection, storage, and dissemination of criminal history records and information. Any criminal justice agencies having in its possession this type of information must adhere to these regulations. A brief analysis of these procedures is provided herein.

I. The regulations require states to develop procedures which will insure:

  A. The completeness and accuracy of criminal history records.

    1. Complete records should be maintained in a central state repository. The regulations do not require a state to establish such a respository, but the Planning Instructions make it clear that LEAA considers a central repository to be a very desirable feature of any state program.

       To be complete, a central record, which shows that an individual has been arrested, must show what disposition occurred within 90 days after the disposition. Criminal justice agencies must be required to query the central repository prior to any dissemination to assure use of the most up-to-date disposition information.

       Procedures must be established to require an inquiry of the repository prior to any dissemination, unless time is of the essence and the repository is technically incapable of responding in time.

    2. To insure accuracy, criminal justice agencies must institute procedures of data collection, entry, storage, and audit which minimize the possibility of recording incorrect information.

       Upon discovering incorrect information, agencies must notify all criminal justice agencies known to have received incorrect information.

  B. That the dissemination of nonconviction information be limited to:

    1. Criminal justice agencies -- for use in the administration of criminal justice and in criminal justice agencies.

    2. Individuals and agencies -- for any purpose authorized by statute, ordinance, executive order, court rule, decision, or order.

    3. Individuals and agencies -- for use pursuant to an agreement with a criminal justice agency to provide services required for the administration of criminal justice.

       The agreement must specifically authorize access to data, limit their use to the purpose for which they have been made available, insure the security and confidentiality of these data, and provide sanctions for breach of the agreement.

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4. Individuals and agencies -- for research, evaluation, and statistical analysis pursuant to an agreement with a criminal justice agency.

   The agreement must specifically authorize access to these data, limit their use to the purpose for which they have been made available, insure the security and confidentiality of these data, and provide sanctions for breach of the agreement.

5. These dissemination limits do not apply to conviction data.

C. That certain general policies regarding the use and dissemination of information are implemented. Such policies should provide that:

   1. The use of information given to noncriminal justice agencies will be limited to the purpose for which the information is given.

   2. No agency or individual will confirm the existence or nonexistence of a record to any person or agency not entitled to receive the record itself.

   The state and local governments retain the power to determine for what purposes criminal records will be disseminated.

D. That the dissemination of records, relating to juvenile adjudications, to noncriminal justice agencies be prohibited unless a statute, court order, rule or court decision specifically authorizes dissemination. However, such information can be disseminated for the purposes covered by (B) (3) and (4).

E. That an annual audit of a representative sample of state and local criminal justice agencies, chosen on a random basis, will be carried out to insure compliance with the LEAA regulations.

   As part of this audit, the records maintained should show to whom the information was disseminated and the date of dissemination. Reports to central repositories are not to be counted as dissemination.

F. That certain security standards be established, whether by state legislation or by executive regulation.

   The regulations require the state standards to provide that:

   1. Where computerized data processing is employed, hardware and software designs are used which will prevent unauthorized access to the information.

   2. Access to the information system facilities, operating environment, data file contents, and documentation be limited to authorized organization and personnel.

   3. Where computer systems are used, they be operated in accordance with procedures which insure that:

      a. The records are stored in such a manner that they cannot be modified, destroyed, accessed, changed, purged, or overlaid in any fashion by any noncriminal justice terminal.

      b. The programs will prohibit inquiry or record update or destruction from any terminals other than designated criminal justice terminals.

      c. That the records can only be destroyed by designated terminals under the direct control of the criminal justice agency responsible for the records.

      d. The programs will detect all unauthorized attempts to gain access to the records and will preserve information concerning the attempts for output to designated criminal justice employees.

      e. The programs required by (2) and (4), supra, are known only to agency employees responsible for the record system or to individuals and agencies granted knowledge of the programs by a specific agreement and that the programs will be continuously kept under maximum security conditions.

      f. Any individual or agency authorized direct access will be responsible for (i) the physical security of the records in its control or custody, and (ii) for the protection of such information from unauthorized access, disclosure, or dissemination.

      g. The central repository will be protected from unauthorized access, theft, sabotage, fire, flood, wind, or other natural or man-made disasters.

   The criminal justice agency is required to retain the right to audit, monitor, and inspect the procedures established.

   4. The criminal justice agency will:

      a. Screen and have the right to reject from employment, for good cause, all personnel to be authorized direct access to criminal history records.

      b. Have the right to initiate, or cause to be initiated, the transfer or removal of personnel authorized to have direct access to the records who have violated the present regulations or other security regulations instituted by the state.

      c. Institute procedures, where computers are not employed, to insure (i) the physical security of the records under its control or in its custody, and (ii) the protection of such information from unauthorized access, disclosure, or dissemination.

      d. Institute procedures, where computers are not used, to protect any central repository from unauthorized access, theft, sabotage, fire, flood, wind, or other natural or man-made disasters.

e. Provide that direct access to the information will be available only to authorized officers or employees of a criminal justice agency and, as necessary, to other authorized personnel essential to the proper operation of the system.

5. Each employee working with or having access to the records be made familiar with the substance and intent of the Federal regulations.

G. That the individual has the right to gain access to and review of his criminal history information for purposes of accuracy and completeness.

The states are required to institute procedures such that:

1. Any individual, upon satisfactory proof of his identity, be entitled, without undue burden to himself or to the agency, to review any criminal history records concerning him and to obtain a copy thereof when necessary for a challenge or correction.

2. Administrative review and correction are available where the individual claims inaccuracy or incompleteness.

3. Procedures for administrative appeal are available where the agency refuses to correct challenged information to the satisfaction of the individual.

4. Upon request, an individual whose record has been corrected shall be given a list of all the noncriminal justice agencies to whom the data have been given.

5. The correcting agency shall notify all criminal justice recipients of the corrected information.

6. The individual's right of access shall not extend to data contained in intelligence, investigatory, or other related files and shall not be construed to embrace information other than criminal history record information.

II. In 1976, the states to whom the regulations are applicable were required to submit a plan setting forth the procedures they had decided to adopt in order to comply with the regulations. The regulations require the plan to have been accompanied by a certification that, to the maximum extent feasible, action had been taken to comply with the plan. The certification was required to include: (1) an outline of the action already taken, (2) a description of any legislation or executive order, or of attempts to obtain such authority, that had been instituted to comply with the regulations, (3) a description of the steps which had been taken to overcome any fiscal, technical, or administrative hurdles, (4) a description of the existing system and of the steps being taken to upgrade it to the level required by the regulations, and (5) a list of the categories of noncriminal justice dissemination.

III. Section 20.20 provides that the regulations are applicable to "all state and local agencies and individuals collecting, storing or disseminating criminal history record information processed by manual or automatic operations where such collection, storage, or dissemination has been funded in whole or in part" by funds made available by LEAA subsequent to July 1, 1973, pursuant to Title I of the Act.

The section also provides that the regulations do not apply to:

A. Posters, announcements, or lists for identifying or apprehending wanted persons.

B. Original records of entry, such as police blotters, required by law or long standing custom to be made public, if such records are only compiled chronologically.

C. Court records of public judicial proceedings.

D. Published court or administrative opinions, or public judicial, administration, or legislative proceedings.

E. Records of traffic offenses maintained for the purpose of regulating the issuance, suspension, revocation or renewal of driver's, pilot's, or other operators' licenses.

F. Announcements of executive clemency.

Subpart (2) raises the possibility of additional expense for any states which currently make police blotter information available on a name basis. If they wish to continue to make this information available, they will have to modify their system to insure that only chronological access is possible. The requirement that the records only be available chronologically is based on the belief that a police blotter indexed by name would permit access to an individual's criminal history which would not reflect the disposition of his arrests.

IV. The Planning Instructions provide some clarification of the regulations.

Criminal Justice Agency is defined to be (1) courts, and (2) any governmental agency or subunit thereof performing the administration of criminal justice in accordance with a statutory mandate or executive order, which allocates a substantial part of its budget to the administration of criminal justice.

The administration of justice is defined to include detection, apprehension, detention, pretrial release, posttrial release, prosecution, adjudication, and correctional supervision or rehabilitation. It also includes the identification, collection, storage, and dissemination of criminal history information. It does not, however, include preventive activities or the defense of the accused.

APPENDIX 9

PRIVACY AND INTELLIGENCE INFORMATION

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9. PRIVACY AND INTELLIGENCE INFORMATION*

INTRODUCTION

In the last decade, much progress has been made in the area of privacy of criminal history records. SEARCH surveys indicate that virtually every state has passed legislation which deals with some aspect of security of those records and the privacy rights of record subjects, and many states have established comprehensive controls dealing with the security and privacy of criminal history records.

However, few states have dealt specifically, let alone comprehensively, with the collection and use of intelligence information. This inactivity reflects a widespread reluctance to deal in specific statutory terms with the management and regulation of this highly sensitive information. Intelligence and investigative information generally has been excluded from the coverage of security and privacy legislation and Freedom of Information legislation. Instead, its management has been left to professional law enforcement officials who presumably are more familiar with investigative techniques and, therefore, the special needs of law enforcement agencies for investigative and intelligence data.

This approach is not likely to be acceptable to the public during the coming decade. The Watergate scandal and other publicized examples of abusive and intrusive information gathering practices by Federal intelligence agencies have led Congress to consider legislation to control the record practices of the Federal intelligence community. In addition, publicity surrounding covert police intelligence and surveillance activities against dissident groups has heightened public awareness of the potential threat to individual privacy associated with this kind of police activity. It seems likely that there will be increasing pressure in the states for regulations to balance legitimate law enforcement investigative and intelligence needs against the individual's interest in personal privacy, particularly in the sensitive areas of First Amendment rights, such as political, religious or social activities, associations and beliefs.

This paper summarizes some of the main issues involved in the formulation of policy concerning police intelligence information management, and discusses two recent documents that are relevant to these issues: (1) the revised Criminal Intelligence Systems Operating Policies issued by the Office of Justice Assistance, Research and Statistics (formerly the Law Enforcement Assistance Administration), and (2) an ordinance enacted by the City of Seattle establishing policies governing the Seattle Police Department's investigative and intelligence activities.

ISSUES

In brief, the main issues that must be addressed in a policy on intelligence information management are:

Collection

Questions that must be resolved in connection with collection concern the types of information that may be collected, the circumstances that permit the collection of

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information about a particular individual, and police techniques that may be used in collecting the data. Perhaps the most important questions are those concerning the collection of information about political, religious or other constitutionally protected activities, since these are the activities where patterns of abuse have occurred most often. A related question is whether and for what purposes information may be collected about private sexual activities or tendencies. From the standpoint of privacy protection, rigid controls seem necessary to insure that police intelligence activities do not impinge on constitutionally protected rights. However, the controls must not be so rigid as to unduly hamper the police in dealing with criminal and terrorist activities which may attempt to hide behind the mantle of political, religious or community groups.

Another major issue involves the circumstances which may permit the collection of intelligence data about particular persons. Must the data collection have a nexus to criminal activity and how direct must the connection be? Must there be actual or suspected criminal acts already consummated or about to be consummated, or may information be collected on criminal activities that may or may not occur in the future? Must the individual about whom the information is collected be directly involved in the criminal activity or is it sufficient that the information be relevant to criminal activity by other persons, such as relatives or business or social associates?

The greatest privacy protection would be ensured by a policy requiring the individual to be directly involved in completed or imminent criminal activity. However, from the standpoint of effective police operations, such a strict policy might unduly hamper investigations of organized criminal groups which include large numbers of participants in complex and diverse criminal activities over a broad geographical area and which continue over a long period of time.

Other questions concern the use of particular police investigative techniques. For example, should there be limits on the use of paid informants or infiltrators? If infiltrators are used, should there be limits on the types of groups or organizations they may attempt to infiltrate and on the extent of their activities within these groups?

Security

For obvious reasons, intelligence and investigative information is extremely sensitive and deserves strict protection. Much of the information is unverified and may contain allegations or references to associations that can be extremely damaging to innocent persons. Most of the information will never be used or tested in court and many persons whose names are in intelligence files will never be arrested. Thus, it is critical to the privacy interests of these individuals that the security of intelligence information be protected against unauthorized access.

Most police agencies appreciate the sensitivity of intelligence data and evidence suggests that they guard it carefully. However, the advent of computers and other automated data handling equipment raises new issues about the security of intelligence data. May such data be safely stored in computers? What access controls are necessary to protect against unauthorized penetration? Should remote terminal access be permitted? May raw intelligence information be transmitted over computer links or must computerized systems be limited to name index-pointer systems?

Access

Since much intelligence data is unverified and perhaps unreliable, the issue of access is critical from the standpoint of personal privacy. Within a police agency, which officers may have access to intelligence data and for what purposes? May intelligence data be disseminated outside the agency that collected it and, if so, for what purposes and under what safeguards? May intelligence data be disseminated to non-law enforcement agencies or individuals, such as credit agencies, employers or private investigators?

Retention

Retention is one of the most controversial issues involved in the management of intelligence information. May intelligence data be stored indefinitely or must it be reviewed periodically and purged if no longer relevant or reliable? From the privacy protection viewpoint, periodic review and purge should be required, since much intelligence data is unverified and the passage of time makes the data even less valuable. However, from the viewpoint of the police, frequent review and revalidation is expensive and time consuming, often prohibitively so. Clearly, some periodic review and purge of intelligence files is desirable; the problem is to devise an approach that ensures some degree of relevancy and validity of retained information.

Sanctions

In order for any intelligence information management policy to be effective and to earn public confidence, there must be some means of enforcing adherence to the policy. Among the available methods are civil or criminal penalties against police personnel who violate the policy or civil causes of action for damages against the police department or the parent governmental entity. Questions arising under this approach include whether police personnel should be subject to penalties for good faith unintentional violations in the course of their duties and whether the governmental entity should be subject to liability for violations by employees acting outside the scope of their duties.

Other enforcement approaches include independent outside audit of police intelligence files to insure that violations have not occurred. While outside audit is unquestionably an effective enforcement approach, it raises serious issues concerning the integrity of intelligence files, the compromise of the identity of informants or infiltrators and the willingness of other police agencies to exchange information with an agency subject to outside audit, especially if the audit is by non-law enforcement personnel.

Finally, enforcement methods may include traditional personnel disciplinary sanctions, such as discharge, demotion, suspension or transfer.

THE OJARS POLICY GUIDELINES

The OJARS Policy Guidelines were issued by LEAA in 1978 and subsequently amended and reissued in 1980 by OJARS (the agency that resulted from a congressional reorganization of LEAA). The purpose of the guidelines is to ensure that all criminal intelligence systems supported under the Omnibus Crime Control and Safe Streets Act are operated in conformance with the privacy and constitutional rights of individuals. The guidelines apply to both discretionary grants by OJARS and to formula grants to the states which are subgranted to state and local governments.

While the guidelines are not intended to be comprehensive, they do set important limits on the collection and dissemination of intelligence information by covered law enforcement agencies and require the agencies to adopt more comprehensive policies in some areas.

Collection

The general rule set by the guidelines is that intelligence information about a particular individual may be collected and maintained only if it is "reasonably suspected" that the individual is involved in criminal activity and that the information is relevant to that criminal activity. Thus, it would not be permissible to collect information about business associates, relatives or friends of persons suspected of criminal activity unless there were reason to suspect that these persons were themselves involved in the criminal activity. If the information relates to political, religious or social views, associations or activities, the rule is more stringent. Such information may be collected and maintained only if it "directly relates to an investigation of criminal activities and there are reasonable grounds to suspect the subject of the information is or may be involved in criminal conduct." Thus, there must be a criminal investigation in progress and there must be reasonable "grounds," rather than mere suspicion, that the subject of the information is involved in criminal activities directly related to the investigation.

Dissemination

The guidelines provide that intelligence data may be disseminated only to law enforcement officials, inside or outside of the agency collecting the information, "where there is a need to know/right to know the data in the performance of a law enforcement activity." The commentary to the original guidelines declined to offer a specific definition of "need to know/right to know," but stated that the term is generally understood in the law enforcement community to require that a criminal justice official requesting access to an intelligence file must establish that he is conducting an investigation pursuant to his official duties and that he needs the information in connection with the investigation. The guidelines require each covered agency to establish written standards defining need to know/right to know more specifically.

If intelligence data is disseminated outside the collecting agency, the recipient law enforcement officials must agree to follow procedures regarding data entry, maintenance, security and dissemination that are consistent with the guidelines.

Security

Agencies maintaining intelligence data are required to establish administrative, physical and technical safeguards to protect the data against damage or unauthorized access. These safeguards are to include an audit trail of disseminations outside of the agency.

Review

The guidelines require each covered agency to establish procedures to assure that all information which is retained has continuing relevance and importance. The procedures must provide for "periodic review" of data and destruction of any information which is "misleading, obsolete or otherwise unreliable." The original guidelines required agencies to review intelligence files at least every two years and to indicate the reason for retaining any information longer than two years. However, the amended 1980 guidelines deleted the two-year requirement on the grounds that it might be too burdensome and expensive for some agencies. The guidelines now permit periodic review on time schedules developed by individual agencies, but require that any information retained longer than two years must be reviewed and revalidated before it can be utilized or disseminated.

Automated Equipment

The guidelines provide that OJARS must approve system designs for the use of automated equipment for the storage and dissemination of intelligence information. They also prohibit direct remote terminal access to intelligence data stored in computers.

Sanctions

The guidelines do not provide sanctions, but require each agency to adopt sanctions to control unauthorized access, utilization and disclosure of intelligence information. However, accountability to OJARS is assured by a "funding guideline" which stipulates that intelligence systems will be funded only if control and supervision of information collection and dissemination will be retained by the head of a government agency or by an individual with general policymaking authority who has been expressly delegated control and supervision by the head of the agency. This supervising authority must certify in writing that he takes full responsibility and will be accountable for compliance with the guidelines.

THE SEATTLE POLICE INTELLIGENCE ORDINANCE

Seattle City Ordinance No. 108333, passed on July 2, 1979 and effective January 1, 1980, is perhaps the first legislative attempt to deal comprehensively with all aspects of police intelligence and investigative operations. As such, it should be of interest to other jurisdictions considering the adoption of legislation on this subject.

Because the ordinance deals with all aspects of police work, it is lengthy and complex. Although no attempt will be made in this issue brief to describe the ordinance in detail, its general approach will be described and a summary of its major provisions set out.

Approach

The approach of the ordinance is to deal with all aspects of the work of the Seattle Police Department related to criminal investigations and the collection and utilization of investigative and intelligence information. However, the main direction of the ordinance is to provide protections of individual privacy in areas where patterns of abuse historically have occurred. Thus, special protections are included for constitutionally protected activities, including political, religious and social activities and private sexual activities; and special attention is given to certain police techniques that have historically been overly intrusive in these areas, including the use of infiltrators, paid informants and the collection of information for the protection of visiting dignitaries.

The ordinance seeks to provide these protections through four mechanisms:

(1) Internal controls,
(2) Audit trails,
(3) An independent auditor,
(4) Civil liability.

Since the intent is to provide needed protections in specially sensitive areas, the ordinance carves out exceptions to the main provisions of the bill in areas of police work where patterns of abuse historically have not been experienced. Thus, a major exception exempts criminal investigations where criminal charges have been filed and the rules of discovery and other protections inherent in the criminal process are available for the protection of individuals. The bill also exempts confidential communications, materials open to public inspection, administrative records and "incidental references" to otherwise restricted information. This latter exemption excludes incidental references to sensitive information obtained during the course of normal police work, where the objective of the police activity was not to obtain the sensitive data. For example, passing references to sex or political beliefs or activities contained in incident reports would not be covered by the ordinance.

The effect of the exclusions is to carve out the great majority of work essential to the daily operation of the police department, thus relieving the administrative burden on the department in areas where abuse is not likely and concentrating on the narrow scope of police techniques where abuse has most often occurred.

Restricted Information

"Restricted information" is defined by the ordinance as information about political, religious, social or community associations, activities, beliefs or opinions. The definition covers most activities protected by the constitution, including civil rights activities, community activities, and organizations or demonstrations for the furtherance of such activities or beliefs. This type of information is the main area of concern of the ordinance. The controls, prohibitions and procedures set out in the ordinance are designed primarily to prevent police abuses in the political/religious/social area.

Collection

Restricted information may be collected only upon the issuance of a written authorization obtained from a lieutenant or higher ranking officer. Authorizations may be granted only when there is a reasonable suspicion that the subject of the information is involved in criminal activity or is a victim or witness of criminal activity, and the information sought is relevant to the criminal activity or the arrest of the subject of the information. Authorizations are good for 90 days and may be renewed if grounds, such as new information, can be shown.

The authorization must be issued in writing and must set out detailed reasons for its issuance, including a description of the information to be sought and a statement of the facts and circumstances creating a reasonable suspicion of criminal involvement of the subject of the information. This authorization procedure is designed to create a detailed paper audit trail to facilitate control and examination of the collection of information in this sensitive area.

Dissemination

The ordinance provides that restricted information may not be transmitted to another criminal justice or governmental agency unless the agency has a need for the information that would be sufficient to obtain an authorization. Dissemination logs must be kept of each such dissemination.

Informants

The ordinance contains limits on the use of informants or infiltrators to gather restricted information about political, religious, social, civil rights or community organizations. The use of these police techniques to gather information in other areas, such as organized criminal groups, is not limited by the ordinance.

Where restricted information is to be gathered by an infiltrator, the Chief of the Seattle Police Department must approve an authorization stating the need for the use of the infiltrator, the matters about which information is to be collected and protective measures to insure minimum intrusion and to avoid unreasonable infringement of the rights of the organization to be infiltrated.

The ordinance also limits the use of paid informants to collect restricted information about political/religious groups. In such cases, the techniques of the informant and his participation in criminal activities are subject to specific limitations. If the informant is not paid or if the information to be collected is not restricted, the limitations do not apply.

Protection of Dignitaries

Since police agencies historically have used the pretense of dignitary protection to collect information on dissident political groups, the ordinance contains specific controls applicable to this technique. A separate authorization procedure is established and files including restricted information collected for this purpose are required to be kept separate from other investigative files. Strict time limits for collection and purging of the information are set, access logs are required to be kept and limits are set on the dissemination of such information outside of the Seattle Police Department.

Sexual Information

Sexual information is the second major category of information principally covered by the ordinance. It includes any information about a person's sexual practices or orientation. Private sexual information may be collected only when there is a specific connection to criminal activity involving sexual matters (such as rape, prostitution, pandering, procuring or pornography), and the information appears reasonably relevant to the investigation of such criminal activity or the arrest of the subject of the information. Such information may be disseminated outside of the Seattle Police Department only if the recipient criminal justice or governmental agency has a need for the information that would justify its collection under the ordinance.

No authorization is required for the collection of private sexual information in connection with the investigation of sex-related crimes, and no authorization may be issued to permit the collection of such information for any other purpose.

Auditing

Perhaps the most innovative procedure in the ordinance is the use of an independent outside auditor to assure compliance by the police department. The auditor is appointed by the Mayor and confirmed by the City Council for a three-year term. He is granted access to all Police Department files, except for certain internal personnel and confidential files and files relating to investigations of organized crime or government corruption that are certified by the Court Prosecuting Attorney for exemption from the auditor's review. This exception is included to permit the prosecuting attorney to withhold from the auditor certain especially sensitive case files, provided that the prosecuting attorney certifies that he will discharge the powers and responsibilities of the auditor with respect to such files to assure that the terms of the ordinance are met.

The auditor is required to review police department files at unscheduled intervals (but at least once every 180 days) to assure that the ordinance is satisfied. He is required to make summary reports of his findings to the Mayor and other city officials, including descriptions of any substantial violations of the ordinance discovered during the audit. He is also required to provide written notice to any person about whom restricted information has been collected if he has a reasonable belief that the information was collected in violation of the ordinance and would create civil liability under the ordinance.

Thus, the principal enforcement mechanism is independent audit and notice to individuals whose rights may have been violated, coupled with civil causes of action for damages.

Liability

The ordinance creates a civil cause of action against the City of Seattle for injuries proximately caused by willful violations of the ordinance by police department personnel in the scope and course of their duties. Liquidated damages are provided for in the amount of $500 for individuals and $1,000 for organizations.

The cause of action is against the city only and personal liability is expressly denied for any act or omission by a city employee made in good faith in the scope and course of official duties. However, city employees are subject to disciplinary sanctions, such as reprimand, suspension, transfer or discharge.

CONCLUSION

Although there has been little activity in recent years in the area of the regulation of investigative and intelligence information, this issue brief demonstrates that some attention has been given to the subject and at least one comprehensive legislative package has been produced. The Seattle ordinance is an excellent example of the kind of approach that might be taken to regulation of the full range of police investigative and intelligence activities. Although it remains to be seen how well some of the innovations will work and whether or not the ordinance will hamper legitimate police activities, the Seattle approach is courageous.

Whether other jurisdictions adopt this comprehensive approach or the more limited approach of the OJARS regulations, it seems clear that increased public attention recently focused on police intelligence activities will cause greatly increased legislative and regulatory activity in this important area of criminal justice information law and policy.

APPENDIX 10

FIPS PUB 38

10. FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION 38

FEDERAL INFORMATION
PROCESSING STANDARDS PUBLICATION

1976 FEBRUARY 15

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

Guidelines

FOR DOCUMENTATION OF COMPUTER PROGRAMS AND AUTOMATED DATA SYSTEMS

CATEGORY: SOFTWARE
SUBCATEGORY: DOCUMENTATION

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U.S. DEPARTMENT OF COMMERCE • Elliot L. Richardson, *Secretary*
James A. Baker, III, *Under Secretary*
Dr. Betsy Ancker-Johnson, *Assistant Secretary* for Science and Technology

NATIONAL BUREAU OF STANDARDS • Ernest Ambler, *Acting Director*

Foreword

The Federal Information Processing Standards Publication Series of the National Bureau of Standards is the official publication relating to standards adopted and promulgated under the provisions of Public Law 89-306 (Brooks Bill) and under Part 6 of Title 15, Code of Federal Regulations. These legislative and executive mandates have given the Secretary of Commerce important responsibilities for improving the utilization and management of computers and automatic data processing systems in the Federal Government. To carry out the Secretary's responsibilities, the NBS, through its Institute for Computer Sciences and Technology, provides leadership, technical guidance, and coordination of government efforts in the development of technical guidelines and standards in these areas.

In October 1974, the Comptroller General of the United States in a report to the Congress noted that "adequate documentation of computer programs is clearly an essential element of efficient and economical use of computer systems." Good documentation should provide information to support the effective management of ADP resources and to facilitate the interchange of information. The NBS is pleased to make these Guidelines for Documentation of Computer Programs and Automated Data Systems available for use by Federal agencies in establishing and evaluating documentation practices.

RUTH M. DAVIS, Director
Institute for Computer Sciences
and Technology

Abstract

These guidelines provide a basis for determining the content and extent of documentation for computer programs and automated data systems. Software development phases and related document types are identified, several examples of documentation options are given, and content guidelines for ten document types are provided. The ten document types are:

Functional Requirements Document
Data Requirements Document
System/Subsystem Specification
Program Specification
Data Base Specification
Users Manual
Operations Manual
Program Maintenance Manual
Test Plan
Test Analysis Report

The guidelines are intended to be a basic reference and a checklist for general use throughout the Federal Government to plan and evaluate documentation practices.

Key words: Automated data systems; computer programs; documentation; documentation content guidelines; FIPS guidelines; software.

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Federal Information Processing Standards Publication 38

1976 February 15

ANNOUNCING THE

GUIDELINES FOR DOCUMENTATION OF COMPUTER PROGRAMS AND AUTOMATED DATA SYSTEMS

Federal Information Processing Publications are issued by the National Bureau of Standards pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), and as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973), and Part 6 of Title 15 CFR (Code of Federal Regulations).

Name of Guideline. Guidelines for Documentation of Computer Programs and Automated Data Systems.

Category of Guideline. Federal General Applications and Data Standard—Software, Documentation.

Explanation. These guidelines provide a basis for determining the content and extent of documentation for computer programs and automated data systems.

Approving Authority. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).

Maintenance Agency. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).

Applicability. These guidelines are intended to be a basic reference and a checklist for general use throughout the Federal Government to plan and evaluate documentation practices.

Implementation Schedule. Implementation is desirable at the earliest possible date to achieve more effective use of ADP resources and to facilitate interchange of information about computer programs and automated data systems.

Where documentation standards are already in existence, it is recommended that they be reviewed for conformance with the intent of this guideline and revised as needed to be consistent with the best use of available resources.

Specifications. The following pages define software development phases and related document types, give several examples of documentation options, and provide content guidelines for ten document types.

References.

a. Automated Data System Documentation Standards Manual, Department of Defense Manual 4120.17-M, December 1972.

b. Computer Program Documentation Guideline, National Aeronautics and Space Administration, NHB-2411.1, July 1971.

c. Software Summary for Describing Computer Programs and Automated Data Systems, Federal Information Processing Standards Publication 30, U.S. Department of Commerce, June 30, 1974.

Definitions.

a. Computer program. A series of instructions or statements, in a form acceptable to a computer, prepared in order to achieve a certain result.

b. Automated data system. A set of logically related computer programs designed to accomplish specific objectives or functions.

Where To Obtain Copies of the Guideline.

a. Federal Government activities should obtain copies of this publication from the established sources within each agency. When there is no established source, purchase orders should be submitted to the National Bureau of Standards, Institute for Computer Sciences and Technology, Office of ADP Standards Management, Technology Building, Washington, D.C. 20234. Refer to the Federal Information Processing Standard Number 38.

b. Others may obtain copies of the FIPS PUB from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (SD Catalog Number C13.52:38). There is a 25 percent discount on quantities of 100 or more. When ordering, specify document number, title, and SD Catalog Number. Payment may be made by check, money order, coupons, or deposit account.

c. Copies of this FIPS PUB are also available in Microfiche from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 at 95 cents a copy. Refer to Report Number NBS-FIPS-PUB-38.

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GUIDELINES FOR DOCUMENTATION OF COMPUTER PROGRAMS AND AUTOMATED DATA SYSTEMS

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Introduction

The planning, design, development, and implementation of computer programs and automated data systems[1] represent a considerable investment of human and automated resources. To maximize the return on this investment, and to provide for cost-effective operation, revision, and maintenance, sufficient documentation is needed at each stage of the software development life cycle. This publication has been prepared in response to that need.

Documentation provides information to support the effective management of ADP resources and to facilitate the interchange of information. It serves to:

—Provide managers with technical documents to review at the significant development milestones, to determine that requirements have been met and that resources should continue to be expended.

—Record technical information to allow coordination of later development and use/modification of the software.

—Facilitate understanding among managers, developers, programmers, operators, and users by providing information about maintenance, training, changes, and operation of the software.

—Inform other potential users of the functions and capabilities of the software, so that they can determine whether it will serve their needs.

The quality and consistency of software documentation depend on management commitment and the technical environment. The criteria for evaluating the adequacy of documentation will vary directly with the perceived need for documentation. The utility, quality, and acceptability of the documents prepared will provide a measure of the management judgment exercised in implementing the documentation guidelines.

This publication provides guidelines for the content of software documentation and examples of how management might determine when and how to utilize the ten document types described. Part 1 states the purpose of each document type and its relationship to the software life cycle. Part 2 discusses considerations in using these documentation guidelines including examples of agency or organization level guidance criteria that can be applied to determine the extent of documentation required. Part 3 presents the content guidelines for the ten document types.[2]

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[1] Throughout this FIPS PUB 38 "software" is used in lieu of "computer program and/or automated data system."

[2] Note that the Software Summary for Describing Computer Programs and Automated Data Systems (FIPS PUB 30) is considered a component of documentation, in this context.

PART 1. DOCUMENTATION WITHIN THE SOFTWARE LIFE CYCLE

1.1. Scope. Computer programs and automated data systems evolve in phases from the time that an idea to create the software occurs through the time that that software produces the required output. It is recognized that there are in current usage many different terminologies to identify these phases and the stages within these phases. Three phases applicable to the software life cycle are: initiation, development, and operation. The development phase is further subdivided into four stages.

This publication provides content guidelines for ten document types generally prepared during the development phase. Figure 1 relates the preparation of the ten document types to the stages in the development phase. The amount of documentation produced is flexible, and this flexibility is discussed in Part 2. Content guidelines for the ten document types is provided in Part 3. Each of these document types can stand alone or be combined with others to meet specific documentation requirements.

FIGURE 1. *Documentation within the software life cycle*

INITIATION PHASE	DEVELOPMENT PHASE				OPERATION PHASE
	Definition Stage	Design Stage	Programming Stage	Test Stage	
	Functional Requirements Document	System/ Subsystem Specification	Users Manual		
		Program Specification	Operations Manual		
	Data Requirements Document	Data Base Specification	Program Maintenance Manual		
		Test Plan		Test Analysis Report	

1.2. Phases. While the terminology used to describe the phases is arbitrary, it provides a convenient framework within which the development of software may be discussed.

1.2.1. Initiation. During the Initiation Phase, the objectives and general definition of the requirements for the software are established. Feasibility studies, cost-benefit analyses, and the documentation prepared within this phase are determined by agency procedures and practices.

1.2.2. Development. During the Development Phase, the requirements for the software are determined and the software is then defined, specified, programmed, and tested. Documentation is prepared within this phase to provide an adequate record of the technical information developed.

1.2.3. Operation. During the Operation Phase, the software is maintained, evaluated, and changed as additional requirements are identified.

1.3. Stages. While the terminology used to describe the stages is arbitrary, it provides a convenient framework within which the development of the ten document types may be discussed. It is recognized that not all of the document types are required to document software in every case and that in some cases the various document types may need to be combined. The flexible nature of these guidelines is discussed in Part 2.

1.3.1. Definition. During the definition stage, the requirements for the software and documentation are determined. The Functional Requirements Document and the Data Requirements Document may be prepared.

1.3.2. Design. During the design stage, the design alternatives, specific requirements, and functions to be performed are analyzed and a design is specified. Documents which may be prepared include the System/Subsystem Specification, Program Specification, Data Base Specification, and Test Plan.

1.3.3. Programming. During the programming stage, the software is coded and debugged. Documents which may be prepared during this stage include the Users Manual, Operations Manual, Program Maintenance Manual, and Test Plan.

1.3.4. Test. During the test stage, the software is tested and related documentation reviewed. The software and documentation are evaluated in terms of readiness for implementation. The Test Analysis Report may be prepared.

1.4 Document Types. The purpose of each of the ten document types, described in further detail in part 3, is defined in the following paragraphs.

1.4.1. Functional Requirements Document. The purpose of the Functional Requirements Document is to provide a basis for the mutual understanding between users and designers of the initial definition of the software, including the requirements, operating environment, and development plan.

1.4.2. Data Requirements Document. The purpose of the Data Requirements Document is to provide, during the definition stage of software development, a data description and technical information about data collection requirements.

1.4.3. System/Subsystem Specification. The purpose of the System/Subsystem Specification is to specify for analysts and programmers the requirements, operating environment, design characteristics, and program specifications (if desired) for a system or subsystem.

1.4.4. Program Specification. The purpose of the Program Specification is to specify for programmers the requirements, operating environment, and design characteristics of a computer program.

1.4.5. Data Base Specification. The purpose of the Data Base Specification is to specify the identification, logical characteristics, and physical characteristics of a particular data base.

1.4.6. Users Manual. The purpose of the Users Manual is to sufficiently describe the functions performed by the software in non-ADP terminology, such that the user organization can determine its applicability and when and how to use it. It should serve as a reference document for preparation of input data and parameters and for interpretation of results.

1.4.7. Operations Manual. The purpose of the Operations Manual is to provide computer operation personnel with a description of the software and of the operational environment so that the software can be run.

1.4.8. Program Maintenance Manual. The purpose of the Program Maintenance Manual is to provide the maintenance programmer with the information necessary to understand the programs, their operating environment, and their maintenance procedures.

1.4.9. Test Plan. The purpose of the Test Plan is to provide a plan for the testing of software; detailed specifications, descriptions, and procedures for all tests; and test data reduction and evaluation criteria.

1.4.10. Test Analysis Report. The purpose of the Test Analysis Report is to document the test analysis results and findings, present the demonstrated capabilities and deficiencies for review, and provide a basis for preparing a statement of software readiness for implementation.

PART 2. DOCUMENTATION CONSIDERATIONS

Documentation preparation should be treated as a continuing effort, evolving from preliminary drafts, through changes and reviews, to the documentation and software delivered. The extent of documentation to be prepared is a function of agency management practices and the size, complexity and risk of the project.

2.1. Responsibilities. Separable responsibilities which are inherent in the flexible nature of these guidelines are:

a. Definition of agency guidance to project managers as to what documentation should be prepared under various conditions and, perhaps, to what levels of extent, detail, and formality. See Examples A and B in paragraph 2.5.

b. Determination by a project manager of the documentation plan for a specific project, including:

(1) What document types apply and should be prepared.
(2) The formality, extent, and detail of the documentation.
(3) Responsibilities and a schedule of preparation for the documentation.
(4) Procedures and schedule of review, approval, and distribution and the distribution list.
(5) Responsibilities for documentation maintenance and change control through the development phase.

The formality, extent, and level of detail, and other determinations by the project manager in specific cases will be more consistent if agency guidance and criteria are established. In general, as the size, complexity, and risk of a project increase, so does the need for formality, extent, and level of detail of the documentation. The Users, Operations, and Program Maintenance Manuals should be formal since they support the use of the software, particularly if the software will be used outside of the developing organization or if extensive changes are expected during the life of the software.

2.2 Document Audience. Each document type is written for a particular "audience." The audience may be an individual or a group of individuals who are expected to use the document contents to perform a function, e.g., operation, maintenance, design, programming. The information should be presented using the terminology and level of detail appropriate to the audience.

2.3. Redundancy. The ten document types in this guideline have some apparent redundancy. This apparent redundancy is of two types. Introductory material has been included in each document type to provide the reader with a frame of reference. This information has been included to provide the "stand alone" approach, and understanding of the document with a minimum need for cross-referencing to parts of other documents that may have been produced. A second type of apparent redundancy is that most document types specify, for example, descriptions of inputs, outputs, and equipment to be included. The information that should be included in each of the document types, differs in context and, perhaps, in terminology and level of detail, since the information is intended to be read by different audiences and at different points in the software life cycle.

2.4. Flexibility. Flexibility in the use of the document content guidelines is provided by the basic organization of contents. An attempt has been made to provide an internally consistent organization scheme. The following paragraphs describe various options which should be considered.

2.4.1. "Sizing" of Document Types. Each document type outline may be used to prepare documents that range from a few to several hundred pages in length. The size depends on the size and complexity of the project and the judgment of the project manager as to the level of detail necessary for the environment in which the software will be developed or run.

2.4.2. Combining and Expanding Document Types. It is occasionally necessary to combine several document types under one cover or to produce several volumes of the same document type. Document types that can be combined into one are, for example, the Users, Operations, and Program Maintenance Manuals. When this is done, the substance of the contents covered by each document type should be presented using the outline of that document type, for example, Part I–Users, Part II–Operations, and Part III–Program Maintenance.

When a system is extremely large or is to be documented in a modular fashion, a document may be prepared for each module. In some cases, the size of a document may necessitate that it be issued in multiple volumes to allow ease of user reference. In such cases, the document should be separated at a section division. The contents of the Test Plan document type, for example, may be separated between the sections of plan, specifications and evaluation, and specific test descriptions.

2.4.3. Format. The content guidelines in Part 3 have been prepared using a generally consistent format. Use of this particular format is encouraged but is not essential. It is a tested and accepted format.

2.4.4. Sequencing of Contents. In general, the order of the sections and paragraphs in a particular document type should be the same as shown in the content guidelines in Part 3. The order may be changed if it significantly enhances the presentation.

2.4.5. Documenting Multiple Programs or Multiple Files. Many of the document type content outlines anticipate and are adaptable to documenting a system and its subsystems, multiple programs, or multiple files. All of these outlines can, of course, be used for a single system, subsystem, program, data base, or file.

2.4.6. Section/Paragraph Titles. In general, the titles of sections and paragraphs should be the same as shown in the content guidelines. The titles may be modified to reflect terminology unique to the software being documented if the change significantly enhances the presentation. Sections or paragraphs may be added or deleted as local requirements dictate.

2.4.7. Expansion of Paragraphs. Many of the document types have paragraphs with a general title and a list of factors that might be discussed within that paragraph. The intent of the content guidelines is not to prescribe a discussion of each of these items, but to suggest that these items be considered in writing that paragraph. These and all other paragraphs may be expanded and further subdivided to enhance the presentation.

2.4.8. Flowcharts/Decision Tables. The graphic representations of some problem solutions are treated best in the form of flowcharts, others in the form of decision tables. Either may be included in or appended to the documents produced.

2.4.9. Forms. The use of specific forms is dependent on practices in an agency. Some of the information specified in a paragraph in the content guidelines may be recorded on such forms. If so, the form can be referenced from the appropriate paragraph. The use of standard forms is encouraged.

2.5. Examples of Documentation Guidance and Criteria. The formality, extent, and level of detail of documentation to be prepared is a function of agency ADP management practices and the size, complexity, and risk of a project. The following examples were taken from two Federal agency directives, but are amended to conform to the naming of document types in this publication. The examples illustrate how criteria could be established to aid project managers in determining the extent and level of detail of documentation required.

Example A presents a scheme using development cost and document audience as two criteria to establish thresholds for documentation requirements. See the following pages and Figure 2.

Example B presents a scheme using twelve criteria with weighting factors and a scale of the total weighted criteria to establish formal documentation requirements. Figure 3 illustrates the application of the weighted criteria shown in Figure 4. The procedure to use these tables is:

1. Weight the software by each of the twelve criteria in Figure 4.
2. Sum the weights assigned. (Total weighted criteria.)
3. Find the row in Figure 3 that lists the document types to be prepared.

FIGURE 2. EXAMPLE A. *Cost and/or usage threshold criteria for extent and formality*

Level	If PROJECT COST:	Or USAGE	Then DOCUMENTATION ELEMENTS	And EXTENT OF EFFORT
1	Less than $1000 Or One Man-month	One Shot (Single Use)	Software Summary plus any incidentally produced documentation.	No special effort, normal good practice.
2	$1000 to $5000	Special or Limited Purpose or Application	Level 1 plus Users Manual and Operations Manual.	Minimal documentation effort, spent on informal documentation. No formal documentation effort.
3	Over $5000	Multipurposed, or Multiuser	Level 2 plus Functional Requirements Document, Program Specification, Program Maintenance Manual, Test Plan, Test Analysis Report, and System/Subsystem Specification.	All basic elements of documentation should be typewritten, but need not be prepared in finished format for publication or require external edit or review.
4	Over $5000	Publicly Announced, or Critical to Operations	Level 3 produced in a form suitable for publication.	At a minimum, all basic elements prepared for formal publication, including external review and edit.

EXAMPLE A. LEVELS OF DOCUMENTATION

DEFINITIONS OF LEVELS

To protect against both over and under documentation, computer program documentation has been divided into four levels. From lowest to highest these levels of documentation are: (1) minimal level, (2) internal level, (3) working document[3] level, and (4) formal publication level. The criteria determining these levels of documentation are described in the following paragraphs, and summarized in Figure 2. Additional criteria peculiar to an installation and/or judgment relative to program sharing potential, life expectancy, and usage frequency are also appropriate factors to be considered in the determination of documentation levels.

MINIMAL LEVEL (LEVEL 1)

Level 1 documentation guidelines are applicable to single use programs, or one-shot jobs, of minimal complexity. Although no significant documentation cost should be added, there exists the requirement to show what type of work is being produced and what a given program really does. Hence, it is desirable to keep on file for a minimum period of time the documentation which results from the development of the programs, i.e., program abstract, compile listing, test cases, etc. The criteria for categorizing a program as Level 1 can be its expected usage or the resource expended in its generation, in man-hours or dollars, and may be modified for the peculiar requirements of the installations. Suggested resource expenditure criteria are programs requiring less than one man-month effort or less than $1,000 (these are not assumed to be equal).

INTERNAL LEVEL (LEVEL 2)

Level 2 documentation applies to special purpose programs which, after careful consideration of the possible interest of others, appear to have no sharing potential and to be designed for use only by the requesting scientist or manager in an environment over which he has cognizance. Large programs which have a short life expectancy also fall into this level. The documentation required (other than Level 1) is that necessary for deck setup and modifications. This requirement can be satisfied by the inclusion of detail input/output formats, setup instructions, and the liberal use of comment cards in the source deck to provide clarification in the compile listing. In summary, the effort spent toward formal documentation for Level 2 programs should be minimal.

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[3] The term "working document" or "working paper" as used in this guideline refer to typewritten documents, not necessarily prepared in finished format suitable for publication nor subject to external editorial review.

WORKING DOCUMENT LEVEL (LEVEL 3)

This level applies to programs which are expected to be used by a number of people in the same installation or which may be transmitted on request to other installations or to contractors or grantees. The format of the documentation at this level should include, as a minimum, all elements of documentation. All basic elements of documentation should be prepared in typewritten form, but not necessarily in a finished format suitable for publication. Normally, it will not be formally reviewed or edited above the review required for a working paper. However, if there are certain programs important to the activities of the installations, but not considered appropriate for publication, then local more stringent documentation review standards should be applied.

FORMAL PUBLICATION LEVEL (LEVEL 4)

This level applies to programs which are of sufficient general interest and value to be anounced outside the originating installation. This level of documentation is also desirable if the program is to be referenced by a scientific publication or paper. The format of the documentation at this level should comply with the guidelines on elements of documentation suitable for inclusion in one of the scientific and technical publication series with the attendant review and editing procedures.

Also considered to be within this level are those programs which are critical to the activities of the installation. These programs should be documented in a formal, rigorous manner, with in-depth review and special configuration control procedures enforced. Recurring management applications, such as payroll, should be considered for inclusion in this category so as to maintain an accurate history of conformation to changing laws, rules, and regulations.

FIGURE 3. EXAMPLE B. *Total weighted documentation criteria vs required document types*

(See Figure 4 to determine total weighted criteria.)

TOTAL WEIGHTED CRITERIA	Software Summary	Users Manual	Operations Manual	Program Maintenance Manual	Test Plan	Functional Requirements Document	System/Subsystem Specification	Test Analysis Report	Program Specification	Data Requirements Document	Data Base Specification
0-12*	X										
12-15*	X	X									
12-26	X	X	X	X	X			**		***	***
24-38	X	X	X	X	X	X		**		***	***
36-50	X	X	X	X	X	X	X	X		***	***
48-60	X	X	X	X	X	X	X	X	X	***	***

NOTES: * Additional document types may be required at lower weighted criteria totals to satisfy local requirements.
** The Test Analysis Report logically should be prepared, but may be informal.
*** Preparation of the Data Requirements Document and Data Base Specification is situationally dependent.

FIGURE 4. EXAMPLE B. *An example of weighting for twelve documentation criteria (See Figure 3 for application of total weighted criteria to determination of required documentation types.)*

	WEIGHTS				
Criteria	1	2	3	4	5
1. Originality required	None—reprogram on different equipment	Minimum—more stringent requirements	Limited—new interfaces	Considerable—apply existing state of art to environment	Extensive—requires advance in state of the art
2. Degree of generality	Highly restricted. Single purpose	Restricted—parameterized for a range of capacities	Limited flexibility. Allows some change in format	Multi-purpose. Flexible format. Range of subjects	Very flexible—able to handle a broad range of subject matter on different equipment
3. Span of operation	Local or utility	Component command	Single command	Multi-command	Defense Department. World wide.
4. Change in scope and objective	None	Infrequent	Occasional	Frequent	Continuous.
5. Equipment complexity	Single machine. Routine processing	Single machine. Routine processing. Extended peripheral system	Multi-computer. Standard peripheral system	Multi-computer. Advanced programming. Complex peripheral system	Master control system. Multi-computer auto input/output and display equipment.
6. Personnel assigned	1–2	3–5	5–10	10–18	18 and over
7. Developmental cost	1–10k	10–50k	50–200k	200–500k	Over 500k
8. Criticality	Data processing	Routine operations	Personnel safety	Unit survival	National defense
9. Average response time to program change	2 or more weeks	1–2 weeks	3–7 days	1–3 days	1-24 hours
10. Average response time to data inputs	2 or more weeks	1–2 weeks	1–7 days	1–24 hours	0–60 minutes
11. Programming languages	High level language	High level and limited assembly language	High level and extensive assembly language	Assembly language	Machine language
12. Concurrent software development	None	Limited	Moderate	Extensive	Exhaustive

PART 3. CONTENT GUIDELINES FOR DOCUMENT TYPES

Part 3 provides content guidelines for the following ten document types discussed in Parts 1 and 2.

3.1	Functional Requirements Document
3.2	Data Requirements Document
3.3	System/Subsystem Specification
3.4	Program Specification
3.5	Data Base Specification
3.6	Users Manual
3.7	Operations Manual
3.8	Program Maintenance Manual
3.9	Test Plan
3.10	Test Analysis Report

The document types are presented in the order of development within the software life cycle. Included for each document type are a table of contents and a description of the contents of that document type. The page numbers given in the table of contents for each document type are those within the boxes.

3.1 Functional Requirements Document

The purpose of the Functional Requirements Document is to provide a basis for the mutual understanding between users and designers of the initial definition of the software, including the requirements, operating environment, and development plan.

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Functional Requirements Document

1. GENERAL INFORMATION

1.1. **Summary.** Summarize the general nature of the software to be developed.

1.2. **Environment.** Identify the project sponsor, developer, user, and computer center or network where the software is to be implemented.

1.3. **References.** List applicable references, such as:

a. Project request (authorizations).
b. Previously published documents on the project.
c. Documentation concerning related projects.
d. FIPS publications and other reference documents.

2. OVERVIEW

2.1. **Background.** Present the purpose and scope of the software, and any background information that would orient the reader. Explain relationships with other software.

2.2. **Objectives.** State the major performance objectives of the software, including examples. Identify anticipated operational changes that will affect the software and its use.

2.3. **Existing Methods and Procedures.** Describe the current methods and procedures that satisfy the existing objectives. Include information on:

a. Organizational and personnel responsibilities.
b. Equipment available and required.
c. Volume and frequency of inputs and outputs.
d. Deficiencies and limitations.
e. Pertinent cost considerations.

Illustrate the existing data flow from data acquisition through its processing and eventual output. Explain the sequence in which operational functions are performed by the user.

2.4. **Proposed Methods and Procedures.** Describe the proposed software and its capabilities. Identify techniques and procedures from other software that will be used or that will become part of the proposed software. Identify the requirements that will be satisfied by the proposed software. Include information on:

a. Organizational and personnel responsibilities.
b. Equipment available and required.
c. Volume and frequency of inputs and outputs.
d. Deficiencies and limitations.
e. Pertinent cost considerations (developmental as well as operational).

Illustrate the proposed data flow to present an overall view of the planned capabilities. Describe any capabilities in the existing software that may be changed by the proposed software. State the reasons for these changes. Explain the sequence in which operational functions are to be performed by the user.

2.5. **Summary of Improvements.** Itemize improvements to be obtained from the proposed software, such as:

a. New capabilities.
b. Upgraded existing capabilities.
c. Elimination of existing deficiencies.
d. Improved timeliness, e.g., decreased response time or processing time.
e. Elimination or reduction of existing capabilities that are no longer needed.

2.6. **Summary of Impacts.** Summarize the anticipated impacts of the proposed software on the present system, in the following categories:

2.6.1. Equipment Impacts. Summarize changes to currently available equipment, as well as new equipment requirements and building modifications.

2.6.2. Software Impacts. Summarize any additions or modifications needed to existing applications and support software in order to adapt them to the proposed software.

2.6.3. Organizational Impacts. Summarize organizational impacts, such as:

a. Functional reorganization.
b. Increase/decrease in staff level.
c. Upgrade/downgrade of staff skills.

2.6.4. Operational Impacts. Summarize operational impacts, such as modifications to:

a. Staff and operational procedures.
b. Relationships between the operating center and the users.
c. Procedures of the operating center.
d. Data (sources, volume, medium, timeliness).
e. Data retention and retrieval procedures.
f. Reporting methods.
g. System failure consequences and recovery procedures.
h. Data input procedures.
i. Computer processing time requirements.

2.6.5. Developmental Impacts. Summarize developmental impacts, such as:

a. Specific activities to be performed by the user in support of development of the proposed software.
b. Resources required to develop the data base.
c. Computer processing resources required to develop and test the new software.

2.7. **Cost Considerations.** Describe resource and cost factors that may influence the development, design, and continued operation of the proposed software. Discuss other factors which may determine requirements, such as interfaces with other automated systems and telecommunication facilities.

2.8. **Alternative Proposals.** If alternative software has been proposed to satisfy the requirements, describe each alternative. Compare and contrast the alternatives. Explain the selection reasoning.

3. REQUIREMENTS

3.1. **Functions.** State the functions required of the software in quantitative and qualitative terms, and how these functions will satisfy the performance objectives.

3.2. **Performance.** Specify the performance requirements.

3.2.1. Accuracy. Describe the data accuracy requirements imposed on the software, such as:

a. Mathematical.
b. Logical.
c. Legal.
d. Transmission.

3.2.2. Validation. Describe the data validation requirements imposed on the software.

3.2.3. Timing. Describe the timing requirements imposed on the software, such as, under varying conditions:

a. Response time.
b. Update processing time.
c. Data transfer and transmission time.
d. Throughput time.

3.2.4. Flexibility. Describe the capability for adapting to changes in requirements, such as:

a. Changes in modes of operation.
b. Operating environment.
c. Interfaces with other software.
d. Accuracy and validation timing.
e. Planned changes or improvements.

Identify the software components which are specifically designed to provide this flexibility.

3.3. **Inputs-Outputs.** Explain and show examples of the various data inputs. Specify the medium (disk, cards, magnetic tape), format, range of values, accuracy, etc. Provide examples and explanation of the data outputs required of the software, and any quality control outputs that have been identified. Include descriptions or examples of hard copy reports (routine, situational and exception) as well as graphic or display reports.

3.4. **Data Characteristics.** Describe individual and composite data elements by name, their related coded representations, as well as relevant dictionaries, tables, and reference files. Estimate total storage requirements for the data and related components based on expected growth.

3.5. **Failure Contingencies.** Specify the possible failures of the hardware or software, the consequences (in terms of performance), and the alternative courses of action that may be taken to satisfy the information requirements. Include:

a. Back-up. Specify back-up techniques, i.e., the redundancy available in the event the primary system element goes down. For example, a back-up technique for a disk medium would be to record periodically the contents of the disk to a tape.
b. Fallback. Explain the fallback techniques, i.e., the use of another system or other means to accomplish some portion of requirements. For example, the fallback technique for an automated system might be manual manipulation and recording of data.
c. Recovery and Restart. Discuss the recovery and restart techniques, i.e., the capability to resume execution of software from a point in the software subsequent to which a hardware or software problem occurred, or the re-running of the software from the beginning.

4. OPERATING ENVIRONMENT

4.1. **Equipment.** Identify the equipment required for the operation of the software. Identify any new equipment required and relate it to specific functions and requirements to be supported. Include information such as:

a. Processor and size of internal storage.
b. Storage, online and offline, media, form, and devices.
c. Input/output devices, online and offline.
d. Data transmission devices.

4.2. **Support Software.** Identify the support software and describe any test software. If the operation of the software depends on changes to support software, identify the nature and planned date of these changes.

4.3. **Interfaces.** Describe the interfaces with other software.

4.4. **Security and Privacy.** Describe the overall security and privacy requirements imposed on the software. If no specific requirements are imposed, state this fact.

4.5. **Controls.** Describe the operational controls imposed on the software. Identify the sources of these controls.

5. DEVELOPMENT PLAN

Discuss in this section the overall management approach to the development and implementation of the proposed software. Include a list of the documentation to be produced, time frames and milestones for the development of the software, and necessary participation by other organizations to assure successful development.

3.2 Data Requirements Document

The purpose of the Data Requirements Document is to provide, during the definition stage of software development, a data description and technical information about data collection requirements.

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Data Requirements Document

1. GENERAL INFORMATION

1.1. **Summary.** Summarize the general nature of the software for which these data requirements are being defined.

1.2. **Environment.** Identify the project sponsor, developer, user organization, and computer center where the software is to be installed. Show the relationships of these data requirements and those of other software.

1.3. **References.** List applicable references, such as:

a. Project request (authorization).
b. Previously published documents on the project.
c. Documentation concerning related projects.
d. FIPS publications and other reference documents.

1.4. **Modification of Data Requirements.** Describe or reference procedures for implementing and documenting changes to these data requirements.

2. DATA DESCRIPTION

Separate the data description into two categories, static data and dynamic data. Static data is defined as that data which is used mainly for reference during operation and is usually generated or updated in widely separated time frames independent of normal runs. Dynamic data includes all data which is intended to be updated and which is input during a normal run or is output. Arrange the data elements in each category in logical groupings, such as functions, subjects, or other groupings which are most relevant to their use.

2.1. **Static Data.** List the static data elements used for either control or reference purposes.

2.2. **Dynamic Input Data.** List the dynamic input data elements which constitute the data intended to be changed by a normal run or during online operation.

2.3. **Dynamic Output Data.** List the dynamic output data elements which constitute the data intended to be changed by a normal run or during online operation.

2.4. **Internally Generated Data.** List the internally generated data of informational value to the user or developer.

2.5. **Data Contraints.** State the constraints on the data requirements. Indicate the limits of the data requirements with regard to further expansion or utilization, such as the maximum size and number of files, records, and data elements. Emphasize the constraints that could prove critical during design and development.

3. DATA COLLECTION

3.1. **Requirements and Scope.** Describe the type of information required to document the characteristics of each data element. Specify information to be collected by the user and that to be collected by the developer. It should be logically grouped and presented. Include:

a. Source of Input. Identify the source from which the data will be entered, e.g., an operator, station, organizational unit, or its component group.
b. Input Medium and Device. Identify the medium and hardware device intended for entering the data into the system. In those cases where only certain special stations are to be legitimate entry points, they should be specified.
c. Recipients. Identify the intended recipients of the output data.
d. Output Medium and Device. Identify the medium and hardware device intended for presenting output data to the recipient. Specify whether the recipient is to receive the data as part of a hard copy printout, a symbol in a CRT display, a line on a drawing, a colored light, an alarm bell, etc. If the output is to be passed to some other automated system, the medium should be described, such as magnetic tape, punched cards, or an electronic signal to a solenoid switch.
e. Critical Value. One value from a range of values of data may have particular significance to a recipient.
f. Scales of Measurement. Specify for numeric scales, units of measurement, increments, scale zero-point, and range of values. For non-numeric scales, any relationships indicated by the legal values should be stated.
g. Conversion Factors. Specify the conversion factors of measured quantities that must go through analog or digital conversion processes.
h. Frequency of Update and Processing. Specify the expected frequency of data change and the expected frequency of processing input data. If the input arrives in a random or in an "as occurred" manner, both the average frequency and some measure of the variance must be specified.

3.2. **Input Responsibilities.** Provide recommendations as to responsibilities for preparing specific data inputs. Include any recommendations regarding the establishment of a data input group. Specify by source those data inputs dependent on interfacing software or unrelated organizations.

3.3. **Procedures.** Provide specific instructions for data collection procedures. Include detailed formats where applicable, and identify expected data communications media and timing of inputs.

3.4. **Impacts.** Describe the impacts of these data requirements on equipment, software and the user and developer organizations.

3.3 System/Subsystem Specification

The purpose of the System/Subsystem Specification is to specify for Analysts and Programmers the requirements, operating environment, design characteristics, and program specifications (if desired) for a system or subsystem.

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System/Subsystem Specification

1. GENERAL INFORMATION

1.1. **Summary.** Summarize the specifications and functions of the system/subsystem to be developed.

1.2. **Environment.** Identify the project sponsor, developer, user, and computer center or network on which the system is to be implemented.

1.3. **References.** List applicable references, such as:

a. Project request (authorizations).
b. Previously published documents on the subject.
c. Documentation concerning related projects.
d. FIPS publications and other reference documents.

2. REQUIREMENTS

2.1. **Description.** Provide a general description of the system/subsystem to establish a frame of reference for the remainder of the document. Include a summary of functional requirements to be satisfied by this system/subsystem. Show the general interrelationship of the system/subsystem components.

2.2. **Functions.** Specify the system/subsystem functions in quantitative and qualitative terms and how the functions will satisfy the functional requirements.

2.3. **Performance.** Specify the performance requirements.

2.3.1. **Accuracy.** Describe the data accuracy requirements imposed on the system or subsystem, such as:

a. Mathematical.
b. Logical.
c. Legal.
d. Transmission.

2.3.2. **Validation.** Describe the data validation requirements imposed on the system/subsystem.

2.3.3. **Timing.** Describe the timing requirements imposed on the software, such as, under varying conditions:

a. Response time.
b. Update processing time.
c. Data transfer and transmission time.
d. Throughput time.

2.3.4. Flexibility. Describe the capability for adapting the program to changes in requirements, such as:

The organization of the contents of Sections 2, 3, 4, and 5 may vary according to the purpose of the documentation. See Example following this content guideline, page 28.

a. Changes in modes of operation.
b. Operating environment.
c. Interfaces with other software.
d. Accuracy and validation and timing.
e. Planned changes or improvements.

Identify the system/subsystem components which are specifically designed to provide this flexibility.

3. OPERATING ENVIRONMENT

3.1. **Equipment.** Identify the equipment required for the operation of the system/subsystem. Identify any new equipment required and relate it to specific functional requirements to be supported. Include information, such as:

a. Processor and size of internal storage.
b. Storage, online and offline, media, form, and devices.
c. Input/output devices, online and offline.
d. Data transmission devices.

3.2. **Support Software.** Identify the support software and describe any test software. If the operation of the system/subsystems depends on changes to support software, identify the nature and planned date of these changes.

3.3. **Interfaces.** Describe the interfaces with other software.

3.4. **Security and Privacy.** Describe the overall security and privacy requirements imposed on the system/subsystem. If no specific requirements are imposed, state this fact.

3.5. **Controls.** Describe the operational controls imposed on the system/subsystem. Identify the sources of these controls.

4. DESIGN CHARACTERISTICS

4.1. **Operations.** Describe the operating characteristics of the user and computer centers where the software will be operational.

4.2. **System/Subsystem Logic.** Describe the logic flow of the entire system/subsystem in the form of a flowchart. The flow should provide an integrated presentation of the system/subsystem dynamics, of entrances and exits, computer programs, support software, controls, and data flow.

5. PROGRAM SPECIFICATIONS

5.1. **Program (Identify) Specification.** Specify the system/subsystem functions to be satisfied by the computer program.

a. Describe the program requirements.
b. Describe the operating environment.
c. Describe the design characteristics of the program including inputs, program logic, outputs, and data base.

5.N. **Program (Identify) Specification.** Describe the remaining computer programs in a manner similar to the paragraph above.

EXAMPLES OF ALTERNATIVE SECTION OUTLINES

Sections 2, 3, and 4 of this specification may follow one of several alternative outlines depending on the purpose to which the documentation is directed. Examples of alternative purposes and the corresponding outline are shown below.

Example A: When this document is directed to the documentation of a given system and is not to specifically include the documentation of any subsystem, the appropriate title would be "System Specification." The outline for the specification would be:

- REQUIREMENTS
  - Description
  - Functions
  - Performance
- OPERATING ENVIRONMENT
  - Equipment
  - Support Software
  - Interfaces
  - Security and Privacy
  - Controls
- DESIGN CHARACTERISTICS
  - Operations
  - Logic

Example B: When this documents is directed to the documentation of a given subsystem, the appropriate title would be "Subsystem Specification." The outline for the specification would be the same as Example A above.

Example C: When this document is directed to the documentation of a system and its subsystems, the appropriate title would be "System and Subsystem Specifications." The outline, in brief, for the specification would be:

- System REQUIREMENTS
- System OPERATING ENVIRONMENT
- System DESIGN CHARACTERISTICS
- Subsystem 1 (Identify)
  - REQUIREMENTS
  - OPERATING ENVIRONMENT
  - DESIGN CHARACTERISTICS
  - PROGRAM SPECIFICATIONS
- Subsystem 'n' (Identify)

Example D: In any of the above examples, the program specifications may be documented within as a separate section; as subsections to each subsystem section; or may be documented in a separate document, "Program Specification."

3.4 Program Specification

The purpose of the Program Specification is to specify for programmers the requirements, operating environment, and design characteristics of a computer program.

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Program Specification

1. GENERAL INFORMATION

1.1. **Summary.** Summarize the specifications and functions of the computer program to be developed.

1.2. **Environment.** Identify the project sponsor, developer, user, and computer center where the computer program is to be run.

1.3. **References.** List applicable references, such as:

a. Project request (authorization).
b. Previously published documents on the subject.
c. Documentation concerning related projects.
d. FIPS publications and other reference documents.

2. REQUIREMENTS

2.1. **Program Description.** Provide a general description of the program to establish a frame of reference for the remainder of the document. Include a summary description of the system/subsystem functions to be satisfied by this program.

2.2. **Functions.** Specify the functions of the program to be developed. If the program in itself does not fully satisfy a system/subsystem function, show the relationship to other programs which in aggregate satisfy that function.

2.3. **Performance.** Specify the performance requirements.

2.3.1. Accuracy. Describe data accuracy requirements imposed on the program, such as:

a. Mathematical.
b. Logical.
c. Legal.
d. Transmission.

2.3.2. Validation. Describe the data validation requirements imposed on the program.

2.3.3. Timing. Describe the timing requirements imposed on the program, such as, under varying conditions:

a. Response time.
b. Update processing time.
c. Data transfer and transmission time.
d. Throughput and internal processing time.

2.3.4. Flexibility. Describe the capability for adapting the program to changes in requirements, such as:

a. Modes of operation.
b. Operating environment.
c. Interfaces with other programs.
d. Accuracy, validation, and timing.
e. Planned changes or improvements.

Identify the components of the program which are designed to provide this flexibility.

3. OPERATING ENVIRONMENT

3.1. **Equipment.** Identify the equipment required for the operation of the program. Include information on equipment required, such as:

a. Processor and size of internal storage.
b. Storage, online and offline, media, form, and devices.
c. Input/Output devices, online and offline, and capacities.
d. Data transmission devices.

3.2. **Support Software.** Identify the support software and describe any test programs. If the operation of the program depends on changes to support software, identify the nature and planned date of these changes.

3.3. **Interfaces.** Describe all interactions with the operator. Describe all interactions with other software, including sequence or procedure relationships and data interfaces.

3.4. **Storage.** Specify the storage requirements and any constraints and conditions.

a. Internal. Describe and illustrate the use of internal storage areas, including indexing and working areas. Briefly state the equipment constraints and design considerations that affect the use of internal storage.
b. Device. List by device type all peripheral storage required. Briefly state any constraints imposed on storage requirements by each storage device. State requirements for permanent and temporary storage, including overlays.
c. Offline. Describe the form, media and storage requirements of all offline storage.

3.5. **Security and Privacy.** Describe the security and privacy requirements imposed on the program, the inputs, the outputs, and the data bases. If no specific requirements are imposed, state this fact.

3.6. **Controls.** Describe the program controls such as record counts, accumulated counts, and batch controls. Identify the sources of these controls.

4. DESIGN CHARACTERISTICS

4.1. **Operating Procedures.** Describe the operating procedures and any special program functions or requirements necessary for its implementation. Describe the load, start, stop, recovery, and restart procedures. Describe all other interactions of the program with the operator.

4.2. **Inputs.** Provide information about the characteristics of each input to the program, such as:

a. Title and tag.
b. Format and type of data, such as a record layout.
c. Validation criteria.
d. Volume and frequency.
e. Means of entry.
f. Source document and its disposition, or specific interface source.
g. Security and privacy conditions.

4.3. **Program Logic.** Describe the program logic. The logical flow should be presented in graphic form (flowcharts, decision logic tables) supplemented by narrative explanations.

4.4. **Outputs.** Provide information about the characteristics of each output from the program, such as:

a. Title and tag.
b. Format specifications, such as a report format.
c. Selection criteria for display, output, or transfer.
d. Volume and frequency.
e. Output media.
f. Description of graphic displays and symbols.
g. Security and privacy conditions.
h. Disposition of products.
i. Description of sequence of displays, display contents, fixed and variable formats, and display of error conditions.

4.5. **Data Base.** Describe the logical and physical characteristics of any data base used by the program.

4.5.1. Logical Characteristics. Describe for each unique set, file, record, element, or item of data, its identification, definition, and relationships.

4.5.2. Physical Characteristics. Describe in terms of this data base, the storage requirements for program data, specific access method, and physical relationships of access (index, device, area), design considerations, and access security mechanisms.

3.5 Data Base Specification

The purpose of the Data Base Specification is to specify the identification, logical characteristics, and physical characteristics of a particular data base.

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Data Base Specification

1. GENERAL INFORMATION

1.1. **Summary.** Summarize the purpose of the data base and general functions of the using software.

1.2. **Environment.** Identify the project sponsor, developer, user organization, and computer center where the software and data base are to be installed.

1.3. **References.** List applicable references, such as:

a. Project request (authorization).
b. Previously published documents on the project.
c. Documentation concerning related projects.
d. FIPS publications and other reference documents.

2. DESCRIPTION

2.1. **Identification.** Specify the code name, tag, or label by which the data base is to be identified. If the data base is to be experimental, test, or temporary, specify this characteristic and effective dates or period. Any additional identification information should also be given.

2.2. **Using Software.** Identify all software intended to use or access this data base. Identify for each: the software name, code name, and any release or version number.

2.3. **Conventions.** Describe all labeling or tagging conventions essential for a programmer or analyst to use this data base specification.

2.4. **Special Instructions.** Provide any special instructions to personnel who will contribute to the generation of the data base, or who may use it for testing or operational purposes. Such instructions include criteria, procedures, and formats for:

a. Submitting data for entry into the data base and identification of a data control organization.
b. Entering data into the data base.

Where these instructions are extensive, reference appropriate sections of other documents.

2.5. **Support Software.** Describe briefly all support software directly related to the data base. Descriptions should include name, function, major operating characteristics, and machine run instructions for using the support software. Cite the support software documentation by title, number, and appropriate sections.

Examples of support software are:

a. Data base management systems.
b. Storage allocation software.
c. Data base loading software programs.
d. File processing programs.
e. Other generating, modifying, or updating software.

3. LOGICAL CHARACTERISTICS

A data base is a logical arrangement of data. Sets (aggregates), files, records, elements, and items of data may vary in their logical arrangement and relationships. The organization of the content of this section should provide a meaningful presentation of the logical organization of the data base.

Define each unique set (aggregate), file, record, element, or item of data providing information, such as:

a. **Identification.** Name and tag, or label.
b. **Definition.** Standard or unique; purpose in data base; using software; media; form; format and size; update criteria and conditions; security and privacy restrictions, limitations, or conditions (update or access); integrity and validity characteristics; controlling data elements or items; and graphic representation.
c. **Relationships.** Superior and inferior relationships; update and access relationships.

4. PHYSICAL CHARACTERISTICS

4.1. **Storage.** Specify the storage requirements for the data base and any constraints and conditions.

a. Internal. Describe and illustrate the use of internal storage areas set aside for data including indexing and working areas. Briefly state the equipment constraints and design considerations that affect the use of internal storage.
b. Device. List by device type all peripheral storage required for the data base. Briefly state any contraints imposed on storage requirements by each storage device. State requirements for permanent data storage and temporary data storage, including overlays.
c. Offline. Describe the form, media and storage requirements of all offline data storage.

4.2. **Access.** Describe the access method and specify the physical relationships of access (index, device, area). Describe all physical access security mechanisms.

4.3. **Design Considerations.** State the design considerations for the handling of this data base, such as blocking factors. Emphasize those physical relationships important to the efficient utilization of the data base.

See Examples of Content Organization for Section 3 on page 36.

EXAMPLES OF CONTENT ORGANIZATION FOR SECTION 3

Example A: Simple structure in which the data base is composed only of data elements:

Element 1 (Identification, Definition, Relationships)
Element 2 (Identification, Definition, Relationships)
Element N (Identification, Definition, Relationships)

Example B: Simple hierarchial structure in which the data base is composed of files, records, and data elements:

File 1 (Identification, Definition, Relationships)
  Record 1 (Identification, Definition, Relationships)
    Element 1 (Identification, Definition, Relationships)
    Element N (Identification, Definition, Relationships)
  Record N (Identification, Definition, Relationships)
File N (Identification, Definition, Relationships)

Example C: A structure in which a data base is composed of data elements and sets of data with an organization based on multiple or specific relationships between elements and sets:

Element 1 (Identification, Definition, Relationships)
Element N (Identification, Definition, Relationships)

Set 1 (Identification, Definition, Relationships)
Set N (Identification, Definition, Relationships)

Example D: Any of the above structures, but with a substantial number of sets, files, records, elements, or items of data. Outline in graph or chart form the structure, levels, and relationships with each chart element denoting the Identification of the set, etc., portrayed. Supplement the graph or chart with a suitably organized listing of all sets, etc., with the appropriate Definition and Relationships information.

3.6 Users Manual

The purpose of the Users Manual is to sufficiently describe the functions performed by the software in non-ADP terminology, such that the user organization can determine its applicability and when and how to use it. It should serve as a reference document for preparation of input data and parameter, and interpretation of results.

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Users Manual

1. GENERAL INFORMATION

1.1. Summary. Summarize the application and general functions of the software.

1.2. Environment. Identify the user organization and computer center where the software is installed.

1.3. References. List applicable references, such as:

a. Project request (authorization).
b. Previously published documents on the project.
c. Documentation concerning related projects and software.
d. FIPS publications and other reference documents.

2. APPLICATION

2.1. Description. Describe when and how the software is used and the unique support provided to the user organization. The description should include:

a. Purpose of the software.
b. Capabilities and operating improvements provided.
c. Functions performed.

2.2. Operation. Show the operating relationships of the functions performed to the organization that provides input to and receives output from the software. Describe security and privacy considerations. Include general charts and a description of the inputs and outputs shown on the charts.

2.3. Equipment. Describe the equipment on which the software can be run.

2.4. Structure. Show the structure of the software and describe the role of each component in the operation of the software.

2.5. Performance. Describe the performance capabilities of the software including where appropriate:

a. Quantitative information on inputs, outputs, response time, processing times, and error rates.
b. Qualitative information about flexibility and reliability.

2.6. Data Base. Describe all data files in the data base that are referenced, supported, or kept current by the software. The description should include the purpose for which each data file is maintained.

2.7. Inputs, Processing, and Outputs. Describe the inputs, the flow of data through the processing cycle, and the resultant outputs. Include any applicable relationships among inputs or outputs.

3. PROCEDURES AND REQUIREMENTS

This section should provide information about initiation procedures, and preparation of data and parameter inputs for the software. The scope, quality, and logical arrangement of the information should enable the user to prepare required inputs and should explain in detail the characteristics and meaning of the outputs. It should also describe error, recovery, and file query procedures and requirements.

3.1. Initiation. Describe step-by-step procedures required to initiate processing.

3.2. Input. Define the requirements of preparing input data and parameters. Typical considerations are:

a. Conditions—e.g., personnel transfer, out of stock.
b. Frequency—e.g., periodically, randomly, as a function of an operational situation.
c. Origin—e.g., Personnel Section, Inventory Control.
d. Medium—e.g., keyboard, punched card, magnetic or paper tape.
e. Restrictions—e.g., priority and security handling, limitations on what files may be accessed by this type of transaction.
f. Quality control—e.g., instructions for checking reasonableness of input data, action to be taken when data appears to be in error, documentation of errors.
g. Disposition—e.g., instructions necessary for retention or release of all data files received, other recipients of the inputs.

3.2.1. Input Formats. Provide the layout forms used in the initial preparation program data and parameter inputs. Explain each entry, and reference it to the sample form. Include a description of the grammatical rules and conventions used to prepare input, such as:

a. Length—e.g., characters/line, characters/item.
b. Format—e.g., left justified.
c. Labels—e.g., tags or identifiers.
d. Sequence—e.g., the order and placement of items in the input.
e. Punctuation—e.g., spacing and use of symbols (virgule, asterisk, character combinations, etc.) to denote start and end of input, of lines, of data groups, etc.
f. Combination—e.g., rules forbidding use of groups of particular characters, or combinations of parameters in an input.
g. Vocabulary—e.g., an appendix which lists the allowable character combinations or codes that must be used to identify or compose input items.
h. Omissions and Repeats—e.g., indicate those elements of input that that are optional or may be repeated.
i. Controls—e.g., header or trailer control data.

3.2.2. Sample Inputs. Provide specimens of each complete input form. Include:

a. Control or header—e.g., entries that denote the input class or type, date/time, origin, and instruction codes to the software.
b. Text—e.g., subsections of the input representing data for operational files, request parameters for an information retrieval program.

c. Trailer—e.g., control data denoting the end of input and any additional control data.
d. Omissions—e.g., indicate those classes or types of input that may be omitted or are optional.
e. Repeats—e.g., indicate those positions of the input that may be repeated.

3.3. **Output.** Describe the requirements relevant to each output. Typical considerations are:

a. Use—e.g., by whom and for what.
b. Frequency—e.g., weekly, periodically, or on demand.
c. Variations—e.g., modifications that are available to the basic output.
d. Destination—e.g., computer area, remote terminal.
e. Medium—e.g., printout, CRT, tape, cards.
f. Quality control—e.g., instructions for identification, reasonableness checks, editing and error correction.
g. Disposition—e.g., instructions necessary for retention or release, distribution, transmission, priority, and security handling.

3.3.1. Output Formats. Provide a layout of each output. Explanations should be keyed to particular parts of the format illustrated. Include:

a. Header—e.g., title, identification, date, number of output parts.
b. Body—e.g., information that appears in the body or text of the output, columnar headings in tabular displays, and record layouts in machine readable ouputs. Note which items may be omitted or repeated.
c. Trailer—e.g., summary totals, trailer labels.

3.3.2. Sample Outputs. Provide a sample of each type of output. For each item on a sample, include:

a. Definition—e.g., the meaning and use of each information variable.
b. Source—e.g., the item extracted from a specific input, from a data base file, or calculated by software.
c. Characteristics—e.g., the presence or absence of the item under certain conditions of the output generation, range of values, unit of measure.

3.4. **Error and Recovery.** List error codes or conditions generated by the software and corrective action to be taken by the user. Indicate procedures to be followed by the user to ensure that any restart and recovery capability can be used.

3.5. **File Query.** Prepare this paragraph for software with a file query retrieval capability. Include detailed instructions necessary for initiation, preparation, and processing of a query applicable to the data base. Describe the query capabilities, forms, commands used, and control instructions required.

If the software is queried through a terminal, provide instructions for terminal operators. Describe terminal setup or connect procedures, data or parameter input procedures, and control instructions. Reference related materials describing query capabilities, languages, installation conventions and procedures, program aids, etc.

3.7 Operations Manual

The purpose of the Operations Manual is to provide computer operations personnel with a description of the software and of the operational environment so that the software can be run.

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Operations Manual

1. GENERAL INFORMATION

1.1. **Summary.** Summarize the general functions of the software.

1.2. **Environments.** Identify the software sponsor, developer, user organization, and the computer center where the software is to be installed.

1.3. **References.** List applicable references, such as:

a. Project request (authorization).
b. Previously published documents on the project.
c. Documentation concerning related projects.
d. FIPS publications and other reference documents.

2. OVERVIEW

2.1. **Software Organization.** Provide a diagram showing the inputs, outputs, data files, and sequence of operations of the software. Runs may be grouped by periods of time cycles, by organizational level where they will be performed, or by other groupings.

2.2. **Program Inventory.** Identify each program by title, number, and mnemonic reference.

2.3. **File Inventory.** Identify each permanent file that is referenced, created, or updated by the system. Include the title, mnemonic reference, storage medium, and required storage.

3. DESCRIPTION OF RUNS

3.1. **Run Inventory.** List the various runs possible and summarize the purpose each run. Show the programs that are executed during each run.

3.2. **Run Progression.** Describe the manner in which progression advances from one run to another so that the entire run cycle is completed.

3.3. **Run Description (Identify).** Organize the information on each run into the most useful presentation for the operating center and operations personnel involved.

3.3.1. Control Inputs. List the run stream control statements needed for the run.

3.3.2. Operating Information. Provide information for the operating center personnel and management, such as:

a. Run identification.
b. Operating requirements.
c. Initiation method, such as on request, at predetermined time, etc.
d. Estimated run time and turnaround time.
e. Operator commands and messages.
f. Contacts for problems with the run.

3.3.3. Input-Output Files. Provide information for files created or updated by the run, such as:

a. File name or label.
b. Recording medium.
c. Retention schedule.
d. Disposition of file.

3.3.4. Output Reports. For each output report or type of report, provide information such as:

a. Report identification.
b. Medium.
c. Volume of report.
d. Number of copies.
e. Distribution.

3.3.5. Reproduced Output Reports. For those reports that are computer-generated and then reproduced by other means, provide information such as:

a. Report identification.
b. Reproduction technique.
c. Dimensions of paper or other medium.
d. Binding method.
e. Distribution.

3.3.6. Restart/Recovery Procedures. Describe procedures to restart the run or recover from a failure.

3.4 **Run Description (Identify).** Present information about the subsequent runs in a manner similar to that used in paragraph 3.3.

4. NON-ROUTINE PROCEDURES

Provide any information necessary concerning emergency or non-routine operations, such as:

a. Switchover to a back-up system.
b. Procedures for turnover to maintenance programmers.

5. REMOTE OPERATIONS

Describe the procedures for running the programs through remote terminals.

3.8 Program Maintenance Manual

The purpose of the Program Maintenance Manual is to provide the maintenance programmer with the information necessary to understand the programs, their operating environment, and their maintenance procedures.

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Program Maintenance Manual

1. GENERAL INFORMATION

1.1. **Summary.** Summarize the general nature of the software to be maintained.

1.2. **Environment.** Identify the project sponsor, developer, user and computer center or network where the software is implemented.

1.3. **References.** List applicable references, such as:

a. Project request (authorizations).
b. Previously published documents on the project.
c. Documentation concerning related projects.
d. FIPS publications and other reference documents.

2. PROGRAM DESCRIPTIONS

Describe the program and programs in the system/subsystem for the maintenance programmer. If a complex system is being described, provide a general description of that system identifying each program and its functions.

2.1. **Program (Identify) Description.** Identify the program by title, tag or label, and programming language.

2.1.1. Problem and Solution Method. Describe the problem to be solved or the program function and the solution method used.

2.1.2. Input. Describe the input to the program and provide a layout. Identify the medium used. Include information, such as codes, units of measurement, format, range of values, or reference a data element directory.

2.1.3. Processing. Describe processing features and purposes important to the maintenance programmer, such as:

a. Processing logic.
b. Linkages.
c. Variables and constants.
d. Formulas.
e. Error handling provisions.
f. Restrictions and limitations.
g. Locations, settings, internal switches and flags.
h. Shared storage.

2.1.4. Output. Describe the output of the program and provide a layout. Identify the medium used.

2.1.5. Interfaces. Describe the interfaces with other software, such as data formats, messages, parameters, conversion requirements, interface procedures, and media.

2.1.6. Tables. Identify each table and its items. Describe the location, structure, and purpose of each.

2.1.7. Run Description. Describe or reference the operating procedures to run the program, including loading, operating, terminating, and error handling.

2.2. **Program (Identify) Description.** Describe the second through nth computer program in a manner similar to that used in paragraph 2.1.

3. OPERATING ENVIRONMENT

3.1. **Hardware.** Identify the equipment required for the operation of the system. Describe any unusual features used. Relate the hardware to each program. Include information such as:

a. Processor and size of internal storage.
b. Storage online or offline, media, form, and devices.
c. Input/output devices, online and offline.
d. Data transmission devices.

3.2. **Support Software.** Identify the support software needed for each computer program.

3.2.1. Operating System. Identify and describe the operating system including the version or release number and any unusual features used.

3.2.2. Compiler/Assembler. Identify and describe the compiler or assembler including the version or release number and any special features used.

3.2.3. Other Software. Identify and describe any other software used including data management systems, report generators, etc.

3.3. **Data Base.** Describe or reference documentation on the data base used. Include information such as codes, units of measurement, format, range of values, or reference a data element directory.

4. MAINTENANCE PROCEDURES

4.1. **Programming Conventions.** Identify and describe the programming conventions used.

4.2. **Verification Procedures.** Describe the verification procedures to check the performance of the programs, either general or following modifications. Include a reference to test data and testing procedures.

4.3. **Error Correction Procedures.** Describe all error conditions, their sources, and procedures for their correction.

4.4. **Special Maintenance Procedures.** Describe any special procedures required for the maintenance of the programs. Include information such as periodic purges of the data base, temporary modifications needed for leap years or century changes, etc.

4.5. **Listings and Flowcharts.** Reference, append, or describe the method for obtaining copies of listings of the programs and flowcharts.

3.9 Test Plan

The purpose of the Test Plan is to provide a plan for the testing of software; detailed specifications, descriptions, and procedures for all tests; and test data reduction and evaluation criteria.

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Test Plan

1. GENERAL INFORMATION

1.1. **Summary.** Summarize the functions of the software and the tests to be performed.

1.2. **Environment and Pretest Background.** Summarize the history of the project. Identify the user organization and computer center where the testing will be performed. Describe any prior testing and note results that may affect this testing.

1.3. **References.** List applicable references, such as:

a. Project request (authorization).
b. Previously published documents on the project.
c. Documentation concerning related projects.
d. FIPS publications and other reference documents.

2. PLAN

2.1. **Software Description.** Provide a chart and briefly describe the inputs, outputs, and functions of the software being tested as a frame of reference for the test descriptions.

2.2. **Milestones.** List the locations, milestones events, and dates for the testing.

2.3. **Testing (Identify Location).** Identify the participating organizations and the location where the software will be tested.

2.3.1. Schedule. Show the detailed schedule of dates and events for the testing at this location. Such events may include familiarization, training, data, as well as the volume and frequency of the input.

2.3.2. Requirements. State the resource requirements, including:

a. Equipment. Show the expected period of use, types, and quantities of the equipment needed.
b. Software. List other software that will be needed to support the testing that is not part of the software to be tested.
c. Personnel. List the numbers and skill types of personnel that are expected to be available during the test from both the user and development groups. Include any special requirements such as multishift operation or key personnel.

2.3.3. Testing Materials. List the materials needed for the test, such as:

a. Documentation.
b. Software to be tested and its medium.
c. Test inputs and sample outputs.
d. Test control software and worksheets.

2.3.4. Test Training. Describe or reference the plan for providing training in the use of the software being tested. Specify the types of training, personnel to be trained, and the training staff.

2.4. **Testing (Identify Location).** Describe the plan for the second and subsequent locations where the software will be tested in a manner similar to paragraph 2.3.

3. SPECIFICATIONS AND EVALUATION

3.1. **Specifications.**

3.1.1. Requirements. List the functional requirements established by earlier documentation.

3.1.2. Software Functions. List the detailed software functions to be exercised during the overall test.

3.1.3. Test/Function Relationships. List the tests to be performed on the software and relate them to the functions in paragraph 3.1.2.

3.1.4. Test Progression. Describe the manner in which progression is made from one test to another so that the entire test cycle is completed.

3.2. **Methods and Constraints.**

3.2.1. Methodology. Describe the general method or strategy of the testing.

3.2.2. Conditions. Specify the type of input to be used, such as live or test data, as well as the volume and frequency of the input.

3.2.3. Extent. Indicate the extent of the testing, such as total or partial. Include any rationale for partial testing.

3.2.4. Data Recording. Discuss the method to be used for recording the test results and other information about the testing.

3.2.5. Constraints. Indicate anticipated limitations on the test due to test conditions, such as interfaces, equipment, personnel, data bases.

3.3. **Evaluation.**

3.3.1. Criteria. Describe the rules to be used to evaluate test results, such as range of data values used, combinations of input types used, maximum number of allowable interrupts or halts.

3.3.2. Data Reduction. Describe the techniques to be used for manipulating the test data into a form suitable for evaluation, such as manual or automated methods, to allow comparison of the results that should be produced to those that are produced.

4. TEST DESCRIPTIONS

4.1. **Test (Identify).** Describe the test to be performed.

4.1.1. Control. Describe the test control, such as manual, semi-automatic, or automatic insertion of inputs, sequencing of operations, and recording of results.

4.1.2. Inputs. Describe the input data and input commands used during the test.

4.1.3. Outputs. Describe the output data expected as a result of the test and any intermediate messages that may be produced.

4.1.4. Procedures. Specify the step-by-step procedures to accomplish the test. Include test setup, initialization, steps, and termination.

4.2. Test (Identify). Describe the second and subsequent tests in a manner similar to that used in paragraph 4.1.

3.10 Test Analysis Report

The purpose of the Test Analysis Report is to document the test analysis results and findings; present the demonstrated capabilities and deficiencies for review; and provide a basis for preparing a statement of software readiness for implementation.

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Test Analysis Report

1. GENERAL INFORMATION

1.1. **Summary.** Summarize both the general functions of the software tested and the test analysis performed.

1.2. **Environment.** Identify the software sponsor, developer, user organization, and the computer center where the software is to be installed. Assess the manner in which the test environment may be different from the operational environment and the effects of this difference on the tests.

1.3. **References.** List applicable references, such as:

a. Project request (authorization).
b. Previously published documents on the project.
c. Documentation concerning related projects.
d. FIPS publications and other reference documents.

2. TEST RESULTS AND FINDINGS

Identify and present the results and findings of each test separately in paragraphs 2.1 through 2.N.

2.1. **Test (Identify).**

2.1.1. Dynamic Data Performance. Compare the dynamic data input and output results, including the output of internally generated data, of this test with the dynamic data input and output requirements. State the findings.

2.1.2. Static Data Performance. Compare the static data input and output results, including the output of internally generated data, of this test with the static data input and output requirements. State the findings.

2.N. **Test (Identify).** Present the results and findings of the second and succeeding tests in a manner similar to that of paragraph 2.1.

3. SOFTWARE FUNCTION FINDINGS

Identify and describe the findings on each function separately in paragraphs 3.1 through 3.N.

3.1. **Function (Identify).**

3.1.1. Performance. Describe briefly the function. Describe the software capabilities that were designed to satisfy this function. State the findings as to the demonstrated capabilities from one or more tests.

3.1.2. Limits. Describe the range of data values tested, including both dynamic and static data. Identify the deficiencies, limitations, and constraints detected in the software during the testing with respect to this function.

3.N. **Function (Identify).** Present the findings on the second and succeeding functions in a manner similar to that of paragraph 3.1.

4. ANALYSIS SUMMARY

4.1. **Capabilities.** Describe the capabilities of the software as demonstrated by the tests. Where tests were to demonstrate fulfillment of one or more specific performance requirements, prepare findings showing the comparison of the results with these requirements. Assess the effects any differences in the test environment as compared to the operational environment may have had on this test demonstration of capabilities.

4.2. **Deficiencies.** Describe the deficiencies of the software as demonstrated by the tests. Describe the impact of each deficiency on the performance of the software. Describe the cumulative or overall impact on performance of all detected deficiencies.

4.3. **Recommendations and Estimates.** For each deficiency provide any estimates of time and effort required for its correction and any recommendations as to:

a. The urgency of each correction.
b. Parties responsible for corrections.
c. How the corrections should be made.

State the readiness for implementation of the software.

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LEAA AMENDMENT TO FIPS PUB 38

APPENDIX 11

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11. LEAA AMENDMENT TO FIPS PUB 38

Law Enforcement Assistance Administration Addendum to FIPS PUB 38

FIPS PUB 38, *Guidelines for Documentation of Computer Programs and Automated Data Systems*, has been produced by the National Bureau of Standards for use by government agencies in documenting computer systems. It is an excellent guideline document which can be as useful to state and local government agencies as it is to Federal government agencies. LEAA continues to recommend the use of FIPS PUB 38 by criminal justice agencies as a standard or as a supplement to existing standards currently in use. In addition, LEAA recommends the use of this addendum.

FIPS PUB 38 is comprehensive in its coverage of automated systems documentation requirements. However, because of its generalized nature, it does not provide specific coverage of security and privacy unique to the criminal justice community. The purpose of this addendum is to provide coverage of security and privacy procedures for criminal justice systems and to identify the minimum documentation requirements for criminal justice systems.

1. SECURITY AND PRIVACY DOCUMENTAITON REQUIREMENT

FIPS PUB 38 addresses security and privacy in the guidelines for preparing the Functional Requirements Document, Systems/Subsystems Specification, and Program Specification; however, for criminal justice systems, a requirement exists for a more comprehensive treatment of the subject. Security and privacy procedures regarding the management, use, and operation of the system should be described either in a separate document or incorporated in other appropriate documents. The description of security and privacy procedures should, as a minimum, discuss such topics as:

A. Accuracy and Completeness

- Describe general policy for insuring accuracy of file information, completeness (disposition reporting), and dissemination limitations.

B. Audits

- Describe audit procedures to insuring accuracy, completeness, and adherence to regulations by users.

C. Data Center Security

- Describe regulations developed for security of the data center, including physical access, protection against fire, theft, sabotage, other natural or man-made disasters. Comprehensive coverage of this subject is contained in FIPS PUB 31, *Guidelines for Automatic Data Processing Physical Security and Risk Management.*

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CONTINUED

4 OF 5

D. Hardware and Software Design

- Describe hardware and software designs employed to prevent unauthorized access.

E. Management Control

- Describe management authority relative to setting and enforcing policy for computer operations personnel selection, limitations of access to specified areas, files, etc.

F. User Requirements

- Describe user requirements for direct access, Use and Dissemination Agreements, and sanctions for violations.

G. Acces and Review

- Describe access and review rights provided to individuals.

2. MINIMUM DOCUMENTATION REQUIREMENTS FOR CRIMINAL JUSTICE SYSTEMS

Past expereince in the development of criminal justice computer systems has indicated that a minimum level of documentation is necessary in order to ensure the successful development and implementation of systems and to support the transfer of computer technology. The minimum documentation requirements for criminal justice systems are set forth in the following documents described in FIPS PUB 38:

- Functional Requirements Document
- Data Requirements Documents
- Users Manual
- Operations Manual
- Program Maintenance Manual

It is further recommended that the Functional Requirements and Data Requirements Documents listed above be prepared and approved by user, developer, and operator personnel prior to starting the actual development process. These two documents are extremely important during the developmental period as their primary purpose is to provide the basis for mutual understanding between users and designers concerning the system requirements, operating environment, data collection responsibilities, and development plan. It should be noted that a system, depending on its complexity, may require the additional documentation discussed in FIPS PUB 38 and that the procedures recommended for determining documentation needs should be followed where applicable. (See Part 2, Documentation Considerations, of FIPS PUB 38).

APPENDIX 12

FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION

21-1

FIPS PUB 21-1

Supersedes FIPS PUB 21

1972 March 15

FEDERAL INFORMATION
PROCESSING STANDARDS PUBLICATION

1975 DECEMBER 1

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

COBOL

CATEGORY: SOFTWARE STANDARD
SUBCATEGORY: PROGRAMMING LANGUAGE

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U. S. DEPARTMENT OF COMMERCE, Rogers C. B. Morton, *Secretary*

James A. Baker, III, *Under Secretary*
Dr. Betsy Ancker-Johnson, *Assistant Secretary for Science and Technology*

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Acting Director*

Foreword

The Federal Information Processing Standards Publication Series of the National Bureau of Standards is the official publication relating to standards adopted and promulgated under the provisions of Public Law 89–306, and Part 6 of Title 15 Code of Federal Regulations. The entire series constitutes the FEDERAL INFORMATION PROCESSING STANDARDS REGISTER.

The series is used to announce Federal Information Processing Standards, and to provide standards information of general interest and an index of relevant standards publications and specifications. Publications that announce adoption of standards provide the necessary policy, administrative, and guidance information for effective standards implementation and use. The technical specifications of the standard are usually attached to the publication, otherwise a reference source is cited.

Comments covering Federal Information Processing Standards and Publications are welcomed, and should be addressed to the Associate Director for ADP Standards, Institute for Computer Sciences and Technology, National Bureau of Standards, Washington, D.C. 20234. Such comments will be either considered by NBS or forwarded to the responsible activity as appropriate.

ERNEST AMBLER, *Acting Director*

Abstract

This FIPS PUB announces the adoption of the American National Standard COBOL (X3.23–1974) as the Federal Standard COBOL. This revision supersedes FIPS PUB 21 and reflects major changes and improvements to the COBOL specifications. The American National Standard defines the elements of the COBOL Programming Language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL. The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a variety of automatic data processing systems. The COBOL language is intended for use in computer applications that emphasize the manipulation of characters, records, and files.

Key words: COBOL; data processing; Federal Information Processing Standard; information interchange; information processing; programming language; software; standards conformance.

Nat. Bur. Stand. (U.S.), Fed. Info. Process. Stand. Publ. (FIPS PUB) 21–1, 4 pages (1975)

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Federal Information Processing Standards Publication 21-1

1975 December 1

ANNOUNCING THE STANDARD FOR

COBOL

Federal Information Processing Standards Publications are issued by the National Bureau of Standards pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89–306 (79 Stat. 1127), as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973), and Part 6 of Title 15 CFR (Code of Federal Regulations).

1. Name of Standard. COBOL (FIPS PUB 21–1).

2. Category of Standard. Software Standard, Programming Language.

3. Explanation. This publication announces the adoption of American National Standard COBOL, X3.23–1974, as amplified herein as a Federal Standard. This revision supersedes FIPS PUB 21 and reflects major changes and improvements to the COBOL specifications. The American National Standard defines the elements of the COBOL Programming Language and the rules for their use. The standard is used by implementors as the reference authority in developing compilers and by users for writing programs in COBOL. The primary purpose of the standard is to promote a high degree of interchangeability of programs for use on a wide variety of information processing systems. Other languages, appropriate for applications that are not adequately serviced by COBOL, are being considered for adoption as Federal Standards.

4. Approving Authority. Secretary of Commerce.

5. Maintenance Agency. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).

6. Cross Index. American National Standard X3.23–1974, COBOL.

7. Related Documents.

a. Federal Information Processing Standards Publication 29, Interpretation Procedures for Federal Standard COBOL.

b. Federal Property Management Regulation 101–32.1305–1, Implementation of Federal Information Processing Standards Publications (FIPS PUB) into Solicitation Documents, Software Standards.

c. Federal Information Processing Standards Publication 43, Aids for COBOL Program Conversion (FIPS PUB 21 to FIPS PUB 21–1).

8. Objectives. The basic objectives in applying Federal Standard COBOL are: (1) to achieve the long-recognized advantages that are inherent in the use of higher level languages, and (2) to maximize and protect program investments by making it easier and less expensive to exchange programs among different computer systems, including replacement systems.

The attainment of these objectives, from a government-wide point of view, depends upon the widespread use of Federal Standard COBOL. Thus, the general intent of this publication is to provide a standard language that can be used in programming information processing applications except in circumstances, discussed below, where such use would not be advantageous.

9. Applicability. Federal Standard COBOL will be used in programming computer applications and programs that emphasize the manipulation of characters, records, files and input/output (as contrasted with those concerned primarily with computational problem solving) which are developed or acquired for government use. Specifically, the standard will be used for such applications whenever:

- —the application is being designed and programmed centrally for a decentralized system that employs computers of different makes, models and configurations
- —the program will or might possibly be run on equipment other than that for which the program is initially written
- —it is anticipated that the life of the program will be longer than the life of the presently installed equipment
- —the application or program is under constant review for updating of the specifications, and changes may result frequently
- —the advantages of the use of this higher level language can accrue locally irrespective of interchange potential (e.g., ease of coding, ease of documentation, improved understanding, and ease of debugging).

Exceptions to the use of Federal Standard COBOL may be made when:

a. A comparative analysis shows that the advantages inherent in the use of Federal Standard COBOL are clearly offset by even greater advantages obtainable through use of an alternative language. The language selection should be made in consideration of the government's overall objectives. Such exceptions to the use of Federal Standard COBOL shall be subject to a waiver procedure approved by the head of the agency. The special circumstances identified in paragraphs b through e below are exempted from the requirement for a waiver at the discretion of the head of an agency. See paragraph 12, Waivers.

b. The program requirements are more economically and efficiently satisfied through the use of report generation, data base management, or text processing languages.

c. The program is to be processed on systems for which COBOL compilers are normally not developed. If, however, a COBOL compiler is available on a system other than the target system and the compiler generates object code for the target system (cross-compiler), COBOL should be used to the extent practicable. This exception alone is not to be construed as allowing exemption to the requirement for the use of COBOL on small computer systems, such as mini-computers, where they are being used for applications covered above.

d. The program is to be processed on systems that are in the Federal inventory and for which a standard COBOL compiler is not available.

e. The computer installation is oriented toward the use of scientific and engineering applications in which case incidental information processing applications may be programmed in locally used languages.

Federal agencies should give special attention to ensuring that programs for applications that will or are likely to be used by organizations outside the Federal Government (i.e., State and local governments and others) are written and made available in Federal Standard COBOL, in order to provide maximum interchangeability in their use.

10. Specifications. Federal Standard COBOL specifications are the language specifications contained in American National Standard COBOL, X3.23–1974. For purposes of Federal Standard COBOL, the modules defined in X3.23–1974 are combined into four levels. The four levels of Federal Standard COBOL are identified as: Low, Low-Intermediate, High-Intermediate, and High. Each Federal Standard COBOL level is composed of either the high or low levels of the nucleus and ten of the eleven Functional Processing Modules (FPM's) defined in X3.23–1974. The four Federal Standard COBOL levels are reflected in the following table. The numbers in the table refer to the level within the FPM or nucleus as designated in X3.23–1974, and a dash in the table denotes the corresponding FPM is omitted.

	Low Level	Low Intermediate Level	High Intermediate Level	High Level
Nucleus	1	1	2	2
FPM's				
Table Handling	1	1	2	2
Sequential I–O	1	1	2	2
Relative I–O	—	1	2	2
Indexed I–O	—	—	—	2
Sort-Merge	—	—	1	2
Report Writer	—	—	—	—
Segmentation	—	1	1	2
Library	—	1	1	2
Debug	—	1	2	2
Inter-Program Communication	—	1	2	2
Communication	—	—	2	2

NOTE: The "REPORT WRITER" module is not mandatory in any Federal level. However, the specifications contained in X3.23–1974 should be used to the extent practical, consistent with the requirements.

11. Implementation. Implementation of the Federal Standard COBOL is divided into five areas of consideration: acquisition of COBOL compilers, transition to FIPS PUB 21-1, conformance to Federal Standard COBOL, interpretation of Federal Standard COBOL, and use of COBOL in application programs.

11.1 Acquisition of COBOL Compilers. The provisions reflected in this publication are effective upon the date of this document. All COBOL compilers specified for procurement on or after the effective date must be identified as implementing one of the levels of Federal Standard COBOL. The requirements set forth in this paragraph are applicable to compilers developed in-house, compilers acquired as part of an ADP system procurement, compilers acquired by separate procurement and compilers used under an ADP leasing arrangement.

11.2 Transition to FIPS PUB 21-1. The adoption of American National Standard COBOL, X3.23–1974, as a revised Federal Standard requires that provisions be made for the orderly transition to the revised standard. The transition period will begin on the date of this publication and will continue for eighteen months thereafter. The policies for the acquisition of COBOL compilers during the transition period are:

a. The provisions of FIPS PUB 21 will apply to orders placed before the date of this publication for compilers which are to be delivered subsequent to the date of this publication.

b. The provisions of FIPS PUB 21-1 will apply to orders placed after the date of this publication; however, a compiler conforming to FIPS PUB 21 may be acquired for interim use until the compiler conforming to the revised standard is available. Delivery of the compiler conforming to the revised standard may be deferred to, but not to exceed, the close of the transition period (18 months from the date of this publication).

11.3 Conformance to Federal Standard COBOL. A compiler implemented in conformance to Federal Standard COBOL must satisfy at least the following requirements:

a. The implementation must include *all* of the language elements of at least one of the levels of Federal Standard COBOL.

b. The implementation must satisfy all of the requirements, defined in American National Standard COBOL, X3.23–1974, section I, paragraph 1.5, Definition of an Implementation of American National Standard COBOL. Any requirement stated herein that may differ from the requirements for an implementation of American National Standard COBOL takes precedence over the requirements stated in X3.23–1974.

c. The implementation must provide a facility for the user to optionally specify a level of Federal Standard COBOL for monitoring his source program at compile time. The monitoring may be specified for any level of Federal Standard COBOL at or below the highest level for which the compiler is implemented. The monitoring will be an analysis of the syntax used in a source program against the syntax included in the specified level of Federal Standard COBOL. Any syntax used in the source program that does not conform to that allowed by the user selected level of Federal Standard COBOL will be diagnosed. The syntax diagnosed as not conforming to the specified level will be identified to the user through a diagnostic message on the source program listing. The diagnostic message will contain at least: (1) the identification of the source program line number in which the non-conforming syntax occurs, and (2) the identification of the level of Federal Standard COBOL that supports the syntax or that the syntax is non-standard COBOL.

In order to confirm that an implementation satisfies the requirements of a designated level of Federal Standard COBOL, programs (which include the Report Writer module) have been developed for testing COBOL compilers. A Federal COBOL Compiler Testing Service (FCCTS) also is available to provide testing services. Policies concerning required testing of COBOL compilers are currently being developed and will be published in the near future by the General Services Administration as an appropriate modification to FPMR 101–32.1305. For further information regarding COBOL Compiler Testing Services contact:

Director, Federal COBOL Compiler Testing Service
Department of the Navy
ADPE Selection Office
Washington, D.C. 20376

11.4 Interpretation of Federal Standard COBOL. During the use of Federal Standard COBOL, whether implementing compilers, testing compilers or writing source programs, questions may arise from time to time as to the meaning of specific language specifications. It is desirable when this happens to apply a solution to these questions that can be used uniformly throughout the Federal Government and by all implementors of Federal Standard COBOL and the Report Writer module. To achieve this objective, a Federal COBOL Interpretations Committee has been organized. Procedures for processing interpretation of Federal Standard COBOL are provided in FIPS PUB 29 (paragraph 7a). For further information contact:

Chairman, Federal COBOL Interpretations Committee
Computer Science Section
Systems and Software Division
Institute for Computer Sciences and Technology
National Bureau of Standards
Washington, D.C. 20234

11.5 Use of COBOL. Federal Standard COBOL will be used as defined in paragraph 9, Applicability, as soon as compilers that conform to the standard are available and acquired. It is not intended that existing programs be rewritten solely for the purpose of conforming to the standard.

Programs should, to the extent practicable, be limited to the elements of one of the specified levels of Federal Standard COBOL. It should be recognized that the use of any non-standard language elements may compromise interchangeability of programs between various systems or may complicate future conversion to a replacement system. Extensions should, therefore, be employed only when their use will result in efficiencies that clearly outweigh the difficulties they may cause. To the extent that specifications for the required extensions have already been included in the CODASYL COBOL Journal of Development, use of these specifications should minimize future conversion difficulties.

12. Waivers.

12.1 Policy. Heads of agencies are permitted to waive the requirements stated in this publication in the following circumstances. Each waiver will cover only the specific requirements of this publication related to the need for a waiver.

a. A waiver may be granted for an exception to any of the requirements stated in this publication provided it can be clearly demonstrated that there are appreciable and continuing performance or cost advantages to be gained or that the extenuating circumstances are such that the overall interests of the Federal Government are served by granting the requested waiver.

b. Special capabilities may be required to accommodate the needs of a particular application that cannot be achieved through the use of Federal Standard COBOL. A waiver must be obtained before these special capabilities are specified for implementation or acquisition. Requests for waiver must clearly demonstrate an appreciable and continuing performance or cost advantage will be obtained through the use of these special capabilities.

12.2 Reporting. Waivers granted in the acquisition of compilers will be reported to the National Bureau of Standards, with the following supporting documentation, within seven working days after approval by the head of the agency.

a. Relevant documentation considered by the head of the agency in authorizing the waiver.

b. Detailed technical specifications of the language deviations granted. In the case of deletions, exact reference to the items in X3.23–1974 is all that is required. In case of additions that are already developed and approved by CODASYL, exact reference to the items in the CODASYL COBOL Journal of Development is all that is required.

c. A recommendation for action by NBS concerning future development of COBOL, relative to the waiver, should be included, as appropriate. Correspondence should be addressed to the Associate Director for ADP Standards, Institute for Computer Sciences and Technology, National Bureau of Standards, Washington, D.C. 20234.

13. Special Information.

a. Development and maintenance of the COBOL language are the responsibilities of the Programming Languages Committee of the Conference on Data Systems Languages (CODASYL), a voluntary organization comprised of interested organizations. Standardization of COBOL in the United States is in the purview of the American National Standards Institute (ANSI), X3J4 Committee. The technical specifications of American National Standard COBOL, herein adopted as a Federal Standard, are based on the specifications contained in CODASYL COBOL Journal of Development, 1973, and changes that were made to the JOD in response to X3J4 requests. The COBOL language is under continual review by the CODASYL organization for modification and extension. These changes are then reviewed by ANSI for incorporation in revised editions of ANS COBOL.

b. In the event that there is no prospect for the development of a COBOL compiler conforming to this standard for the machine used, serious consideration should be given to using the existing COBOL compiler, if available, for new or revised applications to ease the eventual conversion to a new system employing a standard COBOL compiler.

14. Where To Obtain Copies of COBOL Publications.

a. Federal Government activities should obtain copies of this publication from established sources within each agency. When there is no established source, purchase orders should be submitted to the National Bureau of Standards, Institute for Computer Sciences and Technology, Office of ADP Standards Management, Technology Building, Washington, D.C. 20234. Refer to Federal Information Processing Standard Publication 21–1 (FIPS PUB 21–1). Copies of the American National Standard COBOL, X3.23–1974, accompany each copy of FIPS PUB 21–1.

b. Others may obtain copies of the FIPS PUB from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (SD Catalog Number C13.52:21–1). There is a 25 percent discount on quantities of 100 or more. When ordering, specify document number, title, and SD Catalog Number. Payment may be made by check, money order, coupons, or deposit account. Copies of the ANSI standard may be obtained from the American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018. Refer to American National Standard X3.23–1974, Standard Programming Language COBOL.

c. Copies of the CODASYL COBOL Journal of Development may be obtained from the Technical Services Branch, Department of Supply and Services, 5th Floor, 88 Metcalfe Street, Ottawa, Ontario, Canada K1A OS5.

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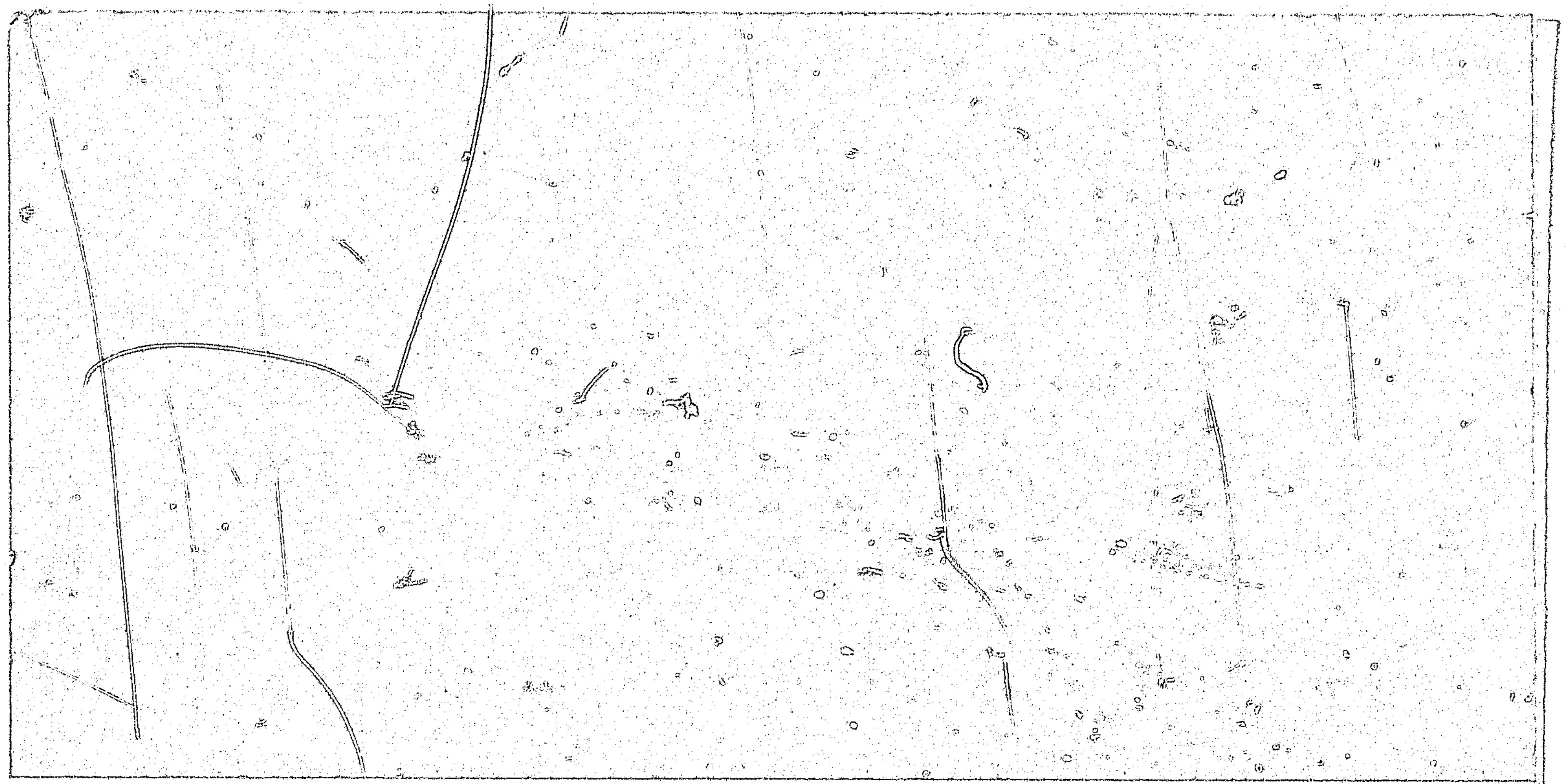

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