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REPORT TO THE PRESIDENT  
ON  
THE MANAGEMENT OF AUTOMATIC DATA  
PROCESSING IN THE FEDERAL GOVERNMENT

PREPARED BY THE  
BUREAU OF THE BUDGET  
AND SUBMITTED BY  
JOHN L. McCLELLAN, Chairman  
COMMITTEE ON GOVERNMENT OPERATIONS  
UNITED STATES SENATE

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EXCERPT FROM THE CONGRESSIONAL RECORD OF MARCH 4, 1965

Mr. McCLELLAN. Mr. President, the President of the United States has submitted to the Congress a "Report to the President on the Management of Automatic Data Processing in the Federal Government," prepared by the Bureau of the Budget, which has been referred to the Committee on Government Operations for consideration. The report contains a number of recommendations for legislative action, along the general lines of a bill, H.R. 5171, which was approved by the House of Representatives and referred to the committee during the 88th Congress.

In view of the interest that has been manifested in this report and in the proposed legislation, I ask unanimous consent that the report be printed as a Senate document for use by the Committee on Government Operations, and other committees of the Congress which have an interest in ADP procurement, operations, and management.

The VICE PRESIDENT. Without objection, it is so ordered.

LETTER OF TRANSMITTAL

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THE WHITE HOUSE,  
*Washington, March 2, 1965.*

The Honorable the PRESIDENT OF THE SENATE.  
The Honorable the SPEAKER OF THE HOUSE OF REPRESENTATIVES.

SIRS: The use of automatic data processing equipment during the past 10 years has contributed significantly to increased effectiveness and rising productivity in governmental operations. The electronic computer has enabled the Government to carry out programs which otherwise would have been impossible. Better and more economical services to the public have been achieved through the use of this equipment.

Government policies with respect to the acquisition and use of automatic data processing equipment have been a matter of interest to a number of congressional committees. In 1963, in response to a congressional request, President Kennedy directed the Bureau of the Budget to undertake a comprehensive review of this subject and to prepare a report to the Congress. This study is now complete. The suggestions for improvement outlined in the enclosed report have my approval.

I have requested the Director of the Bureau of the Budget to work with the interested committees of the Congress and with the executive agencies concerned to assure the most economical and effective use of this highly important area of management.

The Bureau of the Budget at an early date will set forth, in a circular, specific Government-wide responsibilities of the Bureau of the Budget, General Services Administration, Department of Commerce, and Civil Service Commission, to carry out the recommendations contained in the report.

Sincerely,

LYNDON B. JOHNSON.

III

**LETTER OF SUBMITTAL**

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COMMITTEE ON GOVERNMENT OPERATIONS,  
U.S. SENATE,  
*March 4, 1965.*

The Honorable HUBERT H. HUMPHREY,  
*Vice President of the United States.*

DEAR MR. PRESIDENT: I submit herewith a "Report to the President on the Management of Automatic Data Processing in the Federal Government," prepared by the Bureau of the Budget, which has been referred to the Committee on Government Operations for consideration. The report contains a number of recommendations for legislative action, along the general lines of a bill, H.R. 5171, which was approved by the House of Representatives and referred to the committee during the 88th Congress.

In view of the interest that has been manifested in this report and in the proposed legislation, the Senate authorized the report to be printed as a Senate document for use by the Committee on Government Operations, and other committees of the Congress which have an interest in ADP procurement and operations.

A résumé of previous actions taken by the Committee on Government Operations in the 88th and preceding Congresses is set forth in the daily Congressional Record on September 21, 1964, at pages 21677 through 21684.

Sincerely,

JOHN L. McCLELLAN, *Chairman.*

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## INTRODUCTION

In the short span of a decade, the electronic computer has had an unprecedented effect upon the conduct of Government activities. Use of this equipment has enabled Government to carry out programs never before possible, and it has facilitated the provision of services more effectively and economically, thereby contributing significantly to the rising productivity in governmental operations.

However, the use of the electronic computer has created a variety of problems. Some of these have been successfully resolved; others are still matters of concern. In order to aid in the solution of current problems and those that may well arise in the future, a comprehensive study has been made of the management of electronic data processing activities in the Federal Government. This report is based largely upon that study.

### BROAD USE OF COMPUTERS

No single technological advance in recent years has contributed more to effectiveness and efficiency in Government operations than the development of electronic data processing equipment. Most of the important advances that have been made in such diverse fields as space exploration, research of all types, weather forecasting, and atomic energy would not have been possible without the computer. In the field of large-scale clerical operations, such as insurance processing, checkwriting, and the tax system, the computer has materially assisted in producing major economies. Furthermore, the computer is becoming increasingly useful to managers in solving complex problems involving interrelated types of information. The most notable of these have been in military areas and in supply management, but the use of computers to support advanced management techniques is becoming common in a broad range of governmental activity. Based on results achieved to date, this latter type of use of computers holds a potential of outstanding importance in the public service.

In addition, there is the largely untapped area of integrating related information systems that cross organizational lines.

Accordingly, it seems reasonable to assume that the impressive advantages to the Government already achieved through automatic data processing (ADP) are but steppingstones to the future.

### SIZE OF ADP OPERATIONS

The Federal Government is currently making substantial expenditures for the acquisition and utilization of electronic computers. Inventory statistics<sup>1</sup> show that in the fiscal year 1964 nearly \$1 billion

<sup>1</sup> See 1964 Inventory of Automatic Data Processing Equipment in the Federal Government (July 1964). Superintendent of Documents.

was expended for this purpose, and some 54,000 man-years were utilized in the operation of 1,767 computers. This number of computers is estimated to represent about 10 percent of all the computers in the Nation. In addition, however, estimates indicate there are at least an equal number of computers used in the Government that are excluded from the inventory because they are employed primarily in unique military applications. Further, there is another group of equal size operated by contractors who perform work for the Government on a cost-reimbursement basis. The magnitude of the expenditures itself provides sufficient reason for assuring that proper attention is given not only to the effective use of computers, but to economy and efficiency as well.

#### PROBLEMS

The extremely rapid exploitation of the computer which has been evidenced in the Federal Government has not been without problems involving almost every aspect of acquisition and utilization. The following examples illustrate the problems:

The diversity of ADP equipment and its use under varying circumstances has raised questions as to the appropriateness of general policies and guidelines applied uniformly to all ADP activities.

The great range of possible computer applications—that is, the data processing problems to which the computer may be applied—makes it necessary to develop means for selecting those applications which offer the greatest return. Some applications produce distinct advantages while others are marginal at best.

The tremendous effect of system design on the efficiency and effectiveness of computer applications makes it desirable that means be developed for assuring that techniques of high quality system design are utilized. The problem is compounded by the fact that designing systems involves an evolving technology that calls for a high degree of individual competence applied to unique situations.

The selection of equipment requires extensive knowledge of the use for which the equipment is intended and of the performance of available machines. In making the selection, procedures are needed that are not overly expensive, lead to the right choice, and encourage competition.

The high cost of computers requires that, wherever feasible, machines already available within the Government be utilized in lieu of acquiring additional capacity. There are, however, many obstacles—some technical and some administrative—to the optimum utilization of machine time.

Contracting for computers is made difficult by the lack of standard characteristics of the equipment, the more or less intangible nature of supporting services that are required, and the need for timeliness in the issuance of contracts.

Decisions on rental versus purchase involve problems of predicting the economically useful life of equipment under conditions of changing requirements and technology as a basis for determining whether the costs associated with leasing will exceed the costs associated with purchase.

The disposal of excess and surplus machines creates problems that will grow as the Government increases its equipment purchases. The problems involve questions of timing, responsibility for choosing the best means by which agencies may accomplish their missions, and economic obsolescence.

Maintenance of equipment is a relatively new problem. Rented equipment is ordinarily maintained by the manufacturers. For purchased equipment, policies must be developed for choosing between commercial maintenance procedures and maintenance by Government employees.

The differences among electronic data processing equipment make the transfer of data among machines and systems difficult and expensive. As in most expanding technologies, there are problems of providing the resources for, and of achieving, a satisfactory degree of universally accepted standardization without inhibiting advances in the state of the art.

There is a need for coordinating research and disseminating findings. This need stems from the fact that much of the growth in the technology of equipment and of data systems for using it has been brought about by the research and development work carried out on many fronts and by many different agencies that are eager to use the computer as a means toward accomplishing their own missions. The problem of coordination, however, is basically the same as that currently experienced in other areas of research and development.

The way in which contractors, performing work for the Government, acquire and use computers is important because there are indications that the amount of work done for the Government on contractors' computers is large. Problems in assuring efficient and economical use, particularly by contractors who are working on a cost-reimbursement basis, have arisen because of the need for avoiding the usurpation by the Government of the management responsibilities and authorities of the contractor and also for avoiding procedures that would result in the Government's acquiring expensive equipment that would rapidly become obsolete.

The effect of the computer on Federal employment has been felt in two separate directions. On the one hand, there has arisen a continuous and urgent need for personnel in all phases of computer use, ranging from competent key punchers, programmers, and designers of systems to managers who understand the potentialities and limitations of the equipment. On the other hand, in many applications, the computers have made large numbers of skills obsolete; this has brought a concurrent need for enlightened personnel policies and advance planning to alleviate unnecessary hardship without depriving the Government of attainable economies. The Civil Service Commission has made a separate study of this subject.<sup>2</sup> Based on the findings of the study, the Commission has embarked upon additional studies and action programs which will concentrate upon four major problem areas: (1) manning for computer operations, including consideration of

<sup>2</sup> "A Study of the Impact of Automation on Federal Employees," a committee print prepared by the U.S. Civil Service Commission and referred to the Subcommittee on Census and Government Statistics of the Committee on Post Office and Civil Service, dated August 1964.



skill shortages and technical training, (2) upgrading the competence of computer-related personnel, (3) the impact of computer automation on the job security of Government employees, and the need to forecast and plan appropriately for this impact, and (4) the need for keeping abreast of impending advances in the state of the art of computer automation, in order to be able to forecast the impact of these advances on personnel requirements in general and computer-related technicians in particular.<sup>3</sup>

The assignment of appropriate roles to the different echelons of management in the Federal Government is of great importance. Some computer applications, particularly those involved in administrative functions, have a great deal in common and conceivably could be subject to greater centralization. On the other hand, the more significant computer applications are integral parts of agency programs; accordingly, each is a unique application and its management is a responsibility of those officials charged with mission accomplishment. The problem then becomes one of improving the effectiveness and the economy of computer utilization, both within an executive agency and in the Government as a whole, without derogating the proper authorities and responsibilities of managers in the line.

#### MANAGEMENT ACTIVITIES TO DATE

Experience in the Government and in industry has demonstrated the urgent need for management to concern itself intimately with ADP activities. Because ADP is based on a new technology whose most visible manifestation is equipment of an esoteric nature, there has been a tendency to regard it as the particular responsibility of the technician. ADP applications, from the simplest to the most complex, raise problems and require decisions that are the direct responsibility of managers themselves. ADP may have a pronounced effect upon organizational arrangements, the kind of work employees perform, the conditions under which they work, or the type of skills required. Furthermore, ADP can have an effect not only upon the means and cost of providing service to the public, but also upon the kind of service provided. ADP applications that are primarily designed to provide information can have a significant effect upon the way a manager makes decisions and upon the control he exercises over his organization.

Accordingly, it is necessary that managers concern themselves with all aspects of ADP projects including the determination of objectives sought, the decision to proceed, the design, installation and operation of the system, and the utilization of the end product. This requires that managers obtain a broad understanding of the potentialities and limitations of ADP, and of the work of the skilled technicians on whom they must rely, and take steps to assure that decisions that are properly within the sphere of management are made by managers.

The earliest efforts to utilize the computer resulted largely from local initiative and ingenuity. Significant contributions to understanding the potentials and problems in the use of this new technology

<sup>3</sup> See exhibit F for a more detailed discussion of the current and planned ADP-related activities of the Civil Service Commission.

were made by these pioneer installations. As the use of computers began to increase, various organizations in the Federal Government began developing policies governing the management of automatic data processing in order to facilitate proper use of the equipment and to assist in resolving the problems that arose.<sup>4</sup>

The Bureau of the Budget has developed, or sponsored the development of, guidelines and policies relating to—

- (1) Studies that should be made in advance of the acquisition of equipment;
- (2) Selection and acquisition of equipment, with particular reference to purchase-or-rental decisions;
- (3) Agency practices in respect of ADP management; and
- (4) Sharing of equipment.

In addition, the Bureau (1) publishes an annual inventory of equipment in the Federal Government; (2) has initiated and led a project to test the feasibility of sharing exchanges; (3) has published a glossary to provide a set of terms that will be commonly understood, and a directory of training opportunities; (4) has established a special panel on standardization (consisting of representatives of the General Services Administration, Bureau of Standards, and the Department of Defense) to strengthen the Government's participation in the program of the American Standards Association; and (5) has created the large Interagency Committee on Automatic Data Processing and a small council to foster the exchange of experience and to obtain the advice of experienced agencies. By the budget review process and by providing individual consultation, the Bureau has exerted an influence over data processing activities of the Federal Government.

The General Services Administration has negotiated general schedules with equipment suppliers for the acquisition of equipment and has published regulations governing the disposition of excess and surplus equipment. The General Services Administration currently is extending the equipment-sharing concept across the country.

The Civil Service Commission has (1) provided classification and qualification standards for positions related to the operation of computers, (2) provided assistance to agencies in developing aptitude tests, (3) given assistance to agencies faced with employee displacement problems, (4) sponsored and provided extensive training courses, and (5) made special studies of the effect of the computer on Federal employees.

The Bureau of Standards in the Department of Commerce has contributed by conducting experimental work on the design and operation of computers, by providing assistance in designing computer systems and selecting equipment, and by operating a Computer Service Center/Sharing Exchange for the Washington area.

Agencies themselves are developing staff resources at intermediate and headquarters levels to manage computer activities and to provide guidance in specific policies. A significant aspect of efforts by individual organizations has been the technological advancement of system design and the conduct or support of research.

These activities of the various agencies of Government have materially improved both effectiveness and efficiency in the use of computers.

<sup>4</sup> See exhibit E for a résumé of management activities.

An increasing amount of information is being assembled and used; average hours of machine use are increasing; more advantageous contract terms are being negotiated; the proportion of purchased machines has increased sharply, with commensurate savings in rental costs; a significant beginning has been made on the problems of standardization; and more of the scarce skills are being provided.

Nevertheless, the ever-expanding involvement of the Federal Government with the computer—expressed in increasing expenditures, numbers of computers, and personnel—and the effects of certain of the practices followed by various agencies have caused concern in the Congress, in the General Accounting Office, and within the executive branch itself. The General Accounting Office published a number of reports which focused attention on ADP policies and management practices. The House Government Operations Committee sponsored legislation on the management of ADP. The House Committee on Post Office and Civil Service held extensive hearings and, after publishing a report that raised numerous questions, recommended to the President that a study be made of ADP management. The President, aware of the increasing significance of the computer and the problems raised, directed that the Director of the Bureau of the Budget undertake a comprehensive study of the management of ADP activities of the executive branch and make recommendations for such administrative or legislative actions as may be appropriate.<sup>5</sup>

On December 26, 1963, the Director of the Bureau of the Budget announced the beginning of the study and the creation of an Advisory Committee composed of former Congressman Robert Ramspeck as Chairman; Mr. Bernard L. Boutin, Administrator of General Services; Mr. Manuel R. Cueto, vice president in charge of electronic planning and development, New York Life Insurance Co.; Mr. Walter F. Fresco, professor of business administration, Harvard University; Mr. Martin Gainsbrugh, vice president, National Industrial Conference Board; Mr. J. Herbert Hollomon, Assistant Secretary of Commerce for Science and Technology; Mr. Dwight A. Ink, Assistant General Manager, Atomic Energy Commission; Mr. Frederick J. Lawton, former Director of the Bureau of the Budget and former Civil Service Commissioner; Mr. John W. Macy, Jr., Chairman of the Civil Service Commission; Mr. Thomas D. Morris, Assistance Secretary of Defense (Installations and Logistics); Mr. Martin Shubik, professor of economics, Yale University; and Mr. David Z. Robinson, Office of Science and Technology. Staff work for the study was under the direction of Mr. Carl W. Clewlow. Assisting him were persons selected from Government agencies. During the study, Members of Congress and representatives of Federal agencies and of industry, labor, and professional groups were consulted.<sup>6</sup>

This report is based upon the results of the study. The recommendations made outline actions that should be undertaken to bring about the successful resolution of current and future problems occasioned by the use of the computer in the Federal Government. These actions are summarized below:

<sup>5</sup> See exhibits A, B, and C for an exchange of correspondence which led to this study. See also exhibit D for a list of actions taken by the legislative branch.

<sup>6</sup> See exhibit II for the announcement of the study; exhibit I for the project staff members; exhibit J for the non-Government organizations consulted during the study.

1. Modify existing Government-wide policies so that their precise application in different kinds of operating situations is more closely defined.

2. Develop and furnish criteria to assist agencies in evaluating whether computers are being used effectively.

3. Develop and furnish cost principles to be applied uniformly by agencies when computers and related services are shared with others on a reimbursable basis.

4. Expand existing policies for the selection of equipment to provide additional guidelines on (a) the preparation of systems specifications which are transmitted to suppliers when inviting proposals to furnish equipment, and (b) methods for evaluating suppliers' proposals.

5. Continue present policies governing the purchase or rental of computers, except (a) to include the cost of money as a factor in comparing alternative costs, and (b) provide for a general suspension of purchase activity if a review of computer technology indicates that superior equipment will soon be available, or if prospective excesses of Government-owned equipment indicate that additional purchases should not be made. As a consequence of increased purchasing in recent years, policies governing the replacement of equipment to avoid unwarranted long-term use, and the use of alternative ways for maintaining owned equipment will be formulated.

6. Establish a firm time schedule for the negotiation of annual contracts with equipment suppliers, and seek improved contract terms.

7. Strengthen Government support of programs initiated by the American Standards Association to achieve needed compatibility among automatic data processing equipment and systems.

8. Give increased attention to the coordination and evaluation of research and development programs in the field of computer sciences. Expand the resources of the National Bureau of Standards to advance the development of computer technology and systems oriented primarily toward Government needs.

9. Extend Government policies on the purchase or rental of equipment and on the use of excess equipment to contractors who perform work for the Government (primarily Defense, Atomic Energy Commission, and the National Aeronautics and Space Administration) on a cost-reimbursement basis. Include contractor-operated equipment in intra-agency sharing arrangements.

10. Develop and prescribe a Government-wide information system to provide selected managerial levels with information needed to manage computer resources more effectively.

11. Continue present organizational arrangements and general assignments of responsibility among central and line agencies, but strengthen and augment the resources devoted to the management of automatic data processing activities.

12. Propose the enactment of legislation by the Congress which would (a) constitute an expression of congressional policy and interest with respect to effective and economical use of automatic data processing equipment, and (b) strengthen the authorities for the development, testing, and implementation of standards; the performance of research in computer sciences and the provision of advisory services by the National Bureau of Standards; and the establishment of a revolving fund to finance arrangements for the joint utilization of computer facilities.

## MANAGEMENT OF AUTOMATIC DATA PROCESSING IN THE FEDERAL GOVERNMENT

### CHAPTER 1

#### DIFFERENCES AMONG COMPUTER INSTALLATIONS

Failure to give adequate recognition to the differences that exist among computer installations has complicated the problems of management and contributed to misunderstanding. These differences are due to variations in the missions of agencies using the installations, in operating objectives, and in operating requirements surrounding the use of computers. Also, installations vary in respect of the qualifications required of their staffs and the kinds of equipment that are used.

The purposes for which computers are used cover the breadth of governmental activity. They are used to—

- (1) Carry out missions, such as the administration of veterans' benefits and social security benefits, management of natural resources, regulatory functions, weather forecasting, control of air traffic, and tracking of missiles.
- (2) Perform such control functions as scheduling of production, and review and evaluation of agency missions.
- (3) Conduct research and development activities in all fields of science, and perform special operations.
- (4) Perform common administrative-type functions such as those related to personnel, payroll, and accounting.

The kinds of computers used for these purposes vary in design. They range from small desk-type computers costing in the neighborhood of \$50,000 to large-scale computers costing \$3 to \$6 million.

The availability of the computer to the user also varies. Some are placed on-site, to facilitate their use by scientific or engineering personnel; others are operated as service centers, to meet the needs of many users on a scheduled basis; still others are placed organizationally, to service a specific major program function.

Furthermore, the speed with which the computer must respond to the data-processing requirement varies widely. In missiles tracking and air traffic control, the response must be instantaneous (often referred to as "real time"); for other requirements, the response can be controlled on a scheduled basis according to the priority associated with the requirement.

#### CURRENT POLICIES AND GUIDELINES ON USE

Policies and guidelines on the use of computers are at present written in very broad terms so that they may be applied to a wide variety of situations. While this has allowed differing agency requirements

to be accommodated within the policies and guidelines, it has led to misunderstanding and undue variations in agency practices. For example, misunderstanding arises with respect to the policy on sharing, which is intended to increase the use of existing computers. Although this objective is desirable, the policy does not give sufficient recognition to the fact that certain types of computer installations (for example, those which must be available for instantaneous but intermittent response) may not be susceptible to sharing, even though they may have low utilization. Failure to give adequate recognition to this fact tends to brand such installations, by implication, as inefficiently utilized, and unnecessarily involves them in the sharing program.

As another example, there is a general policy requiring that detailed systems specifications be developed as a basis for selecting proper equipment; that is, the data-processing requirements must be set forth in precise terms in order to determine the kind of equipment which is best able to meet those requirements. This policy does not, however, recognize the fact that the extent to which system specifications can be set forth in advance depends largely upon the character of the operations to be performed. In research and development types of operations or in service-center operations, it is often exceedingly difficult to state the requirements with exactness.

#### NEED FOR CLASSIFYING COMPUTER INSTALLATIONS

The extensive use of computers for a wide variety of purposes suggests the need for some classification of these computers in order to provide a reasonable basis for making appropriate distinctions in applying policies. This classification should reflect the different purposes for which computers are used, the different kinds of computers used, and the operating requirements surrounding their use. In attempting to devise some basis for classification, we have considered the following: (1) types of equipment, (2) costs of equipment, and (3) functions and environment.

*Types of equipment.*—Historically, there has been a tendency to distinguish between computers used for processing business data and those used for scientific purposes. While this distinction was reasonably clear cut in the early days of computer use, it no longer has any real validity, because changes in computer technology have enabled the same computer to serve both purposes with equal facility. Consequently, this distinction is having less and less significance. It is not, therefore, a distinction that should be given serious consideration in the determination of policies; nor are there other characteristics of design which seem to be appropriate for this purpose.

*Cost of equipment.*—This distinction was quickly ruled out as a classification device to govern the application of policies and guidelines, except to the extent that consideration of cost ranges would be useful in establishing management review criteria. As a general rule, for example, the process of review and approval for computers costing \$1 million may well be carried to higher organizational levels than is the process for computers costing \$75,000.

*Functions and environment.*—Our study indicates that the most logical distinction that should be made is one that recognizes the differences in the environment in which the computer is operating, including the

response which the computer is required to make. Because the computer is so closely linked to the performance of an activity, these environmental differences largely control the extent to which management actions and criteria can be applied uniformly in achieving maximum practical use of the equipment.

The preliminary analysis made during our study suggests that a classification along the lines depicted in illustration No. 1 could serve as the basis for the distinctions that are necessary. The major headings across the top of the illustration represent categories of environments; the stub column at the left of the chart indicates broad classes of time response that must be met by the computer system. An explanation of these environment categories and response classes follows. General examples are identified within the matrix on the chart.

ILLUSTRATION I  
COMPUTER CLASSIFICATION CHART

Environment Category / Response Class	I Professional Support	II Central Computing Services	III Integrated Operations	IV Real Time Operations	V Research and Development	VI Special Operations
A. Priority	Remote console time shared systems		<ul style="list-style-type: none"> <li>High Response Inventory Control</li> <li>High Response Information Retrieval</li> </ul>	<ul style="list-style-type: none"> <li>Command &amp; Control Communications</li> <li>Network Control</li> <li>Airline Reservations</li> </ul>	<ul style="list-style-type: none"> <li>Time Sharing Computations</li> <li>Engineering Design Modification &amp; Interfacing for:</li> </ul>	<ul style="list-style-type: none"> <li>Includes Military Systems Involving: Guidance computers</li> <li>Range Finding Computations &amp; other "Single Purpose" Uses with Equipment Designed &amp; built to meet special conditions</li> </ul>
B. Time Critical	Experimental & Development Projects	Engineering & Scientific Data Processing Digital Simulation	<ul style="list-style-type: none"> <li>Off-line Inventory Control &amp; Information Retrieval</li> <li>Weather Predictions</li> </ul>	<ul style="list-style-type: none"> <li>Dynamic Simulation</li> <li>Missile Checkout</li> </ul>	<ul style="list-style-type: none"> <li>Communications</li> <li>Display Control</li> <li>Data Reduction</li> </ul>	
C. Scheduled	Engineering & Design Computations	Data Reduction Scientific Computations Business & Management Data Processing	Management & Business Systems	Range Safety Process Control	Increased processing capacity & capability	

1. Environment categories

(a) Professional support.—In this environment, small desk types of computers are used, generally on-site, for experimental development and scientific computations to provide support to professional engineering or research groups. Utilization of this type of equipment is closely associated with the working hours of the professional staff.

(b) Central computing services.—In this environment, a computer installation provides support for many users. Applications are generally diverse and often independent of one another. The workload tends toward mathematical or statistical processing, although these may be intermixed with administrative or management applications. The installation is normally operated by a staff of specialists, but the computer programming is frequently done by personnel assigned to organizations other than the central computer installation. However, the customer is usually not present while the work is being processed.

The equipment used can be in the small, medium, or large-scale class. Medium- or large-scale equipment is often supplemented by small-scale peripheral computers.

(c) *Integrated operations.*—In this environment also, a computer installation provides support for a number of users; but generally one application, which consists of a series of interdependent processes, constitutes the largest part of the workload. In this case, a variety of inputs, usually from different organizations or geographic sources, are processed against a system of group of data files to provide information to support a number of related functions. Applications are cyclic and recurring, with large volumes of data being processed. They tend more toward administrative or management functions, although mathematical, statistical, or operating programs may be involved or intermixed. The computer installation is operated by a staff of specialists, with the systems development and programming usually done by a central computer staff working closely with customer organizations. The computing equipment is generally of the medium- or large-scale class, but it is often supplemented by smaller computers. Equipment to permit direct inquiries from off-site locations may also be associated with these integrated operations.

(d) *Real-time operations.*—In this environment, the computer is a part of a large equipment complex which requires continuous “immediate” response. Since the real-time environment generally requires uninterrupted support, the equipment is normally “backed up” with another computer, or sufficient redundancy is included to insure continuous operation. Communications and display equipment are often incorporated in the equipment complex. Computer equipment usually is large-scale, frequently supported by additional small- or medium-scale peripheral computers.

(e) *Research and development.*—This environment usually involves the adaptation of commercial off-the-shelf or special-purpose equipment, in order to experiment, develop, or test new or improved ways in which computers can be utilized for particular applications. During the process, the equipment is often extensively modified and changed, and the development of new computer programming techniques or concepts is required.

(f) *Special operations.*—In this environment, general-purpose equipment may be used for unique purposes, or specially constructed equipment or modified commercial equipment may be used to meet unusual and specific requirements. In the latter instance, the equipment must frequently meet extremely rigid specifications with respect to size, reliability, or conditions within which it operates.

## 2. *Time-response classes*

Within each of the environment categories, three general time-response classes can be distinguished.

(a) *Priority.*—This type of response involves the use of communications capability; that is, the computer equipment must be in a continuous state of readiness to receive, process, and distribute information, or be capable of interrupting the ongoing process to respond to external demands.

(b) *Time critical.*—In some cases, the project or program being supported by a computer requires a very rapid response to provide the in-



formation before it loses its value or before the next course of action can take place. While these computers do not operate in real time, the time-response requirements nevertheless place constraints on the manner in which the equipment is utilized.

(c) *Scheduled.*—A large part of the computer workload is usually processed on the basis of scheduled start of completion times. While scheduled applications may have some degree of flexibility, and may be postponed depending on external factors, the schedule becomes fixed at some point and must be met.

Although a classification system of this kind will be helpful in determining policies, it must be noted that not all computer installations will fit neatly into one of the classifications. There will be many cases where a single computer installation functions within several of the environment categories and is required to meet varying time-response demands. In these instances, subjective judgments based on those factors which seem most predominant and overriding will often be required in the application of policies and guidelines.

#### RECOMMENDATION

In the development and application of policies, guidelines, and criteria, the Bureau of the Budget will use a classification system which recognizes the essential differences among computer installations. The pattern of classification suggested by the analysis made during this study will serve as the basis for developing this system.

## CHAPTER 2

### DETERMINING THE BEST USE OF COMPUTER CAPABILITIES

The uses now made of computers are in most cases justifiable; but marginal and, at times, uneconomical uses are sufficiently prevalent to cause concern. The computer-based systems that are most efficient and most responsive to the information requirements of those who use their output are the systems that take optimum advantage of advanced techniques in planning the procedures and resources needed for complete operations; that is, the most advanced "system design" techniques. In many of the systems now in operation, however, greater advancement in design is needed. Attention to the two problems—marginal uses and advanced system design techniques—should be given high priority.

#### PROBLEM OF MARGINAL USES

Ordinarily, the greatest advantage for the Government is derived when a computer is devoted to accomplishing the missions of an agency, as opposed to routine administrative tasks. Examples are numerous: they include the use of computers in administering veterans' benefits, social security benefits, and the tax system; in tracking satellites; in performing theoretical investigations for scientific programs; in predicting demands for electric power; in weather forecasting; and in controlling air traffic. There are advantages in using computers for administrative tasks such as payroll and personnel accounting. However, since administrative functions normally are a relatively small part of total operations, the potential benefits to be derived from these applications are limited.

Comparisons in respect of costs and benefits of proposed new computer-based systems and the existing systems are fundamental requirements in determining the most effective use of computers. Manifestly, benefits must outweigh costs. Benefits may be expressed in tangible terms, such as reduced operating costs, or in intangible terms, such as improved service to the public, the accomplishment of missions not otherwise feasible, or better management practices. Unless benefits such as these are assured, the use of a computer would be classified as marginal.

The availability of unused capacity is an invitation to find additional uses for the computer. This search is motivated by the tendency to regard unused time as evidence of inefficient management. While undoubtedly the intention is to improve utilization, the effect often is merely to increase the running time of equipment, with uneconomical applications tending to lessen the true effectiveness of the use of computers. After such marginal applications have found their way onto

a computer, it becomes difficult to eliminate them, even though their presence may later require the procurement of additional equipment.

Management officials in agencies should make decisions on the uses to be made of computers, rather than leave these determinations to specialists in equipment and in system design. As proponents of the use of computers, specialists can be most effective; their technical advice is an essential factor in decisionmaking. However, those who are responsible for mission accomplishment should be prepared to make the final decisions. Involving line management officials in this way will aid in insuring that objectives for the use of electronic data processing equipment in mission accomplishment are carefully established and clearly understood; that adequate resources are made available to insure that the objectives will be achieved; that proper recognition is accorded to the magnitude and complexity of the task; that full cooperation and support of the total organization is obtained; and that marginal uses are minimized.

Finally, it is important that the use of existing computers be evaluated with two purposes in view: (1) to determine whether the benefits anticipated in the cost/benefit analysis made prior to acquisition are being realized, and (2) to redetermine the relative priority of each computer application to insure that, with the passage of time and in view of new potential applications, any application that is considered marginal is removed.

General guidelines stressing the value and purpose of such evaluations are given in Bureau of the Budget Circular A-61: "Guidelines for Appraising Agency Practices in the Management of Automatic Data Processing Equipment in Federal Agencies," issued in August 1963. The essential questions to be answered in the course of the evaluations are as follows:

- (1) What advantages have resulted from the computer system?
- (2) What contribution have these advantages made to the effectiveness with which the agency's function is being performed? This question is crucial in testing the ultimate worth of the advantages of the system, particularly in those cases where increased costs of data processing may be involved.
- (3) What are the resulting costs of the system? Are they justified in terms of the benefits being obtained?
- (4) How efficiently is the system being operated? The fact that substantial benefits are being obtained does not necessarily mean that they are being obtained in the most economical manner.

Although formal programs of evaluation have been undertaken by some agencies (notably by Department of Defense), it is essential that renewed and continuing emphasis be given to this phase of management review activity. There is, however, a general lack of criteria which would be useful in measuring performance in such areas as operation and maintenance of equipment, efficiency of programing, and costs for common applications. The availability of basic data used during the evaluation should, to the extent feasible, become a part of the ADP management information system, which is discussed in chapter 10 of this report.

PROBLEM OF ADVANCED SYSTEM DESIGN

The development of computer-based systems can often be facilitated if there is an adequate frame of reference, so that any given system or subsystem can be viewed in terms of its relationship to the total structure of systems in an agency. This is particularly true in the business type or program type of functional areas; it may be less feasible if novel, experimental, scientific research, or pioneering applications are involved. Therefore, a master systems plan for an agency, at the highest feasible level, is desirable. All efforts to develop systems can then be undertaken in relation to the plan, in order to achieve an orderly and coordinated program. Such a plan, of course, needs to be reviewed periodically for adjustment. Leadership and coordination of a program of this kind requires the provision of adequate staff resources at agency and intermediate levels.

System design, and its importance as a primary consideration in effective utilization of equipment, has been given considerable emphasis by the Bureau of the Budget in policies and guidelines published since 1960.<sup>1</sup> There are three basic reasons for this:

- (1) System design serves as a basis for determining whether or not computer capability is, in fact, necessary. Cases have been reported where a detailed analysis of an existing system resulted in improvements to the point where the computer could make no further significant contribution.

- (2) It governs the proper development of specifications for systems. They, in turn, are highly significant factors in the selection of the most appropriate equipment for the task at hand.

- (3) It aids in insuring that the most efficient and economical means are employed in achieving the objectives of the system.

Several concepts and techniques (made possible by the computer itself) can often make a significant contribution to the advancement of system design. Included are the integration into a single master system of several functions using common basic data; the use of mathematical techniques; the use of "management by exception" techniques in which only unusual circumstances are selected out of the routine process for human consideration; and the coordination of separately operated computer systems to assure machine-to-machine communication where an exchange of data is involved.

There is an awareness among agencies of the importance of system design in assuring the best use of computers. It is no idle claim to say that some of the Government computer systems are outstanding examples of efficiency and of the employment of advanced techniques. Efforts to make such examples more widespread are being deterred in two ways: one of these deterrents stems from the lack of adequately trained personnel. While this is a general problem, its effects are felt most keenly in the smaller agencies, which are only now beginning to consider the use of computers in their operations and which do not have a nucleus of trained personnel to draw upon. Also, because these agencies are not certain that computers will prove advantageous in

<sup>1</sup> Bureau of the Budget Bulletin 60-6: "Studies Preceding the Acquisition of Automatic Data Processing Equipment" (Mar. 18, 1960); Circular A-54: "Policies on the Selection and Acquisition of Automatic Data Processing Equipment in the Executive Branch" (Oct. 14, 1960); Circular A-61: "Guidelines for Appraising Agency Practices in the Management of Automatic Data Processing Equipment in Federal Agencies" (Aug. 3, 1963).

their operations, the investment necessary to build a staff simply for the purpose of finding out may be prohibitive.

This problem has been met in part by the National Bureau of Standards, Department of Commerce, which has upon request provided assistance to agencies, to the extent possible. The demands for assistance have far exceeded resources to service them. Other agencies have at times cooperated by lending trained personnel—often at a sacrifice to their own programs. In other cases, commercial sources have been used to carry out studies.

There is a need for a pool of trained personnel who can be called upon, as needed, to help agencies—particularly smaller ones—in solving problems related to computer systems.

The other deterrent is the general lack of criteria for use by agencies in evaluating systems design. The absence of such criteria creates a void in the process by which management assures itself that appropriate methods are being employed and that a quality product is being obtained within a reasonable period of time at a reasonable cost. Criteria to provide assistance to management in this respect should be developed and furnished.

#### CONCLUSIONS

Greater emphasis is needed on agency evaluations of their computer-based systems. Criteria need to be developed to assist in measuring performance in the operation and maintenance of equipment. Measures of efficiency in computer programming are also needed. Development of these criteria calls for the assembling of information not currently available.

The needs of agencies for assistance in the analysis and design of computer-based systems must be met. Because the National Bureau of Standards has performed this role in the past, to the extent its resources permitted, and because of its established competence in this field, it seems logical that its resources should be expanded to meet more fully the needs of agencies for assistance in systems work.

#### RECOMMENDATIONS

1. The Bureau of the Budget will develop a broadly based program of continuous evaluation of computer systems, to provide an assessment of accomplishments and to serve as a recurring source of information for the development or revision of policies and guidelines. The responsibility for conducting evaluations and preparing appropriate reports will rest with the agency heads, in accordance with their normal management responsibilities.
2. The Bureau of the Budget will develop criteria to assist in evaluating both systems design and various aspects of system performance.
3. Agencies should develop master data-processing plans at appropriate levels, to serve as guides in the orderly development of systems and to assure the most effective use of staff resources available for that development.
4. The Department of Commerce, through the National Bureau of Standards, should expand the advisory services currently being provided to agencies in the analysis and design of computer-based systems. Its resources allocated for this purpose should be increased to the extent required to meet such needs as fully as possible.

## CHAPTER 3

### MEETING REQUIREMENTS FOR COMPUTER CAPACITY

#### PUTTING UNUSED COMPUTER CAPACITY TO WORK

It is the Government's policy<sup>1</sup> that agencies will seek to satisfy computer needs by utilizing unused capacities, and that agencies having unused capacities will offer them to those who need it.

There are distinct economic advantages to be gained by utilizing unused capacity on computers already installed by the Government. If the capacity is available on purchased machines, it can be used with very little additional out-of-pocket cost. If it is available on leased machines, it often can be used at the lower rates charged for extra use; and if the available capacity is within the total number of hours a month for which a minimum lease charge is paid, the cost for additional use of the equipment is negligible.

The potentials inherent in the practice of one computer installation sharing its unused capacity are evident from a review of Government-wide statistics. The latest annual reports submitted by agencies to the Bureau of the Budget indicate that during a given 3-month period about 500,000 hours of computer capacity were not being used among 1,400 computers.

Realistically, however, only a fraction of this capacity can be considered for use by others who may have computer needs. Over 150,000 hours, or almost one-third of the unused hours, are reported as not available for sharing because of security restrictions, unusual workload contingencies, or special equipment modifications. Of the remaining 350,000 unused hours, 140,000 are on relatively small computers, usually located on-site to be available to scientists and engineers for immediate access when needed for computational problems. Another 40,000 hours are associated with systems requiring instant and uninterrupted response and are not suitable for extensive sharing. Thus only about 170,000 hours, or about one-third of the total, can reasonably be considered available for sharing purposes. While this still represents a large potential, there are certain factors including the following that will prevent full realization of this potential: (1) virtually all unused capacity is available only on weekends or on third and second shifts, and this creates administrative difficulties; (2) the computer may not be available at the time the requirement has to be met; and (3) geographical distances or locations may preclude satisfactory arrangements.

Nevertheless, it has been demonstrated that sharing can be facilitated by an arrangement whereby computing needs and availabilities are recorded and matched at a central point. Last year, the

<sup>1</sup> Bureau of the Budget Circular A-27: "Policies and Responsibilities on the Sharing of Electronic Computer Time and Services in the Executive Branch" (June 15, 1964).

Bureau of the Budget, with cooperation of other agencies, completed a computer sharing exchange experiment in the Philadelphia area. Arrangements made through this exchange resulted in a fivefold increase in sharing. This plan is now being extended to other metropolitan areas by the General Services Administration in accordance with responsibilities outlined in Bureau of the Budget Circular A-27. As noted in chapter 10 of this report, the development of an ADP management information system will give specific attention to the information needs of the sharing program to assure that it can be effective in satisfying the needs for computer time. It is essential that this response also be made with respect to supporting services (e.g., systems design, key punching, programming).

#### COMPUTER SERVICE CENTER

The Bureau of the Budget has also broadened the sharing concept by arranging for the National Bureau of Standards to serve as a computer service center for the Washington area—also on an experimental basis to test its value. Under this arrangement, agencies needing computer services can go directly to the service center to have them performed. A sharing exchange, operated with the service center, assists in arranging for these services to be performed elsewhere if the service center, for some reason, cannot meet the requirement. The continuation or extension of the service center concept will depend upon the results of the experiment, which is scheduled for completion in 1965.

#### PRICES FOR SERVICES

A problem involved in sharing arrangements is the matter of prices charged for services. There are at present no guidelines to govern this matter. As a consequence, there may be considerable variation in the prices charged by installations using the same kind of equipment—caused primarily by the inclusion of different cost factors in the price. The result, of course, is to overload the installation having the cheaper price, while the other is unused.

To facilitate an equitable distribution of the sharing workload and to provide the customer some means for better estimating what his costs will be, early attention should be given to establishing cost principles which would be applied uniformly by agencies when developing schedules of rates and charges for the use of ADP equipment and services.

#### USING CONTRACTOR ORGANIZATIONS

According to the last annual report submitted by agencies to the Bureau of the Budget, agencies spent \$55,800,000 in the fiscal year 1964 to acquire automatic data processing services from contractor organizations. Of this amount, \$37,500,000 was spent for systems development activities, and \$18,300,000 was spent for machine time and related services, despite the fact that considerable unused capacity existed in Government installations. This latter fact reinforces the need for an effective sharing program. This is not to say, however, that the use of commercial organizations was not fully justified under the circumstances. The existence of this practice simply adds another dimension to the potentials of the sharing concept.

Contractor organizations are used to provide a wide variety of services. They include:

1. Providing computer time, usually with operator service.
2. Preparing and converting data for machine processing.
3. Designing a system.
4. Programing a system.
5. Evaluating equipment and recommending selections.
6. Operating a computer installation in a Government facility.
7. Designing and developing special equipment.
8. Maintaining equipment.
9. Training.

Types of organizations that provide these services include nonprofit organizations, research institutions, educational institutions, consulting firms, service organizations specializing in equipment operation or in systems design and programing, and equipment manufacturers who, in addition, perform these related services.

The use of contractor organizations usually occurs when peak workloads arise and it is to the agencies' advantage to secure outside assistance instead of augmenting its own work force for a short period of time; or when the talents needed for a task are not available within the Government either as to kind, quantity, or time needed (this occurs particularly with respect to systems development and programing). However, several problems have arisen in the use of contractor organizations:

1. Techniques, processes, or products produced by a contractor for one agency might often meet the needs of another agency that is contracting for the same thing. Some effective means for exchange of information is needed. This problem also extends to activities within Government.
2. Potential conflicts are present when manufacturers of equipment contract to develop systems and then enter the bidding to furnish the equipment. The establishment of criteria by which the objectivity of performance could be evaluated would remove doubts in this area.

#### USE OF EXCESS AND SURPLUS COMPUTER CAPACITY

When an agency has determined that its continuing requirements for computer capacity cannot be met by its own computer or by sharing computers operated by other agencies, Government policy<sup>2</sup> requires that agencies first consider the use of excess or surplus equipment already available within the Government before considering the acquisition of new equipment. This policy requires that consideration be given not only to excess or surplus equipment that is owned by the Government, but also to that which is leased and is about to be returned to the manufacturer. In this latter case, agencies that can benefit by the use of this equipment can ordinarily purchase it at substantial reductions from the original list prices.

<sup>2</sup>General Services Administration Personal Property Management Regulation No. 36: "Utilization Screening of Government-owned and Leased Electronic Data Processing Equipment" (April 1964).



CURRENT EMPHASIS ON MORE EFFECTIVE USE OF EXISTING COMPUTER CAPACITY

The Bureau of the Budget has taken steps designed to emphasize current policies on the use of computer capacity and to encourage the fullest measure of implementation. In July 1964, the Bureau requested the heads of all agencies that were scheduled to increase their computer capacity through new acquisitions during the fiscal year 1965 to re-study their needs, to consider again the possibilities of substituting unused capacity of excess equipment for new additional capacity, and to report their findings to the Bureau for consideration in making apportionments of funds. Similar reports have now been incorporated in our plans for budget hearings in the future.

RECOMMENDATIONS

1. The Bureau of the Budget will establish an interagency group to study and develop cost principles to be applied uniformly by agencies in establishing prices for shared computer time and services.
2. The Bureau of the Budget will continue its evaluation of the service center concept to determine a proper course of action to be taken.
3. The Bureau of the Budget will, with the assistance of the major agencies concerned, undertake a study of the problems associated with the use of contractor organizations for providing services related to electronic data processing activities, with a view toward developing policies, guidelines, or actions that the study may indicate are needed.

## CHAPTER 4

### SELECTING THE PROPER EQUIPMENT FOR USE

The selection of equipment which meets adequately the current and projected data processing requirements of an agency is a complex task, owing largely to the diversity of equipment available. Specifying as fully as necessary the requirements for data processing, as a precedent to decisions on selection, is a painstaking and time-consuming task.

#### CURRENT POLICIES ON SELECTION OF EQUIPMENT

Policies and guidelines governing the selection of equipment to be acquired from manufacturers are set forth by the Bureau of the Budget as follows:<sup>1</sup>

1. Decisions will be based on system specifications.
2. The selection process must accord equal opportunity and appropriate consideration to all manufacturers who offer equipment capable of meeting the system specifications.
3. Two prime factors are to be considered: (a) the capability of the equipment for fulfilling the system requirements, and (b) the cost of the equipment and costs associated with its installation and operation.

#### METHODS OF IMPLEMENTATION

Agencies generally have followed one of two methods in applying current policies for equipment selection:

1. They conduct "in-house evaluations" of equipment based on an examination of characteristics and specifications contained in literature offered by various manufacturers. This method is not used extensively, however. Information regarding latest equipment may not always be available. Regardless of how objective an agency's in-house evaluation may be, manufacturers generally feel uneasy about whether their equipment was properly evaluated.
2. Usually, the agencies provide system specifications to each manufacturer, with a request that he submit a proposal outlining which of his equipment can best do the job. In addition, the proposal should include such information as costs, personnel required, and the availability of programing aids. These proposals are then evaluated, to determine those which may best meet the agencies' requirements.

#### EXPERIENCE IN IMPLEMENTATION OF POLICY

The present study involved extensive discussion of selection policies and practices with manufacturers as well as with the agencies. These discussions disclosed that implementation of current policies

<sup>1</sup> Bureau of the Budget Circular A-54: "Policies on the Selection and Acquisition of Automatic Data Processing Equipment in the Executive Branch" (Oct. 14, 1961).

creates problems for both the agencies and the manufacturers. From the agency viewpoint, the need to solicit and evaluate proposals (at various review levels) delays the delivery date of the computer, to the disadvantage of the Government. The agency is unable to take advantage quickly of new technological developments, with the result that higher costs and lower productivity are continued for longer than would otherwise be so.

From the viewpoint of the manufacturer, there were several disadvantages:

- (1) The cost to him of preparing a detailed proposal is great. Costs could be reduced if (a) there were more uniformity in the format and content of the requests for proposals and the related system specifications, and (b) more effective use of representative ("benchmark") problems were made in the specifications.
- (2) The time allowed by agencies for responding to proposals is often too short to permit proper preparation. Thirty to sixty days was suggested as an appropriate time period.
- (3) Selections are often made without notifying the competing and losing manufacturers of the reason why they lost.

Despite these dissatisfactions, the practice of selecting equipment on the basis of the manufacturers' responses to requests for proposals is regarded as sound. It provides the best means for each manufacturer to present his case on an equal basis with all other manufacturers: the inclusion of system specifications in the request for a proposal properly places the emphasis upon the system, rather than upon a simple comparison of hardware; and it helps to prevent biased selections which may be unfair to the manufacturers. While the practice may cause some delay in improving operations, any costs that might be incurred on this account are considered to be outweighed by the checks and balances which this practice provides against what otherwise might be hasty, ill-conceived actions. Furthermore, the delay may not be occasioned so much by the proposal process as by the internal review and approval process which, again, is necessary to assure proper coordination of all data processing activities.

Nevertheless, the need to simplify the proposals required of manufacturers is recognized. The preparation of systems specifications on a more uniform basis by Government agencies, and the more effective use of benchmark problems which are representative of the data processing requirements, would benefit both the supplier in preparing a proposal as well as the Government in evaluating the proposals.

Further, the development and eventual use of standard, machine-independent program languages will greatly facilitate the comparative evaluation of proposals from the standpoint of the manufacturer's total product, including both equipment performance and related programming support. This emphasizes the importance of adequate Federal support of the program of the American Standards Association, as discussed in chapter 7 of this report, since the association is now in the process of developing American standard languages for computer programming.

#### THE COMPATIBILITY FACTOR

High on the list of factors affecting the selection of equipment are the differences among the equipment offered by the various manufacturers. (See "Chapter 7: Standardization of Equipment and Tech-

niques.") This becomes particularly significant when selection concerns the replacement of equipment. The operation of a given computer often requires a large investment in the development of computer programs. Once developed, these programs often cannot be used on equipment offered by another manufacturer except, perhaps, by means of a costly and often unsatisfactory conversion process. Consequently, the user is "locked in" on a situation which may require him to replace his equipment with compatible equipment offered by the same manufacturer, unless he wishes to ignore the cost of developing new programs, which in some cases cannot be justified from an economic standpoint. Efforts are underway to free the user from such situations by the development of more effective "conversion" programs, and particularly by the development of machine-independent programming languages which can be used irrespective of the equipment used.

#### SHARING INFORMATION ON MANUFACTURERS' PERFORMANCE

There have been instances in which manufacturers have failed to perform satisfactorily. In some cases, equipment was not delivered on time, was not maintained satisfactorily, or did not operate properly. In others, the programming aids (usually referred to as software) were not delivered with the equipment or did not perform as expected.

In general, this information has not been exchanged among agencies on any routine basis, and therefore could not be given appropriate consideration during the selection process and in the negotiation of contract awards by the General Services Administration.

#### PRACTICES IN EVALUATING EQUIPMENT

The absence of detailed guidelines on the techniques and considerations to be employed by agencies in their evaluation of equipment during the selection process has led to a wide range of practices in this regard. Undoubtedly, some are better and more effective than others and, if so, should be uniformly applied. In addition, the current policies and guidelines do not differentiate sufficiently between the acquisition of additional equipment and the replacement or modification of existing equipment. More specific guidance in this respect would help to promote uniformity of action.

#### CONCLUSIONS

Present policies and guidelines on the selection of equipment need expansion and updating to meet the problems and needs set forth in this chapter. Specifically:

1. Current policies, which require that system specifications be developed and used as a basis for selection, need to be supported by a technical issuance, for Government-wide use, which provides criteria and procedures in the preparation of specifications of this kind.

2. Guidelines are needed on the form, scope, and handling of invitations to suppliers to submit equipment proposals. These guidelines should include reference to the use of benchmark problems which are representative of the data-processing requirements.

3. As reference material for the Government as a whole, updated and authoritative information on the capabilities and characteristics

of equipment is essential and should be provided. This guide should also contain comparative studies of selected characteristics of available makes and models.

4. The distinctions between selection decisions for equipment additions, replacements, and modifications, need identification and clarification.

5. Methods should be devised to enable agencies to share their experiences in the selection of equipment.

6. Government-wide criteria for evaluating suppliers' equipment proposals should be provided.

7. Information concerning past performance of suppliers of electronic data-processing equipment would be helpful in the process of equipment selection and should be provided to all executive agencies.

8. The factor of compatibility of equipment of the same or different suppliers is an important consideration in the selection process. However, this fact needs to be emphasized; and most agency officials need, and should be furnished, governmental criteria and guidelines on how to take the compatibility factor into account.

9. Since electronic data-processing equipment in the Government inventory, whether leased or owned, which exceeds the needs of the current holder, competes with suppliers' equipment in the selection process, cost/effectiveness guidelines are needed to assist in determining when excess equipment should be used in lieu of acquiring additional equipment.

#### RECOMMENDATIONS

1. The Bureau of the Budget will provide for the publication of criteria, guidelines, or regulations covering the selection of electronic data-processing equipment. It will do this through new issuances or by expanding upon current issuances, covering the following subjects:

(a) The preparation of system specifications, including benchmark problems, to be furnished equipment suppliers in requests for proposals.

(b) Evaluation of suppliers' proposals.

(c) Compatibility considerations.

(d) Consideration of excess and surplus equipment.

(e) Distinctions to be made between additions, replacements, and modifications when selection policies and criteria are applied.

(f) Interagency sharing of experiences in the selection and performance of equipment.

2. The General Services Administration should maintain current data on the characteristics and performance capabilities of all items of commercially available general-purpose electronic data-processing equipment that are (a) currently in place in the Government, (b) available from suppliers, and (c) scheduled to become available from suppliers. Based on this data, GSA should provide comparative information to agencies on request.

3. The General Services Administration should gather and make available to executive agencies on request information on the performance of the firms that supply electronic data-processing equipment and programing aids to the agencies.

## CHAPTER 5

### PURCHASE OR RENTAL OF COMPUTERS

Public controversy over the management of electronic data processing in Government has centered primarily on the following question: Should computers be purchased or should they be rented? The answer to this question involves the basic problem of deciding how long a given computer can be used advantageously in the Government. If during this period the costs associated with purchase are less than the costs associated with rental, the computer should be purchased; if not, the computer should be rented.

The problem of deciding how long a computer can be used advantageously is not an easy one. It is complicated by the need to consider the effects of future changes in workload and system requirements, the impact of improvements in technology, and the potential longer term use of the computer elsewhere in Government after its original purpose is served. All these considerations involve judgments. Either decision—purchase or rental—resulting from these judgments can be costly if it turns out to be incorrect. If a rented computer is used beyond the break-even point, unnecessary rental costs will be incurred. If a purchased computer cannot be used until the break-even point is reached, a loss on disposal is likely to occur.

Policies and criteria governing these decisions must therefore be developed cautiously, with a view toward minimizing losses. Furthermore, they must give attention to the longer range effects involved in the purchase of equipment. These include the determination of the point in time when purchased equipment should be replaced to avoid uneconomical use; the management problems related to the utilization and disposal of Government-owned equipment when it becomes excess to an agency's needs; and the provision of maintenance and operating support for the equipment which, under a rental arrangement, is the responsibility of the supplier.

#### PRESENT STATUS AND STUDY

As of June 30, 1964, 681 or 38.5 percent of the computers in use by the Government had been purchased. Estimates indicated that by June 1965 the percentage will have increased to 46.

These statistics reveal a significant change in attitude toward the advantages of purchase. Until 1962, most computers in Government (about 85 percent) were rented. This method was usually chosen because computer technology was new and people were inexperienced in its use. Rental offered a certain protection against obsolescence or mistakes in selection because, presumably, the rented equipment could be replaced more readily. In addition, the rental method had become almost traditional because until 1956 the principal supplier did not offer data processing equipment for sale.

In 1961, however, it became apparent that the advantages of purchase were being overlooked in many cases where long-term usage of the computer was anticipated. As a consequence, the Bureau of the Budget undertook the development of policies and criteria to govern an agency's decision whether to buy or rent. A statement of policy was issued in October 1961,<sup>1</sup> and the trend toward increased purchasing was set in motion. Because of the need to make budget adjustments to finance the large capital investments, and because of a general and understandable hesitancy to break with the existing widespread rental practices, substantial increases in purchases were not noted until the fiscal years 1963 and 1964.

The policy on which purchase or rental decisions are now based is one which requires agencies to make an objective evaluation of the relative merits of both alternatives and to select the one which, under the particular circumstances, offers the greatest advantage. The guidelines are relatively simple. They require the agency to—

- (1) Calculate the point in time (break-even point) when accumulated rental costs begin to exceed the cost of purchase. Normally this will range between 2½ and 4½ years. Because rental costs accumulate according to the rate of usage, computers with high utilization rates reach this point earlier.
- (2) Decide whether the computer will satisfy the user for at least that length of time. If so, the equipment should be purchased. If not, it should be rented.

This latter decision involves a judgment which the responsible agency is best able to make. If an agency's programs are relatively stable, future needs for equipment can be determined with relative ease, and a decision to purchase a computer can be made with reasonable certainty that the investment is adequately protected. This is true of the large percentage of computers removed that have been purchased. Statistics show that purchased computers removed during the fiscal year 1964 had been installed an average of 51 months.

On the other hand, the decision concerning usage is often very difficult to make. Many programs on which computers are used are subject to rapid and unpredictable changes in workload. Others may demand the latest, most powerful computer as it becomes available. Therefore, the length of time that the computer being acquired for these programs will be capable of satisfying the need is uncertain. Justifiably, where such uncertainty exists, it would be unwise to risk capital funds until it is reasonably clear that the computer will be satisfactory for a period beyond the break-even point. These cases account for the substantial number of computers still being rented. Statistics show that leased computers removed during the fiscal year 1964 had been installed only 34 months, on the average.

Government agencies have not been uniformly zealous, however, in keeping rental contracts under constant review, in order that prompt action to purchase can be taken when it appears evident that the computer will remain in use beyond the break-even point. This is particularly true where the predicted rate of use is being greatly exceeded and the break-even point consequently will be reached earlier

<sup>1</sup> Bureau of the Budget Circular A-54: "Policies on the Selection and Acquisition of Automatic Data Processing Equipment in the Executive Branch" (Oct. 14, 1961).

than had been anticipated in the original rental decision. In order to avoid unnecessary rental costs, agencies must assure that the conditions justifying rental are being continuously evaluated and that, when rental is no longer justified, prompt purchase action is taken.

#### COST OF MONEY

Current policies do not require that the cost of money be included in determining whether to lease or purchase ADP equipment. It would be desirable to require consideration of this additional factor, although there will probably be few instances when such consideration will be significant enough to alter the decision.

#### TECHNOLOGICAL IMPROVEMENTS

Government policy recognizes the effect of technological advances by stipulating that if the break-even point for purchase is not expected to be achieved within a 6-year period, then (because replacement with superior equipment might be warranted by that time) the computer should be rented. However, since the break-even point is usually reached between 2½ and 4½ years, the policy, in essence, assumes that the rate of technological improvement will not be substantial enough to warrant replacement of equipment during this relatively short period.

On the other hand, in their decisions to buy or rent, private industry gives substantial consideration to technological advancements. A recent survey in a national magazine indicates that about 85 percent of all computers in use by private industry are rented. Although investment policy and tax considerations are also factors, the main reason given for favoring rental is that this gives the user greater flexibility in changing computers as significant technological advances are made.

The effect of technological advances upon the production cycle of selected computers is evident in illustration II. The length of time in which computers remained in production before being superseded range from 18 months to 79 months. Of those still in production in June 1964, only two had been in production for as long as 61 months.



AUTOMATIC DATA PROCESSING

ILLUSTRATION. II  
PRODUCTION CYCLE OF SELECTED COMPUTERS

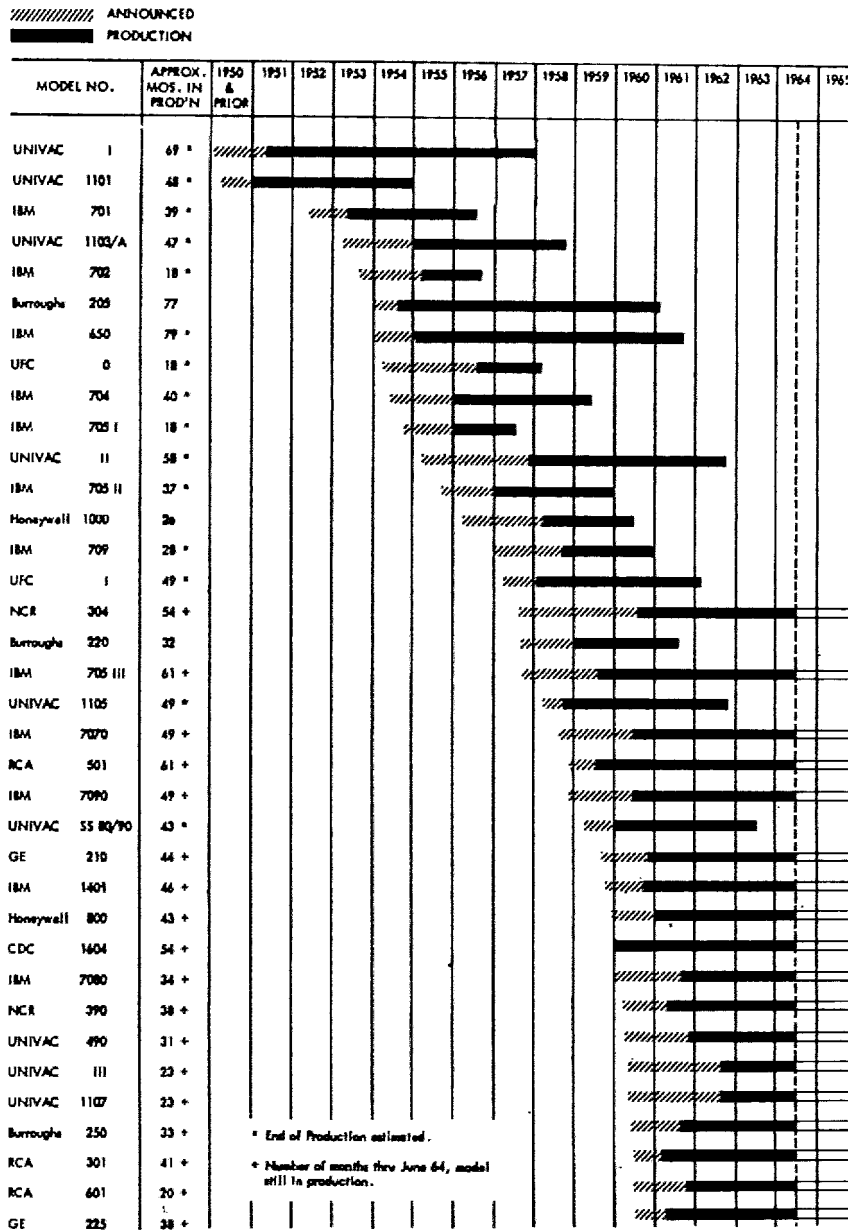
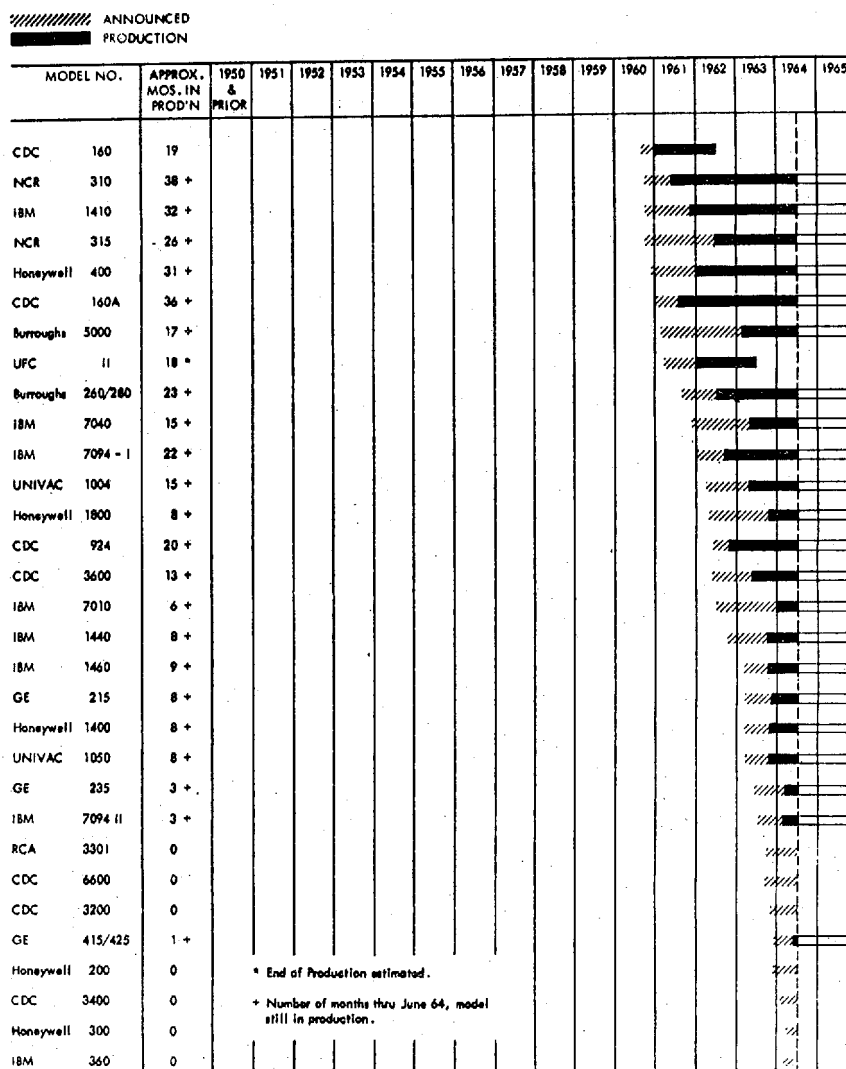


ILLUSTRATION II. (Cont'd)  
 PRODUCTION CYCLE OF SELECTED COMPUTERS



In order to determine the effect of technological advances upon the effectiveness and cost of computers, an analysis was made of four successive computer models offered by the same manufacturer over a period of 7 years. The results are given below, assigning the first computer (computer A) a base figure of 1:

Computer	Effectiveness	Rental cost	Effectiveness in relation to cost
A.....	1.00	1.00	1.00
B.....	2.82	1.86	1.35
C.....	8.16	2.57	3.18
D.....	12.41	2.79	4.45

This tabulation shows that the effectiveness of computers (i.e., the computer's ability to perform a given unit of work) was increased by more than 12 times while the cost was increasing by less than 3 times. Stating it another way, for the same dollar spent on rental cost, computer D provided over four times as much data processing capability as did computer A.

While this analysis supports the conclusion that technological advances bring about significant reductions in cost and increases in operating effectiveness, it does not necessarily follow that computers should be rented as a matter of general policy—as many advocate. There are instances where computers with high-utilization rates will reach the purchase break-even point so quickly that there is little likelihood of a significant advance occurring in such a short period of time. In fact, the same analysis, taken from actual experience of a large Government contractor, demonstrated that the cost of purchasing these four different computers would have been less than the rental costs, assuming that the purchase action would not have prevented the replacement of these computers as necessary to take advantage of the technological advancements.

There are other factors which tend to deemphasize the importance of possible technological improvements as a factor in all situations. Substantial costs are often involved in changing computers, and these costs might offset any operating savings that the advanced computer itself might produce. Also, there are many situations where a more effective computer is unnecessary for the job to which the existing computer is assigned, particularly if an increase in computer costs is involved.

In addition, future technological advancements and the extent to which improved equipment will become available on the market is unpredictable. Certainly, it could not be expected that most local installations of the agencies would be able to make such judgments when considering the possible effects of technological advances on their own computer applications. Consequently, present Government policy as it applies to local installations should be continued.

However, since major technological advances tend to occur in cycles, some protection against continued purchasing by agencies' local installations should be provided when there is reasonable certainty that major breakthroughs are imminent. To afford this protection provision should be made within the Government for a continuing evaluation of current and future technology, and for a general suspension of

purchase activity in respect of certain equipment when this evaluation indicates that superior equipment is, or will soon be, available. But even in these circumstances, there will be instances where extremely high utilization will make it advantageous for a given agency to proceed with the purchase of the older equipment while awaiting delivery of the superior equipment, because of the long delays in delivery that are often involved.

#### REPLACEMENT OF PURCHASED EQUIPMENT

An argument often advanced against the purchase of computers is that it will lead to long-term use of uneconomical equipment, a point which is particularly pertinent in a field where technology is still relatively new and changing. There is, undoubtedly, a strong tendency in Government to require the use of Government-owned property beyond its economically useful life simply to avoid the capital outlays required for the purchase of new equipment. While this is a real danger to be avoided, it should not be avoided by favoring a rental policy. Instead, it should be avoided by general acceptance of a policy which provides that replacement of equipment is justified at any time in its life when the costs of operating old equipment are greater than the operating costs plus depreciation of the newer equipment. The formulation and adoption of a policy of this type, together with appropriate criteria to govern its application, are clearly needed as a consequence of the trend toward Government ownership, and to assure recognition of the fact that equipment still useful may no longer be economically useful.

#### BUDGET CONSIDERATIONS

Decisions with respect to the purchase or rental of a computer inevitably become involved in budget considerations. In most cases, budgets can be prepared or adjusted to accommodate either decision. In other cases, an administrator with limited funds available to perform his mission may find it undesirable to devote a substantial portion of his funds to a capital investment if doing so will force him to forgo an essential element of his operating program. In these cases, the choice reflects a decision on whether the purchase of equipment will yield a return in the form of long-range savings that is greater than the return to be obtained by devoting the funds to another purpose. In Government—unlike most industries where similar judgments must be made—this decision often cannot be validated by agencies because the benefits resulting from public service functions usually can be measured only by value judgments. Although it is recognized that budget considerations may, at times, cause a temporary deferral of a decision to purchase, the circumstances should be fully documented to show justification for such action, and steps should be taken to effect the budget adjustments which would permit purchase as early as practicable.

USE OF EQUIPMENT ON A GOVERNMENT-WIDE BASIS

For several years, the Comptroller General has been recommending<sup>2</sup> that the present policy be changed and that decisions on the purchase or rental of computers be made by a central management office.<sup>3</sup> Such a change would provide a means whereby the potential use of a computer could be considered on the basis of its use to the "Government as a whole," and not only to the original user, which is the case under present policy.

The difference between the existing and the proposed policy can be illustrated by example. Under existing policy, if the original user expects to use a computer for only 3 years and does not meet the criteria for purchase, the computer is rented. Under the proposed policy, the decision would be exercised by a central management office which would determine whether additional uses of the computer elsewhere in Government are likely to be found at the end of the 3-year period and thus warrant purchase at the time of original acquisition.

The Comptroller General's recommendation must be evaluated by comparing it with present policy.

At present, decisions on purchase or rental are based on circumstances that apply to the original user. If the decision is to purchase the equipment, it is based on the anticipation that the equipment can be used beyond the break-even point by the original user. Speculation on potential subsequent uses is not required to validate the decision. When the purchased equipment is ultimately replaced, it is reported to the General Services Administration as excess and is then available for further use by others in Government. Government policy requires that such excess equipment be considered as the first source of acquisition in satisfying computer needs. The present policy thus assures the fullest practical use of purchased equipment on a Government-wide basis.

If, on the other hand, the original user decides to rent the equipment, the decision is made with the expectation that the equipment cannot be used by him until the break-even point is reached. Therefore, rental of the equipment represents the most economical course of action available. When the rented equipment is no longer required or is replaced, it too is reported to the General Services Administration as excess. If no other user needs it, it is returned to the manufacturer. If the equipment will satisfactorily fulfill the needs of a second user, its purchase from the manufacturer at a discounted price can be arranged. The present policy therefore provides for reviewing the continued need of leased equipment on a Government-wide basis, and for the purchase of that equipment at reduced prices if an extended use is found. In the latter circumstance, the overall cost to the Government resulting from the rental costs incurred by the original user, plus the discounted purchase price paid by the second user, would probably be somewhat higher than if a central management office had correctly forecast second-user requests and had purchased the equipment originally. Conversely, however, under the present policy, judgment on the purchase of that equipment is withheld until a second

<sup>2</sup> See Comptroller General's Report to the Congress: "Study of the Financial Advantages of Purchasing Over Leasing of Electronic Data Processing Equipment in the Federal Government" (March 1963).

<sup>3</sup> H.R. 5171 would assign this responsibility to the General Services Administration. The Comptroller General has recommended that the President should establish this office in his own organization.

**IBM 7094 Configurator**

Required  
Optional  
Required On Optional

Note 1: Select final item(s) desired. Read up to CPU. Solid lines are required; dotted, optional.

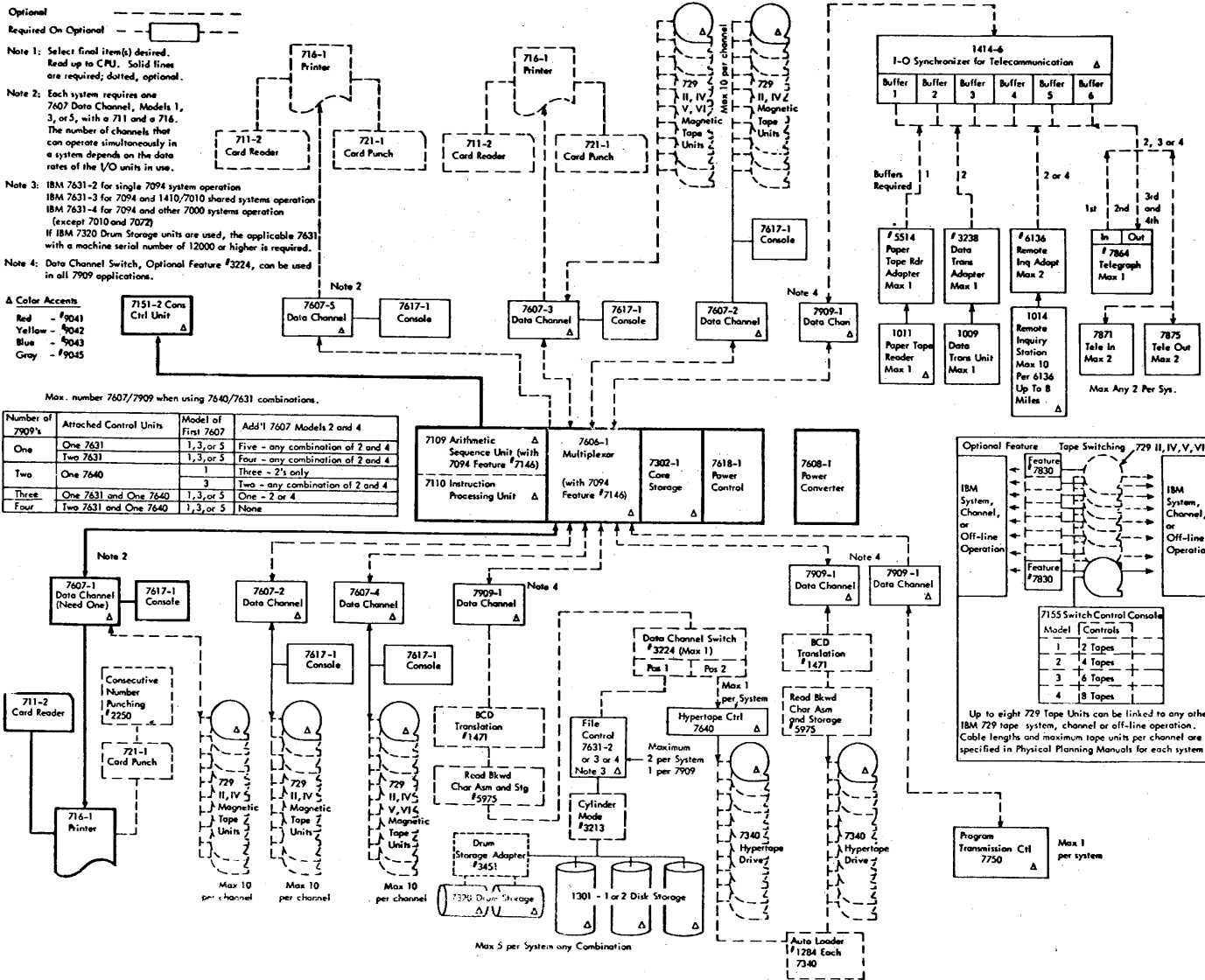
Note 2: Each system requires one 7607 Data Channel, Models 1, 3, or 5, with a 711 and a 716. The number of channels that can operate simultaneously in a system depends on the data rates of the I/O units in use.

Note 3: IBM 7631-2 for single 7094 system operation  
IBM 7631-3 for 7094 and 1410/7010 shared systems operation  
IBM 7631-4 for 7094 and other 7000 systems operation (except 7010 and 7072)  
If IBM 7320 Drum Storage units are used, the applicable 7631 with a machine serial number of 12000 or higher is required.

Note 4: Data Channel Switch, Optional Feature #3224, can be used in all 7909 applications.

Color Accents  
Red - #9041  
Yellow - #9042  
Blue - #9043  
Gray - #9045

**ILLUSTRATION III**



IBM 7094 CONFIGURATOR

user is fully assured, and thus the possibility of a loss resulting from premature disposal of the equipment is averted.

The soundness of the Comptroller General's recommendation therefore depends on the ability to forecast second and third uses of equipment with such accuracy and reliability as to warrant a substantial capital investment. The following are considerations to be taken into account:

1. Manufacturers offer a wide assortment of optional special features and engineering modifications to a customer. The extent and complexity of the combinations available and used are shown by illustration III, which pertains to IBM 7094. This same complexity applies equally to the popular models of computers which are widely used. Thus, although equipment may carry the same model number, equipment capability within that model number can and does vary substantially. It is therefore unlikely that an equipment configuration used at one installation could be used as is by another. This is supported by discussions with one equipment manufacturer who indicated that about one-half of all computers in a popular model returned by lessees needed some modification before they were usable elsewhere. Another one-third of those returned could not be used at all and were dismantled. The cost of operating a system of this kind, according to one manufacturer's experience, would equal at least several million dollars annually.

2. If it is assumed that equipment could be used elsewhere in a given case, the likelihood that it would be released by the current user at the time needed by the second user is small. Planning for replacement and for installation of equipment requires a year or more. The complexities involved with respect to site preparation, system design, computer programming, training, and delivery create serious handicaps in coordinating the transfer of equipment. Therefore, it seems highly probable that some provision would need to be made for special warehousing facilities for the temporary storage of expensive electronic equipment until transfer arrangements from one user to another could be completed.

In support of his recommendation, the Comptroller General pointed out in March 1963 that savings in rental costs of \$148 million would be achieved over a 5-year period by the purchase of 523 selected computers. It is significant that between June 1962 and June 1964 the executive branch purchased 506 computers under its present policies which, in a 5-year period, will have saved \$142 million. Additional purchases planned for the fiscal year 1965 will increase this figure to over \$200 million. Further, by the end of fiscal year 1965, almost 46 percent of the computers will have been purchased under present policies. As these computers become excess in the agencies where they are now in use, attempts will be made to extend their use in Government if economically feasible. It is probable that many of these will not be usable and will be disposed of. Consequently, it does not seem advisable to purchase others solely in anticipation of eventual reuse, when it is probable that those purchased under present criteria will not be fully absorbed within the Government as they become excess.

The system proposed by the Comptroller General clearly would not be workable unless a central management office could direct the use of excess computers. If, for example, the original user releases at

the end of 3 years a computer purchased by the central management office, and if 1½ years of use is still required before the purchase break-even point is reached, then a second user must be found to fully protect the capital investment. Honest differences between potential second users and the central office over whether the old computer can be used economically and advantageously are bound to arise. Logically, these situations can be resolved only by granting sufficient authority to a central management office to make the decision or by referring the matter for decision to the Executive Office of the President. In either case, the decision, which involves a resource vital to an agency's operations, could encroach seriously upon the management responsibilities of agency heads. The vital role now played by electronic computers requires that those who are accountable for mission accomplishment should have flexibility in making decisions on the selection and use of this equipment.

We believe that the basic policies and system now in effect represent a prudent course for the Government to follow and should be continued with such modifications and refinements as may be suggested by future experience.

#### MAINTENANCE OF EQUIPMENT

The substantial increase in the number of purchased computers introduces problems of maintenance which did not exist when the predominant practice was to rent equipment. Under rental contracts, maintenance of the computer is the sole responsibility of the manufacturer. Under purchase contracts, the Government has the option of retaining the services of the manufacturer under a separate maintenance contract, or of arranging to have maintenance performed by Government personnel or by commercial maintenance organizations. Consequently, the Government now has to choose and adopt a maintenance policy which recognizes these alternatives and provides the greatest advantage. Also, to assure adequate service and thereby achieve maximum use of the equipment, it must establish criteria to evaluate the quality of maintenance.

There are basically four methods by which the Government can maintain its equipment:

1. *Contracting with the manufacturer.*—Under this method, the quality of maintenance service would be essentially the same as that under present rental contracts. This alternative, at least as a transitional step until a policy can be developed, is attractive because of the manufacturer's expertise with his own product line. In addition, the vital relationship between sales and maintenance would tend to assure a high standard of performance. If adopted as the sole method, however, it might be more expensive than if other competitive arrangements were encouraged or if the maintenance were performed by the Government.

2. *Contracting with a single manufacturer to service all equipment in an installation, regardless of which manufacturer supplied it.*—From the standpoint of the computer installation, the consolidation under one manufacturer of maintenance responsibility for all equipment would simplify the administrative arrangements that are now complicated by the need to deal with several manufacturers. The ad-



ditional costs of training that would be necessary for a manufacturer to assume this responsibility would, however, tend to make this alternative more expensive—or otherwise result in maintenance of lower quality.

3. *Contracting with a commercial maintenance organization.*—Experience with this type of service is extremely limited because there has been no great demand for such service and very few companies have entered the field. Here again, capability and its dependence upon proper training and continuous updating of that training as engineering modifications are made to the equipment are paramount considerations. Also, there is the question whether commercial organizations would be available in sparsely populated areas; if not, problems of obtaining satisfactory maintenance service might arise.

4. *Establishing maintenance service within the Government.*—Relatively few organizations within the Government provide their own maintenance service. It has been limited essentially to those places where substantial modifications of commercially available equipment have been necessary to meet special purposes, or in isolated geographical areas. Where this practice has been followed, the quality of maintenance has been good, and often less expensive than that otherwise obtained. The retention of experienced personnel tends to be a problem, but has been alleviated in some cases by expanding the role of the maintenance engineer to include design, modification, and development of equipment.

Because experience thus far has generally been confined to manufacturer-provided maintenance, the alternatives should be studied carefully before a policy on this matter is adopted. Such study must give full recognition to ways in which experience on maintaining equipment is reported to the manufacturer to aid him in developing his product and making improvements which ultimately benefit the customer. This feedback is automatically assured when maintenance is performed by the manufacturer, but not when other arrangements are followed. The importance of this feedback is illustrated by the experience of one manufacturer who reported that 200 engineering changes had been made on 1 model of equipment, primarily as the result of such reporting.

Further, full recognition needs to be given to detailed and accurate reporting of all maintenance activity on each component of the equipment. Manufacturers regard this as highly essential to effective performance and to the proper management of their equipment inventory. It applies equally with respect to Government-owned equipment, and will further facilitate the transfer of computers or components among agencies with full knowledge of the equipment's performance capabilities. The recordkeeping required in this respect is extensive and costly and is an important factor to be considered.

The introduction of alternative methods for maintaining equipment highlights the need for criteria to measure the quality of maintenance being provided. Under rental contracts, there is an incentive for the manufacturer to provide satisfactory maintenance because rental payments depend upon the equipment being in good operating condition. Even so, significant differences in maintenance performance under rental contracts are noted. Statistics covering 1,400 computers over a 3-month period indicate that the average time required for

preventive maintenance was 21.9 hours a month, and for remedial maintenance it was 11.8 hours a month. There was no significant difference in these averages as between purchased equipment and rented equipment, indicating that sale of equipment has not thus far tended toward a lower quality of maintenance, as some have feared. Instances were detected, however, where maintenance requirements with respect to different models of equipment deviated considerably from these averages as depicted in illustration IV. These differences point to the need for some criteria to measure quality of performance. Reporting of actual performance against these criteria would form the basis for remedial action on a Government-wide basis, where such is indicated. As these criteria are refined, consideration should be given to their inclusion in maintenance contracts to assure satisfactory performance.

ILLUSTRATION IV.—Average monthly hours of preventive and remedial maintenance for principal computers

Computer	Average months installed	Total number installed	Total hours in service (monthly)	Average maintenance hours (monthly)		
				Preventive	Remedial	Total
A	54.0	87	253.4	10.8	14.1	24.9
B	45.2	26	125.4	4.7	7.2	11.9
C	45.2	41	210.3	14.5	7.3	21.8
D	40.2	22	182.4	13.0	4.1	17.1
E	32.6	101	371.8	10.9	18.5	29.4
F	24.1	38	428.6	66.2	7.4	73.6
G	20.9	34	346.5	22.3	11.9	34.2
H	20.0	110	189.1	3.7	6.7	9.4
I	19.6	54	413.4	30.0	18.5	48.5
J	19.1	446	844.2	10.5	10.3	20.8
K	15.8	25	474.9	33.6	11.8	45.4
L	12.6	47	346.5	60.9	13.2	74.1
M	11.8	23	235.7	35.7	6.4	42.1
N	11.4	48	316.2	23.8	10.6	34.4
O	11.2	51	411.0	24.0	15.7	40.7

MANAGEMENT OF INVENTORIES OF EXCESS EQUIPMENT

The trend toward Government ownership requires that proper provision be made for extending the use of this equipment in the Government as long as it is economical to do so. In this process, the nature of electronic data processing equipment creates problems of a special nature.

1. When reference is made to purchased computers, the impression that all components of the system have been purchased may be left. This is frequently not the case. Agencies may purchase major components, but continue to rent peripheral devices which have a longer break-even point, are subject to more frequent replacement, or involve greater maintenance (e.g., magnetic tape units, high-speed printers, and card punches). Thus, the management of excess purchased equipment may involve "incomplete" systems, which need to be augmented before they are reusable.

2. The large variety of alternative equipment configurations, optional features, or equipment modifications that are possible with each installation<sup>4</sup> requires that the inventory management problem be directed at the component level, thus expanding the equipment inventory far beyond that represented by only the number of computers involved.

<sup>4</sup> See illustration III.

These differences make the placement of excess equipment more difficult and require detailed recordkeeping on the technical characteristics of each component, in order to help a potential user to decide whether it will meet his requirements.

3. Earlier in this chapter it was noted that extensive modifications of equipment are often required before a second user's needs are satisfied. In one manufacturer's experience this was true of almost half of the computers of one model that had been returned after use; for another one-third, modifications could not be made and the equipment was dismantled. Critical evaluations of the economics of redistribution will, therefore, be necessary to determine whether it is advantageous for the Government to effect redistribution in certain cases.

4. Provision must be made for adequate support of equipment whose use is extended over a long period of time. Programing aids must be maintained by skilled programers, and training activities must be conducted for new programers and operators. As this equipment is phased out of production by the manufacturer, there is no assurance that reliance can be placed upon the manufacturer to continue this support and the Government must be prepared to assume the burden.

5. Since much excess equipment will probably not be reusable to advantage, adequate measures must be taken to assure prompt and effective disposal.

6. If it should appear that Government ownership of certain models or of models with certain characteristics might become excessive, additional purchases of that kind of equipment should be suspended temporarily. An agency that needs equipment immediately could rent it temporarily until the Government equipment becomes available. To avoid unnecessary purchases, provision should be made for a continuing evaluation of the potential excesses of owned equipment that might occur.

The basic procedural groundwork for accomplishing the redistribution of excess owned and leased equipment is contained in regulations issued by the General Services Administration.<sup>5</sup> Further attention, however, should now be directed toward the problem areas emerging in the implementation of these procedures.

#### RECOMMENDATIONS

1. Present policy and criteria governing the decision to buy or rent should be continued, except that the cost of money should be included as a factor in cost comparisons. Provision also should be made for a general suspension of purchase activity in respect of certain computer models when it becomes evident that superior equipment is about to become available, or when potential excesses of Government-owned equipment are sufficiently imminent to warrant only the temporary rental of equipment, pending the availability of such excesses.

2. Agency heads should take appropriate steps to assure that decisions to rent equipment remain under constant review, and that prompt action is taken to purchase the equipment if, in accordance with published criteria, it becomes advantageous to do so.

<sup>5</sup> Personal Property Management Regulation No. 36: "Utilization Screening of Government-Owned and Leased Electronic Data Processing Equipment" (April 1964).

3. To avoid use of equipment beyond the point of economic advantage to the Government, the General Services Administration should develop and publish guidelines and criteria governing the replacement of equipment.

4. The General Services Administration should also—

(a) Undertake a comprehensive study of the alternatives for providing adequate maintenance of computer equipment—a study that would lead to the establishment of appropriate policies, guidelines, and practices;

(b) Develop and publish criteria for evaluating the quality of maintenance;

(c) Provide guidance to assure that accurate and detailed records are kept on all maintenance performed on Government-owned equipment;

(d) Give immediate attention to the problems, as outlined in this chapter, with respect to the utilization of excess and disposal of surplus ADP equipment.

## CHAPTER 6

### CONTRACTING FOR THE PROCUREMENT OF EQUIPMENT

The present system whereby the General Services Administration annually negotiates contracts with manufacturers for the purchase, rental, and maintenance of equipment is not satisfactory to either party. The nature of the system causes delays in the execution of contracts, so that often there is no contract in existence until 2 or 3 months after the beginning of each fiscal year.

In these circumstances, Government agencies wishing to extend their rental agreements into the next fiscal year for equipment already in use are prevented from doing so, and they cannot make rental payments to the manufacturer until a contract is finally executed—perhaps as late as October. As a consequence, the manufacturer is forced to “finance” the continued use of the rented equipment by the agency with his own funds until a new contract is available as a basis for the collection of the rental payments due. Meanwhile, both parties are handicapped by the fact that the new contract may revise the conditions which govern the amount of rentals to be paid. Consequently, there is uncertainty regarding the kinds of records that need to be maintained to reflect the basis on which charges ultimately will be made. The determination of payments due on a retroactive basis is, therefore, often an extremely difficult task.

Further, the same terms and conditions negotiated by the Government are usually made available by the manufacturers to commercial users who normally acquire only single units of equipment. The Government obtains no special advantages as a volume purchaser of equipment.

These problems point to the need for a system that provides fair opportunity for negotiation and for prompt execution of contracts, leading to fair terms and conditions.

#### NEGOTIATION PROCEDURES

Contracts negotiated by the General Services Administration are published as a part of a Federal supply schedule. When a Government agency decides to acquire or continue the rental or maintenance of a computer that is included in the schedule, it issues a purchase order against the manufacturer, citing the applicable contract. This system eliminates the need for agencies to negotiate separate contracts for each procurement, although there are circumstances when agencies do undertake their own negotiations, as in the case of large multi-computer orders.

Under its current procedures, the General Services Administration annually advises the manufacturers in January of the terms and

conditions it would prefer to incorporate in the contracts for the next fiscal year beginning July 1. Manufacturers are requested to submit their offers in February, but they rarely meet this date. Thus, negotiations on the offer which should take place between March and June are often delayed, and sometimes do not begin until after July 1. The negotiations themselves may become long, drawn-out affairs. The delays and the undue length of the negotiation process are due to many factors. On the part of the General Services Administration, the need to handle a heavy workload in a given period of time with a limited staff is a contributory cause. On the part of the manufacturers, there is the need of more time to formulate an offer. On both parts, negotiating positions have to be checked with higher levels of authority at various stages of the process. But the main reason is largely tactical. Manufacturers hesitate to execute a contract without knowledge of their competitors' position and, consequently, no manufacturer wishes to have his contract executed and made public first. The General Services Administration, on the other hand, naturally strives to incorporate the best of the terms and conditions offered by one manufacturer in all other contracts.

On both sides, maneuverability is curtailed if an impasse is reached. The Government is faced with the possibility that the contractor may remove rented equipment from the premises if a contract is not executed by July 1 (although realistically he would probably not resort to such drastic action in view of the financial impact). The manufacturer, on the other hand, is faced with the possibility that the Government may release the rented equipment on July 1 (although realistically it could not do this in view of the extensive work and cost involved in changing to another manufacturer's equipment). Consequently, both parties must proceed toward a final agreement, despite the length of time involved.

#### NEED FOR IMPROVEMENTS

Steps clearly need to be taken to correct the nature of existing procedures. Delays in the execution of contracts that are attributable to sincere and worthy negotiations are understandable. Those due to procrastination or jockeying should be eliminated by providing a more disciplined and fair procedure. The establishment of a firm schedule within which negotiations with all contractors would proceed concurrently would contribute materially toward accomplishing this end. The following plan is proposed:

1. All contracts for the fiscal year should be executed and in effect by the beginning of the fiscal year (July 1).
2. The period July 1 through September 15 should serve as a period in which the agencies can develop and submit to the General Services Administration recommendations on changes in the existing contract.
3. By October 15, the General Services Administration should make available to the manufacturers the proposed changes for the following fiscal year.
4. The manufacturers should be required to submit their offers for the coming fiscal year on or before December 15.
5. Negotiation of contracts with all manufacturers should be completed by April 30, at which time authorization would be given to all manufacturers for printing and distributing copies of their contracts.

Between April 30 and May 31 the General Services Administration should develop and distribute to all agencies a bulletin which describes the formulas to be used in the computation of rental or maintenance payments, or other guidance required to assure uniform administration of the contract provisions.

6. For future years, experience would indicate how the above procedure could be streamlined and the time involved in the actual process reduced. In any case, all using agencies of the Government and the manufacturers should be in a legal position to continue to do business several months before the start of the fiscal year.

7. When any manufacturer fails to submit a contract offer by December 15 as provided in the timetable, agencies should not solicit proposals from that manufacturer for any equipment to be procured after July 1 next. Announcement to this effect should be made by the Administrator of General Services. It should become effective on July 1 and remain so for 60 days, plus the number of days after April 30, until a contract is executed.

8. The General Services Administration should convene an ad hoc advisory committee consisting of senior representatives of the major users of data-processing equipment in the Federal Government, to review any conflict existing between the negotiators. This body would make recommendations to the Administrator of General Services on the reasonableness and acceptability of the terms and conditions proposed by the manufacturer. The ad hoc group would not enter into negotiations, but would hear the Government's reasons for not wanting to accept a manufacturer's terms and, possibly, the manufacturer's reasons for being unable to accept the Government's terms. Its recommendations would be based on an objective evaluation of both positions.

Although it is customary to execute new contracts each year, the fact that contracts are negotiated on an annual basis creates an unusual situation with respect to rental contracts. It is conceivable that the terms and conditions under which computer equipment was originally acquired may, by the second or third year hence, be substantially altered. Under certain conditions, therefore, it is possible that a selection which originally carried the best contract terms may, a few years later, carry the least favorable terms. But once committed to a system, it is not feasible to change equipment periodically according to the best terms and conditions being offered by competitors on a year-to-year basis. The nature of this problem suggests there might be some merit in considering whether annual negotiations of this type best serve the interests of the Government or whether some change in this concept would be appropriate.

#### CONTRACT TERMS AND CONDITIONS

The General Services Administration has been successful in achieving progressively better terms and conditions over the years. In general, however, these same terms and conditions are then offered by the manufacturers to users in commercial industry. The similarity of contracts usually offers no advantage to the Federal Government over the small customer who procures only one or a few computers.

In this respect, it seems reasonable that the Government should be entitled to price discounts when multiple procurements are made under a contract. Prices listed in current contracts relate to single units.

Normally, the same price is charged regardless of the number of units procured by either an installation, an agency, or the Government.

When the possibility of discounts has been discussed, manufacturers have indicated that discounts from list prices cannot be made solely on the basis of the number of units sold. The reason is that the price covers more than just the equipment itself; it includes the provision of all supporting services, such as computer programs, compilers, special-purpose routines, and specialized training and systems aids—all of which vary and tend to be custom tailored for each installation. Because of these variances, the costs incurred by the manufacturer to support each installation are substantially the same and are not reduced by virtue of many installations.

Nevertheless, there seems to be some agreement that, when lower production costs for the equipment itself result from a large number of sales over a period of time, discounts would be appropriate and could be passed on to the Government.

In addition, there are situations where a number of computers of like model are to be installed at different locations for a common system in which all software requirements are essentially identical. In these cases, it is also appropriate that discounts should be obtained. Instances have occurred where this has been done on the basis of special negotiations conducted by the agency involved.

Apart from the question of discounts, our review revealed other possibilities for improvements in the terms and conditions:

1. Providing options on use time: Most rental contracts allow equipment to be used up to a specific number of hours a month (usually 176 or 200 hours) for a minimum rental charge. If the equipment is used a greater number of hours a month, extra charges are incurred on an hourly basis at about 40 percent of the basic hourly rate. Recently, several contractors have offered various options on the amount of use time provided at specific rates, each option carrying with it a different, but presumably optimum, cost for that particular situation. As a minimum, efforts should be exerted to have various options written into all contracts to allow agencies to select the option which most nearly meets their operating requirements. One of these options should provide for unlimited use at a given cost rate, to eliminate "extra" charges entirely. Although a number of terms and conditions are the subject of negotiation each year, the problem of accounting for and determining extra charges requires the greatest amount of time, contributes most to the delay in executing contracts, causes the most difficulty in contract administration, and complicates the decision to buy or lease. Because pricing structures of the manufacturers are not matters of general information, it is not possible to determine the basis for such charges. But the complications arising because of them suggest that further explorations should be made into the possible elimination of these extra charges.

2. Specifying more clearly the nature of supporting services, primarily programs and programing aids, that are to be provided by the contractor: The general vagueness of these provisions makes it difficult to administer the contract.

3. Specifying more clearly the extent to which the contractor will provide supporting services for purchased equipment, particularly with respect to second and third users of the equipment, and for purchased equipment which is no longer in production.



4. In the few instances where it is now required, discontinuing the deposit for securing an option to purchase the equipment at a later date: The deposit is forfeited if the equipment is not purchased within a specified time period. Most existing contracts offer this option without a deposit.

5. Achieving as much uniformity as feasible among contracts of the various manufacturers, in order to reduce the variables that otherwise must be considered in the selection of equipment.

6. Establishing more formal and routine procedures for reporting to the General Service Administration any deviations from the contract that are offered to an agency by a manufacturer, so they may be incorporated as revisions in the contract to be available to all users: Similarly, the General Services Administration should assure that prompt notification of price changes or other changes is given to all users.

#### RECOMMENDATIONS

1. The General Services Administration should (a) establish a firm time schedule to be followed in soliciting and negotiating contracts with manufacturers, similar to that proposed in the preceding discussion; (b) inform agencies of the names of manufacturers who, under the plan, fail to submit an offer by the established deadline, so that proposals will not be solicited from such manufacturers; and (c) convene a committee of agency representatives to advise on the resolution of conflicts or disagreements that arise in the negotiation process.

2. The General Services Administration should continue to seek improved contract terms and conditions, with specific reference to discounts on quantity procurements and optional use periods (including unlimited use), but including also such additional possibilities as are noted in the preceding discussion.

## CHAPTER 7

### STANDARDIZATION OF EQUIPMENT AND TECHNIQUES

Significant differences in design details exist among the many makes and models of electronic data processing equipment, and among the programming techniques that are used in their operation. These differences place a severe limitation on the opportunities for transferring work from one computer system to another—because of the extensive and costly conversion processes that are often necessary—and have adverse effects, such as the following:

- (1) Greatly limited opportunities for making satisfactory sharing arrangements to meet one-time or peak workloads.
- (2) Restricted placement of excess equipment.
- (3) Increased costs (already high) of systems design and programming.
- (4) More costly and less efficient systems involving the exchange of information in machine-sensible form (see below) among Government agencies, or between business and Government organizations.
- (5) Limited sharing of computer programs among Government installations.
- (6) Reduced opportunities for sharing the services of trained personnel, who may be highly qualified in the operations of one computer but not another.
- (7) Difficulty in making satisfactory arrangement for back-up computer facilities in the event of emergencies.

A related problem is the lack of standardization of data elements in common use and the codes used to represent those elements. While this lack is a problem of long standing, predating the computer by many years, the advent of electronic data processing has raised the problem to a position of high priority. Today, the close interrelationship among systems, involving the exchange of data between systems of different agencies or the centralized summarization of data common to all agencies, demands that data elements (such as an industry classification, an item of supply, or an individual's date of birth) or the code representing an element of data (such as an alphabetical or numerical code for a State or a country) be standard for the Government. Such standardization could help to reduce the high cost of data conversion.

#### NEED FOR COMPATIBILITY OF EQUIPMENT

Compatibility among the varieties of computer equipment is clearly needed. One way to achieve it is to work toward standardization of equipment. In addition to alleviating the problems mentioned above, greater standardization would be likely to lower the cost of

equipment and to reduce the number of variables that now must be considered when a selection is being made. It also would eliminate the excessive cost of developing and maintaining programing aids for the different kinds of equipment in existence.

On the other hand, innovation and competition thrive when manufacturers are able to market something different and better, with ultimate long-range benefit to the consumer. Therefore, standardization of equipment, in the strictest sense of the word, is not regarded as a feasible objective at this time. Much of the problem could be resolved by a more limited and selective approach, directed at the standardization of those aspects of computer design detail and operations which would enable people to communicate directly with computers, and computers to communicate directly with each other.

Thus, our objective should be to achieve compatibility among computer systems, in order to facilitate direct communication. At the same time, manufacturers should be allowed complete freedom in the design of the internal structure of their equipment as long as the compatibility requirements are met.

#### MAN-TO-COMPUTER COMMUNICATIONS

People communicate with computers by means of a "computer program," which is a set of instructions to govern the manner in which the computer operates. These programs may be written in machine language or symbolic language, both of which are oriented to a specific computer. Or they may be written in a "procedures oriented" language, which uses instruction terms closely associated with the broad functional area to which the computer will be applied, and which are therefore more readily taught and understood by people. The procedures-oriented language relies upon another program, known as a compiler, to translate this language into the language of a specific computer.

Many procedures-oriented languages have been developed by the manufacturers for use with their equipment. Potentially, they offer distinct advantages: (a) the programing effort is greatly simplified, resulting in lower costs for program development and maintenance; (b) training requirements are reduced; and (c) management levels are able to exercise better control because the language used can be more readily understood. The ultimate effectiveness of these languages, however, is dependent upon the efficiency of the compilers which translate them to the actual machine language. Performance has often been disappointing in terms of the computer operating time required for executing the program. A program for evaluating these languages being used by the Government is needed in order to assess their effectiveness and to determine whether criteria can be established to measure quality of performance and thus assist in the proper selection of equipment and associated compilers.

In recent years, efforts have been devoted to the establishment of common procedures-oriented languages which would be adopted universally by all users. In turn, each manufacturer would develop his own compiler to translate this commonly used language into the machine required to operate his equipment.

The most popular of these common "procedures oriented languages" are COBOL (*common business-oriented language*), used for com-

mercial-type computer applications, and FORTRAN (*formula translator*), used for scientific or engineering-type applications.

The development of COBOL was initiated by a group of people representing business organizations, equipment manufacturers, and the Government, and it has been actively fostered by the Department of Defense. FORTRAN was originally developed by one manufacturer, but is used widely with other manufacturers' equipment.

By using these common languages, a user theoretically no longer needs to develop different programs for the same application to be performed on different computers. In Government, for example, a program could be written once for a widely used supply application; this would mean a substantial saving of time and expense, even though each supply activity might use different equipment.

However, in order to maximize for competitive purposes the advantages of his own computer, a manufacturer often finds it desirable to construct his compiler in a way that requires the user to deviate from the common language. Thus, many "variations" of the common language are in existence, and the full advantages that might be attained from use of a common language have not been realized.

To achieve these advantages, efforts now underway within the American Standards Association to effect appropriate standardization of common languages need to be accelerated. An additional reason for accelerating the development of standard program languages is to facilitate the selection of equipment, as indicated in chapter 4, by providing a firm base for evaluation of performance.

#### COMPUTER-TO-COMPUTER COMMUNICATION

Although the standardization of common programming languages will go a long way toward achieving the necessary compatibility, attention needs also to be directed toward the problems associated with communication between computers. Such communication is accomplished by accepting punched cards, punched paper tape, or magnetic tape produced by one computer and feeding it into another, or it may be accomplished directly by wire or wireless transmission.

The exchange of information between computers will be greatly facilitated by the recent adoption of an American Standard Code for Information Interchange. This action is intended to assure that, when data are transmitted from one computer installation to another, all information will be coded in the prescribed fashion; this would eliminate the need for conversion processes that are now required because of dissimilarities in coding. Work is being undertaken to standardize the way in which these codes will be represented in each of the principal communications media mentioned above.

There still remains the problem of assuring that certain physical characteristics of the equipment itself be standardized, to facilitate the handling and processing of cards or tape. When large volumes of information are exchanged, for example, the medium of magnetic tape is usually chosen. But magnetic tape systems differ among manufacturers and even among different machine models of the same manufacturer. Among the differences are tape width, tape speed, recording density, the number of channels used to record information, and size of the tape reel. Manufacturers claim that they derive competitive advantages from their varied approaches. However, exchanges of

information between computers would unquestionably be simplified if all computers could process a standardized magnetic tape in a standard format, so that tape output from one computer could be used as direct input for another.

#### AMERICAN STANDARDS ASSOCIATION

Since 1960, the American Standards Association (ASA) through the Business Equipment Manufacturer's Association (BEMA) initiated an active program for the development of standards in the automatic data processing field. Representation in this program is divided equally among equipment manufacturers, users, and general interest groups. The Federal Government has been represented in both the user and general interest groups since the beginning. In addition, more than a score of Government personnel from many agencies are devoting some of their time to working on technical subcommittees in this program. These efforts are coordinated by a standards panel created by the Bureau of the Budget for this purpose. However, virtually all of this governmental activity is being carried on by these personnel in addition to their regular duties. Also, it is being done without adequate central guidance to assure consistency and continuity in the developmental efforts.

Progress toward standardization under the American Standards Association program has not been swift. This is due in part to the checks and balances built into the system. A standard is adopted only if it is supported by a consensus of all national groups substantially concerned with its provisions. This procedure assures that the potential impacts upon all groups are properly considered, and often requires the reconciliation of deeply conflicting but sincerely held views regarding the proper course of action. The importance of the issues involved, particularly as they affect a new and burgeoning industry, justifies this careful consideration.

Progress, however, is also dependent upon motivation. This clearly must be stimulated by the user who generally stands to gain most from the standardization effort. The Federal Government, therefore, has a responsibility to work effectively with all users in pressing for those standardization actions that will permit more effective and economical use of the equipment.

It is our view that American standards approved by the American Standards Association for automatic data processing equipment and techniques are, on balance, more advantageous to the Federal Government than Federal standards and therefore that Federal standards should be developed only in those situations in which the association would not foster standards development because the need is unique to the Government, or when a Federal standard is appropriate as an interim step pending the adoption of an American standard.

#### CONCLUSIONS

We believe that the immediate goal should be to achieve compatibility among computer systems by concentrating first on programing languages and other utilization techniques. Progress in meeting this objective has been slow thus far. The pace must be increased. To this end, we see the need for strengthening Federal Government sup-

port of the American Standards Association and for providing at the National Bureau of Standards the staff resources needed to support the testing of proposed standards and providing technical guidance and monitorship in standards development.

There is need also for a centrally directed program for standardizing when feasible those data elements that are in common use in Government systems, and the codes used to represent those elements.

#### RECOMMENDATIONS

1. The Bureau of the Budget will assume overall leadership of an executive branch program for the standardization of automatic data processing equipment and techniques for its use. In the fulfillment of this responsibility the Bureau will—

(a) Establish standardization policies and objectives.

(b) Insure that the American Standards Association program for the development of voluntary American standards for automatic data processing equipment and techniques receives more adequate support by the Federal Government.

(c) Provide for appropriate Government use of American ADP standards approved by the American Standards Association, when it is in the best interests of the Government and the Nation to take this action.

(d) Provide for the approval and implementation of Federal ADP standards in those instances in which the needs of the Government would not be served by adoption of voluntary American standards approved by the American Standards Association, or interim standards are needed pending adoption of an American standard.

2. The National Bureau of Standards, Department of Commerce, should be responsible for the day-to-day guidance and monitorship of the ADP standardization program, for the development of criteria for determining standards primarily for Government needs, but also be responsive to non-Government requirements and developments in industry.

3. The Bureau of the Budget will assume overall leadership of a program for the standardization of data elements in common use in the Government and the codes used to represent those elements. In the fulfillment of this responsibility the Bureau will—

(a) Invite agencies to submit information and recommendations concerning data elements in common use that should be considered for standardization.

(b) Assign responsibility for the studies necessary to establish the feasibility of standardization of data elements and codes.

(c) Make provision for the approval and implementation of standard data elements and codes, the use of which involves two or more agencies.

(d) Make provision for the revision of standard data elements and codes when circumstances justify this action.

## CHAPTER 8

### GOVERNMENT-SPONSORED RESEARCH AND DEVELOPMENT IN COMPUTER SCIENCES

Of the \$15 billion being devoted to research and development by the Government, at least \$135 million is applied to computer sciences.<sup>1</sup> About two-thirds (or \$91 million) of this latter amount is applied by the Department of Defense. Additional effort, not separately identifiable, is devoted to computer sciences in the development of multi-million-dollar weapons systems, military command and control systems, and intelligence systems, which are heavy users of computers, usually of special design.

The problems related to the administration of funds for computer sciences are similar to those with respect to the broad spectrum of all research and development efforts. Since most research and development efforts are sponsored by individual agencies in terms of their own program needs, there is a substantial risk of program imbalances and unnecessary duplication.

There is no doubt that work in the same general subject area of the computer sciences is being funded at many locations, as for example, in computer time-sharing, data displays, programing languages, compilers, and informational retrieval. But this does not necessarily constitute program imbalance and duplication of effort. Projects are often undertaken to explore alternative approaches to achieve the same objective. Also, the special requirements of a system may call for the development of equipment of unique design even though it may be the same kind of equipment; for example, data display equipment of one design needed in one area may be completely unsuitable in another. But, despite the fact that what appears to be duplication may not be duplication at all, there remains the question of whether more formal coordination would lead to a better balanced Government-wide research program in the computer sciences.

#### COORDINATED PLANNING AND EXCHANGE OF INFORMATION

Exchange of information among agencies and personnel regarding research and development projects that are planned, underway, and completed is essential to a more coordinated program. There are several activities in Government today devoted to compiling, indexing, and disseminating such information, as follows:

1. The results of completed research and development projects of an unclassified nature are available through the clearinghouse for Federal scientific and technical information in the National Bureau of Standards, Department of Commerce. The Defense Documentation

<sup>1</sup> Includes the design and development of computers and of programing techniques, and mathematics related to the use of computers, including simulation and related aids.

Center has similar information (but including classified projects) for projects completed for the Department of Defense and furnishes much of it to the clearinghouse for further distribution.

2. Descriptions of unclassified proposals for contracts or grants and projects currently underway are available through the science information exchange, although its coverage of projects sponsored by the Department of Defense and the National Aeronautics and Space Administration has been somewhat limited.

3. State-of-the-art reviews in some aspects of the computer sciences are prepared and distributed by the Research Information Center and Advisory Service on Information Processing, which is a part of the Institute for Applied Technology in the National Bureau of Standards.

4. A semiannual compendium of current research projects on scientific documentation underway throughout the world is compiled and published by the Office of Science Information Service of the National Science Foundation.

5. Information on projects in their sphere of interest is shared by members of an informal and voluntary interagency group for research on information systems, which has been formed at the laboratory level by representatives of Federal agencies.

The existence of these various groups and the general fragmentation of effort raises a basic question of whether there is a need for a more complete, central index of proposed, current, and completed projects.

General responsibilities for providing a framework of coordination and evaluation of research and development programs are vested in the Office of Science and Technology. The Office draws on the President's Science Advisory Committee, the National Academy of Sciences, and expert consultants for advice and assistance. The Director also serves as Chairman of the Federal Council for Science and Technology, which is comprised of policy officials from the principal scientific agencies in the Government and which considers ways for improving the planning and management of the scientific activities. Program planning and coordination are effected through committees on oceanography, materials research and development, high-energy physics, atmospheric sciences, natural resources, water resources research, behavioral sciences, patent policy, long-range planning, international programs, science information, and scientific and technical personnel.

In the exercise of its general responsibilities, the Office of Science and Technology is urged to give consideration to the adequacy of planning and coordination as it relates to the field of computer sciences. The important role being assumed by computer technology in Government and industry would appear to warrant special attention. Establishment of a committee on computer sciences under the Federal Council on Science and Technology merits consideration.

#### NEED FOR EXPANDED RESEARCH ON SPECIAL ACTIVITIES

The Government currently devotes insufficient resources to evaluate the need for, and to undertake or support, efforts that are directed toward the general advancement of computer systems and technology.

The area of standardization, discussed in chapter 7, is indicative



of this need. Because of the far-reaching impact that any proposed standardization action might have upon both the supplier and the user, each proposal should be explored and tested to assure that it is both technically and economically feasible. As a principal proponent of greater compatibility, the Government should be prepared to share the burden of such testing.

Other activities to which such resources might be devoted include the following:

(1) The advancement of knowledge in the mathematics of computation, especially in numerical analysis, with emphasis upon problem definition, algorithms, and approaches to the formalized solution of the problem.

(2) The development of computer-based systems of advanced design which make more effective use of computer capabilities. In particular resources need to be made available to the smaller agencies that often lack personnel qualified to undertake projects involving systems research and development. Assistance needs to be provided in defining problems, monitoring progress if the study is undertaken by an agency or commercial contractor, and, on occasion, conducting the study for an agency.

(3) The development of computer evaluation programs which would provide a basis for measuring the relative performance capabilities of different computers, and would greatly assist agencies in the selection of equipment.

(4) The establishment of criteria to evaluate the performance of programming languages, and to create such programming languages as may be necessary for Government-wide use.

The National Bureau of Standards has pioneered in the development and use of computers since 1946. It currently emphasizes research and development on common use aspects of computers and, on a reimbursable basis, it assists other Federal agencies in systems research. It therefore is the logical organization to fill the need described above. To do this adequately, however, would require an expansion of its present resources. This expansion should be governed by a determination of the priorities to be accorded to the various project possibilities, and the availability of qualified personnel to assure effective accomplishments.

#### RECOMMENDATIONS

1. The Office of Science and Technology should review the need for coordinating and evaluating all research and development activities in the field of computer sciences.

2. The Department of Commerce should determine the extent to which the resources of the National Bureau of Standards need to be expanded to serve as a research center on computer science and technology, primarily oriented toward Government applications, and to serve as an advisory service and consulting center for all Government agencies.

## CHAPTER 9

### GOVERNMENT-CONTRACTOR RELATIONSHIPS

A major and highly complex problem relates to the policies and standards which ought to be applied to the acquisition and operation of computers by cost-reimbursement type contractors at Government expense. Current inventory figures include 179 computers operated for 8 agencies by such contractors, principally in Government-owned, contractor-operated facilities. This figure appears to represent only the top of the iceberg. While no complete and accurate statistics are now maintained, a special review undertaken during the present study discloses that the inventory of computers acquired by all such contractors, either directly or indirectly at Federal expense, approximates closely in size the number of computers owned or rented by Federal agencies. Most of these are operated under contracts with agencies of the Department of Defense, National Aeronautics and Space Administration, and the Atomic Energy Commission.

Contrary to the current trend within the Government but consistent with the general practice in industry, contractors usually rent rather than buy computers. They generally manage to obtain the latest models of equipment available from various manufacturers. Since the Government bears the costs of obtaining this equipment, the Comptroller General has recommended, in a series of audit reports, that Government contractors be required to observe much the same policies and standards as are now applicable to Federal agencies in making rent versus buy decisions.

While the Comptroller General's specific recommendation is limited to computers, the implications of his recommendation for Government-contractor relationships are much more far reaching. The same logic could well dictate that Government regulations and controls be applied to the acquisition of buildings and other types of facilities, tools, and equipment, where the costs are chargeable to the Government.

Increasing reliance on contractors to perform vital Government work, particularly in the field of research and development, has given rise to many difficult problems. These are dealt with at length in the report submitted to President Kennedy in April 1962 on "Government Contracting for Research and Development." As indicated in that report, "the developments of recent years have inevitably blurred the traditional dividing lines between the public and private sectors of our Nation." The classical distinctions between what is public and what is private no longer apply, particularly in situations where (1) the Government is the sole or predominant customer; (2) competition and other normal economic incentives are largely nonexistent; and (3) the Government directly reimburses the contractor for the costs of facilities and services under cost-plus-fixed-fee contracts. Under such

circumstances, the new and growing partnership between the Government and private industry poses a fundamental dilemma. How do we reconcile the need to maintain essential controls to assure proper stewardship of public funds with the need to preserve the responsibility, integrity, flexibility, and creativity of the private enterprise system? There are no simple answers.

#### DIVERSITY OF AGENCY PRACTICES

The Government supports, either partially or fully, automatic data processing capabilities for many different purposes and under a wide variety of contractual arrangements. These include:

- (1) Contracts for products or services, including cost-plus-fixed-fee contracts, in which ADP equipment is used by the contractor and the costs are reimbursed by the Government.
- (2) System development and management contracts using Government-furnished equipment.
- (3) Research and development contracts using contractor-furnished equipment.
- (4) Subcontracts under which a Government prime contractor requires services to augment those he has in-house or where he has no such capability.

No attempt has been made to develop uniform Government-wide policies applicable to ADP equipment acquired by Government contractors. Each agency has established the policies and controls which it has deemed to be best adapted to the purposes to be served and to the nature of the contractual arrangements. For this reason, there is considerable diversity in agency practices with respect to ADP equipment utilized by contractors.

The Atomic Energy Commission (AEC) comes the closest to applying to its contractors Government policies for the acquisition of equipment. Such controls are feasible for the AEC, because most of its facilities are Government owned and contractor operated (the so-called GOCO contract). The AEC requires its contractors to prepare systems studies as a basis for selecting ADP equipment. The contractor selects the equipment to be used and prepares a purchase versus rent computation. The package with the contractor's recommendation to purchase or rent is submitted to the AEC for approval. Application of these procedures has resulted in the purchase of about 62 percent of the computers now being used by AEC contractors.

Neither the Department of Defense nor the National Aeronautics and Space Administration (NASA) makes extensive use of GOCO contracts. The Department of Defense is the largest single user of contractor services and has entered into a wide variety of contractual arrangements. Consequently, the problem of establishing uniform policies and procedures is much more difficult than that of the AEC. Defense and NASA have not differentiated between ADP equipment and other types of facilities and equipment acquired by their contractors and have not imposed special controls over ADP equipment similar to those applied by the AEC to its contractors.

The Department of Defense has recently proposed an amendment to the Armed Services Procurement Regulations which would limit the amount of rental costs, including rental of ADP equipment, chargeable to a contract.<sup>1</sup> Under this proposal, the contractor would be

<sup>1</sup> See exhibit G: "Proposed Amendment to ASPA-15-205.84, Rental Costs (July 1964)."

free to buy or rent according to his choice, but if the purchase method were shown to be to the Government's economic advantage, charges would be limited to the amount that the contractor would receive if the equipment was purchased. This procedure would achieve the objectives of present Government policy, but it would leave the method of acquisition to the discretion of the contractor. The proposal is now under review within the Department of Defense and is being considered by NASA for application to its contractors.

#### COMPTROLLER GENERAL'S POSITION

The Comptroller General is highly critical of present arrangements and policies. His view is that "substantial unnecessary costs relating to computer use are being regularly incurred under Government contracts and will continue as long as there is no provision in the Government's management system for better coordination of computer equipment procurement and utilization by Government agencies and contractors." The Comptroller General recommends that a central management agency should be responsible for (1) evaluating the financial advantages from a Government-wide standpoint of the purchase or rental of ADP equipment by contractors and (2) providing for the transfer of used equipment between Federal agencies and Government contractors and among Government contractors. In effect, the Comptroller General would bring into the same management system ADP equipment acquired directly by Federal agencies and ADP equipment acquired by contractors but at Government expense, and would apply the same criteria and policies to both.

#### CONCLUSIONS

The Comptroller General's reports have served to highlight a major problem. Existing information concerning the number, type, and cost of ADP services and equipment acquired by cost-reimbursement type of contractors at Government expense is wholly inadequate. The development and application of better reporting procedures would assist in contract administration and would also enable the Government to gain the benefit of contractor experience as well as its own in the development of policies, guidelines, and criteria for evaluating performance of its computer installations.

Certain of the assumptions which appear to underlie the particular solutions proposed by the Comptroller General have far-reaching implications for management. For example, the Comptroller General has recommended that a contractor's decision to buy or rent equipment should take into account not only his own anticipated needs but the potential needs of the Government as a whole. Under this concept, a central management office would make determinations as to the needs of the Government as a whole. Implicit in this concept is the assumption that (1) a means could be developed to estimate reliably the potential needs of the Government as a whole, and (2) second and third users could readily be found for excess ADP equipment. As indicated in chapter 5, we do not concur in these assumptions.

The Department of Defense has expressed the view that the Comptroller General's recommendations, if pursued to their end, would require the Federal Government to own all computers utilized by con-

tractors. Such a result would conflict directly with established Defense policy of requiring contractors to furnish their own facilities. It would also complicate efforts now being made by the Department of Defense to divest itself of the ownership of obsolete facilities.

In developing controls applicable to Government contractors, we must be certain that the controls (1) are adapted to the needs of the particular type of contractual arrangement, (2) are compatible with the general system of Government-contractor relationships, and (3) do not shift from the contractor to the Government responsibility for making sound management judgments with respect to ADP equipment.

The Government does have a responsibility to assure that reimbursements under cost-reimbursement type of contracts are reasonable and proper. Normally, established cost principles govern the kinds and amounts of costs which may be properly charged to a contract. We believe that, in determining the amounts of reimbursement to contractors, it would be reasonable to apply present Government criteria with respect to lease and purchase. Such criteria are now applicable to AEC contractors who operate Government-owned facilities. The proposed amendment to the Armed Services Procurement Regulations would be entirely consistent with this objective. The amendment should be made effective at the earliest possible date.

To minimize the costs of acquisition and use of equipment we believe that it would be reasonable to (1) require contractors, before acquiring new equipment, to screen excess Government equipment to determine whether any is available which would satisfy their needs, and (2) include contractor-operated equipment in intra-agency equipment sharing programs, thus broadening the opportunities within an agency for utilizing unused capacity as an alternative to acquiring additional computers or using commercial sources. Policies governing the utilization of excess equipment and the sharing of equipment within an agency should be amended where necessary to make this possible.

#### RECOMMENDATIONS

1. The Bureau of the Budget will revise its current policies to provide that (a) established criteria with respect to the purchase or rental of automatic data processing equipment shall be applied in determining costs to be reimbursed under cost-reimbursement type of contracts, and (b) agencies will include equipment operated by their cost-reimbursement type of contractors in intra-agency sharing arrangements.

2. The Bureau of the Budget, in cooperation with the Department of Defense, National Aeronautics and Space Administration, Atomic Energy Commission, General Services Administration, and other agencies will undertake the development of reporting procedures to obtain an inventory, together with related data on costs, of automatic data processing equipment and services provided under cost-reimbursement type of contracts. This information should be incorporated in the ADP management information system recommended in chapter 10.

3. The Department of Defense should make effective at the earliest practicable date the proposed amendment to the Armed Services Procurement Regulations on "Rental Costs." This regulation also should be adopted by the National Aeronautics and Space Administration.

4. The General Services Administration should clarify and amend its existing regulations relating to the utilization of excess equipment to emphasize the importance of those provisions which now require that contracting agencies make excess Government ADP equipment available to cost-reimbursement type of contractors when such equipment will satisfy their needs.

## CHAPTER 10

### INFORMATION FOR MANAGING AUTOMATIC DATA PROCESSING ACTIVITIES

The lack of availability of essential information on a timely basis constitutes an important obstacle to attaining effective management of automatic data processing equipment in the Federal Government. While the annual inventory produced by the Bureau of the Budget is useful, it was not intended to provide current and full information needed for management purposes.

The present report notes that a large amount of unused capacity on existing computers is available to Government agencies and that this should be considered for use before additional computers are installed. However, if agency officials are expected to use this equipment, they need information on the location, the precise kind of equipment being offered, the times and conditions under which it is available, the kinds of data processing services that are available, and the prices charged. Such information must be current and readily accessible on a geographical basis, so that the potential user can select effectively and quickly the most appropriate arrangement available to satisfy his particular need.

The general absence of information on the performance of installations is a handicap in establishing Government-wide criteria to evaluate performance. If such criteria were available at each computer installation, they could be used by local management to evaluate the performance of its installation and to determine where improvements are needed. At departmental and Government-wide levels, such criteria would help in comparing installations in similar situations, pointing out problems needing corrective action, and assessing total agency or Government-wide effectiveness. In addition, information on performance would assist in the development of Government policies and guidelines and in the evaluation of agency conformance to such guidelines. General areas where such information is lacking include (1) manufacturers' performance with respect to quality of equipment engineering, maintenance, and program support, (2) utilization of equipment in terms of productive and unproductive time, (3) operating costs for performing applications common to many Government installations, and (4) utilization of personnel.

Information on the extent to which the Government uses commercial sources for automatic data processing services is sketchy. It is reasonable to expect that existing Government facilities should be used whenever feasible before resorting to commercial contracting. More specific information regarding the extent to which commercial contracts are used, the purposes of the contracts, the reasons why this method was chosen, and the quality of performance would permit a determination on the need for definitive policies and guidelines on the use of such services.

The trend toward increased purchasing focuses attention on a relatively new need for assuring that detailed information on the engineering and performance characteristics of each component of equipment is properly recorded and reported to reflect maintenance activity and modifications. Such information is essential, of course, for keeping Government-owned equipment in good operating condition, but it also facilitates decisions on the redistribution of the equipment as it becomes excess. If properly and promptly reported, it also assists the manufacturer in effecting engineering improvements which may be passed on to the customer.

This report suggests more formalized reporting procedures in the area of contract negotiation and administration. Contract negotiations by the General Services Administration for the purchase, rental, and maintenance of equipment are handicapped currently by the lack of information from local installations concerning their experience with administering existing contracts. Information on manufacturer performance, difficulties in contract interpretations, and deviations from the provisions of the contract is especially needed to assist in negotiating improved contracts.

The extensive use of automatic data processing equipment by Government cost-reimbursement contractors requires that more information regarding these operations be obtained. Although some information is available on contractors who operate Government-owned facilities, it is almost totally lacking on those who operate their own facilities but whose costs are borne by the Government. In particular, better information is needed to improve contract administration practices as they relate to the contractor's use of equipment. Information is also needed to include contractor-operated equipment in intra-agency sharing arrangements, thus enabling an agency to make the fullest practicable use of agency-financed equipment. Furthermore, information on ADP performance, as discussed earlier in this chapter, would enable the Government to derive the benefit of contractor experience in its efforts to develop broad measurement criteria for evaluating the performance of its computer installations.

Information on specific accomplishments which have been made possible largely by the use of electronic computers, together with general plans for the future, is essential, but at present it is not reported on a routine basis. Benefits being obtained by the Government in terms of improvements in mission performance, reductions in costs, and lower manpower requirements should be reported. Where manpower requirements are involved, information is needed regarding the extent of reductions and the placement of the employees affected so that the problem of displaced employees can be evaluated on a continuing basis. All this information would provide the means for a broad assessment of progress and plans.

#### PRESENT GOVERNMENT-WIDE REPORTING SYSTEM

Since 1959, the Bureau of the Budget has prescribed a Government-wide reporting system<sup>1</sup> which requires agencies to submit annual re-

<sup>1</sup> Bureau of the Budget Circular A-55: "Annual Reports on the Utilization of Automatic Data Processing Equipment in the Executive Branch" (revised Nov. 15, 1963).



ports on their use of automatic data processing equipment. These reports include information on computer models installed, the number of hours used, purposes for which used, status with respect to lease or purchase, operating and capital costs, and personnel employed. The data are projected for 3 years.

This system has proved useful in budgetary reviews of agency plans for the use of this equipment, and in the formulation and evaluation of broad Government-wide policies and guidelines. It has also formed the basis for publishing the Annual Inventory of Automatic Data Processing Equipment in the Federal Government. This publication has helped agencies in identifying possibilities for sharing equipment and exchanging experiences with other agencies that use computers for similar purposes.

But this reporting system is conceived basically as an annual "status report." It was not intended, nor does it begin, to meet the information requirements necessary for improvements in the Government's management practices.

#### NEED FOR AN EXPANDED SYSTEM

A Government-wide information system which will meet the management needs of each major organizational level (i.e., local level, intermediate level such as bureaus or commands, departmental level, and Government-wide level) is clearly needed. It should prescribe the minimum amount of information to be maintained at each level to assure prompt and uniform reporting of selected information to successively higher levels. While the information must flow upward to form the basis for evaluation, the results of such evaluations must flow downward in the form of policy and guidance.

Although the precise form of the system will be determined by further study, a preliminary assessment of needs indicates it should cover the following broad categories of information:

1. Equipment.
  - (a) Equipment configuration in use, by component.
  - (b) Ownership status.
  - (c) Plans for additions, replacements, or modifications.
  - (d) Availability of related equipment, such as communication facilities.
  - (e) Maintenance and performance.
2. Software.
  - (a) Program language compilers.
  - (b) Assembly programs.
  - (c) Monitors.
  - (d) Special programs.
3. Utilization.
  - (a) Purposes for which equipment is used.
  - (b) Analysis of operating time, including time shared.
  - (c) Analysis of unused time.
4. Sharing.
  - (a) Conditions to be met by potential users.
  - (b) Assistance available to users.
  - (c) Charges.

5. Costs.
  - (a) Incurred by major cost elements.
  - (b) Budget requirements.
6. Personnel.
  - (a) Currently employed (by occupational classification).
  - (b) Projected requirements.
  - (c) Training needs.
7. Services contracted out.
  - (a) Purpose.
  - (b) Cost.
8. Administration of purchase, rental, and maintenance contracts.
  - (a) Problem.
  - (b) Suggestions for improvement and clarification.
9. Accomplishments.
  - (a) Improvements in mission performance.
  - (b) Reductions in costs.
  - (c) Manpower reductions and placements.
  - (d) Plans for the future.

RECOMMENDATION

The Bureau of the Budget will undertake the development of a broadly based ADP management information system as a matter of high priority, and will seek the advice and assistance of those agencies most vitally concerned, including agencies with Government-wide responsibilities, such as the General Services Administration and the Civil Service Commission.

## CHAPTER 11

### ORGANIZATION AND LEGISLATION

The earlier chapters of this report are designed (1) to examine present problems relating to the effective management of ADP within both the central agencies and line departments of the executive branch, and (2) to establish a framework for making decisions about the adequacy of existing organizational arrangements and legislative authority respecting ADP matters.

With respect to both organization and legislation, the alternatives are (1) to improve the existing structure or (2) to change it by establishing more central management.

In general, the weight of evidence supports the belief that existing organizational arrangements are basically sound but that there is a clear need to strengthen the resources devoted to the management of ADP. This conclusion leads us to recommend against the position taken by the Comptroller General which favors establishment of strong central management authorities and responsibilities. That alternative will be discussed first.

#### CENTRALIZATION OF AUTHORITY

The Comptroller General has recommended that the President establish a central management office suitably empowered with authority and responsibility to make decisions on the procurement and utilization of data processing equipment. This recommendation assumes that a central office will control the type of equipment to be used and its availability, and will make the decisions as to whether equipment should be purchased or leased.

The impracticability of making individual procurement decisions on the basis of predictions as to the future needs of the Government as a whole has been pointed out in various sections of the present report. The procurement and utilization of data processing equipment are dissimilar in significant respects to routine logistics management. ADP equipment is increasingly becoming integral to the accomplishment of agency missions and, in certain instances, it is virtually synonymous with program accomplishment. Decisions as to equipment, the arrangements for its availability, and the manner in which it is to be used directly affect the success or failure of Government programs to a degree not experienced with such items as office space, typewriters, and even communications. Accordingly, departments and agencies require considerable flexibility and discretion in making decisions on ADP procurement and utilization.

The President has made it quite clear that he holds agency heads directly responsible for the management of their organizations. Within that framework of responsibility, the President expects the Director

of the Bureau of the Budget, in his role as staff assistant to the President, to develop policies and guidelines, provide or arrange for leadership in matters of general concern, and evaluate and advise the President on current and proposed activities of the executive branch, primarily through the budget review process. The Bureau of the Budget expects to strengthen and augment its efforts to enable the Director to carry out his responsibilities effectively.

Comparable actions will need to be taken to strengthen the ADP management capability within other central agencies—such as the U.S. Civil Service Commission and the General Services Administration—and within the line departments and agencies that are major users of ADP systems, as discussed in subsequent sections of this chapter.

The recommendation of the Comptroller General also assumes that the Federal Government will, to a high degree, take title to or control the ADP equipment used by contractors performing services for the Government. Chapter 9 of this report discusses Government-contractor relationships and suggests means to bring about improvements needed in them. We believe that there is no need to go as far as the Comptroller General recommends.

In summary, we have concluded that the establishment of a separate office empowered with authority and responsibility to make decisions on the procurement and utilization of ADP equipment would dilute the responsibility of agency heads for the management of their organizations, that it would serve to divorce ADP management from the established arrangements for Presidential surveillance over the overall management of the executive branch, and that it would interfere with direct Government agency-contractor relationships unnecessarily.

#### IMPROVEMENT OF THE EXISTING STRUCTURE

To carry out the recommendations made in this report no significant changes would be required in existing organizational arrangements or in the assignments of responsibility to the Bureau of the Budget, U.S. Civil Service Commission, General Services Administration, the Bureau of Standards, or the departments and agencies. We believe that the existing organizational arrangements are basically sound.

There is a clear need, however, to strengthen the resources devoted to the management of ADP within both the central agencies and line departments. This problem can best be highlighted by discussion of what present statutory authorities are, how they have been and are now being used, how they will be used in the future, and how they can effectively be extended and strengthened.

#### ADEQUACY OF STATUTORY AUTHORITIES

There are at present no congressional expressions of policy or legislation specifically addressed to the management of ADP in the executive branch of the Federal Government. The several chapters of this report reinforce the belief that the lack of specific legislation creates unnecessary handicaps to the most effective management of ADP. Steps to remedy this lack are suggested at the end of this chapter.

As indicated below, general statutory authorities, conferred upon the Bureau of the Budget, the General Services Administration, and

the Department of Commerce are sufficiently broad to encompass existing activities with respect to ADP as well as most, but not all of the additional actions proposed in this report.

Bureau of the Budget authority to develop and establish policies and guidelines for the improved management and coordination of ADP within the executive branch derives principally from the Budget and Accounting Act of 1921, as amended, and the Budget and Accounting Procedures Act of 1950, as amended.

There is created in the Executive Office of the President, a bureau to be known as the Bureau of the Budget. \* \* \* The Bureau, under such rules and regulations as the President may prescribe, shall prepare the Budget, and any proposed supplemental or deficiency appropriations, and to this end shall have authority to assemble, correlate, revise, reduce, or increase the requests for appropriations of the several departments or establishments (31 U.S.C. 16a).

The Bureau, when directed by the President, shall make a detailed study of the departments and establishments for the purpose of enabling the President to determine what changes (with a view of securing greater economy and efficiency in the conduct of the public service) and should be made in (1) the existing organization activities, and methods of business of such departments or establishments, (2) the appropriations therefor, (3) the assignment of particular activities to particular services, or (4) the regrouping of services. The results of such study shall be embodied in a report or reports to the President, who may transmit to Congress such report or reports or any part thereof with his recommendations on the matters covered thereby (31 U.S.C. 18).

The President, through the Director of the Bureau of the Budget, is authorized and directed to evaluate and develop improved plans for the organization, coordination, and management of the executive branch of the Government with a view to efficient and economical service (31 U.S.C. 18a).

The President, through the Director of the Bureau of the Budget, is authorized and directed to develop programs and to issue regulations and orders for the improved gathering, compiling, analyzing, publishing, and disseminating of statistical information for any purpose by the various agencies in the executive branch of the Government. Such regulations and orders shall be adhered to by such agencies (31 U.S.C. 18b).

In addition to its review of requests for funds to finance the acquisition and use of automatic data-processing equipment as part of the regular budget review process, the Bureau of the Budget has taken the following specific actions, with respect to the management of ADP equipment, under its authority to "develop improved plans for the organization, coordination, and management of the executive branch of the Government":

1. The Bureau has made basic studies and issued policies and guidelines, such as:

(a) Bureau of the Budget Bulletin No. 60-6, March 18, 1960, which provided guidelines on "Studies preceding the acquisition of equipment" as a basis for making determinations as to the best uses to be made of computers. (See ch. 2.)

(b) Bureau of the Budget Circular No. A-54, October 1961, provided "Policies on the selection and acquisition of ADP equipment," which covers preselection determinations, a competitive base for selections (See ch. 2) and purchase-lease considerations. (See ch. 5.)

(c) "Guidelines for appraising agency practices in the management of ADP equipment in Federal agencies" were published in August 1963 as Bureau of the Budget Circular No. A-61. Prior to publication these guidelines had been in use by our budget examiners for a year. (See ch. 2.)

(d) In recognition of the economic advantages inherent in equipment sharing within and among agencies, as discussed in chapter 3, "Policies and Responsibilities for Sharing Electronic Computer Time and Services" were published in Bureau of the Budget Circular No. A-27 in June 1964.

2. Since 1960, the Bureau has obtained from the executive agencies reports on ADP equipment utilization. Based on these reports, we have published annually an ADP equipment inventory which includes information on costs and personnel. Beginning with this year's publication, computer applications are included. (See ch. 10.)

3. A "Glossary of ADP Terms" was published by the Bureau in December 1962. For use Government wide, the glossary was developed by a subcommittee of the Interagency Committee on ADP. As one of the many things needed to achieve compatibility in and among ADP activities in the Government, as discussed in chapter 7 hereof, the Bureau's glossary is intended to bridge the gap that will exist from now until an American standard ADP glossary is approved by the American Standards Association.

4. An Interagency Committee on ADP was formed in 1957. This Committee has been continuously active since that date and has provided the Bureau with many useful reports and suggestions. Forty-seven departments and establishments have memberships. A smaller 14-member ADP Advisory Council was formed in 1962 and, within the Council, a 4-member Standardization Panel. Both the Council and the Panel, like the Committee, have provided useful advice in planning and implementing the ADP program of the executive branch. We anticipate calling upon all three groups to assist in implementing many of the recommendations appearing in the several chapters of this report.

5. This year the Bureau sponsored a research demonstration project to apply computer technology and advanced management techniques to the ratemaking process in the Interstate Commerce Commission. Other regulatory agencies are expected to benefit by this demonstration.

6. Bureau staff has made a number of surveys of ADP installations in the agencies.

7. On the basis of many requests received, Bureau staff has provided consultative assistance to agencies on a wide variety of ADP management problems.

We believe the Bureau's present statutory authorities for executive branch coordination and management improvement are sufficient to permit the Bureau to move forward promptly, without additional legislation, substantially to carry out the following recommendations contained in this report:

1. *Differences among computer installations (ch. 1).*

Provide a classification system for computer installation for use as a guide in the application of ADP policies.

2. *Determining the best use of computer capabilities (ch. 2).*

Develop a program and criteria for agencies to use in evaluating their effectiveness in using their computer facilities.  
Provide criteria for evaluating computer system design.

3. *Meeting requirements for computer capacity (ch. 3).*

Provide cost principles for use in billing charges for computer sharing.

Evaluate the computer service center now being operated experimentally at the National Bureau of Standards.

Provide policies on the use of private ADP service bureaus.

4. *Selecting the proper equipment for use (ch. 4).*

Provide criteria and technical guidelines on the development of system specifications, including the use of benchmark problems.

Provide guidelines for evaluating suppliers' equipment proposals.

Provide for consideration of equipment compatibility as a factor in the equipment selection process.

Provide policies and criteria governing the status to be accorded excess and surplus ADP equipment in the selection process.

Clarify the distinctions to be made between equipment additions, replacements, and modifications when selection policies and criteria are applied.

Provide for interagency sharing of experience in equipment selection.

5. *Purchase or rental of computers (ch. 5).*

Provide policies on the use of the cost-of-money factor in lease-purchase considerations.

6. *Standardization of equipment and techniques (ch. 7).*

Assume overall leadership of executive branch programs for the standardization of (a) ADP equipment, programming languages and other techniques and (b) data elements and codes in common use among Government systems.

7. *Government-contractor relationships (ch. 9).*

Provide for the extension of ADP lease-purchase policies to make them applicable to cost-type Government contractors.

Provide for obtaining ADP information from cost-type Government contractors as appropriate.

8. *Information for managing automatic data processing activities (ch. 10).*

Develop an ADP Management Information System.

General Services Administration authority for the procurement and management of property derives from the Federal Property and Administrative Services Act of 1949, as amended, subject to such policies and directives as the President may prescribe.

Sec. 109. (a) There is hereby authorized to be set aside in the Treasury a special fund which shall be known as the General Supply Fund. \* \* \* The General Supply Fund shall be available for use by or under the direction and control of the Administrator (1) for procuring personal property . . . and nonpersonal services for the use of Federal agencies in the proper discharge of their responsibilities, and (2) for paying the purchase price, transportation of personal property, and services, and the cost of personal services employed directly in the repair, rehabilitation, and conversion of personal property.

(b) Payment by requisitioning agencies shall be at prices fixed by the Administrator. Such prices shall be fixed at levels so as to recover so far as

practicable the applicable purchase price, the transportation cost, inventory losses, the cost of personal services employed directly in the repair, rehabilitation, and conversion of personal property, and the cost of amortization and repair of equipment utilized for lease or rent to executive agencies. \* \* \*

Sec. 201. (a) The Administrator shall, in respect of executive agencies, and to the extent that he determines that so doing is advantageous to the Government in terms of economy, efficiency, or service, and with due regard to the program activities of the agencies concerned—

(1) prescribe policies and methods of procurement and supply of personal property and nonpersonal services, including related functions such as contracting, inspection, storage, issue, property identification and classification, transportation and traffic management, management of public utility services, and repairing and converting; and \* \* \*

(3) procure and supply personal property and nonpersonal services for the use of executive agencies in the proper discharge of their responsibilities, and perform functions related to procurement and supply such as those mentioned above in subparagraph (1) \* \* \*.

Sec. 202. (a) In order to minimize expenditures for property, the Administrator shall prescribe policies and methods to promote the maximum utilization of excess property by executive agencies, and he shall provide for the transfer of excess property among Federal agencies. \* \* \*

Sec. 203. (a) Except as otherwise provided in this section, the Administrator shall have supervision and direction over the disposition of surplus property. Such property shall be disposed of to such extent, at such time, in such areas, by such agencies, at such terms and conditions, and in such manner, as may be prescribed in or pursuant to this act. \* \* \*

(c) (1) All disposals or contracts for disposal of surplus property (other than by abandonment, destruction, donation, or through contract brokers) made or authorized by the Administrator shall be made after publicly advertising for bids, under regulations prescribed by the Administrator, except as provided in paragraphs (3) and (5) of this subsection. (Paragraphs (3) and (5) provide specific exceptions to paragraph (1).)

Sec. 205. (a) The President may prescribe such policies and directives, not inconsistent with the provisions of this Act, as he shall deem necessary to effectuate the provisions of this Act, which policies and directives shall govern the Administrator and executive agencies in carrying out their respective functions hereunder. \* \* \*

(c) The Administrator shall prescribe such regulations as he deems necessary to effectuate his functions under this Act, and the head of each executive agency shall cause to be issued such orders and directives as such head deems necessary to carry out such regulations.

(d) The Administrator is authorized to delegate and to authorize successive redelegation of any authority transferred to or vested in him by this Act (except for the authority to issue regulations on matters of policy having application to executive agencies, the authority contained in section 106, and except as otherwise provided in this Act) to any official in the General Services Administration or to the head of any other Federal agency.

The General Services Administration has taken the following ADP-related actions under its general authority to prescribe policies and methods of procurement and supply of personal property and nonpersonal services, including related functions:

1. GSA has assumed executive branch leadership for the development and operation of ADP equipment sharing exchanges in all regional areas of the country where appropriate, as provided in Bureau of the Budget Circular A-27. A temporary GSA regulation outlining the policies and procedures governing the national sharing program has been issued and appears in the Federal Register for November 28, 1964. (See ch. 3.)

2. GSA has performed limited data processing services for other executive agencies, using the ADP equipment installed and used by GSA in its regional offices and national headquarters. (See ch. 3.)



3. GSA issued Personal Property Management Regulation No. 36, "Utilization Screening of Government Owned and Leased Electronic Data Processing Equipment," April 1964, to promote effective utilization of excess and disposal of surplus ADP equipment. A significant feature of this regulation is the provision for screening leased as well as owned equipment in view of the potential economies in some cases in taking advantage of reduced purchase prices of leased equipment. (See ch. 5.)

4. Since 1955, GSA has provided, for the use of all executive agencies, Federal Schedules of Supply for the rental of ADP equipment and, since 1963, schedules for equipment purchase and maintenance as well as rental. Through these negotiations GSA has improved each year the terms and conditions under which ADP equipment could be acquired, with significant economic benefits. (See ch. 6.)

5. Since 1960 when the American Standards Association began the development of standards for computers and information processing, GSA has provided Government representation on the several ASA committees engaged in this work. (See ch. 7.)

6. GSA processes the incoming annual reports from executive agencies on ADP equipment utilization and prepares for the Bureau of the Budget, statistical information on ADP equipment inventories, costs, and personnel. (See ch. 10.)

7. The Public Buildings Service of GSA performs for executive agencies the construction or remodeling of buildings to provide the special housing, wiring, and air-conditioning facilities that computers require.

We believe that the General Services Administration is empowered to carry out the following recommendations of this report under its existing statutory authority for property and supply management:

1. *Selecting equipment (ch. 4).*

Provide comparative information, upon request, on the characteristics and performance capabilities of electronic data processing equipment.

Provide information, upon request, on the performance of the firms that supply electronic data processing equipment and programing aids to the Government.

2. *Purchase or rental of computers (ch. 5).*

Develop and publish guidelines and criteria governing the replacement of equipment to avoid usage beyond the point of economic advantage.

Establish policies, guidelines and practices for the maintenance of computer equipment.

Develop and publish criteria for evaluating the quality of maintenance.

Provide guidance to assure that accurate and detailed maintenance records are kept.

Prepare to cope with emerging problems of utilization and disposal of excess computer equipment.

3. *Contracting for the procurement of equipment (ch. 6).*

Establish and administer a firm time schedule for developing Federal Supply Schedules for ADP equipment rental, purchase, and maintenance.

Improve terms and conditions in Federal Supply Schedules for ADP equipment.

4. *Government-contractor relationships (ch. 9).*

Cooperate in the development of reporting procedures to obtain an inventory of automatic data processing equipment from cost-type contractors.

Make excess Government ADP equipment available to cost-type Government contractors.

5. *Information for managing automatic data processing activities (ch. 10).*

Assist in the development of, and maintain, a broadly based ADP management information system.

The National Bureau of Standards of the Department of Commerce derives authority for its scientific and consultative activities related to ADP principally from the organic act of the Department (15 U.S.C. 272). The Secretary of Commerce is authorized to undertake the following functions:

(a) The custody, maintenance, and development of the national standards of measurement, and the provision of means and methods for making measurements consistent with those standards. \* \* \*

(d) Cooperation with other governmental agencies and with private organizations in the establishment of standard practices, incorporated in codes and specifications.

(e) Advisory service to Government agencies on scientific and technical problems.

(f) Invention and development of devices to service special needs of the Government.

In carrying out the enumerated functions the Secretary is authorized to undertake the following activities and similar ones for which need may arise in the operations of Government agencies, scientific institutions, and industrial enterprises:

(17) the operation of a laboratory of applied mathematics;

(18) the prosecution of such research in engineering, mathematics, and the physical sciences as may be necessary to obtain basic data pertinent to the functions specified herein;

Under its authority to develop standards, perform scientific research, and advise Government agencies on scientific and technical problems, the National Bureau of Standards has engaged in the following automatic data processing activities:

1. NBS, to the extent its limited resources permitted, has provided technical advice and assistance to executive agencies in information problem analysis, computer systems design, development of system specifications, and equipment selection. (See ch. 2.)

2. At the invitation of the Bureau of the Budget, the Secretary of Commerce made provision for the ADP equipment in place at NBS to be used experimentally as a service center for executive agencies in the Washington area. Concurrently, arrangements were made for the administrator of the center to establish an ADP equipment-sharing exchange.

3. Both on the national scene and in behalf of the Federal Government, NBS has been an active participant in the development of standards for ADP equipment and techniques. The agency provides Government representation on most of the American Standards Association committees involved in this work.

4. NBS research in the computer sciences began with its direct involvement in the design, construction, programing, operation, and

use of the first computers built. Dating from the late 1940's, computer science research at NBS has continued to the present and includes the provision of advisory services in the application of computer sciences to the problems of various executive agencies.

An augmented program of automatic data processing activities in the National Bureau of Standards would be facilitated by the enactment of legislation providing clear authority to implement the following recommendations to the full extent contemplated in this report.

1. *Determining the best use of computer capabilities (ch. 2)*

Expand the provision of advisory services to agencies in the analysis and design of computer based systems.

2. *Standardization of equipment and techniques (ch. 7)*

Assume responsibility for the day-to-day guidance and monitoring of the ADP standardization program, and for the development of criteria for the determination of standards.

3. *Government-sponsored research and development in computer sciences (ch. 8)*

Provide a research center on computer science and technology to serve as an advisory service and consulting center for all Government agencies as needed, in computer systems development and related problems.

RECOMMENDATIONS FOR NEW LEGISLATION

Both general and specific legislation is needed to supplement existing statutory authorities in order (1) to make present work more effective by removing doubts as to its authorization and (2) to provide a clear statement of congressional policy respecting ADP matters.

*General legislation.*—We believe that management of ADP within the executive branch would be strengthened by the enactment of legislation (1) providing an expression of congressional policy on the acquisition and use of automatic data processing equipment, and (2) giving a specific directive to the Bureau of the Budget and the General Services Administration, within the areas of their presently assigned responsibilities, to take necessary actions to assure the most economic and effective use of automatic data processing. Enactment of such legislation would serve to highlight the very significant and increasingly important role played by ADP in the management and administration of Government programs. It would accord ADP a status comparable to that of Government statistical activities and financial management, which are the subjects of the Federal Reports Act of 1942 and separate provisions of the Budget and Accounting Procedures Act, and motor vehicles which are the subject of a separate provision in the Federal Property and Administrative Services Act.

*Specific legislation.*—In certain areas the objectives of this report can be achieved most effectively by clarifying and strengthening present authorities or by granting new authority. For example, the general supply fund of General Services Administration is now available only for procuring personal property and nonpersonal services and the cost of personal services employed directly in the repair, rehabilitation, and conversion of personal property. Thus the general supply fund

probably could not be used to finance consultative, programing, and other personal services which might be provided by a computer service center. No specific statutory authority now exists to develop, test, and make provision for the approval and implementation of standards for automatic data processing equipment and techniques, standard data elements, and codes. There is considerable doubt whether the National Bureau of Standards could undertake the full range of research activities and computer advisory services contemplated by this report without clarification of its present basic charter.

Consequently, we recommend that explicit legislative authority be provided in the following areas:

1. *Joint utilization of ADP equipment.*—We recommend that specific legislative authority be provided for the establishment of a revolving fund to facilitate the establishment of service centers, equipment pools, and time-sharing arrangements. This fund could be used by appropriate Federal agencies to finance the acquisition and utilization of ADP equipment and the procurement of personal services related thereto where existing authority is inadequate.

2. *Compatibility.*—In order to improve compatibility in automatic data processing we recommend that specific legislative authority be provided to develop, measure, test, and make provision for the approval and implementation of Federal standards for ADP equipment and techniques, and Federal standard data elements and codes.

3. *Technical improvement.*—In order to improve the state-of-the-art and to provide a source of expertise to Government agencies we recommend legislation to provide specific authority and direction to the Secretary of Commerce to establish a centralized research center on computer sciences and technology and to provide advisory and consultative services to Government agencies on computer systems development and related scientific and technical problems.

Constructive interest by the Congress, particularly by the Committees on Government Operations and Post Office and Civil Service, has contributed materially to improved management and utilization of ADP within the Federal Government. Close collaboration between the executive branch and the Congress is essential to assure continued progress in obtaining optimum utilization of ADP within the Federal Government.

EXHIBIT A

U.S. HOUSE OF REPRESENTATIVES,  
COMMITTEE ON POST OFFICE AND CIVIL SERVICE,  
*Washington, D.C., August 1, 1953.*

THE PRESIDENT,  
*The White House,*  
*Washington, D.C.*

DEAR MR. PRESIDENT: There is enclosed a copy of a committee print, an interim report<sup>1</sup> of the House Post Office and Civil Service Committee, summarizing the results of a series of hearings conducted by the Committee's Subcommittee on Census and Government Statistics on the procurement and use of electronic data processing equipment in the Federal Government. Your particular attention is invited to the conclusions and recommendation set forth in the interim report.

In 1951, there was one electronic data processing system in the Federal Government engaged in business-type application at the Bureau of the Census. At the close of fiscal year 1963, there were 1,248 such systems in use in the Federal Government (exclusive of tactical and classified installations) with a total annual cost of \$704 million. Informed opinion tells us that by 1970 the number of systems and the annual cost may be expected to triple. In other words, although there has been a phenomenal growth in this activity during the past 12 years, we are only at the threshold of startling advances and growth in this new technology. You may know that these developments are being referred to as "the electronic revolution" and some foresee greater impact upon our society and our institutions than that of the 19th century industrial revolution.

The enclosed report emphasizes the need for improving the Federal Government's management of electronic data processing and its peripheral equipment, and for a coordinated, Government-wide approach to the many problems faced by the Federal agencies. There is widespread disagreement in Congress and among the agencies as to how best to resolve such basic problems as central management, employee dislocations, standardization and compatibility of equipment and programs, the efficient utilization of installed computers, and other matters. Because of this, this committee feels that the enactment of legislation is undesirable at this time since it would conceivably retard the development of this new technology especially in its scientific and technical application.

We believe that before Congress legislates on electronic data processing, an opportunity should be given to the executive branch, in the exercise of its management responsibility, to evaluate the present system and to develop guidelines for future Federal policy. We are, therefore, recommending that you request the Director of the Bureau

<sup>1</sup> H. Rept. 627, "Interim Report on the Use of Electronic Data Processing Equipment in the Federal Agencies" (copy not attached to this exhibit).

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of the Budget to review these matters and to report to you and to Congress, on or before June 30, 1964, with such recommendations for management and administrative improvements, and for legislative action, as are determined to be in the public interest. We further recommend that, in conducting the review, the Director of the Budget consult with Members of Congress and with representatives of the principal Federal agencies, industry, business, labor, professional groups, and others concerned.

Respectfully yours,

TOM MURRAY, *Chairman.*

Approved For Release 2005/11/21 : CIA-RDP67B00446R000600050004-7

EXHIBIT B

THE WHITE HOUSE,  
*Washington, September 19, 1963.*

HON. TOM MURRAY,  
*Chairman, House Post Office and Civil Service Committee,  
House of Representatives,  
Washington, D.C.*

DEAR MR. CHAIRMAN: House Report 627, "Interim Report on the Use of Electronic Data Processing Equipment in the Federal Agencies," which you forwarded with your letter to me of August 1, 1963, has been reviewed with much interest. It deals with many of the problems involved in the use of automatic data processing (ADP) equipment for which there is no easy solution.

I agree with your recommendation and I have requested the Director of the Bureau of the Budget to initiate a study of the administration of automatic data processing in the executive branch of the Government, along the lines you have suggested. The Director will submit appropriate recommendations to me and to the Congress by June 30, 1964.

Sincerely,

JOHN F. KENNEDY.

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EXHIBIT C

EXECUTIVE OFFICE OF THE PRESIDENT,  
BUREAU OF THE BUDGET,  
*Washington, D.C., September 25, 1963.*

HON. TOM MURRAY,  
*Chairman, House Post Office and Civil Service Committee,  
House of Representatives,  
Washington, D.C.*

DEAR MR. CHAIRMAN: This is to advise you that I am taking steps to initiate a study of the administration of automatic data processing within the executive branch as requested of me by the President. The study will be planned to permit me to submit appropriate recommendations to the President and to the Congress by June 30, 1964.

The scope of the study will be along the lines outlined in your recommendation to the President of August 1, 1963. The recommendations arising from the study will give consideration to the fact that the purpose in using this equipment is to improve the effectiveness with which the Government's operations are conducted, and to the need for encouraging appropriate competition and technological progress in the industry. In conducting the study, we will consult with Members of the Congress and representatives of Federal agencies, industry, business, labor, professional groups, and others who can make effective contributions.

I wish to assure you that, in addition to reviewing the practices and policies of using agencies and agencies with more central responsibilities, the study will give particular attention to the functions and policies of the Bureau of the Budget. We welcome an objective and critical evaluation of the Bureau's automatic data processing program, and hope that the study will develop specific recommendations for strengthening our current efforts.

Sincerely,

KERMIT GORDON, *Director.*



## EXHIBIT D

### SELECTED ACTIONS BY THE LEGISLATIVE BRANCH RELATED TO THE MANAGEMENT OF AUTOMATIC DATA PROCESSING

1. House Report 858, 88th Congress, 1st session: "Use of Electronic Data Processing Equipment in the Federal Government," Committee on Post Office and Civil Service (October 16, 1963).

2. House Report 627, 88th Congress, 1st session: "Interim Report on the Use of Electronic Data-Processing Equipment in the Federal Agencies," Committee on Post Office and Civil Service (August 1, 1963).

3. H.R. 5171, introduced by Congressman Jack Brooks, was passed by the House of Representatives, with amendments, on July 18, 1963. This bill would authorize the Administrator of the General Services Administration "to coordinate and otherwise provide for the economic and efficient purchase, lease, maintenance, operation, and utilization of automatic data-processing equipment by Federal departments and agencies."

4. S. 1577, a bill somewhat similar to H.R. 5171, was introduced by Senator Paul Douglas in July 1963 and referred to the Senate Government Operations Committee.

5. House Report 428, 88th Congress, 1st session: Report to accompany H.R. 5171 (June 19, 1963).

6. Report to the Congress of the United States by the Comptroller General: "Study of the Financial Advantages of Purchasing over Leasing of Electronic Data Processing Equipment in the Federal Government" (March 1963).

## EXHIBIT E

### RÉSUMÉ OF MANAGEMENT ACTIVITIES WITHIN THE EXECUTIVE BRANCH

The number of computers used in the Government has grown from 10 in 1954 to 1,767 in 1964. This rapid growth was accompanied by management activities within the executive branch at several levels which were directed toward assuring the best and most economical use.

#### MANAGEMENT ACTIVITIES

##### *1. Department and agencies*

In the earlier years, local Government installations, foreseeing the possibilities for improving their operations, obtained computers with little guidance or review from higher organizational levels. As was to be expected, the lack of experience and precedent in the use of this revolutionary device caused many of the pioneering installations to encounter serious difficulties. Concurrently, however, there came a broader recognition of the potentials of computers and a desire to bring about a more orderly introduction of computer capability into the total organization.

The combination of these factors led the larger departments and agencies to establish staff resources at intermediate and headquarters levels for this purpose of guiding, coordinating, and controlling the acquisition and use of computers. Such steps were taken in the Department of Defense as early as 1956; other departments and agencies followed in accordance with the progress each made in the use of computers. The general pattern of the functions performed at these levels is to (a) review and approve the installation of proposed computer systems, (b) implement, with detailed guidance, policies established by the Bureau of the Budget and central agencies such as the General Services Administration, and (c) assist and guide the development of systems which cut across organizational lines. More recently, emphasis has been given to the promotion of computer sharing as a means for satisfying computing needs.

Outstanding contributions have been made by the departments and agencies in the development of new and improved computer systems. The initiative exercised in this respect, and in other activities related to the advancement of computer technology and techniques, has been a major factor in the Government's progress in exploiting the tremendous potential of this equipment.

##### *2. Bureau of the Budget*

In 1958, the Bureau of the Budget undertook a study to identify and clarify the Government-wide functions related to the use of computers that should be performed by the respective central agencies. As an outgrowth of this study, the Bureau, in accordance with its responsi-

bilities for advising on matters of organization and management improvement, initiated a broad program to—

- (a) Provide policy and planning guidelines to the agencies.
- (b) Review, as part of the established budget and program review processes, agencies' plans for the use of computers.
- (c) Assist in strengthening agency programs for management.
- (d) Assist in identifying and providing information or training needed by officials in the executive branch.
- (e) Sponsor or perform special studies leading to the solution of managerial problems and the more effective use of computers.
- (f) Minimize incompatibility of equipment by strengthening and coordinating the Government's participation in the program of the American Standards Association.
- (g) Foster the exchange of experience and advice among the agencies and the Bureau of the Budget.

In the exercise of its responsibilities in this area, the Bureau has adhered to a certain basic principle which underlies all of its activities; namely, that the responsibility for the performance of agency programs rests solely with the head of the agency. Because, as noted earlier, the use of computers is so vitally linked to program performance, decisions regarding use must also be controlled by the head of the agency. In this context, the Bureau program has been devoted to those activities which will guide and assist the agency head. Reviews of agency performance in accordance with this guidance and assistance are normally accomplished as a part of the regular budget formulation and execution processes, and are augmented by special studies as required.

### 3. General Services Administration

The General Services Administration (GSA) has similarly been active in its area of general responsibility:

(a) Since 1955 it has negotiated Federal supply schedule contracts with manufacturers for the rental of ADP equipment; these contracts are then used by Federal agencies in procuring the equipment that they select. In recent years, the contracts have been extended to cover the purchase and maintenance of equipment. Through these negotiations, GSA has successfully obtained improved terms and conditions over the years, with resulting benefits and economies to the Government agencies. Among these are the following:

- (1) The rental concept was changed from an availability basis (rent is paid for the period that the equipment is available, whether or not used) to a use basis (rent is paid for actual use, with a minimum rental charge being paid).
- (2) Standards of performance were developed as a basis for accepting delivery.
- (3) Liquidated damages were assessed for failure to install equipment as agreed.
- (4) Options on alternative use periods, and limited use discount options, were obtained.

(b) Regulations have been issued recently to govern the screening of excess leased and purchased computers prior to the acquisition of computers from other sources.

(c) Regional sharing exchanges are being established throughout the country to facilitate the use of all available computer capacity.

(d) Government representation has been provided on the American Standards Association Committee on Computers and Information Processing and on several of its subcommittees.

#### 4. *Civil Service Commission*

The Civil Service Commission also has long recognized the impact of computers in the exercise of its responsibilities:

(a) It has made a consistent effort to provide useful classification and qualification standards for computer occupations. The first of these were published in March 1958; they were reviewed and updated in 1959, 1961, and 1964.

(b) Extensive advice and assistance have been provided to agencies in developing aptitude tests for computer occupations, to aid agencies in making the maximum use of their own employees in this field.

(c) Special assistance has been given to agencies in the reassignment of employees whose jobs were affected by the installation of a computer. This has been done by authorizing the use of extended temporary appointments for additional personnel needed during the period of conversion to the computer system; waiving qualifications standards in reassignments; and disseminating information to Federal agencies about surplus personnel.

(d) Training in use of computers and their application has been sponsored and provided. In the past 4 years, nearly 6,000 employees from 60 agencies have attended courses conducted by the Commission.

(e) A study of the impact of automation on Federal employees was recently completed as a basis for charting its program for the future. Recognition is given in this study to the need for expanded technical training.

#### 5. *National Bureau of Standards, Department of Commerce*

The National Bureau of Standards has been instrumental in promoting the effective use of computers among agencies by its representation, along with General Services Administration and the Department of Defense, on the American Standards Association Committee on Computers and Information Processing; providing assistance to agencies in the design of computer systems and the selection of equipment; operating a Computer Service Center/Sharing Exchange for the Washington area; and conducting experimental work on computer design and operation.

### POLICIES AND GUIDELINES

In the performance of these management activities, a large body of policy and guideline documents have been issued. The principal documents that provide Government-wide policy and which are prominently referred to in the present report are described below. They are followed by a brief analysis of the guidelines issued by the agencies.

#### 1. *Government-wide policies and guidelines*

Government-wide policies and guidelines have been issued by the Bureau of the Budget and General Services Administration as follows:

(a) Bureau of the Budget Bulletin 60-6, dated March 18, 1960, subject: "Studies Preceding the Acquisition of Automatic Data Processing Equipment." This bulletin deals with the methodology and

considerations involved in studying the feasibility of using ADP equipment. Its contents were developed by the Interagency Committee on ADP. Although it needs to be updated and expanded to reflect the experience and knowledge gained in the past 4 years, it still serves to stress most of the fundamental principles to be observed in deciding upon the use of ADP systems.

(b) Bureau of the Budget Circular A-54, dated October 14, 1961, subject: "Policies on Selection and Acquisition of Automatic Data Processing Equipment in the Executive Branch." This circular (1) stresses the importance of studies of systems as a requisite of effective use of equipment, (2) provides basic criteria for the selection of equipment, (3) provides guidelines for determining whether equipment should be purchased or leased, and (4) requires a review of existing procurement arrangements to determine conformance with these guidelines. This circular has been effective in stimulating objective consideration of the relative merits of purchase or lease before deciding which is the more advantageous. The present report points to areas in which the circular should be more explicit, so as to achieve greater uniformity in the application of the guidelines.

(c) Bureau of the Budget Circular A-55, revised, dated November 15, 1963, subject: "Annual Reports on the Utilization of Automatic Data Processing Equipment in the Executive Branch." This circular prescribes the format by which agencies submit annual reports (with the data projected for 3 years) on computer installations, including costs, personnel, utilization, and applications. The establishment of an ADP management information system, incorporating information not prescribed by this circular but including additional elements to be furnished more frequently, is a key recommendation of the present report.

(d) Bureau of the Budget Circular A-61, dated August 3, 1963, subject: "Guidelines for Appraising Agency Practices in the Management of Automatic Data Processing Equipment in Federal Agencies." This is a concisely prepared document directed primarily toward persons having broad ADP management or review responsibilities, to assist them in the appraisal of their own agency ADP programs. It covers such subjects as (1) the organization and contents of the ADP program, (2) the decision to use equipment, (3) selecting equipment, (4) method of acquisition, and (5) performance evaluation.

(e) Bureau of the Budget Circular A-27, dated June 15, 1964, subject: "Policies and Responsibilities on the Sharing of Electronic Computer Time and Services in the Executive Branch." This circular provides that computer installations will share unused equipment time and creates regional sharing exchanges to facilitate the negotiation of sharing arrangements. It takes account of the recommendations on sharing made in the present study.

(f) The General Services Administration Personal Property Management Regulation No. 36, dated April 1964, subject: "Utilization of Screening of Government-owned and Leased Electronic Data Processing Equipment." This deals with the reuse or disposition of rented or owned ADP equipment which exceeds a user's needs. The present report covers several aspects of the management of the Government's equipment inventory.

*2. Guidelines of departments and agencies*

An examination of policy and guideline documents issued by 23 representative agencies indicated that, in general, coverage was reasonably adequate with respect to (a) assignment of organizational responsibilities, (b) requirements for appropriate studies and management review of ADP decisions, (c) criteria for selection and method of acquiring equipment, and (d) recognition of impacts upon personnel.

Coverage is less comprehensive with respect to (a) readiness reviews which precede delivery of the equipment to assure that it can be productively used immediately upon installation, (b) periodic evaluations of performance to determine whether system objectives are being met, and (c) sharing arrangements. The general lack of agency emphasis on these three aspects of ADP management has undoubtedly contributed to instances of poor and ineffective utilization of equipment which, in turn, points to the relative importance of these phases of ADP management, as noted in the present report.

As might be expected, the comprehensiveness of the guidelines issued at the department and agency level vary according to the numbers of computers installed. Guidelines issued by the military departments, where about two-thirds of the total number of computers in the Government are used, are a great deal more comprehensive than those issued by smaller agencies where the control function is not subject to the diverse computer uses and circumstances found in the larger agencies. Nevertheless, organizational responsibilities for administering these guidelines are generally as well defined in the smaller agencies as they are in the larger. In fact, in several cases, large civilian departments and agencies have only recently initiated efforts at the headquarters level to establish an element of control over constituent bureaus in an effort to promote more effective management of ADP resources.

It must be pointed out, however, that the general observations made herein apply only to what was found in the "written word." Policy and guideline documents are not necessarily self-implementing. Their application requires a conscious awareness of their importance on the part of those to whom they apply, and a zealous effort to assure their application on the part of those who provide them. To the extent that guidelines are expertly developed, properly understood, diligently applied, and periodically evaluated, they will contribute significantly to improving the management of ADP in the Federal Government.

## EXHIBIT F

(Furnished by the Chairman, Civil Service Commission)

### THE MANPOWER AND PERSONNEL IMPACT

#### A STUDY OF THE IMPACT

During its relatively short existence, the computer has created new and unusual problems for personnel management. The effectiveness of the computer depends upon man's ingenuity to utilize it to accomplish tasks better than man can do them. This places a responsibility upon personnel management to obtain persons with the skills the computer needs while simultaneously attempting to find work for the persons with the skills the computer replaces.

Federal agencies and the Civil Service Commission have long worked together to overcome the personnel problems attributable to automation. The Commission has provided special programs and authorities which have been effective in responding to agency requirements. However, the burgeoning growth of automation in the Government prompted concern in the Commission whether the effects of automation on personnel would become more critical in the future, necessitating "crash" programs of action if advance planning were inadequate.

A comprehensive study was initiated in the summer of 1963 in which 21 departments and agencies possessing a computer capability participated. Information was sought through statistics and consultation on both the direct and indirect effects of the various categories of automation applications, including physical operations as well as the ADP applications of record processing and problem solving. In view of the emphasis upon ascertaining the imminence of any changes of consequence in personnel impact, agencies were asked to supply information from available data. Because of the wide variance in the quality and quantity of statistical data agencies were able to provide, the main reliance for information was placed in the expert advice obtained from agency representatives, whose views were remarkably similar on the important questions and issues. Employee organizations were asked for their views and special consideration was given to the recommendations made by the Subcommittee on Census and Government Statistics of the House Post Office and Civil Service Committee in its report of October 16, 1963 (H. Rept. 858).

#### RESULTS OF THE STUDY

The study revealed that the current problems of most concern to the agencies are related to the manning and utilization of computers. The displacement of employees attributable to automation has been small in relation to the total employment and, while troublesome problems persist, the extensive efforts of agencies have minimized involun-

tary separations. A significant change in the displacement impact is not expected in the near future. However, all agencies recognize that the dynamic and evolutionary growth forecast for automation necessitates a continuing effort to anticipate future personnel effects. The results of the study led to the development of a program to seek solutions to existing and predicted personnel problems and to maintain an alertness to potential changes in impact. The findings and the program are contained in a report entitled "A Study of the Impact of Automation on Federal Employees" which was published in August 1964 as a committee print by the House Committee on Post Office and Civil Service.

The program which evolved from the study has been subdivided into the following units in order to facilitate individualized attention to the elements of this complex subject:

1. Manning for computer operations.
2. Manning for better utilization of computers.
3. Personnel adjustments.
4. Forecasts of changes in personnel requirements.
5. Analysis of the future.

There is a need to unify attention to this program and to bring to bear on the problems the widespread knowledge existing in the Government. Consequently, the Civil Service Commission will study and act upon the several aspects of the program with the cooperation of other Federal agencies through the medium of a committee of the Interagency Advisory Group, which is sponsored by the Commission.

#### MANNING FOR COMPUTER OPERATIONS

Agencies have obtained personnel for computer operations primarily by reassigning employees and by hiring inexperienced applicants who have passed the Federal service entrance examination of the Civil Service Commission. Extensive training programs have been required to develop the needed skills. However, the shortage of experienced personnel has necessitated the use of this method of manning computer operations. This shortage is exemplified by the considerable movement between Federal agencies of personnel who transfer, often with promotions, as they accumulate experience. The retraining and reassignment of employees to work in computer operations has been beneficial in reducing the displacement effects of automation, but this source of potentially capable employees is expected to diminish in importance, particularly with the advent of more complex applications of the computer. Consequently, a continued shortage of capable computer specialists is foreseen as the demand for them expands. Estimated increases in the requirements for personnel in special automation occupations during fiscal year 1964 through fiscal year 1968 approximate 52 percent over actual employment at the end of fiscal year 1963. In this group of occupations the greatest increase in demand will be for systems analysts—85 percent.

The Civil Service Commission has conducted examinations for computer positions in its field regions and has announced an examination in the critical Washington metropolitan area. These actions are to be supplemented by studies to be conducted by the IAG Committee to find additional ways of increasing the inflow of capable employees



to the Government. Among the subjects which are to be considered are (1) the need for a special program to develop a reservoir of experienced applicants, (2) the feasibility of a Government-wide career development and advancement program, (3) an evaluation of current testing practices, and (4) the need for more centralized technical training of programmers and systems analysts.

#### MANNING FOR BETTER UTILIZATION OF COMPUTERS

To be employed effectively, the computer is demanding an increased technical competence among its utilizers. Managers at all levels and key staff personnel need to understand the computer—its capabilities and its limitations—to realize the full potential of automation and to define its potential impact. Requirements will increase for specialists in various disciplines to assist the manager in utilizing the computer. However, the manager is the person with the full perspective of the operations and goals of his organization and, while he is not expected to be a technical expert, he must have sufficient technical competence to provide leadership in the applications of automation. The conviction that few managers now have this competence is an important concern among agencies.

The degree and rapidity of movement toward more complex applications of the computer, particularly in the administrative areas of operation, is a factor affecting the impact of automation on personnel. The knowledge of management in the use of the computer will have an important bearing on the rapidity of its application as a management tool. The knowledge of management methods possessed by computer specialists will also be a factor in the development of effective systems.

Ways of extending the use of the computer from applications which reduce manual work in repetitive operations to those which facilitate planning and control of operations by management are receiving increased attention in Government. When management can readily obtain current information needed for planning and decisions, management concepts may well change. Elimination of the need for intermediate assembly and manipulation of information will provide management with better direct control. This can lead to changes in the organizational structure, causing extensive adjustments in the workload pattern and in personnel requirements. The possibility that fewer middle management positions may be required raises the problem of providing a ladder of experience and training leading to top management positions.

Increased educational and training opportunities are the key to manning for better utilization of computers. Many training courses are being provided by some of the agencies and by the Civil Service Commission, and these are being expanded. Some of the subjects which will be considered as a further means of utilizing the computer more effectively are: (1) Methods of encouraging educators to emphasize instruction of high school and college students in the applications and operations of automation and its place in the future, (2) intensification of efforts to educate managers to understand the computer and to define and quantify factors involved in decisionmaking, and (3) the education of computer specialists in management practices.

#### PERSONNEL ADJUSTMENTS

The statistical data obtained from agencies concerning the displacement effects of automation during fiscal year 1961 through fiscal year 1963, while incomplete, did provide valuable indications of the patterns of personnel adjustments. Ten agencies whose aggregate employment approximated 1,325,000 persons reported a total of 1,628 actions concerning employees whose positions were eliminated because of automation. Of these actions—

77 percent were reassignments.

1.5 percent involved a reduction in grade and salary.

98 percent of the offers for reassignment locally were accepted.

43 percent of the offers requiring relocation were accepted.

9 percent were declinations of reassignment offers.

6 percent were resignations.

2 percent were separations by reduction in force.

6 percent were separations for other reasons, including retirement and refusal to accept reassignment.

Three-fourths of the actions affected clerical personnel, followed by those categorized as technical nonsupervisory (15 percent), technical supervisory (5 percent), and wage board (5 percent) employees. Continuation of a reduction in clerical personnel is forecast for the fiscal 1964 through fiscal year 1968 period while employees in automation operations and other technical occupations are expected to increase.

Although agencies expect to be able to minimize the impact of personnel adjustments caused by automation within the foreseeable future, a need exists for additional study and planning to cope with existing problems and those which are likely to cause the greatest difficulties in the future. The possibility that reassignment and retraining may become more difficult with the gradual upgrading of work force necessitates an evaluation of the basic capabilities of employees likely to be displaced by automation and the feasibility of training them in the needed skills. Special attention must be given to the problems of the older worker who is displaced. The effects a reduction in the lead time between planning and converting operations to automation will have upon attrition and reassignment possibilities should be looked at carefully. A greater need to relocate personnel is likely to occur and this vexing problem needs intensive study in order to develop ways to mitigate the effects upon both employer and employee.

#### FORECASTS OF CHANGES IN PERSONNEL REQUIREMENTS

The ability of agencies to forecast manpower requirements attributable to automation during the fiscal year 1964 through fiscal year 1968 period varied considerably. This is understandable inasmuch as a Government-wide requirement to segregate statistically the effects of automation on personnel does not exist. However, the likelihood that the continued growth and evolution of automation will have a new and more extensive impact on personnel demands more detailed and consistent data forecasting changes in personnel requirements. Information is needed that will show both the direct and indirect

impact of the various types of automation. Expected changes in skill requirements should be defined to assure a sufficient period to prepare for the adjustments.

The program provides for the development of an appropriate system which can be used throughout Government to supply the information required for timely action to avoid a negative impact upon automation operations and employees. The management information system the Bureau of the Budget recommends can be a valuable medium for obtaining essential information. Also included in the program is a recommendation that personnel specialists in all agencies should participate from the outset in the planning of automation applications which may affect personnel.

#### ANALYSIS OF THE FUTURE

Advances in the "state of the art" of automation are occurring continually and many more are foreseen for the future. Among the improvements in equipment and operating methods which will have important effects upon applications and personnel are greater compatibility of equipment, a simplified common computer language, more standard programs, and a versatile optical scanner. The use of the computer and optical techniques in the assembly, storage and retrieval of information coupled with improved communication transmission methods has the potential to change the methods of accumulating and utilizing information. Speech recognition by computers will have a great impact when a practicable and economically feasible system is developed.

The time the improvements will occur is difficult to forecast which necessitates a continuous effort to keep abreast of developments in order to be ready for their impact upon personnel. Consequently, it is planned that essential information will be obtained continually from sources within the Government such as the National Bureau of Standards and the General Services Administration. This information will be evaluated for the effects the advances will have upon personnel and personnel planning.

#### CONCLUSION

The basis has been established to meet the challenges of automation to personnel management. By combining the individual efforts and knowledge of agencies within a framework which provides for attention to both the current and future impact of automation on personnel, the Interagency Advisory Group Committee should be valuable in improving the effectiveness of automation and minimizing the adverse effects upon personnel.

EXHIBIT G

PROPOSED CHANGE TO ARMED FORCES PROCUREMENT REGULATIONS

TAB A  
8 July 1964 Minutes  
Case 63-85

15-205.34 *Rental Costs (Including Sale and Leaseback of Facilities).*

(a) Rental costs of real property and personal property are allowable, to the extent that the contractor demonstrates that:

(i) adequate alternate facilities which will serve the purpose are not or were not available at lower cost;

(ii) leasing from an economic and technical standpoint, is the appropriate method of acquiring or retaining the use of the property (see (c) below);

(iii) the rental rates are reasonable in light of such factors as rental costs of comparable facilities and market conditions in the area, the type, life expectancy, condition, and value of the facilities rented, various types of leases available, and other provisions of the rental agreement; and

(iv) the rental payments do not give rise to the acquisition by the contractor of a material equity in the facilities, but represent charges only for the current use of the facilities including any incidental service costs such as maintenance, insurance and property taxes (see (d) below).

(b) Rental costs shall be limited to the amount that the contractor would have received were he the owner of the property when from an economic standpoint, purchasing is determined to be the most appropriate method of acquiring or retaining the use of the property (see (c) below).

(c) The determination as to whether purchasing or leasing in the appropriate method of acquiring or retaining the use of the property shall be based on two factors—(1) the anticipated useful life of the property to the contractor and (2) the least cost estimated for such useful life based upon a comparison of the cumulative costs that would be allowed the contractor if he owned the property with the cumulative costs that would be allowed under any of the various types of leasing arrangements available.

(i) An estimate of the anticipated useful life of the property may represent the application life (utility in a given function), technological life (utility before becoming obsolete in whole or in part) or physical life (utility before physically wearing out) depending upon the facts and circumstances and the particular facilities involved. Therefore, each case must be evaluated individually.

AUTOMATIC DATA PROCESSING

*a.* In estimating anticipated useful life the contractor may use the application life if he can clearly demonstrate that the facility has utility only in a given function and the duration of the function can be determined.

*b.* Technological life may be used by the contractor to justify leasing if he can demonstrate that existing leased facilities will have to be replaced because of (i) specific program objectives or contract requirements which cannot be accomplished with the existing facilities, (ii) cost reductions which will provide identifiable savings in production or overhead costs, (iii) increase in workload volume which cannot be accomplished efficiently by modifying or augmenting existing facilities or (iv) consistent pattern of capacity operation (2½-3 shifts) on existing facilities. Technological advances per se will not be recognized as a valid requirement for replacement of existing facilities before the end of their physical life if such existing facilities will be able to satisfy future requirements or demands.

(ii) The useful life and "least cost" information mentioned respectively in (c) (1) and (c) (2) above, shall be developed by the contractor and furnished to the Government for the purposes mentioned in (iii) below. If availability of facilities for purchase does not exist, the cost comparisons shall be made under the various types of rental arrangements available. (But see (d) below.)

(iii) If the contractor is able to demonstrate to the satisfaction of the Government that leasing as opposed to purchasing is the appropriate method of acquiring the use of the property under the criteria herein set forth, then the rental which would have to be paid under the most favorable type of leasing arrangement available shall be allowed. On the other hand, if the contractor cannot so demonstrate, the rental otherwise allowable will be limited to the amount the contractor would receive were he the owner of the facilities.

(iv) When rental costs are substantial in amount the information referred to in (c) (ii) above shall ordinarily be submitted annually. In those situations where leasing has been determined to be the appropriate method of acquiring the facilities in prior years, the comparative cost analysis will be restricted to the remaining useful life of the facilities involved. Purchase cost will be the price at which the facilities could be acquired at the time the comparative analysis is made. In the event purchase is determined to be the appropriate method of acquiring facilities for which previous annual determinations justified leasing, retroactive cost determinations limiting costs for such prior years to costs which would have been received by the contractor if he were the owner shall not be made.

(d) Some lease agreements are, in fact, installment purchases of facilities. In such cases, the substance of the arrangement, rather than its legal form, determines the treatment for cost determination purposes. Allowance of payments made as rent under such lease agreements will be limited to the costs the contractor would normally receive as owner of such property. The presence of either of the following conditions will generally establish that a lease is, in substance, a purchase:

(i) The initial term is less than the useful life of the facilities and the contractor has the option to renew the lease at termination at a nominal price.

(ii) The contractor has the right (during or at the expiration of the lease) to acquire the facilities at a price which at the inception of the lease appears to be substantially less than the probable fair value of the facilities at the time or times of permitted acquisition by the contractor.

In these cases, the fact that the payments under the lease usually run well ahead of any reasonable measure of depreciation of the service value of the property, coupled with the options which permit either a bargain purchase by the contractor or the renewal of the lease during the anticipated useful life at bargain rentals constitutes convincing evidence that an equity in the property is being built up as payments are made under the lease.

(e) Charges in the nature of rent between plants, divisions, or organizations under common control are allowable to the extent such charges do not exceed the normal costs of ownership, such as depreciation, taxes, insurance, and maintenance; *Provided*, that no part of such costs shall duplicate any other allowed costs.

(f) Unless otherwise specifically provided in the contract, rental costs specified in sale and leaseback agreements incurred by contractors through selling plant facilities to investment organizations, such as insurance companies, or to private investors, and concurrently leasing back the same facilities, are allowable only to the extent that such costs do not exceed the amount which the contractor would have received had he retained legal title to the facilities. This limitation is not applicable to cases where leasing in lieu of purchasing is justified and a sale and leaseback arrangement results in costs to the Government lower than the costs under other leasing arrangements.

(g) The allowability of rental costs under unexpired leases in connection with terminations is treated in 15-205.42(e).

(h) Allowable rental costs need not be adjusted by the amount of any investment credit accruing to the contractor by reason of election made by a lessor of new "section 38" property pursuant to section 48(d) of the Revenue Code of 1962, as amended, to treat the contractor as purchaser of such property.

## EXHIBIT H

EXECUTIVE OFFICE OF THE PRESIDENT,  
BUREAU OF THE BUDGET,  
Washington, D.C., December 26, 1963.

BULLETIN No. 64-8.

To the Heads of Executive Departments and Establishments.

Subject: Study of the management of automatic data processing in the Federal Government.

1. *Purpose.* The purpose of this Bulletin is to announce a study by the Bureau of the Budget of the management of automatic data processing activities in the executive branch, and to request the cooperation of departments and establishments in the conduct of the study.

2. *Origin and scope of study.* The study will include a review and evaluation of existing Government-wide and individual agency policies, organizational arrangements and programs for the use of automatic data processing equipment. Based on the study findings, recommendations are to be made for such administrative or legislative actions as may be appropriate to improve the management of these activities. The recommendations are to be submitted to the President and the Congress by June 30, 1964.

3. *Advisory Committee.* An Advisory Committee has been formed to advise the Director of the Bureau of the Budget and the project staff on matters relating to the study. Various other persons will be consulted during the course of the study, including Members of Congress and representatives of Federal agencies, industry, business, labor and professional groups. Members of the advisory committee are:

Robert Ramspeck, a former Member of Congress and former Chairman of the Civil Service Commission, now a consultant for Eastern Airlines (Chairman).

Bernard L. Boutin, Administrator of General Services.

Manuel R. Cueto, vice president in charge of electronic planning and development, New York Life Insurance Co.

Walter F. Frese, professor of business administration, Harvard University.

Martin Gainsbrugh, vice president, National Industrial Conference Board.

J. Herbert Hollomon, Assistant Secretary of Commerce for Science and Technology.

Dwight A. Ink, Assistant General Manager, Atomic Energy Commission.

Frederick J. Lawton, former Director of the Bureau of the Budget and former Civil Service Commissioner.

John W. Macy, Jr., Chairman of the Civil Service Commission.  
Thomas D. Morris, Assistant Secretary of Defense (Installations and  
Logistics).

Martin Shubik, professor of economics, Yale University.

4. *Project staff.* The study will be made under the direction of Carl W. Clewlow, who is on leave from his position as managing associate, Arthur Young & Co., to serve as the project director. Mr. Clewlow has served as Deputy Administrative Assistant Secretary, Department of the Treasury, and prior to that as Director of the Office of Analysis and Review, Department of the Army. He will be assisted by a small full-time project staff selected from various Government departments and agencies.

5. *Agency assistance to project staff.* The findings and recommendations of this study will be considered by the President and the Congress in formulating policies in regard to the future use of automatic data processing equipment throughout Government. It is important that they be based on full and accurate information. It is requested that all departments and establishments assist by responding as promptly as possible to requests of the project director and staff for information and assistance during the course of the study.

KERMIT GORDON, *Director.*



EXHIBIT I

STUDY OF AUTOMATIC DATA PROCESSING IN THE FEDERAL  
GOVERNMENT

PROJECT STAFF MEMBERS

Carl W. Clewlow, director, management services, Arthur Young & Co., Washington office; on loan to the Bureau of the Budget.  
Joseph F. Cunningham, Associate Director of Data Automation, Department of the Air Force.  
Howard Gammon, Assistant to the Director. National Bureau of Standards.  
Martin Hochdorf, Chief, Computing Center, Tennessee Valley Authority, Chattanooga, Tenn.  
Donald B. Rock, Chief, ADP Evaluation Branch, Federal Aviation Agency.  
Richard G. Shook, Chief, Data Processing Evaluation and Control Branch, Office of the Controller, Atomic Energy Commission.  
William H. Smith, Assistant Commissioner for Planning and Research, Internal Revenue Service.

EXHIBIT J

NON-GOVERNMENT ORGANIZATIONS CONSULTED

*Industry*

American Telephone & Telegraph Co., New York, N.Y.  
Bell Telephone Laboratories, Holmdel, N.J.  
Hughes Aircraft Co., Culver City, Calif.  
Lockheed Aircraft Corp., Burbank, Calif.  
U.S. Steel Corp., Pittsburgh, Pa.  
Westinghouse Electric Corp., Pittsburgh, Pa.

*Educational institutions*

California Institute of Technology, Pasadena, Calif.  
Carnegie Institute of Technology, Pittsburgh, Pa.  
Massachusetts Institute of Technology, Cambridge, Mass.  
University of California, Berkeley, Calif.  
University of Pittsburgh, Pittsburgh, Pa.

*Consultants*

Diebold Group.  
Lybrand, Ross Bros., and Montgomery, New York, N.Y.  
McKinsey and Co., Inc., New York, N.Y.  
MITRE Corp., Bedford, Mass.  
Price Waterhouse, New York, N.Y.  
Rand Corp., Santa Monica, Calif.  
Stanford Research Institute, Menlo Park, Calif.  
Systems Development Corp., Santa Monica, Calif.

*Associations*

Business Equipment Manufacturers Association, New York, N.Y.  
American Management Association, New York, N.Y.  
American Standards Association, New York, N.Y.

*Employee unions*

American Federation of Government Employees.  
Federation of Postal Clerks.  
Government Employees Council AFL-CIO.  
National Federation of Federal Employees.

*Equipment manufacturers*

Burroughs Corp.	Honeywell, Inc.
Computer Control Co., Inc.	IBM Corp.
Control Data Corp.	National Cash Register Co.
Farrington Corp.	Radio Corp. of America
General Electric Co.	Sperry-Rand Corp. (UNIVAC)

EXHIBIT K

EXECUTIVE OFFICE OF THE PRESIDENT,  
BUREAU OF THE BUDGET,  
*Washington, D.C., March 6, 1965.*

To the heads of executive departments and agencies.

Subject: Implementation of responsibilities for the management of automatic data processing (ADP).

1. This memorandum transmits (a) the "Report on the Management of Automatic Data Processing in the Federal Government," which the President approved and transmitted to the Congress on March 2, 1965, and (b) Bureau of the Budget Circular A-71: Responsibilities for the administration and management of automatic data processing activities, March 6, 1965.

2. The report emphasizes that significant improvements can be made in the conduct of Government programs by the use of automatic data processing equipment. The electronic computer has already enabled the Government to make outstanding progress in its scientific programs, achieve greater effectiveness and major economies in its business-type operations, and provide improved service to the public. As further advancements are made in computer technology, and as our understanding of its use increases, the prospects for future accomplishments seem even greater. These opportunities for improvement require that the Government's efforts be directed toward the objectives of using this equipment creatively, as well as prudently and economically. The actions to be taken by the executive branch in accordance with the attached report will further our efforts in this regard.

3. The expansion of central policy guidance and assistance, which is recommended in the report, for the most part can best be accomplished through Government-wide efforts. Agencies, therefore, will be expected to support such efforts, and to contribute directly to their accomplishment when called upon to do so. Meanwhile, agencies should begin immediately to review their activities in light of the responsibilities specified in the attached circular, and take such steps as are necessary to meet these responsibilities in full. Existing Government-wide policies and guidelines, which will remain effective until formally revised, provide assistance in this respect. For convenient reference, the documents that contain these policies and guidelines are listed below:

(a) Bureau of the Budget Bulletin No. 60-6: Studies preceding the acquisition of ADP equipment (March 18, 1960).

(b) Bureau of the Budget Circular A-54: Policies on selection and acquisition of automatic data processing equipment (October 14, 1961).

(c) Bureau of the Budget Circular A-61: Guidelines for appraising agency practices in the management of automatic data processing equipment in Federal agencies (August 3, 1963).

(d) Bureau of the Budget Circular A-55: Annual reports on the utilization of automatic data processing equipment (November 15, 1963).

(e) Bureau of the Budget Bulletin No. 64-9: Establishment of an Experimental Computer Sharing Exchange and Computer Service Center at the National Bureau of Standards (January 2, 1964).

(f) Department of Commerce (National Bureau of Standards) letter to the heads of executive departments and establishments: Plans for Operation of Experimental Computer Sharing Exchange and Computer Service Center (January 17, 1964).

(g) General Services Administration Personal Property Management Regulation No. 36: Utilization screening of Government owned and leased electronic data processing equipment (April 17, 1964).

(h) Bureau of the Budget Circular A-27: Policies and responsibilities on the sharing of electronic computer time and services (June 15, 1964).

(i) General Services Administration Federal Property Management Temporary Regulation No. A-1: Government-wide automatic data processing sharing program (November 27, 1964).

KERMIT GORDON, *Director.*

EXECUTIVE OFFICE OF THE PRESIDENT,  
BUREAU OF THE BUDGET,  
*Washington, D.C., March 6, 1965.*

Circular No. A-71.

To: The heads of executive departments and establishments.

Subject: Responsibilities for the administration and management of automatic data processing activities.

1. *Purpose.*—This circular identifies certain responsibilities of executive agencies for the administration and management of automatic data processing (ADP) activities, and is intended to provide for maximum cooperation and coordination between and among the staff and operating agencies of the executive branch.

2. *Scope.*—The ADP equipment affected by this circular is that equipment identified in paragraph 2 of Bureau of the Budget Circular No. A-54, "Policies on the selection and acquisition of automatic data processing (ADP) equipment, October 14, 1961."

3. *Responsibilities of the Bureau of the Budget.*—The Bureau of the Budget will provide overall leadership and coordination of executive branchwide activities pertaining to the management of automatic data processing equipment and related resources and will develop programs and issue instructions for achieving increased cost effectiveness through improved practices and techniques for the selection, acquisition, and utilization of automatic data processing equipment and resources. In this connection, the Bureau of the Budget will—

(a) Provide policies and criteria, procedures, regulations, information, technical advice, and assistance to executive agencies.

(b) Evaluate, through the review of agency programs and budgets and through other means, the effectiveness of executive

agencies and the executive branch as a whole in managing auto- it is in the best interests of the Government to do so, and arrange

(c) Foster adequate Federal Government support of programs for developing voluntary commercial standards for automatic data processing equipment and techniques, arrange for the approval and promulgation of voluntary commercial standards when it is in the best interests of the Government to do so, and arrange for the development, approval and promulgation of Federal standards for automatic data processing equipment and techniques on an interim basis, or permanent basis, when voluntary commercial standards are not available or usable.

(d) Support the development and promulgation of standard data elements and codes in Government systems, when such data elements and codes are in common use in some or all executive agencies.

(e) Encourage the use of advanced techniques in the design of data systems and support research in advanced system design through demonstration projects.

(f) Advocate intra-agency and interagency integration of systems.

(g) Sponsor the development of a system which provides to line and staff officials at all levels of Government the information needed for effective management of automatic data processing equipment and related resources.

4. *Responsibilities of the General Services Administration.*—The General Services Administration is responsible for aiding in the achievement of increased cost effectiveness in the selection, acquisition, and utilization of automatic data processing equipment and appropriate related resources and will perform the following functions:

(a) In connection with the selection of automatic data processing equipment, provide to executive agencies, on request, comparative information on the characteristics and performance capabilities of equipment and on the contractual performance of the firms that supply equipment and programing aids to the Government.

(b) In connection with the acquisition of automatic data processing equipment (1) provide Federal schedules of supply for renting, purchasing and maintaining automatic data processing equipment, for use by executive agencies each fiscal year, (2) take such steps as may be feasible and necessary to insure to the extent practicable, that the Federal schedules of supply for ADP equipment each year will be available for use on the first day of that year, and (3) through continuous study and negotiation, seek improvements in the terms, conditions, and prices stated in Federal schedules of supply for automatic data processing equipment and services.

(c) In connection with the utilization of automatic data processing equipment (1) develop and publish guidelines and criteria governing the replacement of equipment to avoid usage of such equipment beyond the point of economic advantage, (2) provide overall coordination and leadership of the executive branch in fostering the effective utilization of excess, and disposal of surplus, automatic data processing equipment, including rented, leased or owned equipment, and promulgate such regulations as may be needed to insure effective Government-wide screening and utilization of excess ADP equipment; and, further, to

plan and undertake appropriate measures for coping with emerging problems associated with the management of excess and surplus automatic data processing equipment, (3) prepare Government-wide inventory reports and other statistical information pertaining to ADP equipment utilization, based upon reports submitted in accordance with applicable Bureau of the Budget circulars; and, further, to cooperate in the continuous refinement and improvement of management information systems relating to automatic data processing activities, (4) exercise leadership for the executive branch in the development and operation of arrangements which are designed to promote the sharing and joint utilization of automatic data processing equipment time and services within and among the executive agencies, and obtain such information on sharing practices as is necessary to evaluate the sharing program on a Government-wide and regional basis, including acquisition of equipment in connection with joint utilization programs, and (5) provide policies, guidelines and evaluation criteria for use by executive agencies in the maintenance of automatic data processing equipment.

(d) In connection with the standardization of automatic data processing equipment and techniques, (1) promulgate standard purchase specifications based upon ADP standards which have been approved for adoption by the Federal Government, and (2) support programs for the development of voluntary commercial or Federal standards as they pertain to automatic data processing equipment and techniques and coordinate these activities with other executive agencies similarly involved.

(e) In connection with automatic data processing equipment used with data communications systems, insure that planning for the Federal telecommunications system embraces consideration of the rising need for data communication facilities which provide for high-speed data transmission between computer-based systems.

5. *Responsibilities of the Department of Commerce.*—The Department of Commerce is responsible for aiding in the achievement of increased cost effectiveness in the selection, acquisition, and utilization of automatic data processing equipment, and in this connection will perform the following functions:

(a) Provide advisory and consultative services to executive agencies on the methods for developing information systems based on the use of computers and the programing and languages thereof.

(b) Undertake research on computer sciences and techniques, including system design, oriented primarily toward Government applications.

(c) Provide day-to-day guidance and monitorship of an executive branch program for supporting the development, measurement, and testing of voluntary commercial standards for automatic data processing equipment, techniques, and computer languages.

(d) Improve compatibility in automatic data processing equipment procured by the Federal Government by recommending uniform Federal standards for automatic data processing equipment, techniques, and computer languages.

6. *Responsibilities of the Civil Service Commission.*—The Civil Service Commission is responsible for providing executive branch-wide leadership and assistance in the personnel management and man-

power aspects of automatic data processing. In this connection, the Commission will foster programs designed to—

(a) Staff automatic data processing activities effectively by, among other things, (1) formulating position classification and qualification standards, (2) developing necessary special recruiting techniques, (3) devising improved testing and selection devices, and (4) stimulating and coordinating necessary training.

(b) Educate executives and other key personnel to achieve greater effectiveness in ADP management.

(c) Anticipate and minimize, to the greatest practicable extent, any adverse effects of automatic data processing upon the people involved.

(d) Provide a medium within the executive branch to focus and coordinate preparation for the future personnel management and manpower effects and requirements of automatic data processing.

7. *Responsibilities of the heads of executive agencies.*—The heads of all executive departments and establishments are responsible for the administration and management of their automatic data processing activities including—

(a) Agencywide planning, coordination, and control of equipment utilization.

(b) Determination and use of those equipment applications that offer the greatest return in terms of increased effectiveness in mission accomplishment and higher productivity.

(c) Development of data systems that employ the use of the most advanced design techniques.

(d) Merger or integration of data systems irrespective of intra-agency or interagency organizational lines, when cost effectiveness in equipment utilization, data systems management, or program accomplishment can be increased.

(e) Determination of automatic data processing equipment requirements.

(f) Sharing equipment time and services within the agency, and with other agencies through support of the Government-wide program for sharing exchanges; cooperation in the establishment of service centers and other interagency joint use arrangements.

(g) Consideration of the potential impact of the introduction of ADP equipment on the agency work force and taking such steps as are necessary to alleviate adverse effects to the greatest extent practicable.

(h) Participation in Government-wide studies and programs for improving the administration and management of automatic data processing activities in the executive branch.

8. *Effective data.*—The provisions of this circular are effective immediately.

KERMIT GORDON, *Director.*

