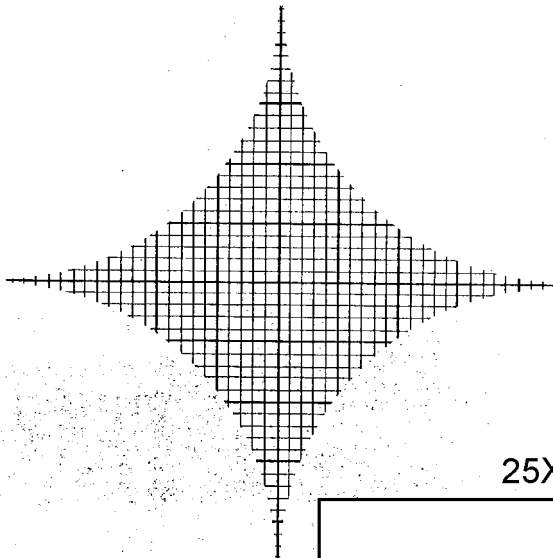


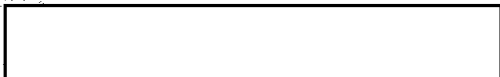
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STATUS STUDY OF  
DATA PROCESSING SYSTEM OF  
DEPUTY DIRECTOR FOR SUPPORT  
CENTRAL INTELLIGENCE AGENCY  
BOOK 3  
APPENDICES A THRU F

19 FEBRUARY 1962



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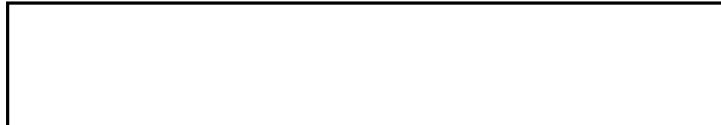
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STATUS STUDY OF  
DATA PROCESSING SYSTEM OF  
DEPUTY DIRECTOR FOR SUPPORT  
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19 February 1962

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## BOOK 3

## APPENDICES

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APPENDIX A

MANAGEMENT STAFF STUDIES

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19 August 1957

MEMORANDUM FOR: Deputy Director (Support)

SUBJECT: Electronic Data Processing Feasibility Study of  
Supply Division, Office of Logistics

This memorandum contains recommendations submitted for DD/S approval. Such recommendations are contained in paragraph 5.

## 1. PROBLEM:

- a. Determine the feasibility and advisability of applying electronic data processing (EDP) to the procedures of the Supply Division, Office of Logistics.

## 2. FACTS BEARING ON THE PROBLEM:

- a. It has been accepted generally by both commercial enterprises and governmental agencies that inventory control offers one of the best fields for EDP. Such control in the Agency is maintained principally through the processing of purchase orders, receipts, requisitions and shipments, and the compilation of reports incorporating the data accumulated from these documents.
- b. Large stocks of Agency material (including some combustible ordnance material) are maintained at the [redacted] and limited stocks at the [redacted], the first two of which also function as transhipping points. Certain ordnance materials are warehoused at various arsenals.
- c. For Agency use an item of material is identified by a stock number and more or less extensive nomenclature, plus a four-part code to denote: (1) type of sterility, (2) allocation to an Agency component, (3) location by station or warehouse, and (4) condition of usability. An item thus identified is called a "line item". A variance is one or more parts of the code creates a different line item, even though the stock number and nomenclature are identical with other line items. Items for which the SD/OL is accountable are carried as "in stock" or as "property in use".
- d. Records of the SD/OL indicated that, as of 30 June 1957, a total of 39,304 items of possible Agency use had been identified and assigned stock numbers and nomenclature. Of these, 20,005 were in stock (or carried on stock-status reports compiled periodically). Because of variances in codes these 20,005 items represented approximately 27,000 line items. In addition, the property in use items totalled approximately 11,000 line items.

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- e. Stock-status reports are prepared by Machine Records Division, Office of the Comptroller, and are up-dated in total from previous balances by transactions in receipts, requisitions and issues, and shipments. In the interim between reports such up-dating is performed in detail manually by the Stock-Editing Unit SD/OL. Records of the SD/OL indicate that during FY 1957 there were processed 15,499 receipts, 17,426 requisitions and 52,399 shipments. The requisitions represented 78,219 line items, but no totals of line items were available for receipts and shipments. Each receipt, requisition and shipment requires one or more original documents and one or more entries.
- f. Requisitions may be originated by headquarters components, by Stock Management Section, SD/OL (for replenishment) or by components outside of headquarters. The latter may be referred directly to OL through the [redacted] indicator.
- g. Currently, at least 174 different forms are used at headquarters and the [redacted] in the receiving, requisitioning and shipping operations of SD/OL. Only 50 of these have been approved by Forms Management Branch, Records Management Staff.
- h. At least 214 steps are involved in the present method of processing a requisition for a non-technical cargo. While the same requisition form may be used for all requirements, at least 15 different procedures have been used in handling them; there appears to be no standard for all. Inventory control data is all produced manually by SD/OL and reproduced in MRD by card punching each items for printing reports.
- i. At the inception of this study 67 reports were being produced by MRD on the IBM tabulating equipment from data produced in SD/OL. Ten people are required for this work.
- j. The [redacted] (control procedure) is so arranged that, not only the flow of material, but the handling of paperwork is cumbersome. Deliveries of material to headquarters frequently require several weeks. No visits have been made [redacted] in connection with this study.
- k. The Mission of the SD/OL ([redacted] 4 December 1956) is stated as follows:

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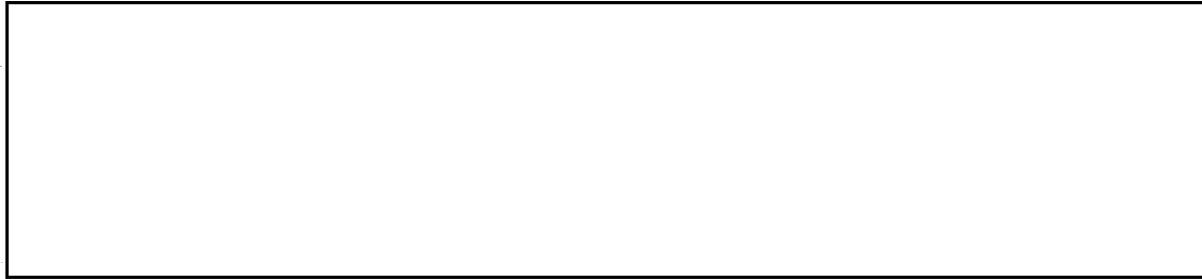
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1.



- m. The IBM 350 RAMAC is an electronic computer having memory storage capacity for 50,000 records of 100 characters each, and computing speed capable of handling all of the data arising from such documents as purchase orders, receiving reports, requisitions, etc., randomly at a rate of over 300 line items per hour, simultaneously turning out shipping documents, replenishment lists, and punched cards for printing such reports as might be essential to maintain inventory control and furnish compiled data for accounting purposes, program analysis, audit trails, and stock research and management. It would eliminate the necessity for most of the stock editing, locating and document processing, and, with proper programming, make many logical decisions now the responsibility of the Stock Management and Requirements Section, OL.
- n. Two flexowriters are in process of being installed in OL, one in the headquarters Procurement Division and one in the Receiving Unit,  to simplify the procurement and receiving procedures.
- o. This report embodies the results from approximately 25 man-months of study on the part of a feasibility team consisting of 4 members from Management Staff, assisted from time to time by 3 others from Management Staff, 1 from Supply Division and 1 from Administrative Staff, OL and 1 from the Office of the Comptroller. The latter 2 have collaborated in arriving at most of the conclusions contained herein. The cost is estimated at \$19,650.

### 3. DISCUSSION:

- a. In conducting this study the specific requirements of the Comptroller, Annex I, Tab A, and a general procedural outline of possible computer application, Tab B, were set up as guides. For convenience the work was divided into several sections each of which is discussed separately in the other Annexes attached hereto and may contain suggestions which amount to subsidiary recommendations.
- b. Annex II describes the present requisitioning procedure and shows how a change in this procedure in conjunction with publication of a catalog in two parts would simplify even a manual procedure; how elimination of

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the [ ] indicator could reduce criticism and possibly speed up shipments; and why carrying material "in stock" under more than one classification code is unnecessary. Paragraph 7 contains 9 specific suggestions.

- c. Annex III lists the 67 reports (Tab D) which were being produced from SD/OL data by the MRD at the time this study was started. Elimination of 35 (TAB E) and combination of 13 others into 6 (Tab F) of these 67 reports is justified even under a manual procedure, with an indicated annual gross saving of \$25,620. Under a computer system, 15 new reports (Tab H) would replace all 67 with an indicated annual gross saving of \$84,000.
- d. Annex IV points up through Tabs I, J, K, L, and M the necessity for 25X1 "control" that has accrued because of decentralization of functions and excessive detail, both at headquarters and the [ ]. It has been estimated that as many as 2,000,000 pieces of paper are generated annually. Tab N suggests a different procedure to simplify this work even under an Electric Accounting Machine-Manual operation. No estimate of dollar savings which might result has been made. On the other hand, in certain filing areas at the [ ] Tabs R, S, X, 1 and T, definite dollar savings are indicated amounting to some \$13,000 one-time and \$8,000 annually under a manual system, or \$14,000 one-time and \$12,000 annually under a computer system. Tab W furnishes some pictorial information re these problems. All indicate the need for a complete management study.
- e. Annex V shows under Tab X a complete sub-division of the SD/OL into its various components and, under Tab Y, the specific functions of each, and serves to emphasize the extent to which decentralization has necessitated the build-up of control mechanisms with resulting unnecessary forms and steps. It also shows in paragraphs 3 and 4 that installation of electronic processing equipment and a reorganization of certain components will result in an annual gross saving in payroll of [ ].
- f. Annex VI shows the advantages of the IBM 305 RAMAC over other types of computers; how the SD/OL work would flow through this computer (Tab Z) and the time it would take (paragraph 5); data on installation (Tab AA) at an estimated cost not to exceed \$10,000; and monthly operating costs (paragraph 7) of \$7,416.07. The MRD presently has all peripheral equipment except a tape-to-card converter (required to make full use of the flexowriters with or without a computer); in fact, some MRD equipment can be dispensed with if the computer is placed under its supervision. On the other hand, should the computer be placed else-

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where it will be necessary to provide duplicate peripheral equipment and train other employees to operate it, at an increased cost of at least \$2,500.00 per month. It is worthy of note that IBM and many companies represented at seminars attended by members of this team report that best results are obtained by centralizing all computer operations under one head.

- g. Annex VII describes in general and by detail charts, Tabs AE, AF, and AG, how the flexowriter installation may be used to simplify all procurement action from the receipt of a requisition through invitation to bid, actual procurement, receiving and accounting. It also indicates justification for the transfer of the Identification and Cataloguing Branch from the Supply Division to the Procurement Division, OL.
- h. Annex VIII analyses the estimated cost of making this study, which must be counted against the advantages to be gained. It is felt that a similar study might have been made at a somewhat lower cost if a team of full time personnel, especially representatives of the Comptroller and Director of Logistics, had been available from the start.
- i. Annex IX reflects the net dollar savings and costs (excepting the cost of this study), as estimated by the feasibility team, in the areas where such values were assigned, from improvements in present procedures, as follows:

	<u>Without Computer</u>	<u>With Computer</u>
ONE-TIME SAVINGS	\$16,623.41	\$ 272.34
NET ANNUAL SAVINGS	\$33,676.52	\$172,143.68

#### 4. CONCLUSIONS:

- a. Application of electronic data processing to the procedures of the Supply Division/OL is both feasible and advisable.
- b. Improvements in the manual procedures of SD/OL, as outlined in the Annexes, should result in appreciable dollar savings and increased efficiency of operation.
- c. Immediate installation of an EDP system should result in very substantial dollar savings and efficiency of operation, and provide a means for its operating unit and/or others to acquire practical experiences in the techniques of EDP essential in connection with this or any larger computer which subsequently might be installed. Such installation should be under the control of MRD.
- d. Organization changes in two Divisions of OL, as indicated in the Annexes, should result in much greater efficiency of operation.

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- e. A complete management study of all phases of procurement, supply and transportation functions in the Agency should result in much greater dollar savings and efficiency of operation.

5. RECOMMENDATIONS:

It is recommended that:

- a. Reports, as listed in Tab E be discontinued and those listed in Tab F be combined, as indicated, forthwith.
- b. The suggestions outlined in Annex II, paragraph 7, be implemented by the date of computer installation (estimated at 6 months after approval of this report).
- c. An IBM 305 RAMAC and such peripheral equipment as may be required to support it be installed in the MRD on a rental basis at the earliest date possible (estimated delivery, 6 months), and funds in the amount of \$10,000 be allocated to cover the cost of installation.
- d. The organizational changes suggested in Annex V, Paragraph 6 be implemented at once, and those in Paragraphs 3.b. and 5. be implemented concurrently with the installation of a computer.
- e. (1) OL personnel [ ] be assigned by the Director of Logistics on a full time schedule for implementing the EDP procedures listed herein and for studying the potential and use of the IBM 305 RAMAC. (Full knowledge of the RAMAC is essential in implementing the new procedures and developing future applications).
- (2) MRD personnel [ ] be assigned by the Comptroller to the operation of the IBM 305 RAMAC and be enrolled in IBM courses of instruction covering all phases of RAMAC operation, programming, use and maintenance techniques.
- (3) The Chief, Management Staff be made responsible for directing and assisting the above OL and MRD personnel; establishing completion schedules covering the periods of implementing procedural changes, training and installation of the RAMAC; and for rendering periodic progress reports to the DD/S, the Director of Logistics and the Comptroller.

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- f. During the period of preparation for the computer installation a complete management study of all OL procurement, supply and transportation functions and operations be conducted.
- g. The Records Management Staff immediately institute a survey of all unauthorized forms being used by the SD/OL.

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Chief, Management Staff

**ANNEXES:**

See Table of Contents

The recommendations in paragraph 5 are Approved:

\_\_\_\_\_  
Date

L. K. WHITE  
Deputy Director  
(Support)

**DISTRIBUTION:**

Orig. & 1 - DD/S  
2 - Dir. of Log.  
1 - Comptroller  
1 - Mgt/S

Mgt/S/DLD:ee (19 Aug 1957)

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[ ] ANALYSIS OF EDP FEASIBILITY STUDY

SUPPLY DIVISION, OFFICE OF LOGISTICS

AUGUST 19, 1957

- Annex I Tab A Specific Requirements of the Comptroller
- Tab B General procedural outline of possible computer application.
- Annex II 1. Present requisitioning procedure and how a change in the procedure in conjunction with publication of stock catalogue in two parts will simplify even a manual procedure.
- 2. How elimination of the [ ] 25X1A status) could reduce and possibly speed up shipments.
- 3. Why carrying material in stock under more than one classification code is unnecessary.
- 4. Suggestions in Paragraph 7
- Annex III Tab D-H Shows how 15 new reports, under a computer system, can be used in place of the present 67 to permit a gross saving of \$84,000 annually.
- Annex IV Tab I-T-1 Shows an EAM-Manual method of reducing paper work
- Tab I-T-2 Recommends changes in filing areas.
- Tab I-T-3 Shows need for complete management study.
- Annex V Tab X, Y Recommends reorganization of some components of SD/OL and shows a saving, by computer methods, of \$165,000 annually.

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Annex VI Shows 305 advantages, SD/OL workflow diagrams, cost of installation and operation, and the advantages of putting the 305 in MRD (centralization).

Annex VII Tab AE-AG

1 Shows flexowriter installation and flow.

2 Justifies transfer of Identification and Cataloging Branch from Supply Division to Procurement Division (O/L).

Annex VIII Costs of this study - Salaries \$16,140.

Annex IX Net savings to be expected from a computer (305) system - \$172,143,68 annually.

Location of Recommendations for Changes

1. Tab E and Tab F Reports
2. Annex V Paragraph 3B, 5, 6
3. Report Recommendations, Page 6
  - (a) Installation of 305 under MRD
  - (b) Assignment of O/L personnel for study and implementation of EDP for O/L.
  - (c) Assignment of MRD personnel for 305 training with IBM.
  - (d) Assignment of Chief of Management Staff for scheduling, direction and assisting implementation of changeover.
  - (e) Management system study for O/L.
  - (f) Analysis of O/L forms.

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Present Status -- Annex II

Stock Report Shows:

Control

Stock No.

Allocation Code

Condition Code

Property and In Use Account

Voucher No.

Warehouse

In Transfer

Fy

Cost Account

Property Code

Transaction Analysis Code

Guarantee

Unit Price

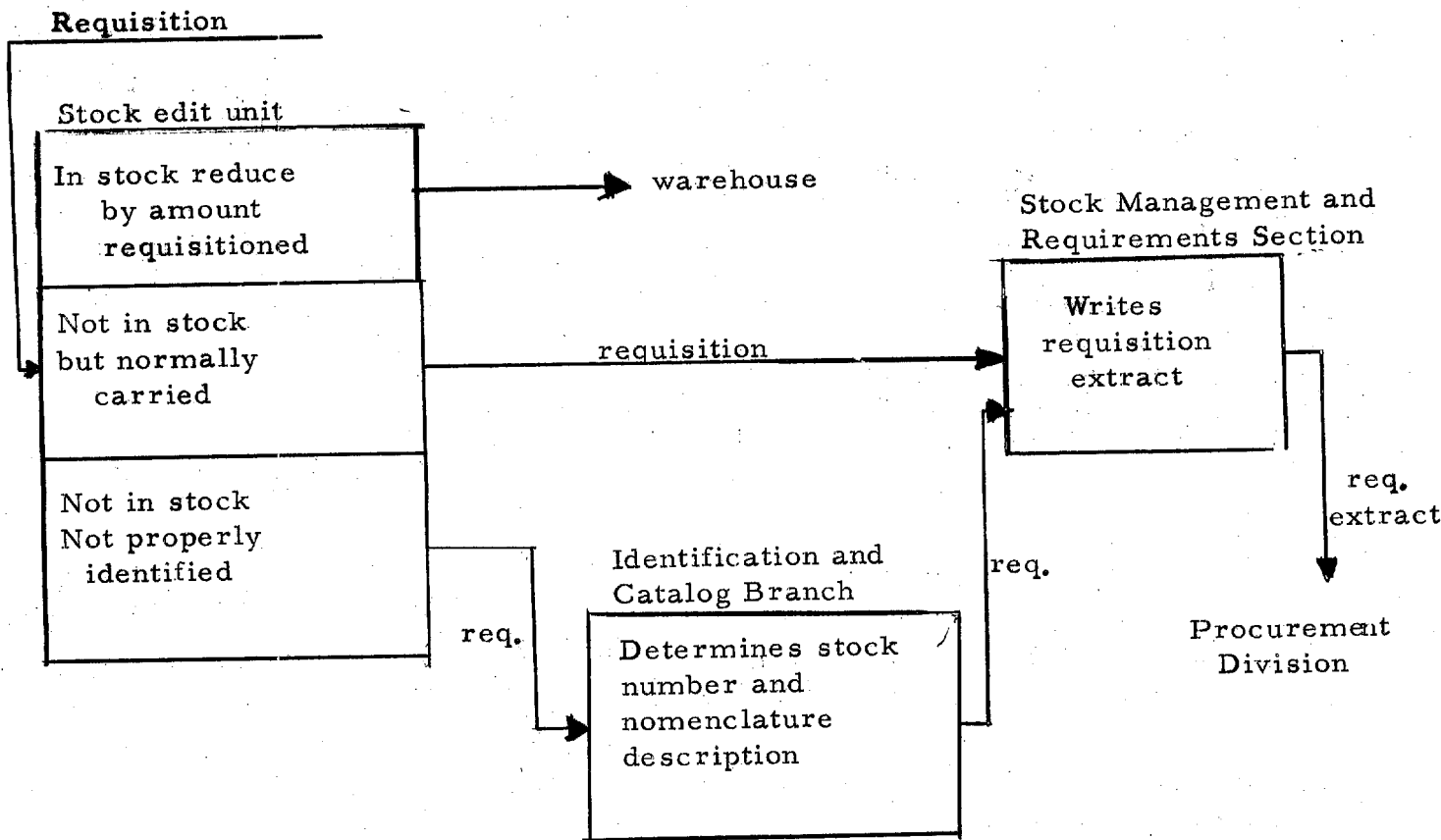
Dollar Value

Day, Month, Year of Transaction

Material Classification Code

Once a line item is established, it usually stays one year after out of stock at the warehouse.

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No complete catalog of stock items was on hand.

The Solution

1. Complete catalog of in-stock items
  2. Catalog of items which would have to be procured
- then:
- (1) Only in-stock items would go to inventory record
  - (2) Requisition for non-stock items directly to SMC section
- EDP
1. Would eliminate manual stock recording

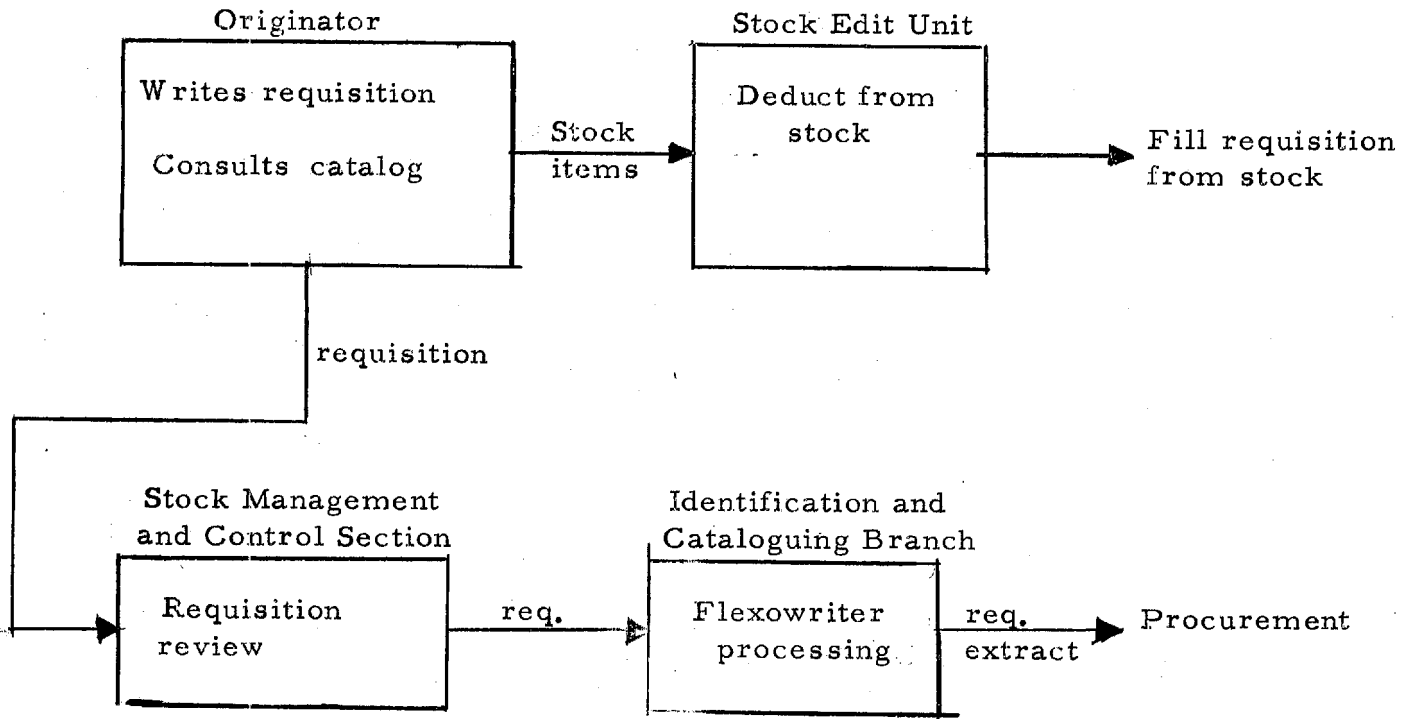
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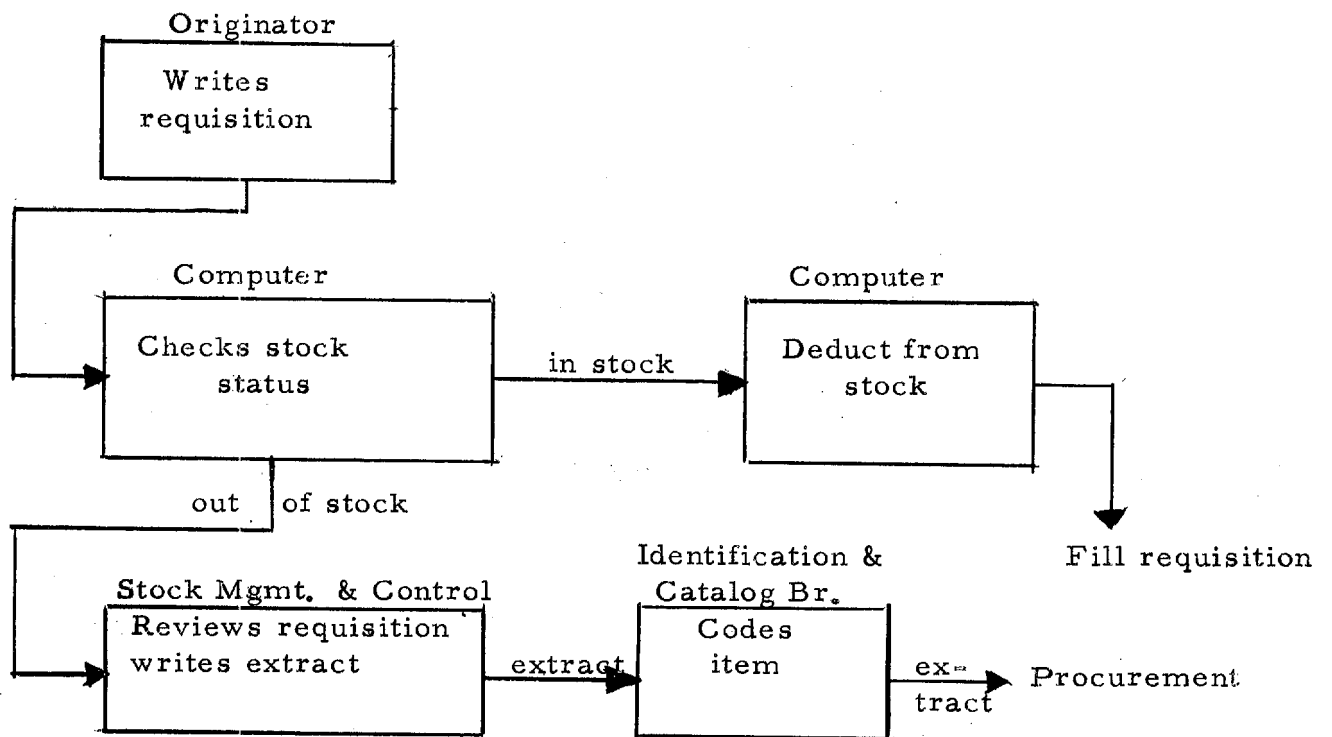
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Annex II

Manual Solution:



EDP Solution:



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Other Recommendations Annex II P. 3

- a. Publish catalogues for in-stock material showing stock number, single name description, normal order quantity, , no allocation codes.
- b. Provide two types of requisitions, one for in-stock items, one for "to be procured" items.
- c. Items requested in larger than normal quantities or in  other than that one in stock, to be put in "to be procured" category.
- d. Condition codes one and two combined.
- e. Reclassification and rehabilitation of items for placement in use or other disposition should be done item by item, rather than batching.
- f. Establishment of "proper" stock levels.
- g. Standard substitution procedure and establishment of substitutions in stock catalog.
- h. Remove all stock items from in-stock catalog for which there has been no activity for one year.
- i. Separate combustibles.
- j.  should not be used as warehouses unless given full capacity of meeting normal demand.

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Annex II Tab G.

Estimated savings from elimination and consolidation of reports	\$25,620
Elimination of 7-8 drawer card safe cabinets	3,395

Annex IV

Back up of recommendations for a management study

1. Burdensome control procedures caused by decentralization of SD/OL.
2. Large volume of paper flow for each requisition.
3. Devious routes of paper work and material flow at warehouse
4. Cumbersome locator files could be eliminated by computer locator system.
5. This is only a summary from cursory examination.
6. Utilization of floor areas extremely inefficient.

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Annex V Organization and Functions O/L

1. Functions to be performed electronically:

- (1) Editing - comparison of requisition and stock status report issue records, receipts, coding sheets, updating inventory
- (2) Stock management
- (3) Document processing
- (4) Receipts control
- (5) Locator
- (6) Packing and shipping documents
- (7) Machine records - reports
- (8) Depot stock control

2. Eliminate  positions in 25X1  
 MRD with  retained for computer.

Elimination breakdown:

- Stock Editing Unit
- Stock Management and Requisition Section
- Document Procurement Unit
- Receipts Control Unit
- Depot Stock Control Section
- Shipping Sub Unit
  
- Locator Sub Units
- MRD



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### Abolition of Special Accounts Unit

3. Expected dollar savings in salaries \$165,000
4. Establishment of a Stock Management and Control Section to replace the Stock Editing Unit  
Stock Managements Requirements Section  
Document Processing Unit  
Depot Stock Control Section
5. Move several components of Identification and Cataloging Branch (Supply Division) to Procurement Division.
6. Additional management study

### Tab VI Computer Requirements and Estimated Cost of IBM 305

1. Inventory control by a random access computer will permit updating of information as the transaction occurs so as to furnish at any given moment exact status of any inventory item  
It will automatically perform the following inventory functions:
  - (a) Check inventory, location, substitute if necessary, adjust stock balances.
  - (b) Enter receipts, evaluate new average price; price items and make extensions.
  - (c) Note item activity, adjust due-in, due-outs.
  - (d) Issue punched cards for financial accounting.
  - (e) Eliminate form copying and duplication of items.
2. Average time required for 305 to process all transactions

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involved in an average day's work of SD/OL would be 83 minutes.

3. Installation costs will not exceed \$10,000.
4. Cost of IBM 305 Ramic System:

Monthly Rental	\$ 4,916.00
Personnel (monthly)	1,932.07
Materials	<u>568.00</u>
Total Monthly Costs	\$ 7,416.07
Total Annual Cost	\$ 88,992.84

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MEMORANDUM FOR: Deputy Director (Support)

SUBJECT: Electronic Data Processing

This memorandum contains recommendations for approval of the Deputy Director (Support). Such recommendations are presented in paragraph 5 below.

1. PROBLEM

It is feasible and advisable for the Machine Records Division (MRD) to perform its work by the use of electronic data processing (EDP) equipment? If so, what type of electronic computer should be installed?

2. ASSUMPTION:

For the purpose of reaching a conclusion regarding the problem questions this study has been limited to the Offices of Comptroller and Personnel but it is desirable that it contemplate the possibility of all components, which are or may be served by MRD, receiving the benefits to be derived from a computer installation.

3. FACTS AND DISCUSSION:

a. Data

(1) Facts:

- (a) Data, in numerical and alphabetical form presently originating in the Offices under consideration and necessary for their records and reports consists principally of:
1. Personnel: statistical, historical and qualifying information in respect to each employee, and tables or organization and statistics in respect to groups of employees; extracted from employment resumes, personal histories, and actions affecting transfers, step increases, promotions, separations, etc. From Form 50 alone, there are an average of 200 transactions daily.

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2. Comptroller: payroll, leave, general ledger, subsidiary ledgers, allotment, budgetary, financial property and other accounts information; extracted from time and attendance reports, personnel actions, travel vouchers, purchase orders, requisitions, receipts, etc. General ledger transactions alone average 1400 daily.
- (b)
1. Most of this data, after manual preparation, is presently processed on a non-integrated basis by the Machine Records Division (MRD) on electric accounting machinery (EAM), the input to which consists of punched cards. The correct status of a record is maintained in a "desk" of punched cards numbering from a few hundred to over 1000,000 for a single record. The total of cards in all desks approximates 4,000,000. To up-date these record desks approximately 950,000 cards are processed monthly.
  2. Various other records of statistical or historical nature are maintained manually, and much manual work is performed outside of MRD in preparing documents for card punching by MRD.
  3. All of the data under consideration could be processed by EDP on an integrated basis.

(2) Discussion:

- (a) Data presently being processed by MRD is distributed by major functions to six organizational branches within MRD, each charged with the responsibility for performing all processing and for producing all reports required by the components it serves. There is very little integration of these data, primarily because of punched card limitations and various procedural problems. Requirements scheduling and cut-off dates frequently create peak loads necessitating overtime operations. Obviously, since many records, because of their lengths require multiple cards, there is much duplication of some data. A great amount of sorting, merging, summarizing and combining of cards becomes necessary to maintain the records and produce reports required in varying formats. Because records originate from different sources it is practically impossible, remembering the limitation of a card, to integrate these records into one storage from which any desired item might be extracted.

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(a) In electronic processing each item of data could be entered into the record storage just one, currently maintained and up-dated, and selected automatically, through proper programming for production (within the limits of the equipment) in any desired format. In the case of transaction input affecting more than one file or account, each individual record might be up-dated with one punched card. Many records could be maintained on a daily basis making possible the elimination of cut-off dates, peak loads and resulting overtime, and the production of special reports upon demand. Because of such ready demand availability, many periodic reports presently prepared in anticipation of possible need or for manual preparation of summaries could be eliminated. "Decks" of cards would give way to magnetic tape.

b. (1) Facts:

(a) The annual cost of operating the MRD, not including overhead, using EAM, is approximately \$502,000, including \$22,500 for overtime of personnel. This may be distributed as follows:



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(b) No estimate of the cost of maintaining records manually or preparing documents for card punching has been made but significant numbers of people are employed in this work, such as:

FI Section, OP  
Payroll Branch (Fiscal), Compt  
to name a few examples



25X1

(c) The study has progressed far enough to indicate savings and reduction of personnel. However, the figures below are necessarily subject to any modification the completed study may produce. The estimated annual cost of operation the MRD, not including overhead, using EDP with IBM 650 or Datatron 220 is:



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- (d) The Bureau of the Budget is concerned about the likelihood of the proselyting of trained EDP personnel as the use of EDP expands. Hence, the Civil Service Commission presently has under consideration the establishment of a proper grade structure for EDP operating and programming personnel. The estimates for personnel costs shown above are based upon available information re present grades in other organizations using EDP. These costs are subject to possible change when firm grades have been established.

## (2) Discussion:

- (a) Since it has been impossible to complete full systems studies, the costs presented in (c) above are for maximum EDP equipment considered at this time to be necessary to perform all of the present MRD work in one eight hour shift. Should the completion of the systems studies indicate that less equipment might be required, any letter of intent should be amended accordingly.
- (b) No meaningful estimate of savings in components outside of MRD can be made at this time. However, EDP will result in the elimination of much manual work now performed in preparation of documents prior to card punching and of summary reports prepared manually. After the computer system has been completely installed and has been in operation for a period of time savings should be substantial.
- (c) No dollar value can be placed upon the better and more timely products that may result from EDP.

c. Equipment

## (1) Facts:

- (a) Manufacturers have produced various types of EDP computers for processing data as outlined in paragraph 3. a. above. These computers have been regarded as being divided into three broad classifications, based on purchase prices which are, to some extent, indicative of their processing potentials:

1.	Small-scale - under	100, 000
2.	Medium-scale - from	100, 000 to \$1, 000, 000
3.	Large-scale - over	1, 000, 000

- (b) The Feasibility Team considered computers in all classifications and conducted exhaustive research into the experiences of many other organizations to determine that a computer of the medium-scale classification would be required and would

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satisfy the demands for processing the data outlined above.

(c) The following five computers were studied in detail:

1. NCR 304
2. Univac File Computer, Model 1
3. Datatron 205
4. IBM 650, with and without RAMAC
5. Datatron 220

The following were eliminated for final consideration for the reasons specified:

1. NCR 304, too expensive and delivery uncertain
2. Univac File Computer, rated 4th in most desirable features
3. Datatron 205, rated 3rd or 4th in three characteristics considered essential
4. IBM 650 RAMAC, no application apparent at this time

(d) Final consideration was given to the IBM 650 tape system with Read/Write device and off-line Tape-Date-Selector and to the Datatron 220 tape system as two computer systems either of which would satisfy the requirements for processing the data outlined in paragraph 3, a above. Comparison indicates the great superiority of the 220 over the 650. (See TAB A)

(e) There are certain "intangible" factors which contribute to the success and growth of a machine installation regardless of the type of EDP equipment used. These factors are:

1. System Service - The service rendered the user by the manufacturer in respect to assistance in designing and installing the system, assistance in programming the applications, training of programmers and machine operators and providing for the education in the field of EDP to other officials in the user Agency.
2. Research and Development - The introduction of new products and the improvement to existing equipment permit the user to improve the operation of his system and expand its use in more fields of work. Basic research leads to better methods and to the solution of problems previously not susceptible to mechanical solution.

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3. Range of Products - A wide range of products makes it possible to meet limited requirements with small capacity equipment and to expand the system where greater capacity equipment is needed, without the cost of changing from one make of machine to that of another manufacturer.

(f) EDP equipment may be rented or purchased and a letter of intent will be accepted in lieu of a purchase order to buy or lease. Equipment installed on a leased basis may be discontinued upon 30 days notice. A letter of intent may be withdrawn 90 days prior to delivery of equipment.

(2) Discussion:

(a) Research conducted by the Feasibility Team convinced it that a medium-scale computer having prime features of flexibility, large internal storage, expandable external storage, and adequate speed for input-output, internal operations and file searching would suffice for data processing in the components affected. The IBM 650, with certain added equipment or the Datatron 220 tape systems are the two computers which best satisfy these requirements.

(b) In comparing these two computers the Team considered not only the basic equipment but such additional equipment as might be required to perform the task now apparent, with some allowance for expansion within the area covered by this study. This comparison indicated beyond doubt the superiority of the 220 over the 650 in technical features as disclosed in paragraph 3. c (1)(d) above.

(c) In considering the intangible factors with respect to:

1. The IBM Corporation: It can be said that, based on over 10 years experience in using IBM products to meet Agency requirements and knowledge of the policies of the IBM Corporation, all of the factors enumerated in 3. c. (1)(e) above are present in their operations and service to customers.

2. The Burroughs Corporation: The Agency has not used their equipment in its accounting work. However, inquiries directed to other users, particularly the Department of the Interior, which made a nation-wide survey of Datatron users, disclosed that support furnished to customers has been excellent. Interviews held with Burroughs officials convinced the Feasibility Team that the Burroughs Corporation is well equipped to render service comparable to that furnished by IBM.

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**SECRET**d. Systems Concepts

## (1) Facts:

- (a) Two systems concepts have been advanced by manufacturers and users with respect to the manner of acquiring a computer.
1. The "building-block" concept under which pieces of computer systems hardware are installed as programs are developed for individual application.
  2. The "integrated system" under which all of the computer system hardware is installed at one time for completely integrated programs including all foreseeable applications.
- Practically all users favor the "integrated system".

## (2) Discussion:

- (a) In all of the studies conducted by the Feasibility Team only isolated examples of "building-block" installations were found. The great majority of users, consultants and experts in EDP advocate an integrated system.
- (b) In cost, the "building-block" concept would actually be more expensive over a period of time than the "integrated system" concept due to the fact that, until all programs had been placed on the computer, it would be necessary to retain EAM equipment and personnel to operate it. While no dollar cost can be assigned re-programming old applications to integrate new ones each time one was added would also be much more costly than a completely integrated set of programs from the start, each to be applied as rapidly as feasible.

e. Implementation

## (1) Fact:

- (a) Manufacturers require lead time of twelve to sixteen months from the date of receiving a letter of intent or order before making delivery of a computer. In order to avoid the loss of this time the Feasibility Team has confined its work to an over-all estimate of EDP requirements so that a letter of intent may be entered at once. Completion of detailed systems studies will be required before taking delivery of any computer.

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**SECRET****(2) Discussion:**

- (a) These studies include the completion of procedures analysis, flow charts, block diagramming and computer programming, in order to have an integrated system ready at the time of computer delivery. A year or more may be required to finish this task. Programmers and operators will have to be trained. To assist the Management Staff in this work and to keep the interested offices fully informed with respect to anticipated changes in procedures, T/O's, etc., the continued fine cooperation of these components is necessary. At least one representative from each office, placed in a position of reporting directly to the head of his component and with responsibility for obtaining concurrences in procedural changes will be essential to complete this work.
- (b) A one-month parallel operation under EAM before discontinuing any present method of processing any record is estimated to be sufficient to prove the efficacy of a computer with respect to each record.

**4. CONCLUSIONS:**

- (a) The application of EDP to the work of MRD is both feasible and advisable.
- (b) Significant savings will result from a computer installation.
- (c) A Datatron 220 Computer will be the best to install.
- (d) A fully "integrated" systems concept should be adopted in conjunction with the installation of any computer.
- (e) Detailed studies to complete systems analysis and training for programming and computer operation will be required.
- (f) In order to retain EDP personnel after training it will be necessary to provide a grade structure comparable with industry and other governmental organizations, and be prepared continually to keep abreast of compensation changes in this field.

**5. RECOMMENDATIONS:**

It is recommended that:

- a. The Comptroller be authorized and direct to execute a letter of intent to the Electro Data Division of the Burroughs Corporation for installation in early 1959 of a Datatron 220 system on a rental basis (with purchase option.)

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CONCURRENCE SHEET

SUBJECT        Electronic Data Processing

CONCURRENCE:

\_\_\_\_\_

Comptroller

\_\_\_\_\_

Date

The recommendations in paragraph 5 are approved:

\_\_\_\_\_

L. K. WHITE  
Deputy Director (Support)

Distribution:    Orig & 1 - DD/S w/att.  
                  4 - Compt. w/att.  
                  1 - Feas. Team w/att.  
                  1 - Mgt/S file w/att.  
                  1 - Mgt/S chrono

Mgt/S <sup>25X1A</sup>  :hps (22 April 59)

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20 May 1959

MEMORANDUM FOR: Deputy Director (Support)

VIA: The Comptroller

SUBJECT: Electronic Data Processing

REFERENCE: Report of 10 June 1958 from Chief, Management Staff to DD/S, Entitled "Electronic Data Processing" (This report embraced a general review of support area data processing required of Machine Records Division, comparative costs of EAM and EDP, types of computers - with particular emphasis on five different makes in the medium scale class, computer systems concepts, and impingements consequent upon installation of a computer. The study concluded that EDP, in the support areas, is both feasible and adviseable, and resulted in approval by the DD/S of a recommendation to execute a letter of intent for installation of a Datatron 220 system. Responsibility for making a final recommendation regarding action under such letter was placed upon the Management Staff).

This memorandum contains recommendations for approval of the Deputy Director (Support). Such recommendations are contained in paragraph 5 below.

1. PROBLEM

Determine which electronic computer system shall be acquired to do the work of MRD.

2. FACTS

- a. Systems studies sufficient in scope to make a final determination with respect to computer equipment have been made by Feasibility Team\*in the area of:

- (1) Personnel Records
- (2) Payroll Records
- (3) General Accounting
- (4) Supply Accounting

\* See TAB C.

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comprising approximately 90% of the work presently performed by the Machine Records Division (MRD) on electric accounting machines (EAM).

- b. The methods and cost of handling data at present are as follows:

(1) In MRD, data is abstracted from 101 different types of source documents, transferred to punched cards, then processed to up-date 156 permanent card files, which are the media for retaining such data. EAM equipment, working with these punched cards, is doing all of this work but intelligent manual intervention is involved in every step of any job. Every such job required some of the following operations, each of which necessitates several manual steps:

Key Punching	Merging
Verifying	Gang Punching
Interpreting	Reproducing
Sorting	Calculating
Matching	Tabulating

To illustrate, the permanently retained cards plus the monthly transaction cards average a total of 2, 314, 000. Commonly, the bulk of these cards pass through one or more machines one or more times a month. It is closely estimated that such processing involves approximately 39, 000, 000 individual card passes. These operations are now necessary because Agency components require MRD to produce (as of January 1959) an average of 669 reports a month - 378 Comptroller,  Personnel, 133 Logistics, and 25 others.

25X1

Present plans call for an increased worklead in MRD arising from changes in allotment coding, cost accounting, Fiscal Division accounting to be put on tabulating machines, etc.

25X9

(2) As of 31 December 1958 there were  employees in MRD. In fiscal year 1958 the cost of operating MRD was  consisting of  for personal services (including \$33, 888. 37 for supplies).

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(3) A projected cost for fiscal year 1959 - based on personnel costs of  for the first 18 pay periods of FY 1959, monthly machine rental of \$47, 710 (as of January 1959), and an average monthly cost of \$3, 300 for supplies - is  This does not include any beginning of the substantial increase in the work referred to above.

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- e. Any computer suitable for Agency use will have the potential to accomplish all of the work presently required of MRD more efficiently, with greater speed and accuracy, more convenient access to stored records, and very much less manual intervention - hence, fewer personnel.

(1) Prior to submitting the referenced report, comparisons of the NCR 304, the IBM 650, the Datatron 205, the Datatron 220, and the Univac File Computer were made, showing the Datatron 220 to be the most suitable computer then available.

Within the class (medium scale) under consideration, the computers which have been placed on the market since that report are the Philco S-2000, the IBM 7070, and the RCA 501. All of these are transistorized but, among computer manufacturers, RCA is the oldest and largest producer of transistors.

The Philco S-2000 is too expensive to consider - the yearly rental for a minimum recommended system being \$376,200 without corresponding offset.

(a) A comparison of the overall estimated costs of MRD operations, using the IBM 7070, Datatron 220, or RCA 501, and the 1959 fiscal year projected cost of MRD, using present EAM, is given below:

	<u>7070</u>	<u>220</u>	<u>501</u>	<u>EAM</u>
Machine Rental	\$332,298	\$317,448	\$279,852	\$176,520
Personnel *1	214,735	214,735	214,735	358,154
Supplies *1	50,000	50,000	50,000	39,600
Total	<u>\$597,033</u>	<u>\$582,183</u>	<u>\$544,587</u>	<u>\$574,274</u>

(b) The cost of one-time expense for installation of an RCA 501 is estimated to range from \$100,000 to \$125,000. The cost is made up as follows:

- For the first two months' rental of a card transcriber, Model 527 and tape station Model 581, totalling \$5,650.00
- One-time cost magnetic tape 8,000.00
- Site preparation 20,000.00
- De-bugging 5,000.00

(\*) See page 4. A-32

Total	\$33,000.00
Grand total for two months is	\$38,650.00

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2. The parallel operation now begins and runs for three months with the following costs:

The Computer (including the card transcriber and tape station) \$20,100 each month, plus \$1,000 each month for supplies. This is a total of \$63,300 additional for these three parallel-operation months.

3. The grand total amounts to \$101,950, without taking into account any release of punch card equipment now operating under EAM or release of personnel.

This type of cost for IBM 7070 or the Datatron 220 would be substantially more.

(2) A hypothetical accounting problem, typical of support area transaction processing, was presented to manufacturers for timing their equipment. This problem comprised 3,500 transactions (represented by non-sequenced punched cards), to be processed to up-date a permanent file of 35,000 records (in sequence), and to produce a listing (in sequence) of the transaction amounts and the up-dated records showing the old and new balances. The results, given below, were based upon the most efficient manner of processing on each manufacturer's equipment and were carefully checked by the Feasibility Team. Time in minutes, is shown for each system under two headings: "C" represents time of the basic computer; "OL" (off-line) represents time of integrated detached peripheral equipment.

	7070		220		501	
	C	OL	C	OL	C	OL
Input	31	-	25	-	9	15
Processing	30	-	19	-	13	-
Output	-	24	-	13	-	20
Basis Computer Time	61		44		22	
Peripheral Time		24		13		35
Total Clapsed Time	85		57		57	

- (3) Significant technical characteristics are compared in TAB B.

d. Space currently occupied in Curie Hall by MRD totals 8,080 square feet; 2,400 square feet additional in Curie Hall will be required to accommodate the computer during the period of parallel operation. The ultimate space requirement for a computer and its peripheral equipment will not exceed 4,000 square feet, based upon the present MRD workload.

\*1. These computer estimates include anticipated substantial increase in the MRD workload from both present and future customers in the Support Area -2. b. (1) and 3. f. Neither of these two additional workloads show in the EAM table.

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### 3. DISCUSSION

- a. The acceptance of this study does not complete the work to be done in connection with the installation of a computer.

(1) Systems studies have progressed to a point where it is essential that a decision be made regarding the type of computer to be installed. Detailed systems design (block diagramming) can be most efficiently accomplished with a specific computer in mind, and programming cannot be done without one. This will require approximately six months prior to installation.

- (2) Other tasks to be completed before installation include:

(a) Training in programming

(b) Testing of programs

(c) Review of requirements with operating officials to obtain their concurrences in the recommendations of the Feasibility Team regarding the elimination and/or modification of reports.

(d) Dissemination of information concerning EDP and its impact on systems and procedures to all interested operating components and their personnel.

- b. The Feasibility Team has made careful estimates of the possible effects which may result from the installation of an EDP integrated system.

(1) Reduction of at least 90% of the individual punched card operations, see par. 2. b. (1) above, resulting from automatic processing within the computer as opposed to present EAM.

(2) Reduction of 1/4 of the tabulations (reports) presently produced by MRD, resulting from the computer ability to turn out end products now prepared from several tabulations, and the facility with which reports can be produced on a required basis, rather than at stipulated intervals, and acceptance by operating officials of the "management by exception" concept.

(3) Reduction of  positions in MRD.

(4) The Feasibility Team is convinced that there are appreciable personnel savings within other affected components, arising from the revised systems which will be made possible by the use of computer.

These savings much more than effect continuation of personnel within or outside of MRD.

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- (5) Stimulation of increased demands as a result of having a computer - thus providing faster and more flexible information suggests that a new form of control of workload should be considered by the Comptroller. A good possibility here is the imposition of charges on using components-responsive to cost accounting.
- c. The comparisons presented in par. 2. c., above, are those which the Feasibility Team consider to be essential for making an intelligent determination with respect to both the advisability of any installation and the selection of a specific computer.

(1) The operating costs for computers were obtained as follows:

Machine rentals from GSA schedules.  
Personnel from consultations with manufacturers.  
Supplies from estimates based upon MRD experience,  
making allowance for added cost of magnetic tapes.  
MRD costs were obtained from Agency records.

One-time expenses were estimated as follows:

Site preparation and physical installation is an average suggested by manufacturers. Testing and debugging programs, and parallel operation are based on careful studies made by the Feasibility Team.

(2) In any evaluation of computers, timing of an actual or typical application is essential to determine the utility of the system. Since peripheral equipment may be added as needed, timing of the "main frame" or basic computer is particularly important to ascertain the possible expansible potential.

(3) Generally, there are significant technical advantages of one computer over another for any specific application. The features which the Feasibility Team feels are of most importance to the Agency have been compared in detail in TAB B. These include punched paper tape reading speed, size and character of "computer" words and records, method of handling alphabetic information, safety in recording information on magnetic tape and speed of reading and writing on such tape, and pre-installation conversion of records from punched cards to magnetic tape. Features more or less comparable in all computer systems were not included in this comparison.

TAB B makes a significant addition, which coincides with the direction of the previous comparisons.

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- d. The problem of additional space for the computer during the period of parallel operation is one which will require immediate attention following the acceptance of this report. "E" wing, first floor of Curie Hall, has the floor-loading capacity required, will need a minimum of electrical wiring, and is adjacent to space presently occupied by MRD - a necessary condition. It should be noted that, with completion of parallel operation, the space occupied by MRD will be reduced by approximately 50%.
- e. Staff security clearance for selected manufacturer's personnel would give the Team access to invaluable training and systems assistance, and must be initiated immediately following acceptance of the recommendations herein. Such clearances are necessary for equipment maintenance in any event.
- f. Further studies in the Offices of Logistics, Training, Security Medical, and other components will result in additional applications being programmed for a computer.

#### 4. CONCLUSIONS.

- a. Systems studies made to date by the Feasibility Team confirm that annual savings of \$29,000 which may be realized within MRD by transferring the bulk of the MRD work to an electronic computer, combined with more timely up-dating of records and production of reports, warrant the installation of such equipment.
- b. The redesigning of systems and procedures is inherent in the successful application of computer to data processing.
- c. Such redesigning will result in substantial additional savings, as discussed in paragraphs 3. a. , page 5; 3. b. (4), page 5; and 3. f. , page 7.
- d. The RCA 501 is the most suitable computer for the requirements of MRD, has the additional capacity for work presently performed on EAM by other components and can readily be expanded further to most foreseeable future demands in other areas.

#### 5. RECOMMENDATIONS

It is recommended that:

- a. The Comptroller be authorized to secure a firm rental contract with the Radio Corporation of America for an RCA 501 computer system (TAB A) to be installed 1 November 1959 under his operating supervision.

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- b. The Comptroller be authorized to take the steps necessary to secure, on or before 15 July 1959, space of approximately 2400 square feet suitable for computer installation and adjacent to other space occupied by MRD.
- c. The Comptroller be authorized to construct a simple cost accounting plan to charge back appropriate costs on the components making MRD demands.
- d. Funds in the amount of \$115,000 be set aside for fiscal year 1960 to cover one-time expenses.
- e. The period of one year for which the Comptroller was provided with two ceiling positions by the report of 6 June 1958 be extended by the DD/S to cover such period of time as may be required to complete initial parallel operations, not to extend beyond 1 June 1960.
- f. The Management Staff in coordination with Office of Comptroller and other offices affected be made responsible for direction all studies requisite to such installation and authorized, to design and program an electronic data processing system utilizing the RCA 501 for all work presently performed by MRD.
- g. The Management Staff, with the concurrence of the Comptroller be authorized to deal directly with the Radio Corporation of America in connection with establishing any date other than 1 November 1959 for the delivery of the various pieces of equipment.

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Chief, Management Staff

Attachments:

TAB A  
TAB B  
TAB C

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**SECRET**COMPARISON OF SIGNIFICANT  
TECHNICAL FEATURES

The paper tape reading speed of the 7070 is negligible and its maximum card read speed is at the rate of 667 characters per second compared to 1,000 from paper tape for the 501 and 220. The 220 paper tape must be coded for each 10 numeric or five alphabetic characters, placing a burden on the operator preparing the tape and making document reproduction from such tape impossible without the probability that a code indicator will be printed within the end limits of a number or word. The preparation of 501 paper tape required a code indicator only at the beginning of each number or word, regardless of length, minimizing the burden on the operator and resulting in tape which may be used for document reproduction. It is quite conceivable that much key punching could be eliminated because of this feature.

2. The 501 will handle numbers or words of any conceivable length; the 7070 and 220 require that a number of more than 10 digits or a word of more than five letters be broken into two or more "computer words".
3. The 501 requires only one digit space on magnetic tape or within computer memory for each alphabetic character; on tape the 7070 requires one and the 220 two, in memory both require two.
4. The read-write speed of the 501 exceeds that of the 7070 (except with higher priced systems) and the 220.
5. The variability of record length on magnetic tape for the 501 permits greater compression of information than is possible for the 7070 or 220 and has the effect of providing faster reading.
6. Dual recording of information on magnetic tape is a safety feature of the 501 not available with the 7070 or 220.
7. The 501 system considered by the Feasibility Team includes a card transcriber (not recommended by the manufacturer for use with the 7070, and not available with the 220). This is a device for converting information from punched cards to magnetic tape which, in turn, is used as input to the basic computer. It can be rented as a separate unit prior to installation for the purpose of converting permanent card files to magnetic tape in preparation for parallel operation - an important consideration in keeping the cost for such operation at a minimum.

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PROPOSED RCA 501 INSTALLATION

	<u>Model No.</u>	<u>Quantity</u>	<u>Monthly Rental</u>
(Computer	503	1	\$ 5,400
(			
(Core Storage	561-2	1	3,400
(			
RCA (Tape Stations	581	7	3,850
to be order			
ed (High Speed Printer	535	1	3,400
(			
(Card Transcriber	527	1	2,275
(			
(Card Punch	538	1	1,700
(			
(Tape Switching Unit		1	75
			<u>75</u>
		Total Cost For Month.....	\$ 20,100
( Disbursing Office Equipment			\$ 368.00
(			
( Collator	089	1	242.00
(			
IBM (Printer	408	1	1,292.50
on			
hand (Sorter	083	1	121.00
(			
( Reproducing Punch	514	1	141.50
(			
( Key Punch	024	14	616.00
(			
( Key Verifier	056	8	440.00
			<u>440.00</u>
		Total Cost For Month.....	\$ 3,221.00
Total Monthly Machine Rental.....			\$23,321.00
Total Annual Machine Rental.....			\$279,852.00

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Approved For Release 2005/08/24 : CIA-RDP90-00708R000600130001-9

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TAB A

Machine Rental	\$ 279,852.00
Personnel Expenses	214,735.00
Supplies	<u>50,000.00</u>
Total Annual Cost of Proposed Installation	\$ 554,587.00

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**FEASIBILITY TEAM**

**DIRECTION:** 25X1A  
 Chief, Business Machines  
Service, Management Staff

**MEMBERSHIP:** 25X1A  
 MS, Management Staff, Leader  
BMS, Management Staff, Member  
BMS, Management Staff, Member  
S, Management Staff, Member  
AS, Office of Comptroller, Member  
Office of Comptroller, Member  
Office of Personnel, Member

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25 October 1961

(classification - CONFIDENTIAL) \*

MEMORANDUM FOR: Chief, Automatic Data Processing Staff

FROM: 25X1A [redacted] (formerly Leader of Feasibility Team)\*

SUBJECT: Utilization of 501 Computer

1. Approval by the DD/S of the recommendation for installation of the RCA 501 Computer System was based primarily on the data processing requirements of the Support Area of the Agency and the assumption that dollar savings would result therefrom. In support of this assumption various other assumptions were relied upon by the Group which made the study, to wit:

- a. Initial use of the computer would be confined to the work then being performed by the Machine Records Division. Office of the Comptroller, through a simple conversion from EAM to EDP.
- b. This amount of work processed in this manner should not require more than an average of 4 hours per day of computer time.
- c. During this conversion, systems would be "frozen" and no changes of a major nature would be made.
- d. Space would be provided in the basement of Central Building for such EAM equipment as might be required to support the computer.
- e. A minimum of eight, and up to fourteen trained programmers from MRD would be available full-time to support the program-

\* Not on original

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ming effort of Management Staff and other personnel under the direction of Management Staff.

- f. After this initial conversion from EAM, a revision of programs to effect simplification, integration and introduction of systems changes would be undertaken along with studies in other components of the Support Area with a view to making full use of computer time.
  - g. Management would accept at least some degree of the "total systems" and "management by exception" concepts to simplify both input and output through compatibility of source documentation with reports, and reduction in both the size and number of reports as well as compatibility in the reporting dates of related reports.
2. To expedite implementation of computer use:
- a. The following persons were given authority for final approval of systems by the heads of their respective offices:  
25X1A  

--

    - /C ompt.
    - O/Pe rs.
    - /Log.
  - b. In addition to MRD and Management personnel a number of designees from the Office of Personnel, Logistics, Training, Communications, etc. were trained by RCA in programming procedures for the 501.

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c. Two systems analysts, with some programming training, were assigned by RCA to work with and conduct additional training of Agency personnel.

3. The detailed systems studies and charting necessary for programming was started in the fall of 1959, and the computer was installed as operational 3 October 1960. As of this date (25 October 1961) the following programs, designed to process data for the Office of Personnel, Comptroller and Logistics, (as well as several for other components, not included in this survey) have been planned, comprising practically all of the work formerly accomplished by MRD, plus some work formerly, presently, or neither previously nor presently processed by others:

a. Personnel: 38 Programs consisting of over 38,000 steps. Three of these were for single-use-conversion from punched cards to mag. tape; the 35 others were or will be parallel or operational as follows:

9 as of Nov. 30-60

2 as of Feb. 1-61

5 as of Mar. 1-61

1 as of June 30-61

2 as of July 31-61

2 as of Sep. 30-61

9 as of Oct. 31-61

3 as of Nov. 30-61

2 as of Dec. 31-61

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From these programs some 200 reports, listings, tabulations, tapes for payroll input, tapes for vital records storage, etc. are being or will be produced on a request, bi-weekly, monthly, quarterly, semi-annually or annual frequency. In addition, an average of seven reports per month, for which programs have not yet been written, have been planned.

b. Payroll:

(1) Vouchered: 29 Programs consisting of over 22,000 steps.

These were or will be parallel or operational as follows:

2 as of Jan. 1-61

12 as of July 20-61

8 as of July 27-61

2 as of Oct. 1-61

2 as of Oct. 14-61

2 as of Jan. 1-62

Final details respecting various outputs is not yet available.

(2) Unvouchered: 2 Temporary Programs consisting of 375

steps have been written and are operational, processing

work formerly accomplished on the IBM 604. One con-

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c. Accounts: 15 Programs completed consisting of over 23,000 steps.

6 Programs incomplete.

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These 21 programs were or are expected to be parallel or operational as follows:

7 as of April 1-61

2 as of May 1-61

2 as of June 1-61

2 as of Aug. 1-61

1 as of Nov. 1-61

1 as of Dec. 1-61

2 as of Jan. 1-61

2 as of Mar. 31-62

2 as of June 30-62

Final details respecting various outputs is not yet available.

d. Logistics: 20 Programs consisting of over 23,000 steps.

These programs were or are expected to be parallel or operational as follows:

2 as of June 1-61

11 as of July 1-61

1 as of Sep. 30-61

1 as of Nov. 1-61

2 as of Nov 30-61

2 as of Jan. 1-62

1 as of June 30-62

Final details respecting various outputs is not yet available

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e. In these four areas of Personnel, Payroll, Accounts and Logistics there are presently planned a minimum of 115 programs consisting of well over 1000,000 steps. Of these, approximately 80% are in parallel or production operation.

Aside from  on which no firm estimate is available, all are expected to be fully operational for the next calendar or fiscal year's annual reports as may be desired. The total operational time to run these programs has been estimated by the ADP Division at 270 hours average per month.

4. In justice to all personnel involved in this effort, the following should be considered:

a. When systems representing the work being processed by MRD, were drawn for computer processing and submitted to the appointed officials for approval, demands for changes and enlargements poured in from all directions. At no time has it been possible to secure a firm approval of a system as conceived by the analysts, and demands for changes continue to pour in. For example, as recently as 60 days ago, it was necessary to review all Logistics programming to satisfy changes requested in that area. In view of the extent of these demands for changes, and at the urging of RCA analyst personnel, a decision was made to scrap the idea of a simple conversion from EAM and proceed with a fully integrated system except in respect to Logistics which has been developing its own concept of conversion.

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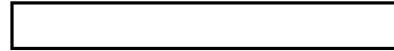
- b. At no time has it been possible to "sell" the idea of "management" by exception with the result that the number and size of reports, some certainly of questionable justification, has increased rather than decreased. No apparent effort has been made to take a hard look at the "total system" or to achieve any compatibility of input with output or of reporting periods for related reports. Very little, if any effort has been put for achieving accuracy of input except by the Accounts Branch, Finance Division. For example, Personnel Input has been showing as much as 6% error and Logistics up to 12%.
- c. Insufficient space for programmers and no space for EAM equipment was provided in Central Building. This necessitated a constant flow of information back and forth between Central Building and Curie and Barton Halls.
- d. It was necessary to use MRD personnel, intended to be full-time programmers, as EAM operators part-time not only to keep up with the basic workload, but frequently to implement the many changes in punch-card form for future conversion to computer. Early in the programming effort, at the suggestion of the Office of the Comptroller, Management Staff personnel were relieved of responsibility for completing the conversion to computer and left in an advisory capacity only.
5. In view of the above trend away from the original concept of simple conversion and the failure of the other assumptions to materialize objectively,

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it is impossible to evaluate the soundness of the estimates of computer time or dollar savings. It is strongly felt that entirely too much computer time is being consumed for legitimate processing of support data and that dollar savings can still be achieved by the elimination of all redundant reports, an objective approach to justifiable requirements, a revision of systems (including source documentation for input), and an insistence upon accuracy in clerical work involving input.

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## DATA

## Comparison of Data Processing by EAM vs. EDP

1. Under the present EAM system of processing data every transaction issuing from the Offices of the Support Area must be punched into a card or cards, each card limited to 80 characters, either alphabetic or numeric. This data may be a record originating from a personnel form 50, a logistics requisition, an accounting voucher, a payroll T & A, or any one of a large number of other records from various sources. Because it is practically impossible to integrate most of this data under the present EAM system, much duplication of identifying and descriptive information in punched card form results. A great amount of sorting, merging, summarizing and combining of card records becomes necessary. Each individual record may consist of several punched cards containing a total of up to several hundred characters of numerical and alphabetical information. Files of these punched card records, maintained for the production of some 10,000 reports annually, reach voluminous proportions. Often the same or nearly the same information is printed out in more than one report in differing formats. In many instances these reports are used to compile manually still other (ultimate) reports.
2. In electronic processing, each item of data could be entered into the system storage just once through punched cards (or paper tape), currently maintained, processed, manipulated and selected automatically, through proper programming, for production (within the limits of the equipment) in any desired format. All such information could be kept together in one "block" of magnetic tape, as compared to a "deck" of punched cards. In the case of transaction input affecting more than one file or account, each individual record affected in such files or accounts might be updated simultaneously with one punched card (or tape), thereby saving a substantial amount of card duplication, processing and storage space and achieving real integration of records. Many of these records could be maintained on a daily basis, making possible the timely production of special reports upon demand. In addition, many subsidiary or periodic reports, those prepared in anticipation of possible need and the manual preparation of "ultimate" reports could be eliminated because of the availability of such information within the memory of the computer system. Because of the speed of operation, many scheduling problems should be overcome, minimizing the need for overtime.

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**COSTS**

**Comparative Costs of MRD - EAM vs. EDP  
(RENTAL BASIS)**

1. The Feasibility Team has made various comparisons of the present cost of operating the MRD as an EAM service organization versus the estimated cost of its operation as a computer center. These comparisons, below, show that the estimated annual cost of operation as a computer center, despite savings of \$131,200 in personnel and supplies, will be from \$5,000 to \$30,000 more than the present EAM cost, because of increased machine rental, depending upon the type of computer installed. The maximum one-time physical installation cost is estimated at \$50,000.
  
2. No estimate of anticipated savings in components outside of MRD resulting from EDP installation has been made. However, it should be evident that if a complete systems analysis is made and an efficient integrated system is designed prior to such installation, such savings must result from elimination of much manual work now being performed in the preparation of data for EAM processing, the manual accumulation of data for "ultimate" reports, and elimination of duplication of data by proper integration. Many organizations have reported large savings in these areas. However, there is always the tendency, when equipment is available, to increase the demands upon it for reports not presently being processed. If these demands are held to actual requirements, based upon the experience of others and possible improvements in procedures now evident, the annual savings should far exceed the increased cost of computer operation.

	EAM <u>Present Cost</u>	EDP <u>Datatron 220</u>	<u>IBM 650</u>
Machine Rental			
EAM Equipment	\$159,810	\$	\$
Computer		194,100	197,100
* Peripheral Equipment		101,202	124,008
TOTAL RENTAL	<u>\$159,810</u>	<u>\$295,302</u>	<u>\$321,108</u>
Salaries - Personnel	\$250,000	\$160,800	\$160,800
Supplies	92,000	50,000	50,000
TOTAL, SALARIES, SUPPLIES	<u>\$342,000</u>	<u>\$210,800</u>	<u>\$210,800</u>
<u>GRAND TOTAL</u>	<u>\$501,800</u>	<u>\$506,102</u>	<u>\$531,908</u>
		<u>LESS EAM COST</u>	<u>\$501,800</u>
		<u>ADDED COST, EDP</u>	<u>\$ 4,292</u>
			<u>\$30,098</u>

\* Peripheral Equipment Consists of:

Computer Input/Output Card Equipment	\$ 35,310	\$ 56,070
Off-Line Card Equipment	65,892	67,938
TOTAL	<u>\$101,202</u>	<u>\$124,008</u>

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ANNEX III.

TAB - B

## EQUIPMENT

## Types of Computers - Comparisons of Medium Scale Computers

1. The members of the Feasibility Team have studied manufacturers' specifications and many case histories of users, read many descriptive pamphlets, articles and technical books, visited computer installations, participated in seminars and conferences, and attended manufacturers's detailed briefings on various computers and computer systems. They have made arrangements for representatives of all components concerned to attend similar conferences, seminars, briefings and installations so that those interested could become familiar with the theories, at least, under which computers function and how data is electronically processed.
2. Manufacturers have devised various types of EDP computers for processing such data as outlined in ANNEX I. These computers have been regarded as being divided into three broad classifications based on purchase prices:
  - a. Small scale - under \$ 100,000
  - b. Medium scale - from 100,000 to \$1,000,000
  - c. Large scale - over 1,000,000
3. As disclosed in published reports of their experiences, many large organizations have concluded, and the experience of the Feasibility Team dictates, that electronic processing of a variety of data such as is indicated by the current support requirements of this Agency demands a medium scale computer.
4. A medium scale computer having the following capabilities is believed to be essential for any computer system intended to replace present EAM equipment:
  - a. Flexibility of Command Structure. As a computer must be directed by means of instruction codes to perform each individual step in each routine to be processed, a large number of instruction codes for programming such directions is required. Among the medium scale computer systems, many different types of programming are provided. However, those which have the most flexible and widest range in instruction codes are more efficient for data processing.
  - b. Internal Storage. Integrated data processing often requires complex, lengthy programs. It logically follows that greater internal storage capacity will accommodate not only larger programs, but more tables of reference, constants, and sub-routines, and facilitate manipulation during processing. As a general rule, the larger the internal storage, the more efficient the programs.

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- c. Speed of Internal Operation. Internal operating speed should be fast enough to accomplish arithmetic operations, computer decision making, and transfer of data, while at the same time permitting the input-output facilities to be utilized at their maximum speeds.
  - d. Expandable, Large Capacity External Storage. To avoid the necessity for sorting, collating, maintaining, and otherwise processing large files of punched cards, and for filing source documents containing duplicate data, and the time spent in such processing and filing, a large, expandable external storage capacity is needed. Magnetic storage is available in medium scale computer systems in the form of additional magnetic drums, magnetic tape, or magnetic disk files.
  - e. High Speed, Flexible Input-Output. To meet present requirements, to produce additional reports not now possible, and to assure maximum use of input-output machines, this feature is needed.
  - f. High Speed Search and Extraction of Information from Magnetic Tape. To retrieve and update information, abstract parts of files, summarize various categories, and re-arrange data within reasonable time limits, the ability to perform high speed search and retrieval operations from magnetic external storage is mandatory.
5. Medium scale computers studied in detail and compared as to their capabilities by the Feasibility Team and presently being produced by manufacturers considered to be reliable and in a position to furnish adequate maintenance support included the IBM 650, Datatron 205, Datatron 220 and Univac File Computer. Others were found to be lacking in one or more desirable features. The attached table, compiled from published reports, gives the ratings of these four medium scale computers with respect to the features enumerated in paragraph 4 above. Datatron 220 ranks first in most respects on this table.
  6. The Datatron 205, Univac File Computer and the RAMAC feature of the IBM 650 were eliminated from final consideration for various reasons, such as indicated increased costs for personnel and equipment, increased processing and off-line time, randomization or cross-indexing of machine generated address systems, and slower access time to and limited capacity of storage. The NCR 304 was not considered because of its higher comparative cost and the fact that it would not be available for delivery for two years. Final consideration is thus narrowed to the Datatron 220 tape system and the IBM 650 tape system.

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COMPARATIVE TABLE - MEDIUM SCALE COMPUTERS

Computer	Internal Characteristics				Input/Output Characteristics							
	Logic Command	Word Capacity	Arithmetic Speed	Access Speed	Magnetic Tape					Punch Card Speed	Printer Speed	Paper Tape Speed
					Reel Capacity	Transport Speed	Access Time	On-Line Independent Search	Off-Line Operations			
IBM 650 Tape System	2	4	3	3	3	2	3	NONE	2	3	2	NONE
Datatron 205	3	3	2	2	2	4	2	2	NONE	1	2	2
Datatron 220	1	2	1	1	1	1	1	1	NONE	1	2	1
Univac File Computer	4	1	4	4	4	3	4	2	1	4	1	3

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ANNEX III

Tab C

Equipment

1. The IBM 650 and Datatron 220 systems have been thoroughly investigated and compared, keeping in mind the features considered essential. Each of the systems is deemed capable of processing the work now being done by MRD. The technical comparisons (Tab A) are expanded below by narrative comparisons, summarizing the features and what they mean in terms of applications. The advantages and disadvantages of each system have been carefully weighed and, although each system contains some desirable features not available at the present time in the other, the comparisons show the superiority of the 220 system in most of the areas considered essential.

Comparison of Outstanding Features  
220 System Versus 650 System

- | 220  | 650  |
|--|--|
| <p>1. One reel of 220 magnetic tape will accommodate over 13 1/2 million digits of useful data.</p>  | <p>One reel of 650 magnetic tape will accommodate a maximum of 4,608,000 digits of useful data, about 1/3 the capacity of the 220 tape.</p>  |
| <p>2. The 220 tape units are equipped with independent search features utilized in file inquiry and updating operations, which permit tapes to be searched in either forward or backward directions without interfering with other operations of the computer.</p> | <p>File searching on the 650 computer can be processed in a forward direction only, is performed by the computer instead of the tape unit, and occupies the computer full time, unless offline tape searching is performed through a Tape Data Selector (see item 13).</p> |
| <p>3. The 220 tape units are also equipped with independent scan features which permit the high speed scanning of any (or any part) of the first 10 words of any tape record without interfering with other operations of the computer.</p>                        | <p>See Tape Data Selector (item 13).</p>   |
| <p>4. The high internal speed and tape transfer speed of the 220 made possible by core storage, allow faster rearrangement of data, and should result in faster overall operations than could be obtained with any drum type computer.</p>                         | <p>The 650 is not a core storage computer and speeds are limited by the drum.</p>  |

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220

5. 220 tape records can vary in length from 10 to 100 words, any combination of record length in any file. This makes possible a great deal of flexibility in establishing and maintaining tape files.
6. The expandable core memory of 2000 to 10,000 words in the 220 permits in-line processing of exceptions, large scale programs, storage of more tables of reference and constants, simplified programming, and summarization of information.
7. The input/output facilities available with the 220 and the format control of the Cardatron system make possible the on-line production of a wide variety of printed reports, punched cards and paper tapes.
8. In the 220 system, tape files may be changed by either writing a complete new record on tape or re-writing on the same tape only that portion of the record which is changed, thus increasing the flexibility of tape operations.
9. The method of handling alphabetic information in the 220 system is simple, not limited to a specific number of characters, does not require special devices, and does not take excess storage space for controlling alphabetic information written on magnetic tape.

650

650 tape records can vary in length from 1 to 60 words, but all records in any one file must be of the same length, thus reducing tape file flexibility, unless extra storage space and special programming techniques are resorted to.

The drum memory of 2000 words is not expandable.

The 650 is limited in formats and in the number of on-line input/output devices.

To change any portion of a tape file in the 650 system, a complete new tape must be written.

The 650 system requires special devices to handle alphabetic and special characters and, when alphabetic information is included in tape records, one work out of each 10 must be sacrificed for alphabetic control purposes, thus reducing the amount of usable alphabetic information.

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10. The 220 system was designed to cope with the full range of electronic computing problems.
11. The 220 system has a supervisory printer which can be used to print error items, results of inquiries, etc., without disturbing card punching, report printing or computer processing.
12. The 220 system is not yet in use by customers.
13. Off-line devices for use with the 220 are scheduled to be available in two years.
14. On-line punch card equipment can not be used as input/output at the same time. Controlling Cardatron units are fixed as either input or output.

650

The 650 was originally designed as a scientific computer and has been adapted for other uses through the addition of special devices and other machines.

Supervisory printer is not available with the 650 system except with the disk storage feature.

The length of time the 650 computer has been in use provides a source of knowledge and experience available to the user.

A Tape Data Selector presently available in conjunction with a tape unit and a printer or punch can be utilized for off-line searching and file scanning operations. The computer is not affected and is free for other uses. (see items 2 and 3).

On-line punch card equipment can be used as either input devices, output devices, or simultaneous input/output devices.

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Miscellaneous Comparisons

	220	650
<u>Delivery Time</u>		
Quoted by manufacturers' representatives	9 months	6 months
<u>Maintenance</u>		
Furnished at no cost when equipment is rented	Yes	Yes
Engineer on site full time	Yes	Yes - if manufacturer feels installation is large enough to require it
Time requested by manufacturer for testing and preventative maintenance	At least 2 hours before start of shift	During regular shift operations, if possible
Furnished by contract, if desired, when equipment is purchased	Yes	Yes
<u>Standby Equipment</u>		
Provisions for standby equipment	Will be provided by manufacturer	Available from manufacturer and/or possibly at other installations
<u>Assistance</u>		
Customer assistance by manufacturer	The Burroughs Corporation is well established in the electronic computer field and has the reputation of furnishing excellent support	The IBM Corporation has the largest organization in the data-processing field to provide customer service and assistance.

2. Based upon the experience of others, it is probable that after equipment is installed, unforeseen demands and applications will arise. These added demands, plus growth of existing jobs, may tax the original computer system beyond the bounds of efficient operation. Therefore, the expansion possibilities of each computer system must be considered. These comparisons have been made and show the growth potential of the Datatron 220 system is much greater than the IBM 650.

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Expansion PossibilitiesDatatron 220

1. Internal memory can be expanded from the proposed 3000 words to a maximum of 10,000 words.
2. The number of card input/output units can be increased from the proposed 4 to a maximum of 7.
3. The number of taps units can be increased from the proposed 4 to a maximum of 10.
4. As many as 10 Datafiles, each accommodating a maximum of 50,000,000 digits can be incorporated into the 220 system. However, the system is limited to a total of 10 tape units and/or Datafiles in any combination.
5. The number of paper tape readers can be increased from the proposed one (included in control console) to a maximum of 10.
6. As many as 10 paper tape punches can be incorporated into the system.
7. The number of supervisory printers can be increased from the proposed one (included in the control console) to a maximum of 10.
8. High speed printers (up to 900 lines per minute) for either on-line use with the computer or, off-line use with a tape unit will be available in less than 24 months.
9. The Burroughs Corporation representatives have advised us that new high speed card input/output equipment for use with the computer will be available for order in the near future.

IBM 650

1. Up to 4 disk storage units, each accommodating a maximum of 6,000,000 digits can be added to the 650 tape system.
2. With the addition of disk storage, up to 10 inquiry typewriters, which may also be used to a limited degree a supervisory controls for the 650 can be added.
3. The number of tape units on line can be increased from the proposed 4 to a maximum of 6; according to manufacturer's representatives, can be increased to a maximum of 10 (with the addition of concurrent read/write equipment).
4. An unlimited number of Tape Data Selectors can be installed.

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Tab D

5. Certain types of punches and printers designed for 700 series IBM computers can be used in conjunction with a 650 system, off-line.

SYSTEMS CONCEPTS

1. In considering the two systems concepts, the Feasibility Team studied many case histories, articles and books dealing with electronic data processing. Only isolated instances which advocated the "building block" approach were found. In the information available, preponderant support was given to the integrated systems approach. Examples of systems concepts of various writers, all experienced in the field of EDP, are contained in the attached abstracts.
2. Some 34 case histories of large organizations whose installations were for Payroll, Inventory Control, Billing, Personnel Statistics and Control, Budgeting, and various other data processing applications are enumerated in this Tab. Of these, the lone organization which adopted the "building block" approach has experienced no net cost savings as yet, but expects to over a period of five years. Those organizations giving cost information and which had installed a complete integrated system as the initial step realized savings within one to two years. These case histories are attached following the abstracted information.

ABSTRACTSFalse Starts In Office Automation

John Diebold

"The Management Review", July 1957; pages 81-88

As quoted in "Data Processing Digest", October, 1957; pages 3-4

"Many of the problems which have frustrated management in realizing the full potentials of their electronic computer installations are the result of two major managerial errors.

The first of these errors is the concentration on hardware rather than on the system. 'Although the scope of the automation problem encompasses virtually all areas of the business organization, the nature of the analysis and the decisions that must be undertaken --- does not lend itself well to committee organization. These are operational problems and should be treated as such.... The problem of automation should be specifically assigned as the responsibility of an operating executive.' Delegating authority to a committee 'usually leads the company to approach automation from the standpoint of technology or hardware.... The very phrase feasibility study... frequently serves to imply... that they are trying to find an application for a computer. Their objective should be to design the best possible information and communication system for meeting the needs of the organization, whether it RELIES UPON A computer, a simple manual and machine system, or entirely upon humans.' "

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"The second error is the delegation of important decisions to technical people, rather than to those thoroughly familiar with the business itself. The introduction into a company of 'experts' who would be considered 'floaters' in any other field, 'has the same consequences as the violation of any other sound personnel policy.... The solution is to train personnel from your own organization in analytical procedures, machine operation, and programming.... The installation of automation equipment cannot be properly made without a thorough understanding of the functions and needs of the business itself.'

A common method of proceeding with the study is the step-by-step method, which term 'is intended to convey the impression of caution and proper business reserve. Actually, it often means that another uncoordinated misstep is being taken into automation.'

'The step-by-step approach frequently ignores that fact that the whole concept of systems analysis and design, which is basic to automation, requires a careful and detailed plan for the entire organization if the benefits realized are to be more than marginal.... This analysis must precede evaluation of equipment: you begin with the system, not with the machinery. Such a study often results in great improvements and substantial savings, even when automatic machinery is not installed.'

'One result of treating the computer as just another tabulating machine and not integrating it into the business system is that the high costs of data-preparation often reduce or eliminate any savings that result from automatic processing. On many existing computer installations, a substantial portion of the savings has been made possible by deriving data automatically from a process as a by-product. This eliminates the extensive key-punching or other data-preparation costs that are encountered when the computer is considered only a new, faster, and more automatic addition to the tabulating room.'

'However, it is important for management to be familiar with the machines that are available, since a knowledge of existing equipment which fits the needs of the system is obviously necessary to the successful accomplishment of the conversion to automation.' "

Never Overestimate the Power of A Computer

Ralph F. Lewis, Arthur Young & Co.

"Harvard Business Review", September-October, 1957; pages 77-84

As quoted in "Data Processing Digest", October 1957; pages 4-5

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"The significant sub-title is: 'It can do the calculating, but it can't do the planning.' Four reasons are given for the majority of orders for EDP systems up to the present: 'to keep up with the Joneses; to see what can be done with computers; to obtain identifiable cost savings; to obtain better or

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faster information. ' An example of each type of motive is given, identified only as Company A, etc. If you have kept up with the literature in the field, it will not be difficult to identify the companies. In commenting on the motives, the author makes the following statements:

'The net gains of transferring an already mechanized operation to the computer will rarely bring any advantage. To produce better facts for management means an entire study of management problems. In many instances such a study may well result in formulating a complete new system of processing paper work'. This is followed by example of Company D (the fourth motive above).

'The sound way of approaching a computer installation is to determine first of all what information management really needs and how fast... Priorities must be established as to which items of information can be of most benefit. At that point, detailed systems work should be started.'

'Normally, no single application will economically carry the cost of a computer system. Only in a few specialized areas can a computer pay its way on a single operation -- for instance, the mass-volume, fairly complicated problem of public utility billing and revenue accounting, or some of the volume operations of the larger insurance companies, such as premium billing and actuarial studies. In most situations economic results can be obtained only by programming a multiapplication installation.'

'This does not necessarily mean, however, that those operations now being handled efficiently on tabulating equipment can be profitably put on computers. As a matter of fact, the best possibilities are those volume operations which defied economic tabulating systems.'

Although the most popular of the applications initially placed on a computing system, payroll 'is normally not a profitable computer application'. An example is given of a well-known company which started with a huge payroll application, and is now 'quietly decentralizing the payroll operations, moving them back to conventional equipment, and substituting more worthwhile operations on the computer.' The author has found few computer systems now in use which could be considered as economic. 'The number that are paying their way at this point can be counted on one hand, with some fingers left over' However, 'in addition to the ever present payroll installations, headway is being made in such potentially profitable areas as inventory control, production control, sales accounting, and in such previously mentioned specialized fields as public utility billing and insurance accounting.'

Four 'don'ts' conclude the article:

'Don't order to keep up with the Joneses. Don't switch established tabulating routines to the computer. Don't expect that one application will pay for the computer. Don't accept delivery until you are really ready.'

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Conducting a Feasibility Study For Inventory Control Application

Neal J. Dean, Ramo-Wooldridge Corp., Los Angeles, Cal.

Paper presented to AMA Seminar, March, 1957

As quoted in "Data Processing Digest", November, 1957; page 12

"... A fully integrated electronic data processing system cannot be obtained by putting together islands of mechanization. Systems must be planned in advance in sufficient detail to accomplish the required integration. Rather, the author recommends that the company 'conduct a comprehensive study of the data processing requirements of an organization.' Two methods may be used for conducting such a study. In the analytical method, the company 'studies in detail the functional possibilities of electronic data processing in order to assess the operational and economic advantages and disadvantages of an electronic system.' The empirical method entails soliciting from several computer manufacturers proposals for application of equipment to a specific system. 'The advantage of the first method is that the company has the assurance that it has explored the full possibilities of electronic data processing and has selected the best system for its needs.' The author considers 'the empirical approach... dangerous unless a company is sure of all the details of its application.'

The feasibility study has four parts: 1. priority study, to determine where the payoff is largest and most immediate; 2. the integration study to reduce the computer work load through relating source documents and management reports; 3. the economic study, to determine costs; 4. the operational study, to determine the machine characteristics needed for the system.

Electronic Data Processing For Business And Industry

Richard G. Canning

Published by John Wiley &amp; Sons, 1956

Chapter I, pages 29-32

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"Alternative Approaches for the Investigation

A very common method of selecting a course of action, which has been used in many problems other than data processing, is for company management to be so engrossed in the day-by-day management that no action is taken on a problem until it reaches crisis proportions. When action can no longer be deferred, the obvious desire is to obtain an immediate remedy. For problems in data processing, this means calling in various equipment manufacturers to see whose equipment comes closest to solving the problem. In some cases, this has resulted in the manufacturer developing a specialized piece of equipment to solve the problem, in the belief that other companies probably have the same problem. In most cases of this type with which the author is familiar, the results have been unsatisfactory; the equipment may perform like it was supposed to, but the crisis seems to shift to another area within company operations, and management still does not get the answers desired.

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Another approach for installing electronic data processing is to have it take over the majority of the functions which the punched card equipment is already performing for a company. Since electronic machines are faster than punched card machines, it is usually expected that the machine will have considerable free time which can then be used to take on additional functions. Thus, electronic systems are looked upon as if they were 'super punched card systems'. A slight variation of this approach is to select certain 'gravy' functions for the first application of electronics, functions that promise to give big savings with the least effort. It is felt that one advantage of such an approach is that the equipment manufacturers, from their experience with punched card equipment, can provide considerable advice on the installation of the 'super punched card system.'

The major difficulty with this type of approach is evident: punched card systems have usually been installed for accounting operations, and accounting practices are reasonably formalized. A 'cookbook' approach often turns out to be reasonable. But the requirements of the accounting operations may not reflect the data processing requirements of the rest of the organization. Thus, management encounters more and more difficulty in trying to expand the 'super punched card system' to other management control operations - the equipment just does not seem to fit the needs.

Another approach is to rent small or medium size electronic equipment for one data processing operation within the company, and plan to expand the system later if the initial installation works out. Since the equipment is rented, it can be returned in favor of a larger machine when expansion is desired, or else additional small units can be rented. As in the case of specialized equipment, this approach often turns out to be unsatisfactory; the bottleneck just seems to shift to another area of company operations, and management is never sure that a real improvement has been accomplished.

These approaches have something in common: all of them propose patchwork types of solutions, trying to fix up one part of the data processing system at a time, without considering the other parts of the system. Such approaches resemble that of the amateur house builder, who draws no plans and who solves each problem as he comes to it while building the house. As new requirements are uncovered, a wall is torn down or a room is added. The completed house might be classified as rambling.

The approach for installing electronic data processing with which this book will be concerned is called the 'systems approach'. It proposes an engineered solution to the data processing problem, rather than a patchwork solution. It considers and solves the overall data processing needs within the company, on paper, before the first step in procuring equipment is taken. It promises a much greater chance for satisfactory operation of the data processing system than does the patchwork solution. In short, it is very similar to having an architect lay out the plan for a large building, in which as many requirements as possible are considered in advance and solutions developed to meet those requirements.

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### The Systems Engineering Approach

A. What is the systems engineering approach? The systems engineering approach considers a company to be an integrated system, working toward the common goal which has been specified by management. The accounting department, production department, purchasing department, and so on, are not looked upon as separate operations, but rather as parts of the overall operation.

From a data processing standpoint, the objective is to achieve a balanced flow of information throughout the company, according to the needs of different departments. The approach does not consider just one department, and try to mechanize its operations with little or no regard for the other departments. So the first step in beginning a systems study is to look at the company as an integrated system, and to visualize the relationships of the various departments in the system.

Looking at the company as an integrated system, the next step is to determine the major data flows. That is, what information must flow from department to department, and perhaps plant to plant, in order for the company to function? At the same time that the data flows are determined, the quantities must also be determined. How many decimal digits and alphabetic characters are being stored in the master active order files of the company, and what is the quantity of data flowing between departments daily? The data flows and quantities of data constitute the data processing needs, or requirements of the company.

Once the requirements have been determined, the next step is to engineer a data processing system to meet those requirements. In this case, the term 'engineer' means the selection of components which can be assembled into a system, under the normal engineering considerations of efficiency and economy. It might seem strange to the reader at first that an information system can be engineered, because people are not accustomed to thinking of information in such terms. However, methods now exist for measuring the quantity of information; information flow can be stopped, started, varied, and manipulated in other ways, similar to a physical system. Information flow, and manipulations upon information, are subject to an engineering analysis.

When the system has been engineered, on paper, the next step is to develop a practical step-by-step program for attaining the system. The whole system need not be installed at one time, but rather may be procured in phases, in most cases."

#### Office Automation Applications

Published by Automation Consultants, Inc.

Case Studies Enumerated.

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Case Study Number D-6, Metropolitan Life Ins. Co.

"From this study it was possible to extract some guiding principles for approaching the design of an operating system suitable for use with electronic devices. These guide-posts were:

- (1) An electronic computer should be applied to the whole job, not to some separately departmentalized piece of it.

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- (2) Small jobs should be combined with others.
- (3) Source records should be consolidated.
- (4) All calculations should be made at one time. "

## Case Study Number E-2, Detroit Edison

"Detroit Edison is currently engaged in a massive conversion operation, according to Mr. J. D. Elliott, Director of Revenue Accounting. The object of the conversion is to transfer the customer accounting operation from an elaborate punched card system that includes IBM 650's to one 705. Until this changeover is completed, the company understandably feels reluctant to publicize any details. "

The two 650 machines were installed in April 1955, and the 705 in November 1956. As of October, 1957, the conversion was not complete, and further systems analyses were being undertaken.

## Case Study Number E-4, Canadian Pacific Railway

"According to Canadian Pacific President N. R. Crump, 'With this new equipment, (IBM 705) we move from the narrow concept of old methods, with a highly departmentalized practice in the collection and processing of information, to the new concept of integrated data processing, based on a system-wide integration to meet all requirements more quickly, more fully and less expensively. "

## Case Study Number G-2, Social Security Administration

"In May, 1955, the Management of the Division of Accounting Operations, Bureau of Old-Age and Survivors Insurance, Social Security Administration, decided to convert a substantial portion of its accounting processes to electronic equipment. At that time the Division had among its thousands of employees less than a half-dozen with an understanding of the capacities of the equipment. Yet by March 1956, when the central processing unit of its IBM 705 was installed, the Division was ready to put the system to work on a 24-hour-a-day basis.

In the ten months intervening, 18 man-years of planning and programming were completed and 5,000 pages of programs, block diagrams, and related procedures were written. And it was done without recruiting personnel with electronic training from outside the organization. "

Installing Electronic Data Processing Systems

Richard G. Canning

Chapter I, pages 4-5

"There are two major approaches being followed throughout the country which, for lack of better names, might be called the 'one step' and the 'two step' approaches. The one-step approach says, 'We see EDP as a powerful management tool, through which we can gain a competitive advantage. Let's not dilute our efforts or delay these benefits by taking some easy course of action. Rather, let's set our minds to doing the job right and go after these big benefits from the outset. '

The two-step approach says, 'We agree that EDP offers big benefits for management, but it is a new tool, one with which we and our employees are unfamiliar. We feel that we should not rush into this program blindly.

Rather, we are going to take a reasonably safe step first by substituting

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this new EDP equipment for some of the punched card equipment we have been using. Then, when we have some experience under our belts we will go after the big benefits.'

It is not the purpose of this book to argue the advantages and disadvantages of the two approaches; each organization will have to make its own decision. Our purpose here is to recognize that eventually all companies will go after the big benefits through the use of EDP. Experience has indicated that when a company is starting to take the second step in the two-step approach, it is still faced with a majority of the problems that the one-step approach tackles at the outset."

Ibid.

Chapter 10, page 154

**CPYRGHT****Crawling Versus Walking**

The AAA Manufacturing Company decided to try to 'walk' in its EDP program right from the beginning, instead of following the 'crawling' approach first as so many other companies have done. They feel that it has taken then somewhat longer to put their operations on the electronic system than if they had merely converted large punched card jobs over to EDP. However, since they were aiming at improving the Company's competitive position, and not just at obtaining some clerical and punched card savings, they feel that the approach they chose was right for them.

They also feel, from their experience, that the 'crawling' approach would not have saved them much time, if any, in eventually acquiring the benefits they desired. Most of the planning and programming that they would have had to do for converting large punched card operations over to EDP would have to be largely scrapped when they started planning and programming the phase I system. So, for this particular case, they have felt that the decision to go after big benefits from the start was a wise one."

Ibid.

Chapter 10, page 155

**CPYRGHT****Other Lessons Learned**

"Also, management has learned that the planning should have looked a little farther into the future and should have provided sufficient system capacity for handling what will likely be put on the equipment during the next year or so. In the planning that was done during the first year, the planners had their eyes set too firmly on the Phase I program and therefore selected a machine that would handle the Phase I operations in approximately one shift of operation. By now, management sees that this one electronic system will soon be overloaded. At that time, they must either get a second machine of this same type or replace the present one with a newer, faster machine. However, during the first year of planning, the company management still was not too sure of EDP and probably would not have accepted a proposal for obtaining a machine considerably faster than was required by the Phase I operations. Now, however, they have overcome that attitude."

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Tab D

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Case Histories Studied, Compiled From  
 "Office Automation Application", published by Automation Consultants, Inc.  
 "A Management Guide to Electronic Computers", by W. D. Bell, published  
 by McGraw-Hill

Installed a Complete Integrated System

Organization

System Installed

Sylvania Electric	Univac I
Carrier Corp	IBM Card 650
Square D Corp.	IBM 305 Ramac
Elwell-Parker Electric Co.	Univac 60
Magnavox Co.	IBM Card 650
Ford Motor Co.	Univac File Computer
B. F. Goodrich-Hood Rubber Co.	Teleregister Special Purpose Computers
Pepperell Mfg. Co.	Datatron 205
Gladding, McBean & Co.	2 Univac 120 Computers
Ashland Oil & Refining Co.	IBM Card 650
Standard Oil of California	IBM Card 650 and 704
General Petroleum Corp.	Datatron 205
Nationwide Ins. Co.	IBM Card 650
Equitable Life Insurance Co.	IBM Card 650
Farmers Insurance Group	IBM 705
Metropolitan Life Insurance	3 Univac I Computers
Equitable Life Assurance Co.	IBM Card 650 and 705
Franklin Life Insurance Co.	Univac I
Arizona Public Service Co.	Univac I
Canadian Pacific Railway	IBM 705
State of California - Department of Employment	IBM 702
U. S. Government - Social Security Administration	IBM 705
County of Los Angeles, California	Datamatic 1000
H. Q. U. S. Air Force, Statistical Services	IBM 705
U. S. Army Signal Supply Agency	IBM 705
U. S. Navy Ships Parts Control Center	IBM 705
Lockheed Aircraft Corp.	2 IBM 704 Computers

Installed One System, Plan Change to Different System

Combustion Engineering	IBM Card 650 to 2 Tape 650 to IBM 709
Mutual Benefit Life Insurance Co.	IBM Card 650 to 2 Card 650 to Tape 650
John Hancock Mutual Life Insurance Co.	Univac I to 2 Univac II Computers

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All-State Insurance Co.

1 Datatron 205 to 6 Datatron  
205 Computers

The Detroit Edison Co.  
New York Central Railroad

2 IBM Card 650 to IBM 705  
5 IBM Card 650 to 6 IBM Ramac  
Tape 650 and IBM 705

Building Block Installation

Pan American Life Insurance Co.

IBM Card 650 to IBM Tape 650  
with Tape Data Selector  
and High Speed Printer.

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## Computer Systems Concepts

1. The Feasibility Team has considered very carefully the advantages and disadvantages of installing a computer under the "building block" concept versus installing a complete integrated system.
2. Under a "building block" concept only the computer and peripheral equipment sufficient for a major application (such as is described below in paragraph 5. Installation I) would be acquired initially. As each succeeding application became converted to computer operation, additional equipment necessary to process the added data would be installed. In each such instance it would be necessary to do extensive re-programming, possibly involving all previous applications, so as ultimately to achieve a fully integrated system and the most efficient use of the equipment. No estimates of the costs of, or of the time required for such re-programming have been made, but it should be emphasized that they could be substantial. Because EAM equipment and operating personnel would be required for processing all applications not transferred to the computer, no significant reduction in either EAM equipment or MRD personnel could be realized until most major applications had been integrated into the computer system.
3. Under a completely integrated system, fully integrated programs would be prepared for all applications and the computer, with all required peripheral equipment, would be installed at one time. Since all the programs for the fully integrated system could be tested prior to installation, a brief period of parallel operation should suffice, following which all EAM equipment not required in the system could be returned to the lessor and a substantial number of MRD positions abolished (see paragraph 5, Installation IV).
4. The costs for a "building block" versus an "integrated" system were compared very carefully by the Feasibility Team. The results are shown at the end of this Tab under "Summary of Comparative Rental Costs". This comparison produced the following estimated overall costs for all equipment rental for Machine Records Division under the two computers receiving final consideration:

Computer	Building Block Cost for Complete System Installed in 4 Steps During 12 Months (First Year Only)	Cost of Complete System Installed at One Time  (Each Year)
IBM 650	\$289,720.50	\$321,108.00
Datatron 220	302,803.50	295,302.00

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**SECRET**Cumulative Costs Based on Building Block in 1st Year

<u>Computer</u>	<u>Year</u>	<u>Yearly</u>	<u>Accumulated</u>
IBM 650	1st	\$289,720.50	\$289,720.50
	2nd	321,108.00	610,828.50*
	3rd	321,108.00	931,936.50
	* * * * *	* * * * *	* * * * *
Datatron 220	1st	\$302,803.50	\$302,803.50
	2nd	295,302.00	598,105.50*
	3rd	295,302.00	893,407.50

\*This comparison shows that by the end of the second year the Datatron 220 would be the less costly of the two systems. It also shows that the cost of a complete installation of a Datatron 220 would be \$7,501.50 less than the "building block" cost of this system in the first year<sup>#</sup> and \$25,806.00 less than the complete installation cost of an IBM 650 each year.

<sup>#</sup>This would be due to the fact that it would not be possible to release certain EAM equipment and operating personnel until (under a "building block" concept) the computer installation was complete.

5. The first three presentations below (Installations I, II and III) are designed to show the progressive changes in equipment requirements thought to be necessary for a "building block" approach. Applications would be converted to computer operations step-by-step as set forth below. The fourth presentation (Installation IV) shows what the Team believes to be the equipment, personnel and supplies needed for either the final "building block" stage or a complete integrated computer system.

Applications Envisioned

- Installation I: Leave accounting, all payroll, a limited amount of financial accounting, and all calculating now being done electronically.
- II: All of the above plus the remainder of financial accounting.
- III: All of the above plus most personnel applications.
- IV: All major applications now being processed by MRD.

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**SECRET**Annex IV  
Tab - E  
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## Installation I

<u>Computer</u>	220 <u>Monthly Rental</u>	650 <u>Monthly Rental</u>
Data Processor	\$ 7,800.00	\$ 2,400.00
Power Unit, Model 2	---	1,100.00
Power Unit, Alpha, Synchronizers	---	150.00
Storage Unit	---	1,575.00
Tape Control Unit	1,200.00	1,050.00
Tape Units (3)	1,725.00	---
Tape Units (4)	---	2,200.00
Cardatron, Basic	2,735.00	---
Sub-total	<u>\$13,460.00</u>	<u>\$ 8,475.00</u>
 <u>Punch Card Equipment</u>		
<u>For Computer</u>		
Collator, Type 089	\$ 209.00	\$ ---
Punch, Type 523	93.50	---
Punch, Type 533	---	550.00
Alpha, Device for 533	---	175.00
Spec. Char. Device for 533	---	100.00
Printer, Type 407 (1)	880.00	880.00
Synchronizer for 407	---	200.00
Alpha. Device for 407	---	175.00
Spec. Char. Device for 407	---	100.00
Sub-total	<u>\$ 1,182.50</u>	<u>\$ 2,180.00</u>
 <u>Peripheral Equipment:</u>		
Punch, Type 024, (14)	\$ 616.00	\$ 616.00
Punch, Type 047, (1)	---	170.50
Verifier, Type 056, (8)	440.00	440.00
Collator, Type 077, (7)	770.00	770.00
Sorter, Type 083, (1)	726.00	726.00
Collator, Type 089, (1)	242.00	242.00
Printer, Type 403, (1)	517.00	517.00
Printer, Type 407, (3)	3,090.00	3,090.00
Printer, Type 408, (2)	2,585.00	2,585.00
Punch, Type 514, (5)	707.50	707.50
Interpreter, Type 552, (1)	88.00	88.00
Sub-total	<u>\$ 9,781.50</u>	<u>\$ 9,952.00</u>
 <u>Treasury D. O. Equipment</u>		
Punch, Type 024, (1)	\$ 44.00	\$ 44.00
Printer, Type 416, (1)	182.00	182.00
Interpreter, Type 556, (1)	142.00	142.00
Sub-total	<u>\$ 368.00</u>	<u>\$ 368.00</u>

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Annex IV

Tab E

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## Installation I

	220	650
	<u>Monthly Rental</u>	<u>Monthly Rental</u>
<u>Summary Monthly Rental</u>		
Computer	\$13,460.00	\$ 8,475.00
Punch Card Equipment		
For Computer	1,182.50	2,180.00
Peripheral Equipment	9,781.50	9,952.00
Treasury D. O. Equipment	368.00	368.00
<u>Total Rental (Monthly) of</u>		
<u>Installation I</u>	\$24,792.00	\$20,975.00
Less,		
<u>Present MRD Machine Rental</u>	<u>13,317.50</u>	<u>13,317.50</u>
<u>Additional MRD Rental Cost,</u>		
<u>Installation I</u>	<u>\$11,474.50</u>	<u>\$ 7,657.50</u>

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## Installation II

<u>Computer</u>	<u>220 Monthly Rental</u>	<u>650 Monthly Rental</u>
Data Processor	\$ 7,800	\$ 2,400
Power Unit, Model 3	NA	1,400
Power Unit, Alpha Synchronizer	NA	225
Storage Unit with Index Register	NA	1,975
Cardatron, Basic	2,735	NA
Cardatron Output	820	NA
Tape Control Unit	1,200	1,050
Tape Units	2,300	2,200
Sub-total	<u>\$14,855</u>	<u>\$ 9,250</u>

Punch Card Equipment for Computer

Collator, Type 089	\$ 209	\$ NA
Punch, Type 523	93.50	NA
Punch, Type 533	NA	550
Alpha Device for 533	NA	175
Special Character Device for 533	NA	100
Printer, Type 407 (2)	1,760	1,760
Alpha Devices for 407 (2)	NA	350
Synchronizer for 407 (1)	NA	200
Special Character Devices for 407 (2)	NA	200
Sub-total	<u>\$ 2,062.50</u>	<u>\$ 3,335.00</u>

Peripheral Equipment

	<u>Number</u>		
024 Punch	14	\$ 616.00	\$ 616.00
047 Punch	1	NA	170.00
056 Verifier	8	440.00	440.00
077 Collator	6	660.00	660.00
083 Sorter	5	605.00	605.00
089 Collator	1	242.00	242.00
403 Printer	1	517.00	517.00
407 Printer	2	2,060.00	2,060.00
408 Printer	2	2,585.00	2,585.00
514 Punch	4	566.00	566.00
552 Interpreter	1	88.00	88.00
Disbursing Office Equipment		368.00	368.00
Sub-total		<u>\$ 8,747.00</u>	<u>\$ 8,917.50</u>

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## Installation II (Cont.)

	<u>220</u>	<u>650</u>
<u>Computer Total</u>	\$14,855.00	\$ 9,250.00
<u>Punch Card Equipment for Computer</u> <u>(Input-Output) Total</u>	2,062.50	3,335.00
<u>Peripheral Equipment Total</u>	<u>8,747.00</u>	<u>8,917.50</u>
Total Installation II	\$25,664.50	\$21,502.50
<u>Less Present MRD Machine Rental</u>	<u>13,317.50</u>	<u>13,317.50</u>
Additional MRD Cost, Installation II	\$12,347.00	\$ 8,185.00

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## Installation III

<u>Computer</u>	<u>220</u> <u>Monthly Rental</u>	<u>650</u> <u>Monthly Rental</u>		
Data Processor	\$ 7,800.00	\$ 2,400.00		
Extra 1,000 Words Memory	500.00	NA		
Power Unit - Model 3	NA	1,400.00		
Power Unit Alpha. Sync.	NA	225.00		
Storage Unit with Index Register	NA	1,975.00		
Storage Unit For Concurrent Read/Write	NA	1,575.00		
One Add Control " " "	NA	700.00		
Cardatron Basic	2,735.00	NA		
Cardatron Outputs (2)	1,640.00	NA		
Tape Control Unit	1,200.00	1,050.00		
" " " For Concurrent R/W	NA	1,050.00		
Tape Units (4 and 5)	2,300.00	2,750.00		
Tape Data Selector	NA	1,870.00		
" " " Power Supply	NA	550.00		
Sub-Total	<u>\$16,175.00</u>	<u>\$15,545.00</u>		
 <u>Punch Card Equipment for Computer</u>				
Collator-Type 089	\$ 209.00	\$ NA		
Punch - Type 523	93.50	NA		
" - Type 533	NA	550.00		
Alpha Device for 533	NA	175.00		
Spec. Char. Device For 533	NA	100.00		
Printer - Type 407 (3)	2,640.00	2,640.00		
Alpha Devices for 407 (2)	NA	350.00		
Spec. Char. Devices for 407 (2)	NA	200.00		
Synchronizer For 407 (1)	NA	200.00		
Tape Data Selector Control For 407	NA	82.50		
Punch - Type 519	NA	148.50		
Tape Data Selector Control For 519	NA	82.50		
Sub-Total	<u>\$ 2,942.50</u>	<u>\$ 4,528.50</u>		
 <u>Peripheral Equipment</u>				
	No.		No.	
024 Punch	14	616.00	14	616.00
047 Punch	0	NA	1	170.50
056 Verifier	8	440.00	8	440.00
077 Collator	2	220.00	4	440.00
083 Sorter	3	363.00	4	484.00
089 Collator	1	242.00	1	242.00
403 Printer	1	517.00	1	517.00
407 Printer	1	1,030.00	1	1,030.00
408 Printer	2	2,858.00	1	2,585.00
514 Punch	2	283.00	2	283.00

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## Installation III Continued

552 Interpreter	1	88.00	1	88.00
D. O. Equipment		368.00		368.00
Sub-Total		<u>\$ 6,752.00</u>		<u>\$ 7,263.50</u>
<u>Summary Monthly Rental</u>		<u>220</u>		<u>650</u>
Computer Total		\$16,175.00		\$15,545.00
Punch Card Equipment				
For Computer		2,942.50		4,528.50
Peripheral Equipment		<u>6,752.00</u>		<u>7,263.50</u>
<u>TOTAL, Installation III</u>		\$25,869.50		\$27,337.00
<u>LESS Present MRD Machine Rental</u>		<u>13,317.50</u>		<u>13,317.50</u>
<u>ADDITIONAL MRD Rental Cost,</u>				
<u>Installation III</u>		<u>\$12,552.00</u>		<u>\$14,019.50</u>

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Installation IV

<u>Computer</u>	<u>220</u> <u>Monthly Rental</u>	<u>650</u> <u>Monthly Rental</u>
Data Processor	\$ 7,800.00	\$ 2,400.00
Extra 1,000 Words Memory	500.00	
Power Unit, Model 3		1,400.00
Power Unit, Alpha. Sync.		225.00
Storage Unit w/index Register		1,975.00
Storage Unit for Concurrent R/W		1,575.00
Add Control, (1)		700.00
Cardatron, Basic	2,735.00	
Cardatron, Output, (2)	1,640.00	
Tape Control Unit	1,200.00	1,050.00
Tape Control Unit, for Conc. R/W		1,050.00
Tape Unit, (4)	2,300.00	
Tape Unit, (5)		2,750.00
Tape Data Selector		1,870.00
Power Supply for TDS		500.00
Auxiliary Alpha. Unit, Type 654-3		750.00
Spec. Char. Device, Type 654-3		130.00
Sub-total	<u>\$16,175.00</u>	<u>\$16,425.00</u>
 <u>Punch Card Equipment</u>		
<u>For Computer:</u>		
Collator, Type 089, (1)	\$ 209.00	\$
Punch, Type 523, (1)	93.50	
Punch, Type 533, (1)		550.00
Alpha Device for 533		175.00
Spec. Char. Device for 533		100.00
Auxil. Alpha. Mod. for 533		45.00
Printer, Type 407, (3)	2,640.00	2,640.00
Alpha Devices for 407, (2)		350.00
Synchronizer for 407, (1)		200.00
Auxil. Alpha. Mod. for 407, (2)		99.00
TDS Control for 407		82.50
Punch, Type 519		148.50
TDS Control for 519		82.50
Spec. Char. Devices for 407, (2)		200.00
Sub-total	<u>\$ 2,942.50</u>	<u>\$ 4,672.50</u>

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## Installation IV

<u>Peripheral Equipment</u>	<u>220 Monthly Rental</u>	<u>650 Monthly Rental</u>
Punch, Type 024, (14)	\$ 616.00	\$ 616.00
Punch, Type 047, (1)		170.50
Verifier, Type 056, (8)	440.00	440.00
Collator, Type 077, (1)	110.00	110.00
Sorter, Type 083, (2)	242.00	242.00
Collator, Type 089, (1)	242.00	242.00
Printer, Type 403, (1)	517.00	517.00
Printer, Type 408, (2)	2,585.00	2,585.00
Punch, Type 514, (2)	283.00	283.00
Interpreter, Type 552, (1)	88.00	88.00
D. O. Equipment	368.00	368.00
Sub-total	<u>\$ 5,491.00</u>	<u>\$ 5,661.50</u>
 <u>Summary Monthly Rental</u>		
Computer	\$16,175.00	\$16,425.00
Punch Card Equipment		
For Computer	2,942.50	4,672.50
Peripheral Equipment	<u>5,491.00</u>	<u>5,661.50</u>
<u>Total Rental (Monthly) of</u>		
<u>Installation IV</u>	\$24,608.50	\$26,759.00
Less,		
<u>Present MRD Machine Rental</u>	<u>13,317.50</u>	<u>13,317.50</u>
 <u>Additional MRD Rental Cost,</u>		
<u>Installation IV</u>	<u>\$11,291.00</u>	<u>\$13,441.50</u>

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Installation IV

Personnel Requirements

	<u>No.</u>	<u>Total Annual Salaries</u>
Chief and Staff	4	\$ 30,000.00
Programmers	4	26,800.00
Console Operators	2	9,600.00
Tape Librarian	1	4,000.00
Machine Operators	6	24,000.00
Key Punch Supervisors	2	8,800.00
Key Punch Operators	<u>16</u>	<u>57,600.00</u>
<u>Total</u>	<u>35</u>	<u>\$160,800.00</u>

Supplies

Tapes, Cards, and Paper \$ 50,000.00

Total Personnel and Supplies \$210,800.00

	<u>220</u>	<u>650</u>
Annual Cost Equipment	\$295,302.00	\$321,108.00
Annual Cost, Personnel and Supplies	<u>210,800.00</u>	<u>210,800.00</u>
<u>Total Annual Cost, Installation IV</u>	<u>\$506,102.00</u>	<u>\$531,908.00</u>

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Comparative Summary - Machine Rental Costs  
(Building Block Approach)

<u>Installation</u>	<u>220</u>		<u>650</u>	
	<u>Per Month</u>	<u>Period</u>	<u>Per Month</u>	<u>Period</u>
I, First 3 Months	\$24,792.00	\$ 74,376.00	\$20,975.00	\$ 62,925.00
II, Second 3 Months	25,664.50	76,993.50	21,502.50	64,507.50
III, Third 3 Months	25,869.50	77,608.50	27,337.00	82,011.00
IV, Fourth 3 Months	24,608.50	<u>73,825.50</u>	26,759.00	<u>80,277.00</u>
<u>Total Cost, First Year</u>		\$302,803.50		\$289,720.50
<u>Installation IV, Second Year</u>		<u>295,302.00</u>		<u>321,108.00</u>
<u>Total Cost, First Two Years</u>		\$598,105.50		\$610,828.50
<u>Excess Cost of 650 System for Two Years</u>				<u>\$ 12,723.00</u>

Comparative Summary - Machine Rental Costs\*  
(Complete Installation)

\*Systems Analysis and Programming Completed Prior to Installation. (IV)

One Year Rental 650 System	\$321,108.00
" " " 220 "	<u>295,302.00</u>
<u>Excess Cost of 650 System over 220 System, Per Year</u>	<u>\$ 25,806.00</u>

Comparative Summary - Machine Rental Costs  
(Building Block vs Complete Installation)

	<u>220</u>	<u>650</u>
Building Block, 1 Year	\$302,803.50	\$289,720.50
Complete System, 1 Year	<u>295,302.00</u>	<u>321,108.00</u>
<u>Excess, Building Block</u>	<u>\$ 7,501.50</u>	<u>\$(31,387.50)</u>

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Annex V

Implementation

1. Following the placing of an order or letter of intent to acquire a computer, it will be necessary for intensive studies of systems and procedures (flow charts and block diagramming) to be completed by the Feasibility Team and for coded programming, based upon such systems, to be accomplished by the MRD. All such work necessarily will be directed toward fitting the programs to the characteristics of the particular computer selected. Such work must be completed in time for applications to be placed upon the computer immediately upon delivery--estimated at twelve to sixteen months after placing an order.
2. A one month parallel operation before discontinuing any present method of processing an application is estimated to be sufficient to prove the efficacy of the computer with respect to such application.
3. Significant changes in systems and procedures with resulting modification of policies and revisions of T/O's are quite possible and should be anticipated by all components concerned.
4. The Feasibility Team must work in close collaboration with representatives of the various components for a period of up to one year. Such representatives must be personnel having a thorough knowledge of present procedures and prospective requirements of their Office, and should be placed in a position of reporting directly to the top officials of their respective components. As the study progresses, and the necessity for procedural changes becomes evident, these representatives, because of time schedule, should have the authority to approve these changes. As stated before, procedures and programs must be completed before computer installation is made, and if even minor procedural changes must be submitted for formal concurrence, it will be most difficult to complete the necessary work on schedule.

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## APPENDIX B

## FINANCIAL REPORTING SURVEY

At the date of this report, the Financial Advisory Committee to the Comptroller is making a study regarding financial reporting. This committee consists of a special assistant to the Comptroller, a member from DD/I, a member from DD/P, and an additional member from DD/S. The purpose of this Comptroller's Financial Advisory Committee is to review financial areas that have Agency-wide applications.

The DD/P is on a single allotment basis. This method is being given a two-year test at this time and may not be continued--even if successful--because of the desirability of cost accounting. The single allotment was not done for security reasons but was done mainly to expedite financial handling in the changing situations peculiar to DD/P.

The various offices of the DD/I are already accounting by cost method; but, even so, these areas are also a major part of the following financial reporting survey. This survey relates mainly to the reports being received by various components. It is included here and is self-explanatory. It is anticipated that this work now going on will be very valuable in future systems determinations for the Agency.

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MEMORANDUM FOR: Budget and Fiscal Offices  
SUBJECT : Financial Reporting Survey

1. The Financial Advisory Committee to the Comptroller is studying the requirements for financial data as a basis for a report of recommendations as to how financial reporting can be improved. You can assist me with this survey by reviewing the attached list of reports which your office receives from the Comptroller and furnish the following information for each report:

- a. How you use the report,
- b. Comments on adequacy and timeliness,
- c. Any suggestions for improvement.

2. I would also like the following additional information:

a. A description of any financial data you are maintaining that is not required by Agency regulations and Comptroller notices; give the need for keeping such data.

b. A listing of the financial data not currently available but which your office feels is required; give the reasons for these requirements.

3. It would be appreciated if two copies of this information could be furnished me by \_\_\_\_\_.

Signed by  
Advisory Committee Representative

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**APPENDIX C**

**LIST OF ORGANIZATIONAL FUNCTIONS**

**1. Office of Comptroller**

**a. Management**

- (1) **Recommend policy**
- (2) **Establish accounting practices**
- (3) **Establish procedures**
- (4) **Approve and initiate new forms**
- (5) **Handle exceptions to published procedures**
- (6) **Report to top management**
- (7) **Handle inter-agency and Congressional requests for information**
- (8) **Interpret new regulations**
- (9) **Maintain liaison with GAO, Bureau of the Budget, and Congressional Committees**

**b. Funds Accounting**

- (1) **Record allotments**
- (2) **Record unliquidated obligations**
- (3) **Record balances**
- (4) **Register invoices**
- (5) **Register payments**
- (6) **Expedite payments**
- (7) **Post travel expenses**
- (8) **Post personal expenses**

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- (9) Budget
  - (10) Record contracts
  - (11) Record expenditures
  - (12) Code for EDP
  - (13) Record costs
  - (14) Transfer funds between agencies, divisions, etc.
  - (15) Manage funds
  - (16) Register receipts
  - (17) Record transactions
  - (18) List collections
  - (19) List check cancellations
  - (20) Record reimbursement for expenditures of personal funds
  - (21) Record tort claims
  - (22) Verify overseas service record
- c. Inventory Accounting
- (1) List property
  - (2) List expendable items
- d. Tax Accounting
- (1) File W-2 withholding tax form
  - (2) Record social security deductions
  - (3) Record W-4 information forms data
  - (4) Record state taxes

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e. Expediting

- (1) Execute mailing receipt
- (2) Route documents
- (3) Schedule bill payments
- (4) Discount bills
- (5) Expedite funds transfer
- (6) Answer inquiries

f. Funds Handling

- (1) Disburse funds (payroll, vendors, operations, expenses, contractors)
- (2) Receive funds
- (3) Handle refunds
- (4) Balance funds
- (5) Make deposits at banks
- (6) Handle monetary transfer
- (7) Handle foreign exchange

g. Payroll Accounting

- (1) Approve pay roster
- (2) Account for adjusted pay
- (3) Account for LWOP
- (4) Account for sick leave
- (5) Account for annual leave
- (6) Account for bonuses
- (7) Account for periodic step increases

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- (8) Account for deductions
  - (9) Face audit time and attendance records
  - (10) Record individual earnings
  - (11) Record individual advances
  - (12) Approve individual advances
  - (13) Record overtime and holiday work
  - (14) Initiate payment record for new employees
  - (15) Notify of pay changes
  - (16) Account for separations
  - (17) Account for pay differential
  - (18) Record retirement data
- h. Auditing
- (1) Audit bills against contracts
  - (2) Audit bills against purchase orders
  - (3) Audit bills against travel orders
  - (4) Audit bill corrections
  - (5) Record payments
  - (6) Complete contracts
  - (7) Recapitulate contracts
  - (8) Pay for printing services
  - (9) Approve service payments
  - (10) Certify for payment
  - (11) Record tort claims
  - (12) Recapitulate contract payments
  - (13) Answer inquiries

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- i. Information Handling
  - (1) Update master file
  - (2) Select
  - (3) Sort
  - (4) Collate
  - (5) Inter-file
  - (6) Process accounts
  - (7) Process payroll
  - (8) List
  - (9) Process personnel records
  - (10) Keypunch
  - (11) File cards
  - (12) Punch tape
  - (13) Handle card output
  - (14) Process inventory
  - (15) Report transactions
  
- j. Records Management
  - (1) Control procedures
  - (2) Control forms
  - (3) Store
  - (4) Maintain archives
  - (5) Perform liaison

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- k. Research
  - (1) Develop procedures
  - (2) Develop systems
  - (3) Develop programs
  - (4) Debug programs
- l. Training
  - (1) Train in computer operation
  - (2) Train in EAM operation
  - (3) Train in procedures
- m. Liaison
  - (1) Determine computer usage requirements
  - (2) Translate requirements for computer personnel
- 2. Office of Logistics
  - a. Management
    - (1) Manage continental United States supply
    - (2) Maintain technical control over overseas supply
    - (3) Perform liaison
    - (4) Approve budget estimates
    - (5) Determine procedures
    - (6) Handle non-standard requirements
  - b. Administration
    - (1) Handle personnel actions
    - (2) Maintain records
    - (3) Train
    - (4) Mail

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- (5) Maintain duty rosters
  - (6) Account for travel
  - (7) Account for property
  - (8) Control records
  - (9) Provide secretarial services
  - (10) Provide clerical services
  - (11) Maintain standards
  - (12) Determine budgetary requirements
- c. Coordination
- (1) Coordinate depot activities
  - (2) Coordinate branch activities
  - (3) Coordinate with Department of Defense
  - (4) Coordinate procurement with GSA
  - (5) Expedite
- d. Technical
- (1) Evaluate material
  - (2) Inspect
  - (3) Upgrade supplies
  - (4) Determine tactical use of domestic and foreign ordnance items
  - (5) Renovate ordnance
  - (6) Determine storage space layout
  - (7) Conduct stock surveillance (preservation of material)
  - (8) Coordinate with safety function

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e. Research

- (1) Conduct research in automatic data processing
- (2) Perform ordnance research
- (3) Perform packaging research

f. Receiving

- (1) Record
- (2) Inspect
- (3) Check
- (4) Process bills of lading
- (5) Test

g. Inventory Handling

- (1) Classify
- (2) Store
- (3) Process requisitions
- (4) Select
- (5) Arrange space utilization
- (6) Care for and preserve materials and supplies
- (7) Provide preservative packing
- (8) Stock strategic reserve materials
- (9) Convert materials and supplies to condition necessary for overseas use
- (10) Account for stock

h. Shipping

- (1) Check requisitions against shipping orders
- (2) Process requisitions

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- (3) Pack
- (4) Route
- (5) Process bills of lading
- (6) Arrange transportation
- i. Inventory Control
  - (1) Procure
  - (2) Record
  - (3) Order
  - (4) Audit
  - (5) Process requisitions
  - (6) Monitor supply level and condition
  - (7) Classify
  - (8) Compare
  - (9) Correct
  - (10) Maintain stock locator
  - (11) Report
  - (12) Account for inventory
  - (13) Eliminate out-of-use stock
- j. Materials Processing
  - (1) Process ordnance and airborne materials
  - (2) Provide special packaging
- k. Reporting
  - (1) Provide inventory information

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- (2) Provide cost information
- (3) Provide shipping information
- l. Item Security
  - (1) Repack
  - (2) Repaint
  - (3) Mark
  - (4) Provide pickup and delivery services
  - (5) Modify
  - (6) Classify trash
  - (7) Provide security for movement of goods
- m. Plant Security
  - (1) Check property passes
  - (2) Maintain safety
  - (3) Maintain station security
  - (4) Obtain security clearances
  - (5) Maintain clearance records
  - (6) Provide physical security
  - (7) Maintain pass and badge records
  - (8) Dispose of classified trash
- n. Plant Maintenance
  - (1) Provide retail issue for Langley
  - (2) Provide delivery service
  - (3) Maintain supply room at all facilities
  - (4) Account for loan of property

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- (5) Provide contractual maintenance services
- (6) Determine property responsibility
- (7) Provide carpenter services
- o. Materials Standardization
  - (1) Maintain test facilities
  - (2) Maintain test stocks
  - (3) Conduct surveillance inspection
  - (4) Write specifications
  - (5) Review test reports
  - (6) Write test specifications
- p. Special Services
  - (1) Construct special tools and equipment
- 3. Office of Personnel
  - a. Direction
    - (1) Determine policy
    - (2) Determine practices
    - (3) Develop procedures
    - (4) Develop standards
    - (5) Review
    - (6) Evaluate
    - (7) Recommend specific actions
  - b. Administration
    - (1) Evaluate positions
    - (2) Administer wages
    - (3) Determine position standards
    - (4) Establish Table of Organization

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c. Liaison

- (1) Maintain liaison with Career Council and Career Services Staffing Authorization
- (2) Maintain liaison with Department of Defense
- (3) Maintain liaison with Civil Service Commission and other agencies
- (4) Provide personnel services to National Security Council

d. Research

- (1) Conduct qualifications analysis
- (2) Maintain specialists files
- (3) Maintain biographical profiles
- (4) Determine availability
- (5) Conduct statistical and analytical research on personnel problems

e. Planning

- (1) Plan for personnel mobilization
- (2) Plan for emergency requirements
- (3) Plan for growth

f. Recruiting and Separation

- (1) Provide nationwide recruitment
- (2) Conduct initial evaluation
- (3) Review involuntary separations
- (4) Process separation actions
- (5) Conduct requirements searches
- (6) Process entrance-on-duty actions

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- g. Assignment
  - (1) Assign initially and re-assign
  - (2) Hold new personnel for assignment
  - (3) Select
- h. Reporting
  - (1) Report payroll information
  - (2) Report personnel inventory
  - (3) Report staffing complement
  - (4) Report development complement
  - (5) Report gains and losses
  - (6) Report military roster
  - (7) Analyze reported data
  - (8) Make forecasts
- i. Review
  - (1) Review personnel recommendations
  - (2) Review officers on promotions
  - (3) Review separations
  - (4) Review office reorganization roster
  - (5) Approve and authenticate
  - (6) Review documents
- j. Records Maintenance
  - (1) Maintain rosters
  - (2) Maintain separations records

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- (3) Maintain personnel actions records
  - (4) Maintain periodic step increase records
  - (5) Maintain EOD records
  - (6) Maintain overseas service records
  - (7) Maintain personnel inventory
  - (8) Maintain retirement records
  - (9) Maintain promotions records
  - (10) Maintain LWOP records
  - (11) Maintain career service information
- k. Compensation
- (1) Record and initiate differentials
  - (2) Record and initiate special allowances
  - (3) Record and initiate reimbursement of DOD for military
  - (4) Initiate periodic step increase action
- l. Contracts
- (1) Contract for overt personnel
  - (2) Contract for covert personnel
  - (3) Contract for individuals
  - (4) Contract for consultants
- m. Training
- (1) Train for inter-agency programs
- n. Administrative Support
- (1) Maintain contact with military personnel

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(2) Provide secretarial services to CIA Career Council, Personnel Development Board, Supergrade Review Board, Agency Retirement Board, and Honor and Merit Award Board

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## APPENDIX D

## LIST OF FORMS

<u>Number</u>	<u>Title</u>
11	Catalog Description
11A	Catalog Description Work Sheet (white)
11A	Catalog Description Work Sheet (green)
20	Time and Attendance Report
20d	Time and Attendance Report (pink)
22	Travel Voucher
34-3	Administration Audit Difference Statement
44a	Purchase Order-Invoice-Voucher
45	Fitness Report
61	Appointment Affidavits
70	Printing Services Requisition
88	Requisition for Material and/or Services
88	Requisition for Material
88a	Requisition and Shipping Instructions for Supplies and Equipment
98	Supply Action Request
109	Security Check Officer List
128	Adjustment Voucher (To Adjust Incorrect Expenditure Charges and Credits)
133	Report on Budget Status

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<u>Number</u>	<u>Title</u>
170	Record of Unliquidated Obligations
183	Notice of Final Payment of Completed Contracts
194	Voucher Abstract
194a	Voucher Abstract-Obligations
201	Master Document Coding and Adjustment
224	Statement of Transactions
237	Official Routing Slip
238	Document Control
240	Courier Receipt and Log Record
282	Accounting by Individual for Advance
291	Shipping Document
293	Report of Overtime and Holiday Work Performed
377	Request for Security Clearance
390	Report of Inventory Adjustments
398	Statement of Personal History
456	Employee Statement of Earnings, Deductions, and Leave Balances
461	Miscellaneous Obligation Record
494	Notification of Transfer of Funds or Accounts
496	Request for Payment of Confidential Funds
513	Mailing Slip
536	Military Status Questionnaire
540	Travel Order

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<u>Number</u>	<u>Title</u>
560	Pay Change Notification
565	Schedule of Expenses & Obligations
595	Receiving Report
606	Confidential Funds Posting Voucher
610	Routing and Record Sheet
626	Entrance on Duty Notice
639	Cancellation of Applicant Processing
669	Analyst Record of Time Distribution
692	Document Control Register
764	Field Duty Status Report
835	Appointment Processing Record
930	Data Processing Project Work Order
971b	Report of Separations
992	Transmittal Control
1001	Payroll Control Register
1014-A	General Ledger
1015A	Allotment Ledger
1017G	Journal Voucher
1021b	Memorandum of Collection
1022	Schedule of Collections for Deposit
1034	Public Voucher for Purchases and Services Other Than Personal

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<u>Number</u>	<u>Title</u>
1070	Batch Cover Sheet
1075	Application and Claim for Home Service Transfer Allowance
1079	Statement of Account
1080	Voucher for Transfers Between Appropriations and/or Funds (Disbursement)
1098	Schedule of Canceled Checks
1099	U. S. Information Return for Calendar Year 1960
1107	Counter Check
1129	Reimbursement Voucher
1137	Leave Record
1145	Voucher for Payment Under Federal Tort Claims Act
1150 (GAO)	Record of Leave Data Transferred
1150	Notification of Personnel Action
1152	Request for Personnel Action
1159	Cash Journal
1164	Claim for Reimbursement for Expenditures on Official Business
1166	Voucher and Schedule of Payments
1173	Security Approval
1215	Voucher Register
1245	Replenishment Requisition
1245a	Replenishment Requisition (Continuation Sheet)

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<u>Number</u>	<u>Title</u>
1266	Mail Slip
1314	Transmittal Notice
1314a	Transmittal Notice
1315	Statement of Earnings and Deductions
1444	Contract-Order-Invoice
1451	Record of Overseas Service
1451a	Verified Record of Overseas Service
1458	Order-Award-Invoice-Voucher
1472	Nomenclature Coding Sheet
1598	Procurement Status
1679	Statement of General Accounts Balances
1707	Headquarters Property Turn-in Document
1733	General/Subsidiary Ledger
1733a	General/Subsidiary Ledger
1747	Position Control Register
1747A	Position Control Register
1748A	Personnel Status Report
1755	Miscellaneous Change Notice - Personnel Data Input
1787	Master File Adjustment
1788	Retirement Record Adjustment
1789	01-Individual Earnings Adjusted (Items 1 thru 21)
1789a	02-Pay This Period Add (Items 1 thru 22)

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<u>Number</u>	<u>Title</u>
1789b	03-Leave Adjustment (Items 1 thru 20)
1789c	04-Pay This Period Compute with Deductions (Items 1 thru 7) et al.
1850	Leave Adjustment Form
1855	Daily Utilization Record
1949	Administrative Audit Difference Statement
2806	Individual Retirement Record (Civil Service Retirement System)
2807-1	Register of Adjustments (Civil Service Retirement System)
W-2	Withholding Tax Statement
W-4	Employee's Withholding Exemption Certificate

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Unnumbered Forms

Batch Control Sheet

Cargo Recapitulation Sheet

Daily Utilization Report

DSR's and T&A's - Summary of Hours Reported

DSR Replacement Form

DSR Supplement

Finance Clearance Worksheet

Foreign Duty Data Sheet

Individual Contract Payment

Insurance Change Notice

Internal Register

Inventory of Vouchered Funds Accrued Costs

Leave Extract Form

Paper Tape Transfer Envelope

PCS Interim Leave Report

Requisition and Shipping Combination

Source Document Control

Summary Obligation Report

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PUBLIC LAW 863 - 84th CONGRESS  
CHAPTER 814 - 2nd SESSION  
S. 3897  
AN ACT

To improve governmental budgeting and accounting methods and procedures,  
and for other purposes.

Be it enacted by the Senate and House of Representatives of the  
United States of America in Congress assembled,

Government budget  
and accounting  
procedure.

AMENDMENTS TO THE BUDGET AND ACCOUNTING  
ACT, 1921

Sec. 1. (a) Section 201 of the Budget and Accounting Act, 1921

as amended (31 U. S. C. 11), is further amended by inserting "(a)" 64 Stat. 832.

after the words "Sec. 201. "; by changing subsection (a) to subpara-

graph (1); by adding after subparagraph (1) a new subparagraph "(2)

at such times as may be practicable, information on program costs

and accomplishments"; by changing subsections (b) through (j) to

subparagraphs (3) through (11), respectively.

(b) Section 216 of such Act, as amended (31 U. S. C. 24), is further

amended by inserting "(a)" after the words "Sec. 216. " and by adding 64 Stat. 834

the following new subsections:

"(b) The requests of the departments and establishment for appro-  
priations shall, in such manner and at such times as may be determined <sup>Cost-based bud-</sup> gets

by the President, be developed from cost-based budgets."

"(c) For purposes of administration and operation, such cost-based  
budgets shall be used by all departments and establishments and their

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subordinate units. Administrative subdivisions of appropriations or funds shall be made on the basis of such cost-based budgets".

AMENDMENTS TO THE BUDGET AND ACCOUNTING PROCEDURES  
ACT of 1950

Sec. 2 (a) The Budget and Accounting Procedures Act of 1950 is amended by inserting after section 105 thereof the following new section:

64 Stat. 834  
31 USC 847

"ACCOUNTING AND BUDGET CLASSIFICATIONS"

"Sec. 106. The head of each executive agency shall, in consultation with the Director of the Bureau of the Budget, take whatever action may be necessary to achieve, insofar as is possible, (1) consistency in accounting and budget classifications, (2) synchronization between accounting and budget classifications and organizational structure, and (3) support of the budget justifications by information on performance and program costs by organizational units".

(b) Section 113 of such Act (31 U. S. C. 66a) is amended by adding at the end thereof the following new subsection:

64 Stat. 836  
70 Stat. 782  

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70 Stat. 783

"(c) As soon as practicable after the date of enactment of this subsection, the head of each executive agency shall, in accordance with principles and standards prescribe by the Comptroller General, cause the accounts of such agency to be maintained on an accrual basis to show the resources, liabilities, and costs of operations of such agency with a view to facilitating the preparation of cost-based budgets as required by section 216 of the Budget and Accounting Act, 1921, as amended. The

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accounting system required by this subsection shall include adequate monetary property accounting records as an integral part of the system."

(c) Section 118 of such Act is amended by inserting "113 (c)" after the words "section 111". 64 Stat. 837  
31 USC 65a.

### SIMPLIFICATION OF SYSTEM FOR SUBDIVIDING FUNDS

Sec. 3. Section 3679 (g), Revised Statutes, as amended (31 U. S. C. 665 (g)), is further amended by adding at the end thereof the following sentence: "In order to have a simplified system for the administrative subdivision of appropriations or funds, each agency shall work toward the objective of financing each operating unit, at the highest practical level, from not more than one administrative subdivision for each appropriation or fund affecting such unit."

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## APPENDIX F

## EVOLUTION OF DD/S COMPUTER SYSTEM

A brief history of the development of the computer facility at the Agency is included here for reference. Since its inception, the Agency has continually grown. Similarly to most organizations which originated during the war period or shortly thereafter, the Agency relied completely upon manual handling of its paper flow. The intervening years, however, have seen great changes in business data processing and what was done a few years ago with pencil and pen is now being done by the most advanced and complicated electronic devices known to man. As the Agency grew in personnel and as the importance of its role increased, it became readily apparent that it would be necessary to take advantage of the advanced mechanical and electrical equipment being placed on the market in order to fulfill its mission. The relatively simple transition from manual equipment to electrical accounting machine (EAM) equipment was done over the years in an efficient manner. By 1957 a major portion of the Agency's business applications were on electrical accounting machines. It might be appropriate to mention here that certain of the work had never gone onto accounting machines and never was intended to. However, a great stride had been taken in the forward direction; and, like any organization of a similar size, the agency was happy with its installation. During the year 1957, it became apparent, however, that the work of the Agency and the personnel available made it necessary to think of still more advanced

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ways of handling business data in addition to, or as a substitute for, their relatively slow EAM capabilities.

The first area of major investigation of these new advanced electronic data processing machines was in and for the Office of Logistics. A management staff reporting directly to the Deputy Director of Support undertook the study. The study was completed, and a memorandum to the Deputy Director of Support (19 August 1957) entitled "Electronic Data Processing Feasibility Study of Supply Division, Office of Logistics" was forwarded. This memorandum contained recommendations submitted for the approval of the Deputy Director of Support and showed how an electronic data processing machine would be of use in the Office of Logistics. The report was very extensive. It contained much graphical information which made it easy to follow the system and to understand the scope of the study. Certain recommendations were made involving the changing of personnel, equipment, and methods. Also, the utilization of a random access type of small computer was recommended. Some exceptions were taken to this report by members of the Office of Logistics, and a written rebuttal was prepared. It is not intended here to dwell on the advisability of following the recommendations of this report. Suffice it to say that for some reason the recommendations to the Deputy Director of Support to provide a computer installation within the Office of Logistics was never carried out.

The Management Staff then turned its activities toward other computer areas of the company. Several more studies were carried out on the basis of their knowledge gathered from the Office of Logistic's report. As a

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result of these additional studies of the Management Staff, the present RCA 501 Computer was leased and placed in operation. The Management Staff completed its reports in June of 1958 and submitted a memorandum for the approval of the Deputy Director of Support on the subject of Electronic Data Processing. The study had been made to determine whether it was feasible and advisable for the Machine Records Division (MRD) to perform its work by the use of electronic data processing (EDP) equipment; and, if so, what type of electronic computer should be installed. Studies were made in the Office of the Comptroller and in the Office of Personnel, but it was contemplated that the computer would be used widely throughout the entire Support component. Five computers were studied in detail; and as a result of this equipment study as well as some feasibility work within the two offices mentioned, the recommendation was made to the Deputy Director of Support that a Datatron Computer be purchased and that the Management Staff be the group to operate it and do the detailed systems study work necessary for a computer installation of this type. These recommendations were never followed; and about a year later, on the 20th of May, 1959, another memorandum for the Deputy Director of Support via the Comptroller on the subject of electronic data processing was submitted by the Management Staff. By this time the Management Staff had formed a feasibility team to do the computer study, and the problem assigned them was to determine which electronic system should be acquired to do the work of the then existing Machine Records Division (MRD). Most of the members of the feasibility team were from the Management Staff. However, there were

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two additional members from the Office of the Comptroller and one additional member from the Office of Personnel. This study was conducted in the Office of Personnel and in the Office of Logistics and also in the Payroll and General Accounting areas of the Office of the Comptroller. As a result of this study, it was recommended, to the Deputy Director of Support, that an RCA 501 Computer be obtained on a lease basis as quickly as possible and that all work of a business nature be placed on it. The Office of the Comptroller approved the purchase of the computer with the reservation that they were unaware of the technical content of the report and were also technically unaware of the value and necessity for a computer. The Comptroller, however, stated that he would place his confidence in the feasibility team from a technical standpoint. The Comptroller, in addition, stated that he doubted very much that some of the statements within the memorandum of 20 May 1959, relating to dollar savings and personnel savings, were valid. The recommendations of this memorandum were approved by the Deputy Director of Support, and a contract was placed with RCA for the 501 Computer. From the beginning, there was an intention of obtaining the computer in a matter of six months and an intention of performing a complete system study to determine how the computer would operate, what problems the computer would handle, and how the whole system would integrate with an electronic data processing machine. In addition, it was intended that all of the work should be done within the Agency and that senior members of the MRD would be reassigned to an EDP (electronic data processing) branch. They would be the ones to

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program the computer and to handle the vast amount of manual work that would have to be done in order to get a data processing system into operation. Of these three intentions, only the last one was followed.

Usually computer systems evolve and are implemented in a sequence of steps. These can be grouped into the following:

- (1) Gain background knowledge
- (2) Plan the feasibility study
- (3) Plan the system study
- (4) Survey computer equipment
- (5) Recommend a course of action
- (6) Organize the data processing activity
- (7) Define jobs and select personnel
- (8) Evaluate performance and progress
- (9) Gain employee cooperation
- (10) Solve administrative problems, such as, whether to work a single shift, whether to rent or buy, personnel training, and so forth.

Of these parameters, the Agency has already accomplished or partially accomplished several of them as follows:

- (1) Background knowledge has been gained
- (2) The feasibility study has been planned
- (3) The computer equipment has been studied
- (4) A course of action has been recommended

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- (5) The data processing activities have been organized
- (6) Jobs have been defined
- (7) Personnel have been selected
- (8) Certain administrative problems have been dealt with

The major areas that have not been dealt with are:

- (1) A systems study
- (2) Performance and progress evaluation. This phase is now going on and this study is a part of it
- (3) The gaining of employee cooperation. Although this has been done to a great extent, it is still necessary to do much more in the way of developing proper employee relations with the computer system.

This is an after-the-fact status study done one year after installation of the computer. Therefore, some of the steps, like gaining background knowledge and feasibility studies, are things of the past. That is why these main areas have been limited to the three that must be improved now: the systems study, evaluation of performance and progress, and the gaining of employee cooperation. For a complete study, well-qualified and organization-oriented men who have Management's backing, authority, cooperation, and the ability needed to do the job should be used. Attention should be focused on the entire problem area. The whole should be considered before considering the individual parts. Also, it is usually best to pay attention to the requirements of the proposed system but not to go any deeper into the current system and procedures than is absolutely

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necessary. In the Agency's case, it was decided to make a one-to-one conversion of the electric accounting machine operations to put them on the electronic data processor. This course of action was highly recommended by RCA, but it is not the usual practice in the computer field.

There are many reasons why this type of conversion will not work. One is that ordinarily electric accounting machine procedures are not ideal for electronic data processing. In addition, when one tries to make a one-to-one conversion, he usually finds that the electric accounting procedures which have been in operation for several years are not up-to-date and are not what is desirable. Therefore, one falls into the trap of going deeper into the present system and procedures in order to straighten them out. One dissipates effort in trying to get them working so that it is possible to go to electronic data processing in the most efficient way. This point will not be dwelled upon, but it is generally conceded that it is fallacious to attempt this one-to-one conversion.

Another rule for systems study is to complete the systems design before considering what equipment is to be used. Of course, in this case, the computer has already been chosen and is in operation. It is not considered wise to recommend the removal of this computer at the present time. The systems study should go ahead on the basis of using the present computer which is well known within the operating groups. Once a workable system has been evolved, the Agency can go to a larger, more advanced computer of a different type, if essential. Of course, detailed programming cannot be done until the equipment is chosen; and, in this case, since the

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equipment was chosen from the start, this is no problem. Another rule for systems study is to have a trained operational group ready to start detailed systems work as soon as the decision has been made to order particular equipment. This step was not followed because of the fact that computer operating personnel were brought up from electric accounting machine areas and had to be trained from the start in electronic data processing. A future systems study will have to bear all of these factors in mind.

Most users rely heavily on machine manufacturers for advice concerning details of proposed new systems. However, views differ as to the value of manufacturers' advice with respect to these systems studies that are made prior to the selection of a particular make of equipment. The decision generally rests on the quantity and quality of systems talent available in the user organization. Users undertaking a computer project for the first time and lacking a staff with adequate training frequently seek advice of equipment manufacturers on systems planning and systems operations.

When a user chooses to seek system advice from manufacturers, he must decide whether to ask for help from one or more manufacturers and which ones. Of course, the source of help is obvious when the make of equipment to be used has already been decided upon. In other cases, however, more than one manufacturer can be asked to help with the systems study. Some companies that have asked for more than one manufacturer to give advice have found that it is not practical because the user study group has had to spend a great deal of their time educating various manufacturer

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representatives regarding user operations and the objectives of the computer project, and in some instances conflicting advice has caused confusion. However, the most satisfied users are those who are willing to put up with these disadvantages in order to be able to compare the various approaches suggested. Users seeking systems advice from machine manufacturers must also determine what kind of advice to seek. Of course, the amount of help that can be obtained is limited by the systems knowledge of the manufacturer's representatives and the amount of time the manufacturer can devote to one account. The manufacturer must be prepared to enter into the specific needs of the user. In the case of the Agency, where the needs are much different from many other businesses and Governmental operations, it is essential that a manufacturer, if he is to be relied upon, enter wholeheartedly into his portion of the task.

In the usual case, it is best not to expect the manufacturer's representatives to advise how a business should be operated or managed. Their advice can be sought as to information necessary regarding current and proposed systems and procedures but not regarding the detailed work involved in collecting the information unless they are given full access to the company and a complete background to the user's needs. They can appraise the relative potential of the various possible computer applications but cannot be expected to determine the basic procedures and the kind of data processing that will best fit the user's needs. It is necessary when working with these people to give them an accurate picture and flow charts of the present system and procedures. Once a determination of

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equipment and systems has been made, then the manufacturer's representatives should be called upon to give details on what equipment will fill the requirements. Also, once equipment has been selected, the manufacturer's representatives should be asked to participate actively in a development of details of the new system. Because of the competitive situation, most manufacturers at the present time are willing to supply as much service as requested and even to go beyond the usual bounds of salesmanship. In the case of the Agency, it is well known to industry that due to their large and vast operations there will be more and more computer operations. Therefore, many manufacturers are willing to give generously of their time to demonstrate the soundness of their thinking and their wares. There are several exceptions, and it is an observation that RCA is one of them. They are not astute in the sales picture and do not have the staff and sometimes the inclination to give the very best service that is specifically needed by an agency of this importance. Their work with various commercial firms may be acceptable; but even in these non-essential industries, there has been a great deal of dissatisfaction.

The computer was actually installed in October, 1960. At that time it was not ready for use and much more time and effort was put forth until it was considered ready to run about July of the following year, 1961. In the interim, however, a great deal of time and effort was spent at RCA's Service Bureaus and at the RCA factory to do debugging and to run

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typical programs. The intention of having a computer installed and ready to run in six months was very unrealistic and even in systems where there is an existing computer, a replacement within six months is considered to be a very short interval of time. The original report of May, 1959 stated clearly that it would be advisable to purchase a computer before doing an involved systems study. There are pros and cons on this statement. It certainly is easier to do a detailed study when one knows what computer is going to be used. However, on the other hand, it is not necessary to know what computer is going to be used in order to do a detailed systems study. A system, in general is largely independent of a computer and the usual procedure is to define the system by going into great details on what the systems needs are and what the specific system is. Then, with this systems study completed, the next step is to find machines that will function most effectively within this system. If a machine is available off the shelf it is well and good, but if not, it is often necessary to have a specific machine designed to fit that system. Be that as it may, it was decided to get the machine first then define the system. The machine was obtained, the RCA 501. The only conclusion that can be reached is that this machine was chosen because it was designed to function in a general business system. It has been pointed out in this study that the Agency's business system corresponds very closely to other business systems. The major drawback in this original determination to buy a machine without further

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study was the fact that there are enough points of difference between the Agency's system and normal systems to warrant investigation of additional computers besides the 501. The Agency's system has a lot more input and output than most systems. There are certain specific limitations upon how some of the work is done. Without going into it deeply at this point, it might be mentioned that in the past the Agency has been using a printer that has a bill-feed attachment. This was not even taken into account when the new EDP system was leased and as a result there is no bill-feed attachment on the EDP equipment. Therefore, this function could never go over to EDP as was originally stated. There are many more instances that make it unrealistic to think that the 501 computer could take over completely the DD/S business requirements. The second intention, that of doing the systems study, was never carried out. It has been mentioned in many of the written reports of the Feasibility Staff that it is absolutely necessary to do a complete systems study with block diagrams, management interviews, and user's reactions, but this was never done. The Feasibility Staff must be given credit for pointing this out, however, it is obvious that this course of action, although absolutely vital for a big system of this sort, was never carried out. Most of the problems now encountered stem from this oversight. The quick choice of an RCA 501 computer is not a limiting factor. Although, at present, there are many better computers for this system one can only give the Feasibility Staff credit for choosing this one, because at that time, 1957, there were not

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many computers actually available.

The third intention was carried out. Senior members of the Electronic Accounting Machine Branch of the Machine Records Division were reassigned to the Electronic Data Processing Branch and did attend schools to learn how to program. These people have been putting forth almost superhuman effort ever since, and have become quite proficient in machine programming the RCA 501. They have done a good job and, as stated before, have carried a tremendous load. Of course, they were unable to make an immediate transition from EAM to EDP because not one of them had had any previous experience with electronic data processing. During the first six to eight months of the computer's installation, it was necessary for these people to familiarize themselves with the machine and with the programming. During this period, there was quite a bit of chaos created because the Electric Accounting Machine Branch was short of the number of people who had left and the Electronic Data Processing Branch was unable to fulfill its work assignment because of the inexperience of the people assigned. Through hard work and learning by experience, the computer complex has evolved to a point where there are many good men associated with it. However, they have been unable to effectively keep in touch with the operating components because of the one hundred per cent devotion of their time in keeping up with the computer requirements.

The usual procedure in obtaining a computer is to contract for it

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years in advance and, in the interim before its delivery, train the user's personnel in its use, its programming, and the system. Another approach is to contract for a computer and contract for outside help to develop the system and the programming. The latter alternative means that a computer can go into operation sooner. While the contractor is getting the computer to a workable stage in a hurry, it is feasible to send one's own personnel to various schools. This allows them to spend one hundred per cent of their time in studying and learning. At the end of this period, there is an optimum time when this computer can be turned over to these people. In the case of the Agency, it was decided to do everything at one time, that is, train the people and get the computer into operation simultaneously. This, of course, led to great difficulties because certain portions of the system that were to go into operation were unable to do so effectively because the people had not been adequately trained. This, however, was a management decision and the users should have been apprised of the fact that optimum results would not be available immediately. The whole system could only function effectively after the growing period was over. It is apparent that the users are not fully aware of what a computer will do and how their system must evolve about it. The need for apprising the users of what a computer system is, and how they fit into it, has been considered in section VIII of this study.

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DANIEL MANN JOHNSON & MENDENHALL

3325 Wilshire Boulevard, Los Angeles 5, California DUinkirk 1-3663

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