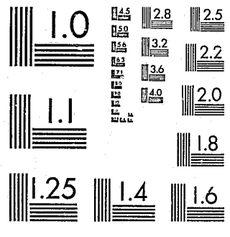

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CRIMINAL JUSTICE HUMAN RESOURCES PLANNING PROJECT

CRIMINAL JUSTICE CENTER SAM HOUSTON STATE UNIVERSITY

INTRODUCTION-

Volume I

of the

FINAL REPORT

for

Grant Number 80-MU-AX-0005

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PREFACE

This collection of eight volumes constitutes the Final Report for grant number 80-MU-AX-0005 from the Office of Criminal Justice Education and Training, Law Enforcement Assistance Administration, U.S. Department of Justice. The first volume contains an overview of the project with emphasis on the conceptualizations necessary for a project of this scope. Volume II presents a model of the interactive nature of manpower planning. Volumes III-VI contain major research dissertations completed during the project and Volumes VII and VIII provide the technical documentation for the planning system developed.

Any project of this scope requires the assistance and cooperation of numerous persons. J. Price Foster, who as Director of the Office of Criminal Justice Education and Training was instrumental in the implementation of the Manpower Planning Project, and the members of the OCJET staff were particularly helpful. Jean Moore and Bob Lewis, who served as project managers for OCJET, were always ready to offer assistance and guidance as needed. The director and staff of the companion grants at the University of South Florida, Frank Sistrunk, and Michigan State University, John Hudzik, added significantly to the project.

We are particularly appreciative of the time and effort expended by the numerous criminal justice agencies who responded to our questionnaires and our requests for agency data. A special thanks is due those who participated in evaluation and assessment proceedings and served on the advisory committee.

The staff at Sam Houston State University deserve whatever credit this project may receive, for they were primarily involved in every step of the project. Particularly creative contributions were made by Allen Sapp, Larry Hoover, Charles Johnson, and Gary Copus. Their efforts were essential to the project and are truly appreciated. To the many others, too numerous to name, who assisted in the project, we offer our gratitude.

Victor G. Strecher
Project Director

VOLUME I . . . . . INTRODUCTION

VOLUME II . . . . . AN INTERACTIVE EFFECTS MODEL IN HUMAN RESOURCES PLANNING FOR CRIMINAL JUSTICE AGENCIES

VOLUME III . . . . . THE EFFECT OF UNIONIZATION VERSUS NON-UNIONIZATION ON WAGE DETERMINATION IN MUNICIPAL POLICE AGENCIES WITH ONE HUNDRED OR MORE SWORN AND NON-SWORN PERSONNEL

VOLUME IV . . . . . AN EXPLORATORY AND DESCRIPTIVE ANALYSIS OF GRIEVANCE PROCEDURES IN LAW ENFORCEMENT COLLECTIVE BARGAINING

VOLUME V . . . . . LAW ENFORCEMENT SELECTION REQUIREMENTS: A NATIONAL ANALYSIS

VOLUME VI . . . . . THE IMPACT OF UNIONIZATION ON CORRECTIONAL OFFICER WAGES AND FRINGE BENEFITS

VOLUME VII . . . . . TECHNICAL DOCUMENTATION AND SYSTEM UTILIZATION (PART I)

VOLUME VIII . . . . TECHNICAL DOCUMENTATION AND SYSTEM UTILIZATION (PART II)

VOLUME I

INTRODUCTION

The following product represents the final report for Law Enforcement Assistance Administration Grant #80-MU-AX-0005, "Criminal Justice Manpower Planning Grant". This project has a lengthy history with the original conceptualization and planning beginning in approximately 1976 and culminating in grant awards to the University of South Florida, grant #78-CD-AX-0003, "Methodologies for Manpower Analysis and Planning in the Criminal Justice System: A Feasibility Study"; Michigan State University, grant #78-CD-AX-0004, "A Criminal Justice Manpower Planning Model: Feasibility Assessment and Design"; and the 78-MU-AX-0034 grant to Sam Houston State University. Individuals from the Office of Criminal Justice Education and Training, Law Enforcement Assistance Administration, as well as the above three universities were involved at various stages in the planning and coordination of the overall goals which each of these grants were to address. Of general concern on the part of the Office of Criminal Justice Education and Training was the status and applicability of manpower planning in the criminal justice sector. The three projects and their related goals were closely planned and coordinated with the purpose in mind of addressing separate but related issues surrounding this general concern.

Given the historical nature of the grant at Sam Houston State University, it is important that the initial thoughts

which led to the development of this project be reviewed. By so doing it is felt that a perspective will be achieved which will allow the reader to more adequately assess the impact of these findings for their own criminal justice manpower planning environment.

Decisions regarding action to be taken by an individual or group are usually based on what is either perceived or rationalized as the best available information. When these decisions are revisited at some point in the future and a different decisional outcome occurs, it is usually based upon: the same information with the same decisional results; the same information with difference decisional results; the same and/or new information with the same decisional results; or the same and/or new information with different decisional results.

Regardless of which process is used, the process may be viewed as evolutionary decision making. Evolutionary decision making will occur in all instances except when the original information, considered in the original way, results in the original decision. This evolutionary decision making process is being outlined because it is descriptive of the nature of the progress of this grant. It is not necessarily implied by this that the goals for which decisions have been made have changed, but rather the methods by which the goals were reached evolved based upon new decisional outcomes.

Initially, the major generic goal of this project, even prior to formal grant application, was to develop a

"criminal justice manpower planning model". While this continues to be true, the nature and description of just what a criminal justice manpower planning model is, has changed as either old information has been reviewed in a different perspective or as new information has indicated a need to change the definition of a criminal justice manpower planning model. In retrospect, some three years after the formal approval of this grant, it has become overwhelmingly apparent that the operational premise, "the best decisions are based on the best relevant information" is true not only for a criminal justice manpower planning model, but was also true in the evolutionary determination of just what a criminal justice manpower planning model should be.

The first section of this report will historically review the conceptual development of this project in the areas of identifying, designing, and implementing a generic method for manpower planning in the criminal justice system.

Planning is the process of bringing information to bear on decisions in both a reactive (immediate problem solving) sense, or a proactive (preventative planning to reduce the need for reactive planning) sense. Two planning model approaches are the national generic model (macro) and the localized indigenous model (micro). Initially, in the germinal stages of this project's development it was thought that the former approach was most consistent with the immediate concern of preparing and managing human resources in criminal

justice agencies. Generally, the basic considerations which influenced this direction of thought were:

- the need for quality control of manpower development, i.e., a generally accepted set of assumptions about performance objectives and credentialing
- reduction in lag time in producing manpower current with the state-of-the-art development in the criminal justice field
- influencing productivity of manpower in the field
- recognition of the need for forcasting employment/ occupational environment trends
- enhancement of information exchange between operational agencies and between operational agencies and planning agencies
- need for consonance and linkage of objectives, policies and practices

Underlying each of the above was a generic premise thought to be applicable in a macro sense to all criminal justice agencies, that being a sameness of direction and general similarity in intensity of specific topical interest and need. It was also recognized at this point in time that there was a rapidly growing fund of information about criminal justice human resources. However to date, there had been no attempt to systematically assemble and organize the information into a coherent, usable, and for the macro perspective, accessible information base. The general objective at this early evolutionary stage of thinking was, to the degree possible, to create

a national manpower planning system. Such a system would allow for the development and use of a national criminal justice manpower planning strategy which would decrease the subjective and value laden nature of much of the planning decisions, to be replaced with an objective and more rational planning approach.

Preliminary attempts to map strategy designed to achieve this general objective addressed or recognized the following:

- the labor intensive nature of the social response to crime
- the recognition that the issues of personnel acquisition, preparation, and utilization have received far less attention (systematically) than have the same issues of hardware
- the intent and impact of public unions
- the new clamor for public accountability
- renewed emphasis in the public sector on career mobility and career ladders
- the need to systematically assemble and organize criminal justice human resource information
- the need to assess quality of information and determine utility for both operational and non-operational level agencies
- the assumed need to develop an operational human resource planning model for the interpretation of information relating to strategies involved in the

acquisition, preparation, and utilization of human resources

- the assumed need to develop a planning model by which existing and future needs for human resources in the criminal justice system are identified and met by an appropriate supply of human resources
- the need for coordination between components of the criminal justice system which should include a planning model complete with need indicators, informational strategy alternatives, delivery systems, and techniques for analyzing their relationships
- the preliminary recognition that the lack of an operational planning model useful and comprehensive to both planning agencies and operational agencies results in a lack of a coordinated system-wide approach to human resource development
- the recognition that little research has taken place in criminal justice concerning system-wide human resource planning and any planning model design must be grounded in the reality of where we are now and what we know now
- the tentative recognition that the planning model should have the following essential qualities:

  Breadth - utility for all relevant criminal justice sectors

  Detail - the full range of issues and processes incorporated under human resource planning

  Reality - considerate of what the criminal justice sector will accept and based on an objective understanding of the the criminal justice environment

- the recognition that the development of a planning system, rather than a straight linear process is a cyclic, reiterative procedure which will result in a conceptually enlarging and evolving model which will redefine itself and its capacity to describe the real world and to deal with real world problems
- the recognition that this process would require a five year developmental period with the bulk of the latter period used to redefine system capabilities so that ultimately the system would be capable of dealing with more detailed needs, incorporating a much larger information base, and serving a greater variety of agencies

In the initial project conceptualization, the first eighteen months were to address the general issues of what kind of manpower planning is appropriate for and has utility in criminal justice, and to what extent and by what means can it be undertaken? The answers to these questions would be the major products of that eighteen month period, specifically the development of an applicable generic planning model for the criminal justice system.

This generic planning model was perceived as a general conceptual framework, manifested in a planning system on which subsequent operational activities would take place. At this stage of conceptualization all conventional knowledge pointed towards a national generic planning model as the most attractive and viable approach to manpower planning in criminal justice. It was determined however, that this model should be protean in nature, that is capable of displaying a great diversity in capability. Two common aspects which it was felt must be present in this model were those of availability of relevant information and utility of method for use of this information. It was perceived that each of the basic considerations which influenced the initial direction of our thought for manpower planning, and the previously considered general objectives, all had in common as a requirement for proper treatment the critical need of relevant information. The planner in a local agency, state planning agency, or national commission when addressing manpower planning subsectors such as policy decision making, manpower research, employment information dissemination, affirmative action, labor relations, recruitment, etc. must be able, both quickly and with confidence, to utilize the volumes of data which could be theoretically brought to bear on the areas of concern. Central then to any manpower planning approach, national generic model or otherwise, must be the base capability of information utilization.

The initial task then, related to the primary goal of this project (development of a national planning model) was to develop a model having a level of abstraction and flexibility which would allow for its refining and redefinition as project staff on each of the three associated grants began to identify those kinds of information and specific planning techniques critical to manpower planning in the criminal justice sector. This model would be obligated to accept a variety of kinds of information while at the same time provide conceptual organization for this information which would in turn allow the user to make sense out of what has been previously characterized as an unorganized "haypile" of data.

The analysis of the problems associated with manpower planner's need for information gave project staff the direction required to identify the broad objectives associated with the realization of project goals. The objective statements outlined below, were for the purpose of providing preliminary definition and structure to the operational activities of project staff.

General Program Objectives

- determination and development of a manpower planning system
- insuring the ability of such a system to accept all types of manpower planning information
- insuring the ability of the system to allow all levels of manpower planners the capability of conceptual organizations of manpower planning information

in a way that meets the indigenous needs of each level of planner

- develop, test, and operationalize sub-sectors within the framework of the above model

Given these general objectives, the first two major tasks were the identification of those informational areas containing data required to make planning decisions in criminal justice and the identification of a system which would meet the criteria imposed by the above objectives.

Criminal justice, as a specific discipline, is a relatively recent phenomenon in both the academic and professional areas. In determining the appropriate method for identifying theoretical information areas required for planning decisions in criminal justice two questions were posed. The first was, Is criminal justice manpower planning inherently different in logic or process than similar planning in other public agencies or in private industry? The second question was, Would reviewing literature in the criminal justice area alone produce a typology of information need areas which is inappropriately parochial to criminal justice resulting in reaffirming what is rather than addressing both what is and what should be? The approach taken to the first question involved a thorough review of the literature in the areas of management and utilization of human resources, written specifically for criminal justice audiences. The typology of informational areas produced from this review was then compared to a typology produced as a result of a similar

review of the literature from the broader fields of industrial psychology, management, public administration, etc. The outcome of this comparison was anticipated and resulted in the obvious identification of the greater coverage and sophistication of the latter review. In addition, reviews of job descriptions of management level positions both within and without criminal justice agencies provided further substantiation that criminal justice agencies have no real inherent differences in manpower planning needs when compared to other occupational environments. What was apparent was that the fields previously mentioned outside of criminal justice, have had a much longer, more technically sophisticated and more exhaustive involvement in the general field of human resource utilization than has criminal justice per se.

Based on conclusions drawn from this effort the decision was made to not limit ourselves to criminal justice manpower planning literature, and related experts in determining the typology of informational needs, but rather to expand to the parent fields of personnel administration, public administration, industrial psychology, etc. The typology that resulted from this effort has as major categorical headings and first level sub-headings the following:

I. Recruitment
   - A. Manpower Sources
   - B. Methods
   - C. Constraints
   - D. Minority Recruitment

II. Selection
   - A. Theory of Selection
   - B. Components of Selection

III. Placement
- A. Theory of Placement
- B. Organizational Policies

IV. Education and Training
- A. Need Determination
- B. Methods

V. Career Development
- A. Evaluation
- B. Minority Considerations
- C. Motivation
- D. Discipline

VI. Wages and Salary Concerns
- A. Reward Criteria
- B. Types of Rewards
- C. Pay and Motivation

VII. Fringe Benefits and Services
- A. Fringe Benefits
- B. Differential Access
- C. Quasi-Benefits

VIII. Health and Safety
- A. Occupational Laws
- B. Safety Programs
- C. Health Programs

IX. Labor Relations
- A. Organizational Considerations
- B. Legal Aspects
- C. Negotiations

X. Systemic Issues
- A. Policy Changes
- B. Legislative Mandate Changes
- C. Priority Changes
- D. Geographic Responsibility Changes

XI. Records Management
- A. Personnel Reports
- B. Personnel Statistics
- C. Records Administration
- D. Legal Considerations
- E. Computer Application

XII. Research and Planning
- A. Types of Personnel Research
- B. Sources of Information
- C. Methods
- D. Assessing Current Status
- E. Assessing Future Status
- F. Structuring Organizational Response

XIII. Futuristics
- A. Changes in the Environment
- B. Trend Development

It is obvious that the science of manpower planning is not new in the sense that persons concerned with such have been writing in the area for years. The thorough study of the development of manpower planning led to the observation that there exists discrete units of activity along a temporarily oriented line or process. Although several such classifications could have been developed, project staff found that the "functional activities" outlined above (with the third level of categories omitted) provided what was believed at that point in the conceptual evolution to be an inclusive framework for data organization. Given the functional areas of manpower planning, the project also addressed manpower planning in the major sub-systems of criminal justice by crossing each of the functional areas against law enforcement, courts, corrections, and academics. While the possibility existed that some changes would occur, it was anticipated that these would be reflected in the second or third level sub-categories and not for major headings. This typology performed two immediate functions. The first being the initial conceptual grasp of informational areas which the planning model would eventually need to address, and the second was to provide for the analysis of data types for purposes of insuring data compatibility with the planning model that was to be developed. With respect to the second function, data types, it was obvious that information beyond

the literal type would be required. This would then involve, in addition to conventional bibliographic data, both numerically active and numerically stable data. The numerically active data would have to be contained in a design which would provide for statistical computation and the numerically stable data could be treated as conventional bibliographic information. Consequent to this determination, four distinct data types were identified.

Conventional Bibliographic - consisting of books, journal articles, and government documents. The latter exemplified by training manuals, special reports, position papers, research results, etc.

Extant Agency - while both bibliographic and numeric in nature, this material consists of information found in any and all criminal justice agencies; but typically the knowledge about which is limited to the producing agency. This is usually so even given that much of this information may have generalizibility to numerous other agency planners. Examples of such documents would be, technical reports, training documents, evaluation strategies, policy statements, labor contracts, and agency specific numeric data.

Numeric - This information consists of data from areas of employment and personnel, revenue and expenditures, descriptive demographic characteristics, and crime reports among others.

Legal - This information encompasses legal reference material required by the manpower planner in criminal justice. Such information would cover the major areas of administrative law, statutory law, and case law.

Given the diversity and complexity of the data types necessary for manpower planning, it became evident that a sophisticated manpower planning model would be required to render the data useful and readily available to the manpower planner. It had also become obvious through the project staff's extensive involvement in the literature identification that the conceptual design of the planning system must be of sufficient sophistication to allow a multi-dimensional approach to information accession. It was anticipated, based on reviews of the literature and informal discussions with criminal justice planners, that four distinct types of inquiries would come from users of the manpower planning model or system.

Type One: Specific Issue Inquiries

Criminal justice agencies across the country face similar recurrent manpower planning issues on a daily basis. These issues relate most frequently to specific decisions or problems. Such problems often merely require immediately available comparative information from similar agencies. Examples are:

1. A police agency desires to implement a field training program for recruit officers. The agency desires to ascertain whether other police agencies have previously developed guidelines and techniques which might be applicable to its jurisdiction.

2. A municipality is engaged in negotiating a labor contract with a police union. It is interested in contract provisions from similar jurisdictions.

Type Two: Complex Problem Inquiries

Legislatures, state planning agencies, and similar entities often need extensive manpower information for broad policy decision making. Examples are:

1. A state law enforcement training commission might be considering adoption of a standard requiring a given amount of college credit for police recruits. It would access the system to ascertain for example: average number of recruits needed per year, current recruit educational levels for that state and nationally, law enforcement/criminal justice degree program enrollment, anticipated graduation rates based upon given enrollment levels, relevant EOOC legislation and case law.

2. A state legislature is considering increasing the number of district court judges. It might access the system to ascertain: the comparative ratio of judges per number of police of that state vs. nationwide, average and/or recommended caseload per judge, research finding regarding the effect of judicial staffing levels upon backlog clearance, impact of accelerated clearance of existing backlog upon correctional committments and institutional populations.

Type Three: Document Content Inquiries

Occasionally an agency may be merely interested in the content of a specific document. For instance, a law enforcement training commission may desire to know whether Project Star addressed the issue of the traffic enforcement function, or a state planning agency may desire to know whether the National Manpower Survey included estimates of diversion agency needs should increased use of diversion occur. Use of the system in this manner presumes that the user has some knowledge of the literature, but lacks familiarity with

a specific citation. What the system provides in such instances is time saving access for the user who either does not possess a particular document or who does not want to read a voluminous multi-volume report.

Type Four: Research Inquiries

One of the primary obstacles to criminal justice manpower research is the incredible amount of work necessary to obtain raw data. Several substantial national projects have generated a tremendous amount of data. However, data types are available to University researchers only after expansive months-long processes. If the data from the National Manpower Survey, Project Star, Expenditure and Employment Surveys, etc. were readily available to researchers, including criminal justice graduate students, it would undoubtedly be "worked" to a considerable extent.

Given the broad range of informational areas reflected in the typology of informational needs and the distinct types of inquiries anticipated it became increasingly obvious that in order to identify an appropriate planning model it would be necessary to select for initial development and expansion a sub-sector of the typology which would involve all possible data types. In addition, such a sub-sector must require, in a problem solving sense, each of the distinct types or levels of inquiry previously mentioned. Only by doing this would a rigorous test for any planning model developed be provided.

After considerable discussion among project staff, review of appropriate literature and consultation with qualified individuals outside the project staff, the decision was reached to operationalize the sub-sector of labor relations in the law enforcement component of criminal justice. The rational for this decision was fourfold. First, the primary prerequisite for the sub-sector selection was that informational areas required to address the distinct types of inquiries be rich and varied. This is important in that it was felt that if a planning model or system could meet the demands of a sub-sector which inherently require all possible data types and involve all levels of inquiry, then little if any system or model modification would be required when the remaining sub-sectors were developed. Planning in the area of labor relations, by its very nature requires both numeric and literal data, including conventional bibliographic (journal articles, books, governmental publications, etc), extant agency information of a bibliographic and numeric nature (labor contracts, local employment and expenditure data, demographic characteristics, etc) and legal data (statutory, case and administrative law relating to collective bargaining and labor negotiations).

The second consideration was the availability of the material. Preliminary investigation revealed that the conventional bibliographic information in this topical area was readily available as was the numeric data for the areas

of employment and expenditures, and comparative demographic variables. The area of legal information was also available in published form through several separate but existing data bases as well as in published form. Further it was ascertained that permission could be secured to use this data in the proposed system. The informational area of most concern regarding availability was the extant information of labor contracts. Initial conversations with selected police departments indicated there would be little difficulty in obtaining this data.

The third concern was with regard to system design and data base testing. It was critical that an actual field test, using planners from agencies who were to be users of the system, be conducted in order to determine system viability. Again, initial contact with law enforcement planners and police labor union representatives indicated an overwhelming receptivity to participating in field testing of the planning system. The final consideration was the long range concern of project viability and continuance beyond cessation of federal funding. It was always the intention of project staff, as reflected in the project goals and objectives, to develop a product which would have both immediate and long-term applicability for manpower planning and not be a short-life shelf product. With this in mind, and being aware of the investment and concern of both labor and management in the area of collective bargaining, it was felt that the

selection of law enforcement labor relations would result in initial interest and real world applicability. This in turn would assist the project in gaining agency receptivity and support following the total system development over the anticipated five year period of federal funding.

Following the selection of labor relations as the sub-sector to be developed and prior to the actual determination of the planning model mechanics, it was necessary to identify that specific data to be collected and the methods of collection to be used. In the category of literal data the specific data to be collected was:

- journal articles
- books
- governmental publications
- extant agency information
- legal information.

In the numeric area the information to be collected was:

- United States census data
- criminal justice employment and expenditure data
- National Manpower Survey data
- Uniform Crime Report Data.

The topical parameters and methods of obtaining data for each of these areas was as follows:

Journal articles - using the topical area of labor relations as an initial starting point, related thesaurus terms were identified which would serve the purpose

of setting topical parameters for the general data areas to be developed. These separate sources were then used to identify those journals which were appropriate for use in this data area; The Criminal Justice Guide to Perodicals; The International Guide to Criminal Justice Periodicals; and, to insure usage and review of appropriate non-criminal justice periodicals, Ulrich's International Periodical Directory. From these sources approximately forty journals were identified which would likely contain articles appropriate for the data base.

The next step, following the identification of the journals, was to ascertain those mechanisms which would allow staff to identify those specific articles in each journal, within predesignated time parameters. This was accomplished by determining those commercial (public and private) enterprises which index the previously identified journals. This task was accomplished using the index/abstracting service listing in the above mentioned International Guide to Criminal Justice Periodicals.

Books - considering all books as the population from which those books relating to labor relations must be identified, the following existing mechanisms/sources were used:

- books in print
- books in demand - out of print books
- forthcoming books

- Directions
- Marc Data Base

Using the subject index each of the above publications were reviewed for the purpose of identifying those books which would have applicability to law enforcement labor relations.

Governmental Publications - Considering that the United States Government publishes approximately 35,000-40,000 new titles each year, it was important that we review this source. Two separate mechanisms were used to perform this activity:

- National Technical Information Service
- Monthly Bulletin

Both of the above are computerized data bases which have on-line accessibility. Using the keyword/term approach these data bases were searched for information related to law enforcement labor relations.

Extant Agency Information - For the purpose of this project, and development of the sub-sector chosen for initial testing this area of information is concerned with police labor contracts or, for those agencies not having labor contracts, partial information comparable to that contained in labor contracts. Using the 1975 Uniform Crime Report all cities and counties with 100 or more law enforcement employees were identified. This resulted in a population of six hundred thirty cities or counties being identified for

the purpose of data collection by survey. In addition, all state police agencies were surveyed for similar information.

Legal Information - In the legal area permission from Commerce Clearing House was requested and obtained to reproduce and cite information from their publication entitled Public Employee Bargaining. This information represents the most complete and up-to-date compilation of information dealing generally with public employee bargaining and specifically with law enforcement collective bargaining. This includes state summaries for each state on collective bargaining legislation as well as citations of administrative, statutory and case law.

Numeric Information - In the numeric area several sources were used to obtain that kind of data. In the area of demographic information, this data is represented by approximately 425 variables collected from a variety of sources including:

- United States Census Report
- Employment and Expenditures for the Criminal Justice System
- Uniform Crime Report
- City/County Summary Tape (a summary of 298 variables on all cities of 25,000 and above).

These variables were selected initially because of their face validity relation with the area of labor relations. However, prior to actual collection and entering this data into the data base individuals experienced in the area of

labor relations were requested to verify our initial assumption. In addition, the National Manpower Survey tapes were obtained for the purpose of inclusion in the numeric portion of the data base.

Having identified specific data areas and methods of obtaining the data, the next phase of the project was to determine the appropriate means of organizing this mini data haypile and providing for accessability by the manpower planner. This was the first step toward the actual development of the planning model or system. It was felt that certain criteria, in addition to the technical criteria previously mentioned, must be met. These criteria are as follows:

- based on the most appropriate method of data dissemination
- user compatibility of system hardware and software
- self-sufficiency and cost efficiency when coupled with the complete data base
- reliability

Appropriateness of Method

There are three basic approaches to disseminating the information requried to address the four previously mentioned types of inquiries involving the variety of data exemplified by the sub-sector of labor relations. The most extensively used is the conventional library system, where the patron searches a variety of locating mechanisms (card catalogue, journal indexes, etc) and then finds the material needed.

A second method is to write, or by other means, contact agencies which collect and catalogue information for specific fields of interest, state your problem and have them send you bibliographic listings and other information describing particular pieces of information (in criminal justice the best example is the National Criminal Justice Reference Service). The final method is through computerized information systems.

There have been a variety of approaches to the storing and retrieval of information via computer, however, the two methods most appropriate for our consideration are the pre-determined interactive method and the keyword interactive method. Both of these involve two basic components. A data base which contained information confined by certain topical parameters and a searching system which allows the user to identify and retrieve topically limited or restricted portions of the data base. The predetermined interactive method is a hierarchical interactive system involving the creation of interactive computer posed questions along broad topical headings which subsume increasingly narrower topics. For example, collective bargaining would be a sub-classification of labor relations which in turn might, dependent upon the originator of the hierarchy, be a sub-classification of personnel (it might just as well be a sub-classification of career development given its impact on this area). Users wishing to find information under this system

are required to work their way down through broad, computer posed questions, with the user response to each question hopefully bringing the user closer toward the ultimate goal of specific information accession. Such a system is replete with difficulties, the most critical of which is the necessity to impose upon the user predetermined topical branching options to each question, thereby not allowing the user flexibility in the conceptual organization of their specific problem. In order to make objective initial judgements on the viability of such a system a prototype software system using the above system design was developed and tested. It became readily apparent after some experimentation that this approach would not provide the sophistication required by the users. In essence, it would require the system designer to "pre-guess" all possible combinations of data requirements and formulate these into hierarchical branching questions. Given the changing and evolving nature of manpower planning in general and in criminal justice in particular, such a system would be outdated within a short period of time.

The second approach, the keyword interactive approach eliminates the need for such hierarchical classification. Keyword information systems are not to be confused with data base management systems. The latter is designed primarily to allow for the management of information per se, while the former is designed to allow the user to retrieve

specific areas of information from a larger, non-dynamic, data base. The keyword approach to information retrieval has as its foundation the use of controlled keywords which reflect the essence of a piece of information.

The use of controlled keywords has been a major advancement in information dissemination and retrieval systems and the theoretical construct on which this is based is boolean logic. A boolean system involves the assignment of as many indexing terms (descriptors) to a particular document (journal article, book, governmental publication, etc) as are necessary to adequately describe its contents. Following the assignment of primary descriptors, usually between four and eight, other terms are assigned to the document which are related to those primary indexing descriptors. Such terms are classified as either a broader term (BT), narrower term (NT), or a related term (RT). The planner accessing documents so classified simply specifies those descriptors in which he is interested and, since such systems are computerized, the computer automatically searches for all index terms assigned to every document in the system for those terms. In effect, such a system allows for a multiple classification scheme which reduces substantially the probability of a document being missed by the planner seeking information. At the same time the system allows for far narrower classification than is possible under the strict hierarchical method. Very specific index terms can be assigned to a document that permits

a relatively unique topical area, e.g., psychological testing for screening police applicants, to be searched for.

These systems operate by not only searching index terms assigned to documents, but also search the standard citation formats (author, title, publisher, year of publication) and abstracts of documents. These "fields" can be searched independently or simultaneously. Thus a researcher can designate specific years of publication (e.g., 1975 forward), a particular indexing term (e.g., police psychological testing) and if desired even a qualifying phrase which might appear in an abstract (e.g., "screening of applicants"). The computer will then search all documents in the data base and report only those meeting all three criteria.

The actual input of search terms by the planner in such a system is perhaps one of the most attractive features in that the end user does not have to be aware of sophisticated terminology or process. There are several boolean operators used for this purpose with the most common ones being "and", "or", "not", and "xor". The conventional "and" restricts searches to retrieve only documents containing terms which are coupled by the "and". The conventional operator "or" does not restrict the search in the same sense, rather, it combines into one search term, two or more independent key-words. The conventional "not" excludes documents which contain the term referenced by the "not" operator. The final boolean operator "xor", while not used as much as the above operators,

is a logical possibility which is available. "Xor" requires the presence of either of two terms but not both.

In addition to boolean operators, there are other easily understood and easily used search aids. These are conventionally known as positional operators and are found in such keyword systems. These operators require not only that a term be found in the document(s) being searched, but further specify in what position they are to be found. For example, using the positional operator "same", the user is telling the computer to retrieve only those documents where the search terms are found in the same paragraph. Using the operator "with" specifies that the search terms must be in the same sentence. The final positional operator "adj" abbreviation for adjacent, specifies that the search terms must be immediately adjacent to each other in the order given by the user.

For the past fifteen years, access to large bibliographic data bases through on-line systems has been the recognized dissemination method for the following reasons: there is no time delay in access to the data base information; on-line allows the user to brouse the file; the user's inquiry is efficiently answered with a minimum of system interaction; with modifications on-line access would permit a unique retrieval mechanism for different types of data in a way that cannot be duplicated using printed products or off-line systems; and, on-line is an interactive process which allows

the user to interrogate the file and develop and refine the search profile during the searching session. This type of dynamic interaction left no doubt that the on-line, keyword approach was the most appropriate method of data dissemination and on this basis at least should be considered as the mechanical basis for the planning model.

User Compatibility

Computerized information systems today have made great strides with respect to user compatibility. The necessity of having a trained intermediary to perform searches for the end user is quickly becoming a thing of the past. The person with the planning information question is able, using the keyword system, to formulate an information search strategy based on that agency's conceptual organization of the planning problem area and obtain information which will allow the planner to make a more timely, adequate and informed planning decision.

Since the 1960's on-line systems have become less complex from the standpoint of the user and thus more available to end users in a wide variety of disciplines. The obvious result has been an increased number of end users entering the "searcher" environment. In addition, end user interface programs are being developed to aid end user searchers. For example, on-line catalog projects have been underway since 1978 at two large academic libraries, Dartmouth

College and Rochester Institute of Technology. In both projects, the library patron (end user), not the trained librarian, will interact with a commercial dial-up on-line system via a specially designed user interface. It will be possible for the patron to ask complicated queries of a very sophisticated free-text searching system without any knowledge of so-called boolean logic. Thus, the effectiveness of such end user interfaces is already being tested.

Finally, brief specialized training programs, simplified technical manuals as is the one produced by the Criminal Justice Center, and other user aids have been developed for most systems to aid novice and non-technical end users. These new programs have been the direct result of recent interest by end users in accessing on-line systems.

Evidence that criminal justice agencies are more than capable of employing this system by self-initiated remote terminal access is overwhelming. The era when a computer terminal was foreign to criminal justice personnel has long since passed. Computer terminals are now a common part of the management of police, court, and correctional agencies. The variety of uses of computers in such agencies is as broad as in any organizational complex in the United States.

First, computers are routinely being employed in agencies for operational information retrieval and transmittal. The National Crime Information Center must be accessed by a series of key computer codes. The accessing codes necessary to

retrieve information from the Criminal Justice Manpower Data Bank are less complex than those for accessing NCIC information. In addition to operational use, criminal justice agencies are employing computers for sophisticated management information analysis. A visit to any of the Integrated Criminal Apprehension Program (ICAP) police departments will reveal the use of computer programs involving techniques far more sophisticated than that necessary to access and employ the manpower information data system. ICAP programs employ the generation of data by variable parameters, computation of measures of central tendency, deviations from central tendency, and computer graphics. Only the uninformed would suggest that agencies which can employ a system this sophisticated will be unable to access an information bank by entering keywords.

An indicated above, this project is employing a basic keyword system no different from that of over ninety financially successful data bases currently on-line with the Bibliographic Retrieval Service (BRS), Lockheed Corporation, and Systems Development Corporation (SDC), the three major data base managers. The keyword systems are used daily around the country by thousands of undergraduate students. There is no mystique or complicated programming necessary to understand and use such systems. This is the case with the Criminal Justice Manpower Data Bank.

Self-Sufficiency and Cost Efficiency

One of the most important issues in determining the proper system of data dissemination is whether the system contributes to the ability of the planning model to sustain itself after the anticipated five year developmental period of federal funding. First of all, it was important to note that there are currently over ninety data bases, similar in design to the one we were going to construct for the purpose of manpower planning. The experience of these other data bases was that users are willing to pay for this service which in turn contributes to self-sufficiency. Second, specialized searches are undertaken by such data bases with concomitant fees. In the instance of this planning system we anticipated that initially the greatest demand for such a service would be in the police labor relations area. Negotiating teams would undoubtedly request comparative searches along several demographic dimensions of comparable contract provisions from other comparable jurisdictions. The value of such information, for labor negotiators, relative to the financial stakes involved for both unions and management coupled with the current cost of manually collecting such data made it obvious that jurisdictions and union organizations would be willing to pay substantial fees to support a system which would provide such comparable information to them. While the project staff realized that ultimately this planning system would be much more than merely a police-labor negotiations

information base, it was obvious that from a financial perspective the immediate inclusion of labor contract information would contribute immensely to the ability of the program to become self-sufficient following the cessation of anticipated five years of federal funding for program design, construction and implementation. A third means such systems have used to generate income is the sale of specialized publications. Based on historical precedent we anticipated many such publications eventually emanating from the Criminal Justice Manpower Planning System. Survey documents such as those published by the Police Executive Research Forum regarding police organization, administration and police collective bargaining are examples of the nature of such publications. Publications such as these could be routinely generated by this system. Staff recognized the necessity of not duplicating National Criminal Justice Reference Service publications, but rather to publish materials relevant to manpower decision making which necessitate the inclusion of data from all four kinds of information included in the system.

If each criminal justice agency were required to purchase a terminal and related computer hardware, it would be impractical to consider on-line systems for occasional usage. We know however, that 90-95% of both law enforcement and correctional agencies currently have and use the computer hardware necessary for accessing such a planning system. In addition, numerous studies in the information management

field indicated that the cost of comparable manual information searches on much less complicated topics than criminal justice human resources planning and usage are on the average 5-10 times more expensive than this system would cost.

These sources of income, it was determined, would provide for the revenue necessary for the data base to become self-sufficient following full system implementation. It was anticipated that a level of income would be achieved which would be sufficient to allow the project staff to develop further innovations in information dissemination and manpower planning in the criminal justice human resources development field.

System Reliability

Each of the three major vendors in data base management use the most modern computerized techniques (software and hardware) available. These systems have an "up time" well in excess of 99.5% of scheduled operations. In addition, the reliability of connect lines such as TELENET communications, which will provide the manpower planning direct linkage to the planning system is in excess of 99%. When outages do occur they are typically of less than ten minute duration.

At this point in the project conceptual development it was felt that a sound strategy had been developed upon which to proceed. The basic problems, considerations, and objectives previously discussed had been theoretically addressed,

a general, protean planning system had been tentatively identified, an initial typology for the "data haypile" had been developed and validated against a similar one produced by the University of South Florida project, a sub-sector of this typology had been decided upon for initial system testing, and methods of data collection had been determined. Up to this point, however, the question of a macro or micro emphasis for the model had not yet been formally addressed and decided upon. It was felt that prior to an immense investment of time and effort in data collection and actual model construction that this question must be addressed and resolved.

While the project staff had planned thus far for a model which would encompass both micro and macro planning our contacts with field agencies and state level planning agencies were beginning to provide feedback which suggested that a national planning model, in the sense we had originally conceived, was not a viable approach. This non-empirical indication was further substantiated by the preliminary reports (and supported in the final report) from the Michigan State University project. Based on these reports and on this project staff's areas of involvement it was becoming increasingly clear that to the SHSU project staff that a new definition of a National Manpower Planning Model was evolving. While each of the basic considerations which influenced the initial direction of thought toward a national

model continued to be viable considerations, the new information indicated that localized planning needs, interest, and limitations resulted in a lack of sameness of direction and a dissimilarity rather than similarity of specific topical interest and need. Specifically the differences in jurisdictional/agency consitutencies, diverse agency objectives related to situational aspects of each jurisdiction, diverse agency capability in using a national planning model, and diverse environmental/situational constraints such as political and budgetary constraints all pointed towards the lack of utility of a national planning model which was unidimensional in that it was perceived as a singular model which could serve as a planning overlay appropriate for and giving direction to all criminal justice human resource development and utilitation.

Given this lack of unidimensionality, the complexity of the criminal justice system itself, the multiplicity of levels and the numerous external sources of influence, it was felt that the idea of a "planning model" had no simple functional analog. The idea of a planning model had to be something more than a paper chart which would obstensively allow planning. From this assumption came the corollary that any planning model could not provide specific answers, but should provide a communication network, such as we had conceptually devised, which linked the planner to information rich in variety and utility.

This evolutionary development of just what a planning model might ultimately be had been for the most part anticipated, however, and as indicated in the general program objective, it was recognized that we must prepare a planning model which was extremely flexible. It must allow all levels of manpower planners the capability of conceptually organizing manpower planning information in a way that would meet the indigenous needs of that particular agency planner. In order to give this localized planning process greater conceptual clarity, for the purpose of insuring model viability, it was felt that the logic associated with informational use capability and methodology of the local planner should be investigated. If we were going to develop a planning system which would meet the needs of a localized planning environment it would be critical to have a conceptual view of the possible levels of information usage vis-a-vis the local planner and decision maker. Being aware that in untold numbers of agencies there are employees who are cast by choice or chance into the role of manpower planner/decision maker it was important for us to get a "theoretical handle" on how those decision makers operate.

It would appear that there are three basic levels of decision maker; the unadvised decision maker, the advised serendipitous decision maker and the advised intentional decision maker. Unadvised decision making involves decision making done without due consideration of additional and new

relevant information. This level reflects the absence of information expansion. Advised serendipitous decision making is decision making done with consideration of relevant information which is not sought but is incidentially happened upon and put to use. This level reflects serendipitous information expansion and use. The final level, advised intentional decision making, is decision making done with consideration of relevant information which is intentionally sought out. This level reflects intentional information expansion.

It is not enough however, to know that decision makers, many of whom are either formally designated or informally cast as manpower planners, use or don't use appropriate information for human resource planning. Of equal or greater importance, for our purposes, is knowing why they operate at the level they do. It would seem that the level of decision maker is dependent on at least the following factors. The first of these is the individual motivation of the decision maker. One outstanding characteristic of most employees in criminal justice agencies, at the decision making level, is their intense commitment to their field of work. It is often only when perceived overwhelming hinderences, such as poor, inadequate or unavailable equipment, lack of training, general resources, are in evidence that employees' motivation begins to diminish. When management can remove these hinderences, coupled with the natural propensity of the employee for the occupation, motivation increases. Another

consideration regarding motivation is, as human resource planning is perceived as and becomes more important in criminal justice agencies, the planners perception of what is a good decision or a poor decision will become more critical and qualitative, thereby leading to increased motivation towards quality in decision making. Another aspect is the historical satisfactions or dissatisfactions of information expansion and the role these play in the employees motivation to perform at a higher level.

A second critical factor, in determining on which level the manpower planner operates with respect to information expansion and use, is time. Oftentimes, decisions made in criminal justice agencies, the problem genesis may be beyond their agency or sub-section of the agency. A "do what you can" attitude may result in the perception that little can be done given the time constraints.

A third factor coming to bear on the determination of the level of decision making and information usage is the perceived cost effectiveness of the information expansion. The tremendous cost of information collection, particularly by manual collection, library or conventional research methods, extant agency research (mailed questionnaires) and legal research may result in a perception that the information obtained via these avenues is not worth the time, effort and cost involved.

A final consideration in determining the level of decision making is the knowledge of the manpower planner/decision maker

of the need to expand the information upon which decisions are made and the knowledge of how to expand this information. With respect to the first concern, there is little doubt in the minds of students of and practitioners in criminal justice that the "system" of criminal justice is an open system. This is especially true for human resource development and utilization in criminal justice. If the manpower planner is making decisions in these areas is only aware of and concerned with internal factors, as opposed to factors both internal and external to the organization, he/she is much less likely to be aware of and prepared to deal with areas outside the organization which will have considerable impact upon human resource development and utilization. The second point, knowledge of how to expand information usage, is as critical. The open system requires consideration of the interplay between all forces, both internal and external to the organization. If the planner lacks knowledge of how to determine the external/internal forces and does not know how to obtain related appropriate decisional information, this will have critical and negative impact on decision and planning outcomes.

It was apparent that with perhaps one exception the system we had conceptually developed would address those areas which have impact upon the level of information usage and expansion of the decision maker. With respect to motivation it was obvious that the impediments which could be

removed or at least mitigated by this system were those hinderences associated with two areas; the lack of utilitarian means by which the planner could obtain information upon which decisions could be made and expansion of awareness on the part of the planner of what a good decision involves. With respect to timeliness, the system would more than meet the demands for identifying critical areas of information in a brief period of time thereby providing the capability of fast and informed decision making. It was also obvious that the cost/effectiveness would satisfy the financial constraints and limitations of all but a few agencies.

The area, however, which had not yet been addressed in the system conceptualization was how to assist the decision maker/planner in expanding qualitatively related areas of information. It had been recognized that linkage of qualitative areas of information which would assure appropriate consideration of those factors/areas external to the immediate concern of the planner, but nevertheless factors/areas which may either have bearing upon or be effected by decisions made for a specific problem area, must be identified. While the development of these linkages would be a difficult and on-going task, it was felt to be critical that these be developed and become an integral part of the information and planning data base. The more immediate question, however was could the system, as currently conceived, provide access to this information in such a way that optimal guidance would

be provided to the planner in the process of qualitative information expansion. In our previous reviews of on-line information systems the capability of thesaurus display had been noted. As previously mentioned this capability allows the user to identify a single word or term and then request the system to display broader terms, narrower terms, related terms and "see also" terms. Using this term expansion capability it would be possible for the decision maker/planner to identify those qualitative areas which would have interplay, an intercomponent effect upon or be affected by the specific planning area under study. This capability would insure that the planner operated at an open system level by informing him/her of those other variables/factors which would be considered when engaged in planning and decision making for any one specific area.

With the recognition that this capability, with minor modifications, was currently available in the system as it was conceptualized to this point, the final major obstacle was resolved and it was realized that the project could begin to collect data and develop the mechanics of the system. The actual development of a system required to provide national information accessibility was a two-step process. The first step was to develop the system specifications and documentation for a formal request for proposal. The second step was to identify the vendor who could provide the disseminating capability and if necessary develop new software capabilities

required by the system and reflected in the request for proposal. With the assistance of consultant services the request for proposal was developed. This document included requirements for the provision of all of the standard data input, accession and display formatting capabilities and in addition required the ability to provide for linkage of numeric and literal information in such a way that statistical comparisons of various jurisdictions might be accomplished. In addition, code books and code forms were developed for purposes of data input via electronic means.

Three major data base vendors were then identified, Bibliographic Retrieval Services, Lockheed and Systems Development Corporation. These vendors' programs include both the standardized software packages for entering and retrieval of data as well as centralized computer storage facilities which were accessible by remote terminal via telephonic linkage. The request for proposal was sent to these vendors and after review of the bids the decision was made to award the contract to Bibliographic Retrieval Services. Bibliographic Retrieval Services provided the standard services of keyword access to literal documents, the development of specialized software for the dissemination of demographic and other numeric information, specialized recall and formatting of matched portions of the data base and statistical manipulation of other selected numeric variables.

Concurrent with the development of the request for proposal and vendor selection, data collection had begun. Using

previously indicated methods of data collection both numeric, conventional bibliographic, legal and extant agency data was collected. The results of this effort culminated in the identification of 3,317 conventional bibliographic documents, including books, journal articles and governmental publications, all having as a common factor their relationship to law enforcement labor relations specifically or criminal justice human resource concerns generally. In the legal area case, statutory and administrative law references were identified for all fifty states and in addition brief state summaries of the legal status of collective bargaining were prepared for each state. In the extant agency information area survey's were mailed to 677 law enforcement agencies at the municipal, county and state level requesting copies of collective bargaining agreements and memorandum of agreement or if not under a collective bargaining agreement, numeric information which would be comparable in scope to that information contained in labor agreements. This survey resulted in a response rate of 78 percent including 328 agencies with collective bargaining agreements and 200 agencies without collective bargaining agreements. In the numeric area data was collected from the Bureau of Census (171 variables), city/county summary tape (298 variables for 4,431 jurisdictions) and employment and expenditure data (12 variables for 628 jurisdictions).

The National Manpower Survey tapes were also obtained by project personnel along with written documentation. The

tapes contained a considerable amount of information on various components of the criminal justice system (municipal police, county sheriffs, prosecutors, etc), however it was discovered, due to inadequate documentation that the data was not useful for our purposes.

As the various information was obtained, the relevant information was taken from each source, coded, abstracted and indexed when appropriate, in a format consistent with the requirement of Bibliographic Retrieval Services system. The data was then electronically transferred to the local Dec-20 system by in-house terminals, transferred to magnetic tape and routed to Bibliographic Retrieval Services for loading on their system.

Testing and Evaluation

The testing and evaluation of the system was a two-stage process. The first stage involved project staff testing in-house and the development of a user's manual. The second phase involved bringing in individuals from law enforcement agencies across the nation, both operational and nonoperational, to provide out-of-house testing and evaluation of the system.

In-house testing involved going through a series of "canned" planning problems in the topical area which the initial data base addressed, law enforcement labor relations. These problems required data from each section of the data

base; specifically, retrieval of demographic information, specialized recall of matched (comparative) portions of the data base, and retrieval of literal documents via the standard keyword access. In addition, using novices to the system, we were able to determine preliminarily the viability of the users manual by giving these novices no instructions on system use other than the user's manual and the presenting then with planning problems to be solved.

The second phase of system testing involved individuals from law enforcement agencies, municipal, county, and state, from across the nation. The purpose of this testing/evaluation was to provide project staff with formal evaluation and feedback on the user's manual, data base, and system mechanics. This evaluation process included both subjective and objective components. Information was solicited by evaluation questionnaires to be used for the purposes of determining how well the system met the users' needs and to ascertain any changes which might need to be made in either the system or user's manual in future phases of the project.

With respect to the user's manual both the instructions included in the manual and the organizational flow of the manual were perceived as appropriate with little modification required. The instructions for the use of the basic system commands were generally felt to be very clear by the respondents, however the "print-off" command will require additional examples in order to achieve peak clarity. The respondents indicated

that the manual needed a general index for quick reference purposes and several additional terms were identified which should be included in the glossary. The evaluators also indicated that the manual required no previous experience with computers in order to be understandable, especially if the error messages given by the system were clarified.

The data base contents, both current (law enforcement labor relations) and projected (reflected in the headings and sub-headings of the taxonomy) were given consistently high responses by the evaluators. In addition several other sub-levels for inclusion in the taxonomy were identified and noted as appropriate and functional additions (i.e., consumer price index). It was clearly indicated by the responses in this portion of the evaluation that with few exceptions, the taxonomy developed to originally guide data identification, both accurately and adequately reflected the major informational areas of human resource development and utilization in criminal justice planning.

The responses to the system mechanics section of the evaluation also indicated strong agreement with and support for the system as it was manifested. Specifically it was indicated that the necessary hardware for system operation is currently available in all but a few agencies, individuals in criminal justice are not a naive population concerning usage of computers, the complexity of manpower planning in criminal justice does not contraindicate the use of computer

application, agencies will use the system, revenue is available to purchase the services of the system, and with minor modifications the output format is appropriate.

With few exceptions, and these were relatively minor, the system as a whole received overwhelming and enthusiastic support. In addition the previously held assumptions of ease of system use, appropriateness of method, receptivity of user population, availability of hardware and time/cost-efficiency were verified.

The product of the first phase of the project culminated in the development of a planning system which both addresses and encompasses the first two primary components mentioned above. The sub-sector of law enforcement labor relations has been developed upon which relevant information can be brought to bear and which allows the local planner to organize the information search and retrieval along a locally conceptualized organization of what the specific planning problem entails. During the on-going developmental stages of the project the information required to address each of the other sub-sectors outlined in the typology of informational needs, crossed with the major areas of law enforcement, courts, and corrections continued to be identified and other critical areas contined to be addressed.

Specifically, the second phase of the project involved broadening the planning data base into all functional areas; continued evaluation of usage potential; exploration of

financial independence; and the identification of the inter-component effects and linkups inherent in the human resource planning process. The companion research project at Michigan State University provided significant input into the second phase development with their contextual findings on the current status of criminal justice manpower planning activities. The Michigan State University project noted that current planning activities in the field was crisis oriented, reactive and uncoordinated and highly situationally variable. Similarly the companion project at the University of South Florida noted a need for increased efforts and upgraded sophistication in the use of human resources planning, development, and utilization methods. These findings provided the impetus for further development of the projected system during Phase II of the project.

In order to insure the broadest possible decisional base for involvement in each of the major areas, an advisory committee was constituted with members drawn from across the criminal justice spectrum of law enforcement, courts, corrections and criminal justice academics. Representatives of each of these areas, carefully selected for their extensive knowledge, experience and expertise, met with the staff of the project to discuss needs, goals and specific tactics to successfully accomplish Phase II. The Advisory Committee was thoroughly briefed on project accomplishments to date, philosophy of operations and future commitments and goals.

A major portion of the committee's time was concerned with the identification of data needs, data sources, and data collection techniques during the completion of the project.

Discussions centered on the progress of the project to date, the goals and objectives of the project and general discussions concerning the future of the project. Generally, committee members were pleased with the depth and scope of the system to date and agreed with the planned additional material areas intended for inclusion.

The discussion of the need and the potential value of the system to criminal justice planners and other users was most useful. The need was acknowledged without question. The potential of the system was seen as nearly unlimited. The use of the completed system would result in great savings to be made in both time and personnel resources.

Research will be greatly enhanced and exchange of data simplified by the system. All members of the Committee were concerned that the entire computerized system could not be completed before the termination of grant funds. The Committee felt, however, that the efforts to date would greatly enhance the development of the system intercomponents model and felt that the model would be extremely valuable for the criminal justice personnel planner. One member of the Committee noted that the intercomponent model alone would be worth the time and resources expended on the entire project. The necessity of using the computerized system to

validate the intuitive linkages in the model was stressed.

Overall, the Advisory Committee meeting provided both encouragement and guidance to the project staff. The committee agreed with the need and urged continuation of the project to ultimate completion of the system.

With respect to financial independence several actions were taken. Based upon previous project staff involvement in the literature review and field agency contact and input from the advisory committee, various methods of moving toward financial independence were investigated. The staff recognized that costs would require careful investigation and reduction wherever possible. A major cost factor in operating a data base system is mainframe computer costs. A detailed study was conducted to determine the feasibility and costs of replacing the contractual agreement with the data base management firm (Bibliographic Retrieval Services-BRS) with microprocessor.

One of the major costs of maintaining and operating a data system is the contractor charge for file loading, data storage, system updates, file updates and basic connect charges. These costs are inherent in any system using a contractor and represent a significant portion of the overall funds necessary to operate a system such as the one under discussion. The recent development and rapid technological advancements made in the area of microcomputers offers an attractive alternative to contracted computer

service. A comprehensive study was conducted of currently available hardware and software suitable for a data base similar to ours. The complete report of this study is in Appendix A to this volume. The report concludes that the major functions of the contractor (BRS) system could be carried out by using the Alpha Micro AM-1051 computer and the STAR™ Data Base Management System built by Cuadra Associates. This hardware-software configuration could be purchased outright for approximately $50,000. As described in Appendix A, this configuration would provide all of the basic services provided by BRS except that of statistical manipulation of data at the detail of SPSS and SCSS. However, less complex statistical routines are readily available for the microcomputers studied.

The problem of interface of data base management systems and sophisticated computer statistical packages, such as SPSS and SCSS, is not unique to this project. Increasingly, data are being maintained in files under the exclusive jurisdiction of data base management systems (DBRS) and, as a result, data are becoming increasingly difficult to the researcher to access for statistical manipulation purposes. The optimum solution to the problem of performing statistical analysis of data in an organized data base would be the existence of an integrated facility. Either the data base management system and its attendant inquiry facility could be given statistical analysis capabilities,

or an existing statistical analysis facility such as SCSS or SPSS could be modified to use the data base management system as its "access method". Either approach would, of course, be specific to the data base management systems, would be costly, and would require a large degree of the resident program core.

A less costly solution to the problem involves an extension to either the data base management system or the statistical system so that there is a mechanism for transferring data from one to the other. Either the DBRS can be modified to create a file acceptable to the statistical system or the statistical system can be modified to read and reformat data extracted from the data base. Still a less costly solution is to develop and integrate a statistical routine into the DBRS, limiting the scope and depth of the statistics to the specific needs of the system user and within fiscal restraints.

Another area of major cost concern was the cost efficiency of ongoing data input by which documents, particularly those bibliographic in nature, were entered into the data base. Prior efforts in this area involved the conventional technique of using data encoders and transcribers to enter data manually, via computer keyboard terminals, into computer disc storage. The data stored on disc was then transferred to magnetic tape, undergoing a translation routine to match computer modes, before being

shipped via mail to the data base management firm for data base loading. This process was expensive, time consuming and subject to translation and transcription errors. A possible alternative was offered by a recent innovation in data entry--optical character recognition--developed by Kurzweil, Inc.

In order to evaluate the cost benefits of optical character recognition data entry, a test was conducted by Kurzweil, Inc. under the direction of Mr. Art Derfall. The cost of manual entry through cathode-ray tube (CRT) terminals is extremely high for literal data such as that in labor contracts. Kurzweil developed an optical character recognition device with the enhancement of individualized character recognition patterning. This process permits the Kurzweil software package to mathematically approximate the shape of each character presented in a given text. Through successive verifications by a human operator, the machine gradually increases its accuracy of approximations. Once the device has recorded its approximation set, no further training is required.

A number of contracts were forwarded to Kurzweil along with the necessary technical tape output specifications for a test of the device. The Kurzweil device was able to throughput the literal material at an average rate of 50,000 characters an hour. However, the read error rate was nearly six percent and the number of dropped or missed characters

was excessive. Kurzweil pointed out the necessity for second generation copies, that is copies made directly from the original, in order to enhance the throughput rate and to reduce errors and omissions.

While the Kurzweil device is capable of handling large volumes of literal data, the need for manual editing, manual tagging and formatting and the requirement for second generation copies greatly reduces the benefits of the rapid processing. However, as Kurzweil refines the capabilities of the reader, it is very likely that the device would prove cost effective for large volume literal data entry.

Still another area of cost analysis dealt with the most cost efficient means of linking the potential users with the data base. The conventional techniques of using time shared data transmission lines is the most commonly used means by current consumers of similar data base systems. However, it was felt that criminal justice agencies, often having existing communications linkages across the nature dedicated specifically for criminal justice utilization might be more receptive to and less costly to use than existing systems. Such a communications network is the National Law Enforcement Telecommunications Systems, Inc. network.

The National Law Enforcement Telecommunications Systems, Inc. (NLETS) is a computer controlled message switching network linking local, state, and federal agencies

together for the purpose of information exchange. This exchange is facilitated by a complex network of dedicated telecommunications circuits, concentrators, multiplexors, and state level interfaced computers with their individual intrastate networks. The NLETS network has a single function: store-and-forward message switching. Through dedicated circuits to its user agencies, it provides the facilities to allow law enforcement and criminal justice users to exchange information across state lines.

In exploring the potential adaptability of NLETS for our purposes it was determined that the existing NLETS hardware would not accomodate the interactive modes used in the manpower system. Since NLETS operates on a store-and-transmit system over a limited number of lines, direct computer-to-computer or computer-to-terminal interactive exchanges would not be feasible. NLETS protocols 8A1 for low (150 baud), or medium (1200 baud) speed and bi-synchronous for high (2400 baud) speed are, however, suitable for interface. Thus, while the suggested use of NLETS telecommunications lines for users of the manpower system is not technically possible at this time, it is a feasible alternative that could be implemented if some basic changes were made in the NLETS system.

Project staff also investigated the state-of-the-art in other data processing technological areas in order to evaluate best possible mixes of processing equipment. One

developing technology is in video players and videodisks. Videodisks are inexpensive plastic disks where video signals are recorded, stored and retrieved. The process involves storing video data in binary-coded formats. Videodisks will permit relatively inexpensive storage and retrieval of printed documents and any type of digital computer information. As many as 10-20,000 documents may be stored on one disk.

Word processing systems are being developed throughout the industry. There are currently more than 250 models available from over 50 major manufacturers. Four major classes of word processors are currently available ranging from the "electronic typewriter" to sophisticated time-sharing systems utilizing multiple work stations. Word processing equipment is likely to become standard office equipment in the near future. Depending on the type and upon future technology, interface between word processors and data base systems may be practical, thus reducing overall equipment costs.

Another means of reducing cost to the primary users of the system is through producing documents based upon information contained in the planning system which would represent state-of-the-art reports for specific planning problem areas and/or bibliographies reflecting the current state-of-the-art literature for certain planning problem areas. This method of income generation has always been an

integral part of the conceptualization of the planning system. Several test publications were produced, featuring findings from extant agency data surveys, and forwarded to potential users of the system for evaluation. Response was unanimously favorable indicating a high degree of interest in such publications if the system were continued to completion.

In addition, formal presentations and request for feedback on the problems of financial areas were made at both formal academic and professional meetings as well as at meetings with specific criminal justice agencies. General consensus was that financial independence of the planning system was feasible after the completion of the system development phase. The costs of system development, and the evolving nature of development, lead to an impasse in attempting financial independence. That is, until the expensive development phases are completed, major sources of income are not available, while costs are at their highest levels.

The tasks of broadening the planning data base into all functional areas were begun during the second phase. Project staff members identified significant bibliographic data through a publishing selective notification program and by continuing review of professional journals and publications. The microfiche index of the National Criminal Justice Reference Service (NCJRS) was procured and reviewed for selective acquisition for input into the system.

Several doctoral dissertations were completed utilizing data from this project. These dissertations, encompassing the areas of Police Unionization, Grievance Procedures, Corrections Officer Unionization and Law Enforcement Selection Procedures and Techniques are included in Volumes III-VI of this report. These studies add significantly to the overall body of knowledge in the area of human resources.

During the life of this project, considerable effort was given to the conceptual development of the planning model. Based on literature review, input from appropriate consultants, consultation with Michigan State University, University of South Florida, the Office of Criminal Justice Education and Training, and involvement of operational and non-operational criminal justice agencies, a model should be evolved. Ultimately it was recognized that no "one" model could address the diverse planning needs of those agencies representing criminal justice concerns. Given the dynamic nature and growth of the entire field of criminal justice, it was recognized that three primary components must be addressed in any planning system. First, information is the basis of any planning decision and as a result planning decisions can not be better than the information that is brought to bear upon them. It is critical therefore, that any planning system have as its basis the availability of relevant information. The second component which must be addressed in any planning system is information dissemination.

This does not merely involve the dissemination of the information but rather involves a system of dissemination which allows the planner to conceptually organize and retrieve relevant information in a way which assures that the specific indigenous concern of that planner, in that agency, serve as the primary focus and guidance for what information is retrieved. The third focus of any planning system is to insure that the planner operates from the perspective of an open system. Only by serving in this manner can the planner be made aware of what previous planning efforts have accomplished or how they have failed and what factors, external to the immediate sub-sector engaged in the planning decision, should be considered.

The Criminal Justice Center at Sam Houston State University, under this LEAA funded project, has begun development of a computerized human resouces/information-planning system that is designed to give agencies immediate access to information needed for human resource development and utilization in criminal justice. In concert with the projects at Michigan State University and the University of South Florida, it is anticipated that new areas of critical information will be identified as well as methods by which this information should be utilized in a planning sense. The flexibility of the system developed at Sam Houston State University could with ease accomodate and be receptive to both new information and methods of dissemination when

fully completed. This project represents the first effort to develop a data base designed specifically for use by operational agencies. This system is not limited in its use and accessibility as is a shelf product but rather has resulted in a system which has potential as an ongoing utility as the field of criminal justice continues to evolve and develop.

The extensive task of developing a refined conceptualization of the complex field of criminal justice manpower which illustrates the interactions and relationships between various elements was a primary area in the second phase. The results of that preliminary task is provided in Volume II of this report.

APPENDIX A

SYSTEM SUPPORT HARDWARE/SOFTWARE ANALYSIS

SYSTEM SUPPORT HARDWARE/SOFTWARE ANALYSIS

I. - EXECUTIVE SUMMARY

The following report responds to a request for evaluation of necessary system products which would permit the eventual independence of the Manpower Planning Project data bank from its current supplier, Bibliographic Retrieval Services.

It is understood by the consultant that the systems proposed should permit the types of functions currently provided within the BRS framework, but at a vastly reduced cost. The consultant is fully cognizant in this report of the tension between technological performance and cost requirements for the Manpower Planning Project should it be continued under other public funding sources.

It is the primary conclusion of this study that the major functions of the BRS system can be carried out by using the hardware and software products evaluated in this report for less than $50,000. This study, however, is not restricted to stand alone hardware-software configurations, but also deals with

software products which would be compatible with the current university system. Consequently, this study discusses both independent hardware which would permit Manpower Planning Data Bank Services to be provided independently of any supporting public sector structure, and software which would permit the functions of the project to be carried out locally on the current Sam Houston State University DEC-20 system.

The statistical manipulations of data required by the project are readily available on all of the systems reviewed. However, it should be noted here that such products as SPSS and others cannot be obtained within the hardware price scope of microcomputer systems required in this study. This is due, not to the unavailability of statistical packages, but rather to their predominate use only on minicomputer systems costing several hundred thousand dollars or more. SPSS for example, runs well on the Hewlett Packard 3000. Consequently the HP-3000 is evaluated in conjunction with MINISIS a system developed in Canada which could possibly be of use to the Manpower Planning Project should complete installation independence be necessary.

The data base management software reviewed in this study is almost all new to the data processing industry. Indeed, the oldest of these products is less than 9 months old.

Finally, it is recognized by the consultant that additional funding from the federal government will probably not be available for this project. However, the consultant is ready to provide additional services to the Manpower Planning Project in event that such funding is terminated before the successful delivery of these services to the general criminal justice community.

II. HARDWARE SURVEY

This chapter evaluates five major commercial systems from five major viewpoints: 1) hardware, 2) configuration, 3) software, 4) vendor support, 5) price and other business factors. Hardware comparisons which involve the use of new technology are always difficult since descriptions of products by different manufacturers tend to stress elements which are unique to a system rather than those elements which are common among others.

Owner's manuals were obtained for all of the systems in this report. From these manuals, information necessary to complete the grid in Section III for each of these manufacturer's models was derived. Grid information was then verified directly with the manufacturer or with a reputable dealer of the manufacturer's equipment.

None of these microcomputer systems will do everything that the Justice Center could possibly wish it to do. However, these devices will fit most of the requirements of the Project for general purpose computing power under $50,000 capable of performing complex, though usually single purpose tasks.

Although a separate section describes each of the reviewed systems, a general section explaning the evaluative criteria of the grid analysis is helpful for most readers. Therefore, the next section introduces the criteria used in this evaluation and the relative fit of various systems to the five major evaluation areas of the grids in Section III.

A. HARDWARE

1. Processor
   1. CPU Type
   2. Instruction Set
2. Memory
   1. ROM
      a. Operating System
      b. Languages
      c. Applications
   2. RAM
      a. Initial or Standard
      b. Increments
      c. Maximum
3. Peripheral Devices
   1. Bus Type
   2. Number and Type of Ports
      a. RS 232 C
      b. Other
   3. Video Display
      a. Colors
      b. Screen Size
      c. Matrix Size
      d. Upper & Lower Case Characters
      e. Graphics
      f. Display Modes
4. Keyboards
   a. Supported Character Set
   b. Function Keys
   c. Numeric Adding Pad
5. Printer
   a. Speed
   b. Impact Method
   c. Print Controls
   d. Ribbon Replacement Method
   e. Adjustable Print
   f. Serial or Parallel Interface
6. Floppy Dics
   a. Size
   b. Storage
   c. Maximum Number Possible
   d. Data Transfer Rate

A. HARDWARE (CONT'D)

7. Hard Disc
   a. Size
   b. Model
   c. Maximum Number Possible
   d. Data Transfer Rate

Microcomputer hardware is broken down into several sections: processor types, memory, and peripheral devices. The section on peripheral devices, or components which may be attached to the system bus board, is the lengthiest since there are so many configuration options. A consideration of each hardware component group follows in reference to the criteria above.

First, the main processor board or CPU type together with its instruction set size is noted as an indicator of processor speed. Next, memory for microcomputer systems which may come in either ROM, PROM or RAM categories is stated, together with the software functions such memories may support. For example, some systems put their entire operating system and programming languages in ROM cartidges or "ROM packs". RAM memory used for internal storage of data and instructions comes in a wide variety of

initial, incremental and maximum configurations ranging from 64K initial and 1000K maximum for the Alpha Micro (at which point in its maximum size the Alpha Micro is much like a rather large minicomputer) to the minimal 16K bytes available initially with the TRS-80.

Other hardware which may be connected to the bus boards of a microcomputer, or "peripheral" devices are described. The method of interconnection for example between hardware components such as a disk, cassettte tape or printer and the bus and CPU of the microcomputer system are noted closely for compatibility with the two most common bus types available in the industry; the IEEE-488 and the S-100. Both the number and types of ports are listed because such factors determine (in most cases) the final number of peripheral devices which may be added to any system.

The presence of RS-232C standard ports is very important because this connection standard simplifies interfacing of non-manufacturer originated equipment. Ports transmit data from peripheral devices to the bus through either serial or parallel

circuits. If serial circuits are used then only serial peripherals may be attached. If parallel circuits are used only parallel peripherals may be attached unless a serial/parallel interface board may be purchased for the system.

Video display devices available range widely in capacity and characteristics throughout all five systems. The Alpha Micro, for example, allows the interconnection of upwards of a half dozen different types of CRT terminals, whereas the TRS-80 is available with only one.

Keyboards are not always directly attached to the microcomputer terminal, but may also be attached through the general bus interface board. Some systems provide "function keys" or undefined keys which can be programmed to execute specific functions, such as running a check digit calculation, or underlining text on command. A numeric adding pad is useful in the event that large amounts of numeric data must be entered, but is not available on all systems (e.g. TRS-80). Printers and their capabilities varied widely in this study and only the most reliable ones offered with each system are described. Most

printers will cost $1000 to $2500 or more depending on the print quality required. Higher quality "lettertype" printers are the most expensive.

Other peripherals listed in this report are floppy disks and hard disks.

B. CONFIGURATION

A. Cabinet Size
   1. Width
   2. Depth
   3. Height
   4. Weight

B. Integrated Keyboard

C. Integrated Diskette

D. Integrated CRT

E. Integrated Memories or Languages

F. Packaging Description

The configuration section of the grid in Section III provides a physical description of each system by general appearance, size and whether or not any peripherals have been integrated into its basic housing. Some systems like the DEC VT-103 for example, are constructed so that cassettes may be inserted in slots at the base or side of a desk top terminal. Other systems such as the Cromemco Z-2D or TRS-80 also have options for integrated diskette drives.

"Office style" desk packaging is available for all of these systems as a normal part of the product line. Finally, the Alpha Micro AM-1051 is much larger physically than the other systems and is available only as an expanded office style package.

C. SOFTWARE

A. Operating Systems
   1. Firmware Components
      a. Auto-start only
      b. Other
   2. Support Functions
      a. Disc Operations
      b. Program Monitoring
      c. Library Maintenance
      d. Interrupt Processing
      e. Direct Memory Access (DMA)
      f. Multi-tasking
      g. Memory Protect
      h. Re-entrant Coding
      i. Error Recovery
      j. Text Editor

B. Higher Level Languages
   1. BASIC
   2. PASCAL
   3. COBOL
   4. FORTRAN

C. Applications Programs & Price

D. Data Communications Software

E. Data Base Management System

Software for the five systems reviewed here may consist of a variety of firmware and software components. For example, a typical firmware component found in today's microcomputers is a ROM based "auto start" feature so that a user need only press a

button on the keyboard in order to begin operating the system. (Older "booting" or starting procedures for microcomputers involve significant user activity for the memory maping of various peripherals.)

The operating system of a microcomputer is another important evaluation factor. A good operating system must support many functions in order for applications software to run properly. In disk operation, for example, the operating system must actually calculate the position of the "read" head on the surface of the disk itself.

Program monitoring, another function of the operating system, refers to the use of the operating system to cancel a program if errors are encountered either in the program logic or in the data used by the program. Library maintenance refers to the ability of the system to record user files stored on tape or disk and provide a display for the user of the number of files maintained and the percentage of diskette, cassette, or hard disk available to record additional information. Interrupt processing signifies the ability of the system to perform a

different task after being "interrupted" from another task. (Interrupt processing is somewhat like the ability of a very busy mother to care for the needs of two or three children while attempting to make dinner. Computers, just like people in such circumstances, often forget what it was they initially set out to do before they were interrupted.) Direct memory access (DMA) refers to the ability of the operating system to support transfer of blocks of information from main memory itself without "interrupting" or using the CPU. Multi-tasking refers to the ability of the operating system to run several jobs at once. However, it should be noted that unless the system also performs interrupt processing and offers memory protection, multi-tasking is not truely available. "Memory protect" is a feature which allows the system to avoid destroying memory areas reserved for previous tasks by recording over the area after additional interrupt sequences. "Re-entrant coding" refers to the ability of the operating system to record which part of a program it is currently running and provide that same program section or "page" for any other user requiring it

simultaneously. Error recovery references the ability of some operating systems to detect hardware failures and errors and reset the hardware without human intervention. Text editors, available with most operating systems, may be used to construct programs in various languages, and edit data to be used by programs.

A wide variety of higher level languages are available for the systems reviewed. However, by far the most common one is BASIC, provided either as a sub set of Darthmouth College BASIC or as super set of BASIC, which usually combine many of the more useful aspects of COBOL. PASCAL is an increasingly popular language among microcomputer users and is increasingly available. COBOL and FORTRAN are available only on about half of the systems reviewed.

The presence or availability of data communications links for a microcomputer is important because it determines whether or not your system will ever be able to leave its environment and communicate through telephone lines to other sources of data

and programs. A few of these systems now include extensive data communications abilities ranging from an eight system linkage by Alpha Micro designed to provide electronic mail, to the simple communications interface boards available for systems such as the TRS-80. The availability of data base management software for a system is important because such software usually simplifies the process of software development. However, the buyer should be prepared to test any data base management system personally before purchasing it, since microcomputer manufacturers sometimes represent simple file or library maintenance capacity as true data base management capacity.

D. VENDOR SUPPORT

A. Documentation
   1. Accuracy
   2. Clarity
   3. Comprehensiveness

B. Factory Warranty

C. Service Availability

The area of vendor support is fairly straightforward. Documentation was evaluated on the basis of three points:

accuracy, clarity and comprehensiveness. Some documentation for these systems was extremely good while others were complex and difficult to follow.

Regarding service, all equipment reviewed has a 90 day parts and labor warranty. However, the means by which service is available either from the dealer or by customer payment of freight costs to ship the microcomputer to the dealer and back. Some manufacturers also make available an annual contract general extension of the parts and labor warranty beyond the initial 90 day period.

E. PRICE AND OTHER BUSINESS FACTORS

A. List Price for Basic Configuration

B. Lease Purchase Option
   1. Manufacturer Lease
   2. Third Party Lease

C. Maintenance Fees

D. Number of Years in Operation

E. Gross Sales or Number of Systems Installed

F. Total Number of Service Centers or Service Method

To a degree price and business related factors indicate

whether or not a company will be able to maintain its market position. It must be remembered carefully that this industry is still in its infancy, and therefore new companies may still arise and established firms still fail. However, the companies currently in this field with a strong growth sales background are much more likely to offer increasingly sophisticated levels of both hardware and software.

One option which should never be overlooked by a potential buyer is the possibility of leasing, rather than purchasing, equipment. Generally, two types of leasing programs are available. First, the manufacturer may directly rent the equipment to the user at a monthly rate. In this instance the manufacturer retains ownership of the equipment but usually provides maintenance without additional charges.

A second type of leasing program available is third party leasing. In this arrangement, the manufacturer sells his equipment to a financial institution which then retains ownership of the equipment until the total sum of the purchasers' payments equals the original purchase price plus interest.

The length or "life" of both types of leases is usually three to five years. Availability of a lease option is another indicator of the general quality of the equipment and financial stability of the manufacturer. If a lease plan is available, it is certain that either the manufacturer or a financial institution is reasonably convinced that the equipment and company will last for the "life" of the lease.

F. MANUFACTURER EQUIPMENT REVIEWS

The following sections review five major microcomputers generally available throughout North America.

1. The Alpha Micro AM-1051

The Alpha Micro AM-1051 business system is truly a full scale, powerful computer. It employs an architecture, interesting from several viewpoints which accomplishes an impressive number of firmware and software feats. The Alpha Micro has received attention from many companies in the information industry. Both BRS, Inc. and Cuadra Associates sell software products available on this device.

The Alpha Micro uses a WD-1600 16 bit CPU arrayed in a tri-processor configuration. The significance of the 16 bit feature is that it allows the CPU to address more than 256,000 locations in main memory. (8 bit machines can address only 65,536 locations in main memory.) The AM-1051 comes standard with 64K bytes, however, terminals may be added only with the addition of 32K bytes main memory for each new CRT. This is due to the partitioned memory architecture of the tri-processor, where up to 1000K bytes main memory may be mapped and addressed. This amount of memory on the system would support 24 terminals, a printer and four 90 million character disk drives. A number of video terminals can be used with the Alpha Micro although some of the most popular are the Soroc IQ-120 and 140 series. Several high speed printers are available as well as 10 and 90 megabyte Control Data Corporation hard disks. (Hard disks, once again, are circular magnetic recording mediums stacked in platters and spun so that a current of air causes a read head and arm to float over specifically magnetized areas of the platter. Since the spin of the hard disk is 15 to 20 times the

speed of any floppy diskette the hard disk data transfer rate is usually 5 to 6 times faster than floppy diskettes.) The Alpha Micro requires no particular physical or electrical housings although it is known to be prone to failure in temperatures above 85 degrees.

Software for the AM-1051 is based on an operating system called AMOS which provides four levels of interrupt processing, direct memory access, multi-tasking, and excellent text editor features. The Alpha Micro is available with BASIC and PASCAL, and will support a variety of application software packages developed by its dealers and owners consisting of various text editors, general ledgers and other accounting systems. Significantly, an outstanding bibliographic retrieval system is available from Cuadra Associates in Santa Monica, California for about $20,000. Data communications and networking is supported for up to eight systems through a communications package called Alphalink. Documentation for this system is outstanding. Service is available from the AlphaServe network which is available in Houston and Dallas.

The list price for a basic configuration, which would include a 90 million byte disk, 256,000 bytes memory, a processor, and two terminals would be about $25,000. Lease-purchase options are available for the Alpha Micro through dealer lease service agreements. AlphaServe service charges for the above configuration would be $400 per month.

Alpha Micro has been in operation only since 1977, however during that time they have installed over 5200 systems. Its text editing and other support functions would make it an inexpensive and valuable library management tool.

2. Cromemco Z-2D

The Cromemco system design, though it is an eight bit Z-80 processor, nonetheless combines powerful hardware and software features yielding the most reasonably priced, highest power system offered in the microcomputer world. Cromemco sales and support staff are outstanding, and are usually readily available to answer technical questions, even though service is available only through dealers.

The Cromemco may be supplied with extended memory of up to 512K bytes. Its bus is the famous S-100, with 8 parallel and 1 to 3 serial RS232-C ports. Up to 8 terminals may be supported in the 512K memory configuration. (Like the Alpha Micro, the Cromemco memory mapping technique necessitates expansion of main memory to support each additional terminal.) Two eleven million byte hard disks may be attached to the system.

The operating system supports almost all of the important features required in a multi-tasking system, though the hardware for this operating system is simplified considerably by the partioning of user memory into 32K "buffer" zones (thus eliminating the need for memory protect features.) Higher level languages are BASIC, COBOL level 74 and FORTRAN IV. Software packages available from Cromemco itself include an outstanding word processing system, a data base management system with up to five levels of inquiry, and various accounting and financial systems. Additional software is also available from clubs through the Cromemco dealer network.

A typical system with a terminal, printer, one floppy disk

and one hard disk would cost between $13,500 and $15,000.

3. Data General - MPT-87

The Data General MPT-87 is an extremely powerful small business machine. This model is Data General's most recent entry into the small systems market. The MPT is reportedly upwardly compatible to the Eclipse 8000 level. A typical configuration of a terminal, keyboard, processor, monitor, printer and 700K bytes of diskette storage will cost between $11,000 and $15,000. The system will support four peripherals including a terminal and two double density, dual sided disk drives. (Hard disks are also available in up to 25 million byte packages.) Both desk top and office style systems may be purchased. Additional 6093 "Dasher" display terminals may be "daisy-chained" to the MPT 87 processor.

This system handles 15 levels of interrupts and provides all the same excellent software functions provided in other larger Data General devices. The system support BASIC, PASCAL, and FORTRAN IV. Documentation for this system is extremely

good and service is widely available at Data General's 80 centers in 48 states. Data General is one of the oldest computer manufacturers with gross sales of approximately $750 million dollars annually.

4. Digital Equipment Corporation VT-103

The Digital Equipment Corporation VT-103 is another recent product introduced by DEC. With the 1SI 11/23 microprocessor, the VT-103 supports up to 256K RAM main memory and handles up to 15 ports with IEEE interface extenders. Graphics capability is standard on the terminals. Two high speed, digitally encoded cassette tapes are available, optionally, with the system. Maximum seek time for any file on the cassette cartidge is 15 seconds. Both floppy and hard disks are available to a maximum of twenty million characters.

Both of the outstanding DEC operating systems, the RT-11 and RSX-11M, are available with the VT-103. Four levels of interrupt processing are handled but there are some limitations on the multi-tasking capacities of the system. BASIC+ and FORTRAN IV are supported as well as standard communications

protocols. Documentation is excellent and service is widely available at over 100 centers throughout the United States. DEC is one of the oldest and largest of computer manufacturers.

The cost of this system with a typical configuration of CRT, 10 million byte disk, 256K memory and printer is approximately $11,000 to $14,000. It should be noted that the primary intended use of DEC for the VT-103 is to support a remote job entry for larger digital equipment computers such as the PDP and 10-20 Series.

5. Radio Shack TRS-80 II

The TRS-80 manufactured by Radio Shack from Tandy Corporation has been the best selling microcomputer in the market. It has the widest assortment of software available of all the microcomputer systems, and also a professional support and service network. The TRS-80 II is Radio Shack's entry into the small business computer market.

The TRS-80 has BASIC in ROM as well as some parts of the operating system. 64K of RAM memory is standard. The TRS-80 has

three ports (two of which conform to RS-232C standards). A variety of excellent printers are also available. The keyboard is a weak feature of the system with only 40 keys available. The system can be expanded with up to four 8" floppy diskettes at 500K bytes per drive for a total of two million bytes of floppy disk storage. One diskette is integrated in the side cabinet of the desk top console.

The operating system for the TRS-80, TRS/DOS, handles disk operations, program monitoring and library maintenance. The TRS-80 II machine is a dedicated device and can not engage in multi-tasking or interrupt processing. BASIC is the only language supported at this time. According to Radio Shack there are over 2,000 applications programs available. One of the RS-232C ports may be used for data communications with other computer centers.

The documentation supplied with the TRS-80 is hard to understand and does not provide a comprehensive series of steps. The service facilities for the TRS-80 however, are outstanding with 130 stores located throughout the United States. The list

price for a configuration with processor, 64K RAM, one 380K byte diskette, CRT, keyboard and 43 CPS daisy-wheel impact letter quality printer is $8017.

CONTINUED

1 OF 2

III. HARDWARE GRID ANALYSIS

CRITERIA	ALPHA MICRO AM-1051	CROMEMCO Z-2D	DATA GENERAL MPT 87,83	DIGITAL EQUIPMENT VT103	TRS-80
I. HARDWARE A. Processor 1. CPU Type 2. Instruction Set	1. WD-1600 3-16 bit CPU's in multi-processor configuration 2. 127	1. Z-80 2. 158 + 8080 Emulation	1. MN602 (16 bit) 2. Upwardly compatible to Eclipse 8000 level	1. LSI 11/2, 11/23 2. 400+	1. Z-80A 2. 157
B. Memory 1. ROM a. Operating System b. Languages c. Applications	a. Auto-start only feature in ROM b. None in ROM c. None in ROM	a. 1K PROM (2708 board) c. Autostart	None	a. 16K, 32K, 64K b. No c. No Memory addressing expansion for application programs	a. 14K ROM b. 2K (I/O only c. BASIC 12K
2. RAM a. Initial or Standard b. Increments c. Maximum	a. 64K bytes b. 32K or 64K bytes c. 1,000K bytes memory mapping. technique	a. 64K bytes b. 4,16,64 c. 512K with 64K RAM card extender	a. 60K	a. LSI 11/2, 64K b. LSI 11/23, 256K c. RAM quantity determined by CPU type	a. 16K b. 16K, 32K c. 64K

CRITERIA	ALPHA MICRO AM-1051	CROMEMCO Z-2D	DATA GENERAL MPT 87,83	DIGITAL EQUIPMENT VT103	TRS-80
C. Peripheral Devices 1. Bus Type 2. Number and type of ports a. RS 232 C b. Other	1. Full word 16 bit 2. 24 terminals, 1 printer, 4 disc drives a. All RS232C interface	1. S-100 2. 8 ports parallel, 1-3 serial 1-3 RS232C	1. Data General 2. Serial 2RS232C	1. LSI-11 (IEEE-488 interface avail.) 2. 15 with IEEE-Istrapack 4 standard 4 serial RS232C ports RS-423, RS-422	1. Parallel, 2 Serial 2. RS 232C Serial Cassette plug
C. Peripheral Devices 3. Video Display a. Colors b. Screen Size c. Matrix Size	a. System handles SOROC IQ 120, Lear Siegler, Hazeltine 1500 - Black & White b. 80 columns x 24 lines c. varies with terminal type	a. 3102 CRT Black & White b. 24 x 80	a. White on Green b. 25 lines x 80 col. c. 5-8 matrix	a. Black on white b. 24 lines x 80 col. c. 7 x 9	a. no b. 80 x 24 40 x 24
d. Upper & Lower Case Characters e. Graphics f. Display Modes	d. all terminals e. SOROC IQ 120 f. Reverse video blink	d. yes e. no f. Dual intensity, blink	d. yes e. yes f. Blink, underscore, dual intensity, reverse video	d. yes e. yes f. Boldface, blink, underscore, reverse video	d. yes e. 36 characters for lines, chart etc. f. reverse video

CRITERIA	ALPHA MICRO AM-1051	CROMEMCO Z-2D	DATA GENERAL MPT 87,83	DIGITAL EQUIPMENT VT103	TRS-80
4. Keyboards a. Supported Character Set b. Function Keys c. Numeric adding pad	(SOROC IQ 120) a. 96 b. 16 c. 10-Key	a. 56 b. 16 c. 10-Key	a. 83 b. 10 c. no	a. 65 b. 4 c. yes	a. 76 keys b. 2 c. yes
5. Printer a. Speed b. Impact Method c. Control features	TI Omni 81-150 CPS 9x7 Dot Matrix, ltr. qlty, horizontal & verticle tabbing hndls 6 part forms. NEC Spinwriter 5510 55 CPS, thimble-ball ltr qlty, horizontal & vertical tabbing 7 copy print	3779 3703 60 CPS 180 CPS Dot Matrix 132 columns	Dasher LP2 180 CPS 7 x 9 Dot Matrix 6 or 8 lines per inch normal or elongated print	LA36 180 CPS 8 x 8 Dot Matrix 6 or 8 lines per inch	43 CPS Daisy Wheel 10 point
6. Floppy Discs a. Size b. Storage Capacity c. Maximum Number Possible d. Data Transfer Rate		a. 5" or 8" b. 180KB, 256KB c. 4	a. 6097A 5¼" Dual Density, Dbl sided b. 2,358KB per drive d. 62,500 BPS	b. 512KB c. 2 d. 62,000 BPS	a. 8" b. 500K c. 4

CRITERIA	ALPHA MICRO AM-1051	CROMEMCO Z-2D	DATA GENERAL MPT 87,83	DIGITAL EQUIPMENT VT103	TRS-80
7. Hard Disc a. Size b. Model c. Maximum Number Possible d. Data Transfer Rate	d. 10 Mega-byte Control Data Hawk Drive c. 4 a. 90 mega-byte Control Data Phoenix Drive c. 4 d. - 1.5 megabytes	a. 11MB b. HDD c. 2 d. 5.6 megabytes	b. 10MR	a. 5.2MB b. RLV11 c. 4 d. 5.2 megabytes	No
II. CONFIGURATION A. Cabinet Size 1. Width 2. Depth 3. Height 4. Weight	See Photos	12 slot mother-boards 1. 19" 2. 20 3/4" 3. 12¾" 4. 49 lbs.	1. 22" 2. 20" 3. 12" 4. 30 lbs.	1. 18" 2. 14.25" 3. 14.5" 4. 82.5 lbs.	1. 14" 2. 21¼" 3. 23½" 4. approx. 40 lb
5. Printer d. Ribbon Replacement Method e. Adjustment Print f. Serial or Parallel Interface	Spool - 132 columns 6 or 8 characters per inch - Parallel Cartridge - 128 character line 10 or 12 characters per inch Serial	No Serial	Cartridge 6-8 lines per inch Serial	Cartridge yes serial	no Cartridge Parallel

CRITERIA	ALPHA MICRO AM-1051	CROMEMCO Z-2D	DATA GENERAL MPT 87,83	DIGITAL EQUIPMENT VT103	TRS-80
B. Integrated Keyboard C. Integrated Diskette D. Integrated CRT E. Integrated Memories or Languages	B. keyboard separate & replaceable. C. no D. no E. ROM Auto-Start only	B. with terminal CRT C. Yes, 2 possible D. no E. no	B. Yes C. possible, 358KB D. Yes E. No	B. No C. No D. No E. No	B. No C. Yes, 1 poss D. Yes E. No
F. Packaging Description	See photos	Desk top or office system package	Desk top, office package can be daisy chained with standard DASHER 6093 display terminals or other MPT 87's	Desk top or rack cabinet office mounted	Desk top or office package
III. SOFTWARE A. Operating Systems 1. Firmware Components a. Auto-start only b. Other	a. AMOS b. Yes	a. CDOS b. Yes, PROM	a. MP/OS b. Yes, PROM	a. RT-11, RSV-11M b. Yes	a. TRSDOS b. Yes

CRITERIA	ALPHA MICRO AM-1051	CROMEMCO Z-2D	DATA GENERAL MPT 87,83	DIGITAL EQUIPMENT VT103	TRS-80
2. Support Functions a. Disc Operations b. Program Monitoring c. Library Maintenance d. Interrupt Processing e. Direct Memory Access (DMA)	a. Yes b. Yes c. Yes d. 4 levels 16 Vector e. Yes	a. Yes b. Yes c. Yes d. No, terminal separation in core e. Yes, on HTI system	a. Yes b. Yes c. Yes d. Yes, 16 levels e. Yes	RT-11 a. Yes b. Yes c. Yes d. 4 levels e. Yes	a. Yes b. Yes c. Yes d. No e. No
2. Support Functions f. Multi-tasking g. Memory Protect h. Re-entrant Coding i. Error Recovery j. Text Editor	f. yes g. no h. Common areas in map with user partions of 32K each i. yes j. yes	f. yes, thru terminal separation g. no h. no i. yes j. yes	f. yes g. yes h. yes i. yes j. yes, for program development	f. two tasks only g. no h. no i. yes j. yes	f. no g. no h. no i. no j. yes
B. Higher Level Languages 1. BASIC 2. PASCAL 3. COBOL 4. FORTRAN	1. Super BASIC 2. Yes 3. Super BASIC Subset 4. No	1. Yes 2. No 3. COBOL Level 74 4. FORTRAN IV	1. MP BASIC 2. Yes 3. No 4. FORTRAN IV	1. BASIC + 4. FORTRAN IV	1. BASIC

CRITERIA	ALPHA MICRO AM-1051	CROMEMCO Z-2D	DATA GENERAL MPT 87,83	DIGITAL EQUIPMENT VT103	TRS-80
C. Applications Programs & Price D. Data Communications Software E. Data Base Management System	C. Various Text editors, business & accounting & bibliographic retrival systems D. Alpha Link - 8 system support - electronic mail E. Cuadra Associates "Star" BRS "PDS II"	C. Word processing, $95, DBMS $195 D. Modem Avail. E. Yes, 5 retrieval levels	C. OEM Network Software available D. Interface avail- E. MUMPS	C. Word Processing Data Fusion DBMS D. 2780, DEC net	C. $2000 + D. Net E. No
IV. VENDOR SUPPORT A. Documentation 1. Accuracy 2. Clarity 3. Comprehensiveness	1. Excellent 2. Excellent 3. Excellent	1. Excellent 2. Excellent 3. Excellent	1. Good 2. Good 3. Excellent	1. Excellent 2. Good 3. Good	1. Good 2. Poor 3. Fair
B. Factory Warranty C. Service Availability	B. 90 Days C. Available from local Alpha Serve maintenance program varying widely in cost and quality	B. 90 Days C. Dealer Servicing	B. 90 Days C. 80 service centers nationally	B. 90 Days C. 111 centers throughout USA 350 worldwide	B. 90 Days C. 130 stores throughout US

CRITERIA	ALPHA MICRO AM-1051	CROMEMCO Z-2D	DATA GENERAL MPT 87,83	DIGITAL EQUIPMENT VT103	TRS-80
V. PRICE					
A. List Price for Basic Configuration	Approx. $25,000	Terminal, printer, 1 floppy disk, 1 hard disk $15,500-16,000 depending on printer.	Terminal, keyboard processor, CRT, printer, modem, 700MB diskette storage $11,000-$14,000	Processor, 25K memory, 256 MB hard disk, CRT and LA36 printer - approx. $35,000	$8017
B. Lease Purchase Option					
1. Manufacturer Lease	1. Dealer Lease Service Only	1. None	1. None	1. None	
2. Third Party Lease			2. Yes		2. Yes
C. Monthly Maintenance	C. Aprox. $400/mth.	C. None	C. 3% of Sales Price per year	C. Not yet established	C. None
D. Number of Years in Operation	D. 4	D. 6	D. 13	D. 20	D. 4
E. Gross Sales or Number of Installations	E. 5200 +	E. 2000 +	E. 750 milliton	E. 1.5 Billion	F. 200,000
F. Total Number of Service Centers or Service Method	F. 32 and local dealer support	F. Local dealer support or ship to factory	F. 80	F. 111	F. 130

IV. SOFTWARE SURVEY

Three outstanding software products are reviewed in this section. They are: the Associate File Processor by Datafusion Corp,; the Star[tm] Data Base Management System from Cuadra Associates; and MINISIS from Systems House Ltd. of Toronto, Canada. Each system has particular merits from both retrieval and equipment standpoints. Some logistical considerations may override pure system performance. For example, the Systems House Ltd. product runs on the Hewlett Packard 3000, which though it is the most expensive of the hardware devices available to the Manpower Planning Project, it would enable the Project to have total independence from all outside computing sources. The Cuadra Associates' product on the other hand may be mounted on the Alpha Micro system, which would allow considerable processing power for the least possible price. The Alpha Micro is the most advanced microcomputer on the market today, surpassing comparable products from Digital Equipment Corporation and others. Finally, the Associate File Processor of the Datafusion has astonishingly good retrieval and user interface

capabilities, and would run on the present Sam Houston State University DEC- 0 system.

Each of the systems is reviewed in the paragraphs below and followed by literature obtained directly from the various companies.

1. Datafusion Corp. Associate File Processor

The Associate File Processor or AFP system of Datafusion Corp. has been available now for about three months. Information retrieval features of this package are clearly better than any comparable product on the market today. Not only does it permit absolute natural language cordial interface queries but also provides field identification for extraction for later statistical analysis. An example of a natural language query permissable with this system follows:

> Find all research on "grievance clauses" in "Cities over 100,000" but not employing "bargaining agents."

This method of file query is obviously better than the current Boolean expressions used with the BRS system. AFP will run on the PDP 11/23, 34, 35, 40, 45, 60 and 70. Typically, response

times are under the 3 second industry standard. However, the maximum research time for 300 million characters is 4 to 5 minutes. The cost of this system, including installation, is approximately $42,000. It would be possible to run this product on a PDP-11/23 which is reviewed in the previous section.

Additionally, the AFP has a DMA interface to IBM 370's, various Univacs, CDC, Burroughs, Honeywell and Data General devices. This type of access facility means that if an inquiry is made to a large IBM 370 processor, though the AFP software is operating on an attached DEC system, the inquiry response will be transparent to the user since memory is moved directly from CPU to CPU between the two computers without intervention of the main accumulator registers.

A Data Load program is provided for entry of documents. However, this does not require the type of formating or programming necessary with the BRS system. This software allows pre-formated entry of data without field delimitors or demarcations. Documents of interest retrieved may be saved for a user's personal file and later accessed for report generation. Finally, the AFP software

allows for automatic thesauri relation within specific queries. This means that synomyns of user oriented words are automatically related in the search term without the user having to know or understand the thesaurus provided by the system. Finally, just as the BRS system permits canned queries of various files by individual profiles, AFP will automatically retrieve documents of interest according to that profiles for users.

2. Cuadra Associates Star^{tm} Data Base Management System

This system is not yet commercially available but is expected to be issued within the next 30 days. It is almost a complete mirror of the BRS system. Boolean searches are standard as well as the types of output, photo composition services offered in the BRS-PDS 1. The most outstanding feature of Star is its applicability to the Alpha Micro system assessed in the hardware survey of Section II. The Alpha Micro system is the most powerful microcomputer available in today's market and employs a 16 bit tri-processor configuration to achieve performance standards equaled only by much larger and more expensive DEC and and Hewlett Packard configurations. The Alpha

Micro complete with Star package is approximately $59,000. This includes the processor, 4 CRT stations, half a billion bytes of disc storage and a tape drive. This configuration is less than half the price of a comparable AFP, DEC combination.

Data entry for the Star system is extremely simple. The system allows automatic definition of record structure through an intreactive process wherein the user is asked to name the field, its abbreviation, the type of data, its length and number of occurrences in an orderly sequence. Records previously recorded on another digital medium must be defined by the same format in order to be loaded. This, however, is still a significant improvement over the file load charges currently levied by BRS. Search logic for the system permits the usual boolean "and", "or", and "not" operators as well as nested parentheses and single and multiple character truncation similar to the "ROOT" command within the BRS structure. Numeric ranging and limit values are readily possible, though a linkage of files to any numeric post-processor is not a part of the current Star system. Following retrieval, records may be sorted in any order

3. Systems House Ltd. MINISIS.

MINISIS is a generalized information retrieval system designed to run on any Hewlett Packard 3000 series minicomputer. It was developed by the International Development Research Center of Canada specifically to meet the needs of a low cost hardware and software package permitting on-line data entry and interactive retrieval. Although MINISIS was developed primarily for use in library bibliographic information systems it is flexible enough to be to be used with many different types of data. Like the BRS system it will readily support the retrieval of criminal justice documentation. MINISIS may also be used to produce bibliographies and indexes and other types of reports of possible interest to the Manpower Planning Project. Moreover, users with unique requirements may write specialized applications programs using a MINISIS macro language. MINISIS has been available since 1978.

MINISIS is an extremely expensive package and by itself costs about $50,000. However, the minimum cost for a Hewlett

Packard machine capable of supporting the software package is approximately $120,000. By contrast the Datafusion and Cuadra products can be developed for less than $60,000 for both hardware and software.

Data entry for the system is either on-line or through local programs. Once again, record definition may be defined by a simple keyboard query system as opposed to the individual programming required in the BRS system. The internal organization of MINISIS is identical to that of BRS in that the same type of data dictionary is used to control terms. Because of this, an excellent thesauri system is also possible which automatically flags new terms as they are entered to the data base. However, unlike the AFP Datafusion system, this device will not automatically relate synomyms of different words as they are entered by a user in a query process.

Boolean logic is standard with this system as well as nested parentheses and individual field limits. Systems House is currently marketing this package in the U.S. as personnel

control and query language. Its use for general retrieval tasks has been restricted in this country and not well known. This product has been more popular in Europe due to the greater penetration of Hewlett Packard equipment in those markets.

END