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Technical Report

AD 489 998

(6) MECHANIZATION STUDY
OF THE MECHANICAL PROPERTIES
DATA CENTER, TRAVERSE CITY, MICHIGAN

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ABSTRACT

The Data Center employs the IBM 1440 in the search and retrieval of its data files. The files are maintained on EAM cards but are to be converted to disk during a search. The Center formerly utilized the IBM 101 Statistical Machine and the IBM 870 Document Writing System. The Center has data relating to more than 1/2 million material tests of metals and plastics. Use of the computer has permitted the Center to cope with the increasing demand on its services without increasing its budget by the same order of magnitude.

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I. SUMMARY

I. SUMMARY

The Mechanical Properties Data Center employs mechanized processes in the storage and retrieval of its data files which consist of the mechanical properties of metals and plastics. Data are stored on EAM punched cards and searched using the Center's IBM 1440 computer which was installed in late 1965. Prior to that time, processing was done with EAM techniques based upon the IBM 870 Document Writer system (for output formatting) and the IBM 101 Statistical Machine (for retrieval by selective file searching).

The Center has stored data relating to more than a half million material tests which is currently growing at the rate of about 8,000 records per month. The major source of this information is in documents from DDC. In addition, original test records are received from some companies. The Center's Director considers a test lab report to be the ideal form in which to receive information. At present no attempt is made to include classified material.

The services of the Mechanical Properties Data Center are available free of charge to DoD, NASA, and their contractors. More that 60 queries are answered in a typical month. The largest number

handled in a single month was [redacted]. A typical search might produce 300 specimen tests from six different references and 10 references cited to documents that discuss the subject, but contain no data. Requests for information may be received by telephone, TWX, telegraph, or mail.

Figure 1 illustrates the flow of information to the Center.

ESTIMATED FLOW OF MATERIAL INFORMATION TO M.P.D.C. IN 1966

Item 4

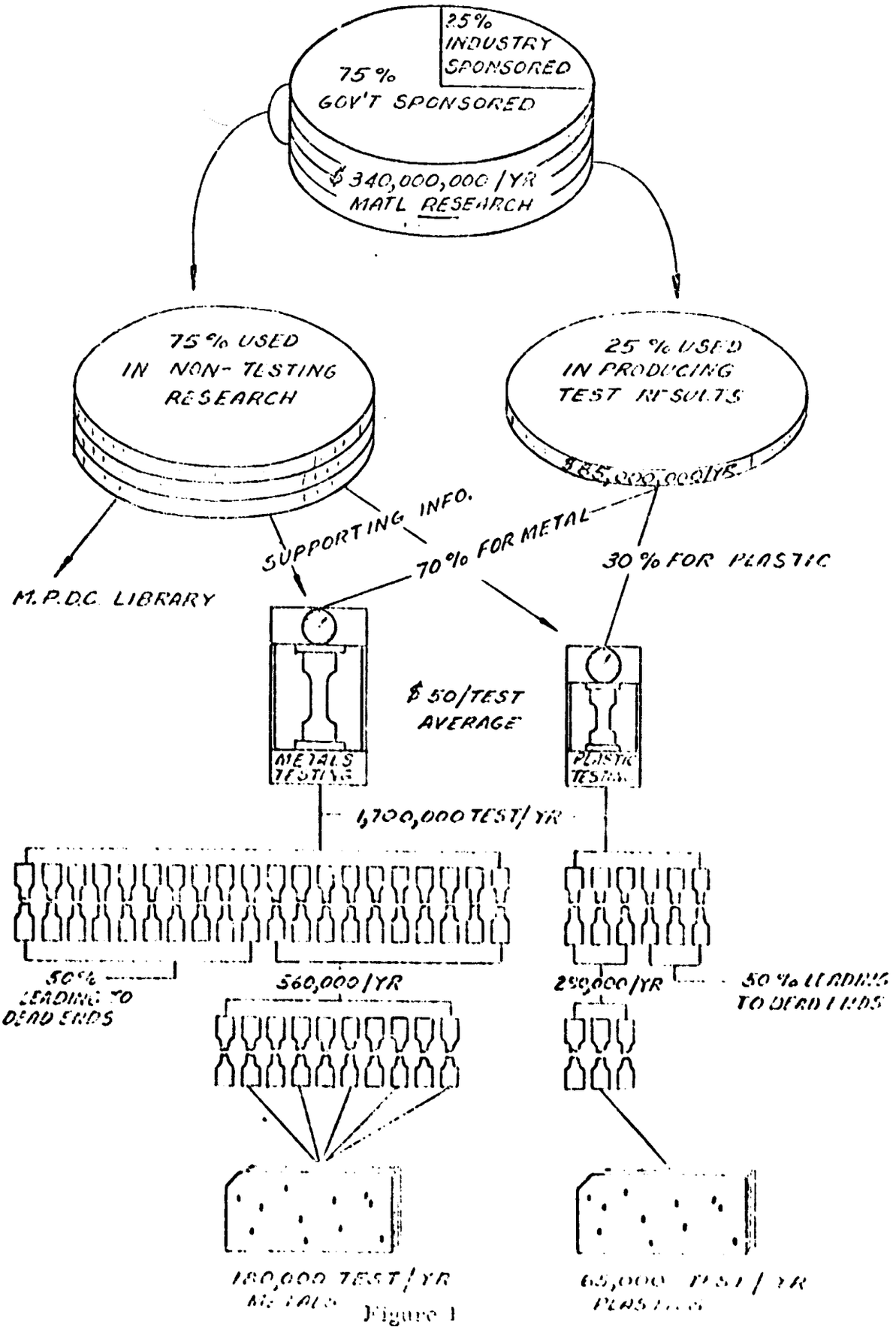


Figure 1

II. MECHANIZATION

II. MECHANIZATION

1. CHRONOLOGY

The Center was started in June 1959 with the award of a contract by the Air Force's Directorate of Materials and Processes, Aeronautical Systems Division. From the beginning, EAM punched cards were chosen as the storage medium. Retrieval of information and processing was done using electronic accounting machines, particularly the IBM 870 system and the IBM 101 Electronic Statistical Machine.

This arrangement was preferred to a computer because of problems associated with obtaining computer time and because of the difficulty of refining a search in mid-process through the data file. These disadvantages were considered greater than the limitation on the number of fields searchable per pass imposed by the IBM 101.

In 1965, after studying available systems, the Center acquired an IBM 1440 computer and developed programs to perform the searching and listing formerly done with the EAM equipment. No change, however, was made in the data storage format. The Center decided on the computer because they felt the level of work (both for the Center and

for Belfour-Stulen's other activities) justified the cost, and because the 1440 had the special feature of random access disk files that are easily changed.

Another reason for acquiring the computer was to lower the unit cost of searches, particularly to keep costs within the Center's budget. Since 1964, search requests have increased from an average of 12 per month to 60 per month (peak was 90 per month).

2. DESCRIPTION OF PROCESSES

(1) Input Procedures

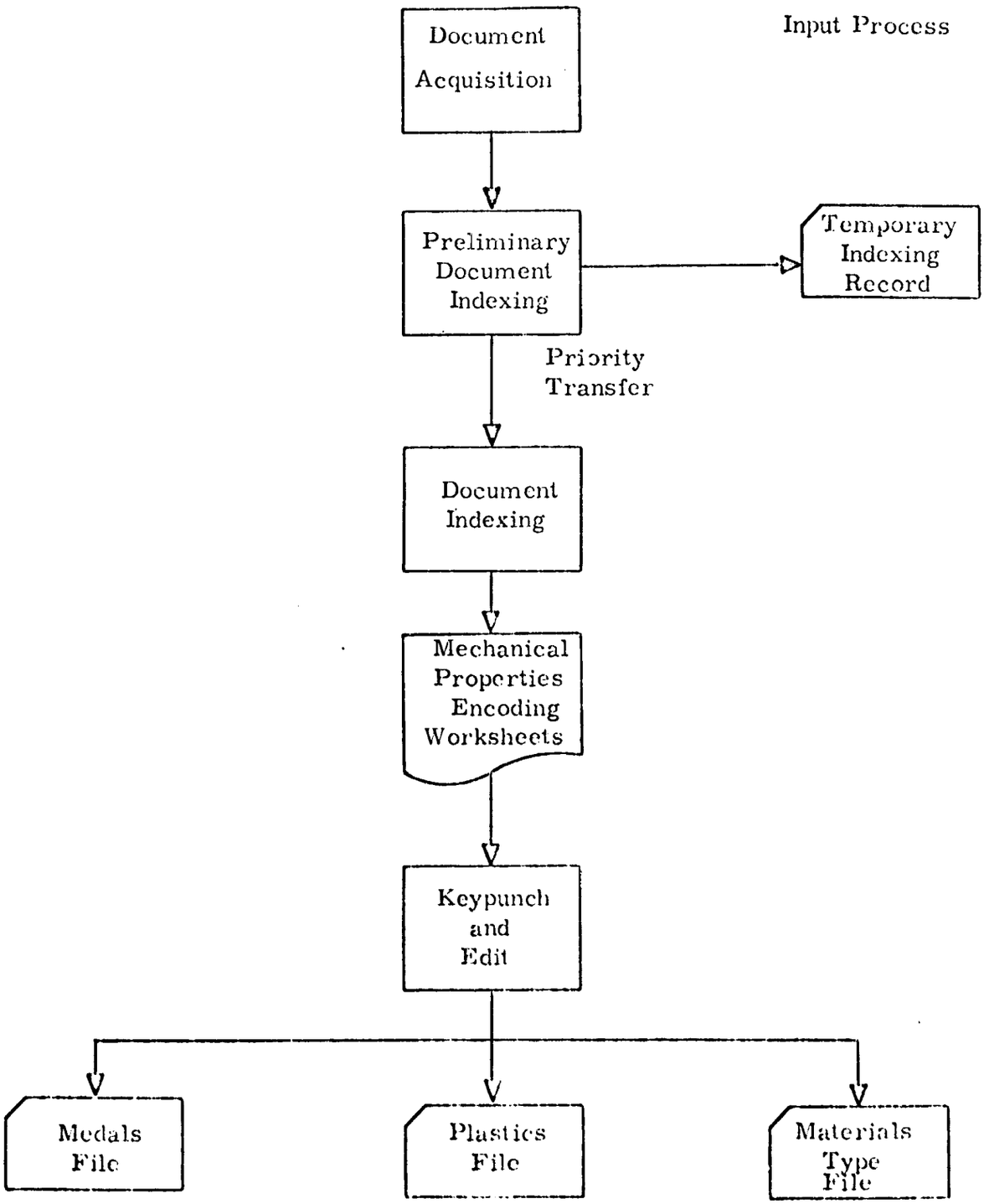
The primary source of information for the Center is documented numerical data from tests such as tensile tests, compression tests, fracture toughness tests, and creep tests. These data are entered on EAM punched cards and filed by test type within material type. The process is illustrated in Figure 2 and has the following procedure:

1. A document which includes test results is selected, checked to see if it is already in the files, and then ordered. At this time a title card for the document is prepared manually.

2. When the document is received, it is matched against the title card, and checked again for duplication. (This step is currently a manual process, but will be eventually converted to a computer process.)

FIGURE 2

Input Process



3. An accession number is assigned to the document. This is a five-digit number for a document containing information that directly relates to the collection. A four-digit number is assigned in the case of a document of a more general nature.

4. At this point, a preliminary indexing takes place in order to provide a means of retrieving the document's information before the document has been selected from the backlog and fully processed. This indexing will permit retrieval by means of one or more of the subject words most frequently mentioned in requests; e.g., alloy, property or test conditions. The information encoded and keypunched is material identification, test types, test conditions, title and author.

5. Documents are filed in numerical accession number order. They are selected for encoding into the data storage on a basis of subjects which are of greatest interest at the moment, or subjects in which the Center's stored data appears to be low.

6. A document containing information selected for routine processing goes to an encoder who extracts the information to be used and records it on encoding forms. Numerical data, such as actual mechanical properties, test temperature, etc. are directly keypunched (except for rounding off to the significant places consistent with desired accuracy) without encoding. Other information is assigned numeric or alphabetic symbols derived from a prepared code book. The code book is not a rigid thesaurus, and new codes are entered whenever necessary. Appendix A illustrates several of the work sheets which are used to format the information for keypunching.

There are two basic formats, A and B. The A format consists of the final test results together with a relatively complete summary of the material condition, manufacturing processes, test specimen configuration, specimen conditioning, and testing environments. All of this A format information is keypunched in a single card for each test. In most searches, this card is all that need be retrieved to obtain the principal information. Two examples of the A format worksheets are shown in Appendices A-1 and A-2. One is

labeled Format MTC-A for metals, tensile-creep test, A format. The other is labeled MBT-A for metals, bending fracture toughness test, A format.

The B format contains more information such as material composition and heat treatment. These cards are filed separately from the A cards and are related by a common serial number, which is a composite of the document accession number, the unit, set and specimen number. The number is discrete within test type (card columns 1-3), and by adding the test type code (columns 4, 5), it becomes unique.

The B format is divided into two types of cards, B and B_1, the worksheets for which are shown in Appendices A-3 and A-4.

One A type card will normally exist for each material specimen and one B type card for each unit of material. Furthermore, the B type express only the basic material and are independent of test types. Thus, the same B cards will normally exist for several A cards.

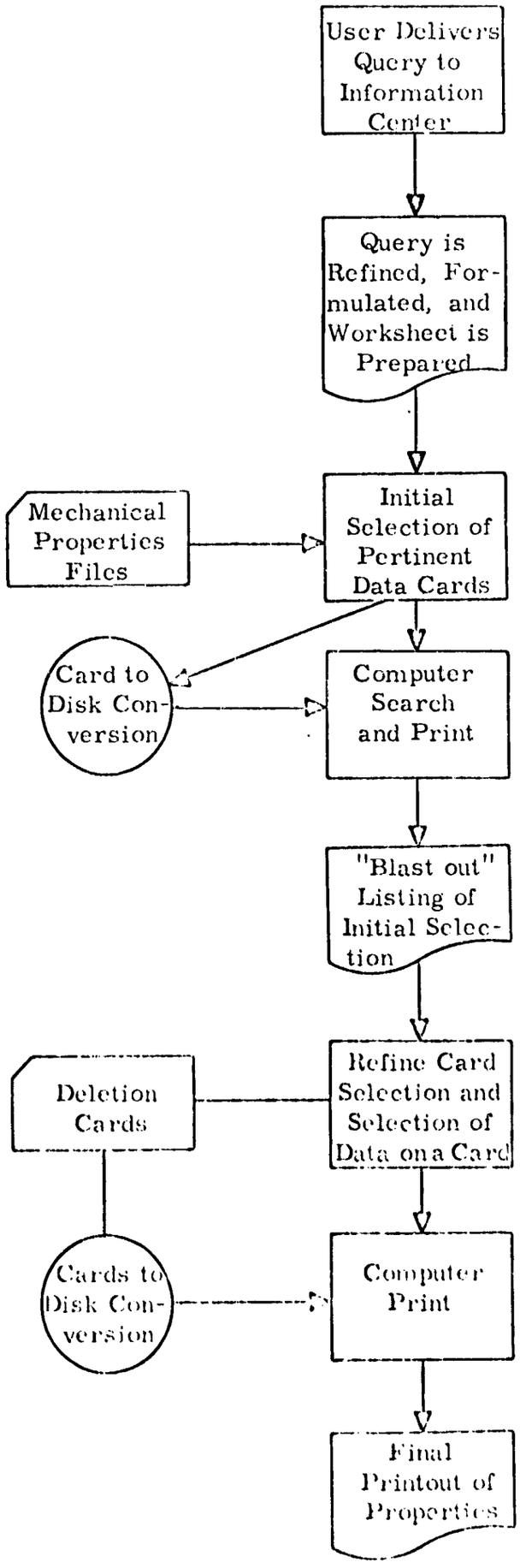
In addition to the A and B formats, there are supplemental card formats referred to as A_n cards and an "encoder's card." There is also a format variation specifically for fatigue tests (which is not discussed). The former are supplemental to the basic A card; e.g., A_1 is the first supplement to its A card, A_2 is the second, etc. Note that each of these A_n's relate to a specific A card and to no other. The "encoder's card" is an 8-1/2" x 11" form which is generated for each document to contain significant information not covered in the standard format. The A_n and encoders formats are shown in Appendices A-5 and A-6.

7. The encoded information is edited to catch obvious errors and interpretative discrepancies. The information is then keypunched on EAM cards and verified.

8. The cards prepared for the document are placed in a storage drawer at the keypunch station. When 8,000 to 10,000 cards are accumulated, a machine edit is made. The cards are sequenced by material and added to the already existing file. The inventory is modified, when necessary, by putting in delete cards.

FIGURE 3

Retrieval Process



In practice, the center maintains three files. Since questions come in by materials type, one file is organized by materials type. The second file is organized by test type within materials type. The third file is completely random. Which file is searched depends upon the characteristics of a query.

(2) Query Preparation and Retrieval Outputs (See Figure 3)

1. A request for information is refined and initially recorded on the Search Request Form illustrated in B-1. The codes for the various parameters are determined and the request is redefined on the coded search form illustrated in B-2. The system will accommodate a maximum of 10 OR conditions and 5 AND conditions within each of these OR conditions. (A NOT parameter is indicated by a flag in the NOT column of a particular AND condition.)

2. Attribute cards are then keypunched with the coded search parameters.

3. Either pertinent data cards are selected from the materials or test type files, or the first group of cards to be searched is obtained from the random file. The computer then searches the data cards for the desired parameters based on the material field (card column 5) and the test type field (card column 4) using the attribute cards to define the desired information. The printout of the first rough sort is referred to as the "blast-out". An example may indicate that further refining or narrowing of the search is necessary. The search is run again using deletion cards to remove undesired information and format heading cards to obtain the desired output form in the final printout. An example of a final printout is shown in Appendix C. The Center is equipped with a card-to-graph x-y plotter which, along with the computer, provides the Center a capability of producing data tabulations, listings, graphic displays and other pre-programmed printouts.

4. From time to time, personnel at the Center retrieve the entire inventory of a particular subject test type. This is published and distributed to members of the aerospace and defense industries as a means of acquainting them with the resources of the Mechanical Properties Data Center.

3. ACTIVITIES BEING PLANNED OR DEVELOPED FOR MECHANIZATION

A KWIC index of document titles may be produced for in-house use. The KWIC index would be used as a tool for locating the contents of documents before indexing them in depth and as a duplicate-checking device. It would also give, as a by-product, some thesaurus information.

All of the data are now stored on punched cards. The Center will probably not convert these to tape files because of the relative ease of updating the cards and the low rate of use of many of them. Converting to tape, however, may be considered if the search rate exceeds about 30 per day. Certain groups of cards may also be converted to tape to create a protable file. Another possibility being considered is to put card groups on disks in order to permit long Boolean-type searches.

III. PROGRAM SYSTEM DATA

III. PROGRAM SYSTEM DATA

The IBM 1440 Computer is used to perform data search and retrieval processes on the Center's data card file. This activity has been done, until recently, semi-manually using EAM equipment centered around the IBM 101 Statistical Machine and the IBM 870 Document Writing System.

1. MAJOR FILES

(1) Data Card File

There are three basic types of EAM cards (denoted by A, A_M, and B) used to record the data. The formats are fixed and are described in Appendix A. The cards are filed manually by materials class (column 7), and within alloys by test type (column 4). Related cards are linked by a reference number (column 1-3) which is discrete within a test type, and a test type (column 4) which, taken with the reference number, form a unique code.

(2) Master Code Disk Pack

The format of this disk file is shown in D-1. The file is used as a code dictionary that relate card types and attributes to numerical codes.

2. ROUTINES

System flow diagrams are shown in Appendices D-2 through D-5. These are described as they appear in the retrieval process in the following paragraphs:

(1) Attribute Cards to Disk

This routine is illustrated in D-2. An attribute card, containing the codes to be later used in searching the data cards, is read and the first attribute is placed in main memory. Next the Master Code Disk Pack is searched for the code strings that relate to the attribute. These are then added to the main memory. This process is iterated for all attributes.

(2) Data Card to Disk

D-3 illustrates the routine. To begin, the Master Code Disk Pack is replaced by a Scratch Disk Pack. The first data card is then read and tested for the desired attribute codes. As these are located, the attribute code is flagged with word marks in the main memory and the corresponding data are written on the scratch disk. This process is iterated until all data cards are read.

(3) End of Job Routine

This routine is illustrated in Appendix D-4. The last sector of the scratch disk that is used is recorded on the trailer sector of the scratch disk. The scratch disk now consists of all of the desired attribute codes with word marks flagging those which were encountered on the data cards. The scratch disk is then sorted, becoming the Organized Work Pack.

(4) Blast Out Routine

This routine is illustrated in Appendix D-5. The Organized Work Pack is then run with heading cards, and the Master Code Pack, and printed out. The heading cards identify the output format and the Master Code Pack supplies the alphabetic descriptions corresponding to the attribute codes.

(5) Final Report Routine

This routine is shown in Appendix D-6. Following a review by the project engineer, the desired data deletions and format instructions are keypunched. These are run with the final report printout and x-y plotting cards (if needed).

IV. EQUIPMENT, COSTS, AND EVALUATIONS

IV. EQUIPMENT, COSTS, AND EVALUATIONS

1. EQUIPMENT

IBM 1440 Computer:

- Central Processor with 8K character core memory
- 2-Model 131 Disk Storage Drives
  (Each disk file has 20,000 addressable locations, 100 characters per address, 7 bits per character.)
- Model 1442 Card Read Punch (400 cpm)
- Model 1403 High Speed Printer (340 lines per minute)

EAM Equipment:

026 Card Punch

047 Tape to card converter

083 Sorter with sort suppression

056 Verifier

053 Collator

IBM 870 Document Writing System:

Mosely X-Y Plotter with model 30A card translator connected to IBM 514 Reproducing Punch. (Reads 6 card columns per data print at 50 cards per minute.)

The following EAM equipments are to be eliminated with the introduction of the 1440 computer:

101 Electronic Statistical Machine

602 Calculating Punch

834 Control Unit

866 Non Trans. Typewriter

2. COSTS

Equipment Monthly Rental:

1440 Computer including processor, disk control, console, etc. - $1,800

1442 Card Read Punch - $445

1403 Printer with 1446 Control - $1,040

1311 Disk Storage Drives (2 units) - $745

083 Sorter with Sort-Suppression - $112

026 Printing Key Punch - $60

101 Electronic Statistical Machine - $275

602 Calculating Punch - $245

834 Control Unit - $124

866 Non Trans. Typewriter - $35

Development:

The Center has been developing its system of data storage and retrieval since its establishment in June, 1959. The recent computer program development was performed by the Center's full time program systems engineer who has spent approximately 2,000 man-hours developing it.

3. FACILITY'S EVALUATION

Experience has indicated to the Center that the cost equivalence point between computer and eam searching is about three to four searches per day. Beyond this rate, the EAM system becomes increasingly cumbersome to the point of impracticability.

The cost of an individual search is not directly related to the number of cards involved. Output form varies, and Data Center personnel review displays and references for each search in varying depth, depending on user requirements.

Both the previous EAM system and, to a greater extent, the present computer system permit the manipulation of data taken from many sources into various formats using a variety of test parameters. This flexibility in relating data gives the Center a capability of pseudo-testing.

Earlier computers were not suitable for the Center because of the long linear tape files and corresponding long search time that would have been required. The present computer has a random-access, high capacity disc memory which avoids this problem and has the additional advantage of simple disc file changing.

The various outputs of the Center have been intentionally restricted to requested information and a few published reports which are for the purpose of publicizing and stimulating the use of the Center. This restriction is due to the Center's policy "not to contribute to the volume of published literature competing for the attention of the technical community".

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APPENDIX A

EXAMPLES OF WORKSHEET FORMATS

1 2 3	4 5 6	7 8 9	10 11 12	13 14 15	16 17 18	19 20 21	22 23 24	25 26 27	28 29 30	31 32 33	34 35 36	37 38 39	40 41 42	43 44 45	46 47 48	49 50 51	52 53 54	55 56 57	58 59 60	61 62 63	64 65 66	67 68 69	70 71 72	73 74 75	76 77 78	79 80	Reference Number	Code	Notes	
0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0				
																											Test Type	M1.2A	-	
																											Mat. Type	M1.3A	-	
																											Material Identification	M1.4A	1	
																											Mat. Design	M1.5A	-	
																											Unit No.	-	1	
																											Set No.	-	1	
																											No.Spec./set	-	1	
																											Specimen No.	-	1	
																											Melt Pract.	M2.1A	3,4	Field 1.0
																											Prim. Opn.	M2.2A	3,4	
																											Second. Opn.	M2.3A	3,4	
																											Heat Treat.	M2.4A	3,4	
																											Surf. Treat.	M2.5A	3,4	
																											Surf. Finish	M2.6A	3,4,6	
																											Spec. Config.	M2.7A	3,4	
																											Spec.Th. x 10	-	2,3,4	
																											Spec. Fabric.	M2.9A	3,4	
																											Notch Config.	M2.10	3,4	
																											Notch Fac.	-	A,3,4	
																											Pre-test Condition	M3.1A	3,4	Field 3.0
																											Pre-test Cond. Amount	-	2,3,4 5 & 6	
																											Units	M3.3A	3	
																											Pre-test Cond. Time	-	2,3,4 & 6	
																											Type Hard.	M4.1A	3,4,6	4.0
																											Hard./100	M4.2A	2,3,4 & 6	
																											Orient. - Ld.	-	3,4,6	Field 5.0
																											Rate Units	M5.2A	3,4	
																											Test Rate	-	2,3,4 & 6	
																											Environ.& Unt.	M5.4A	3,4	
																											Environ. Amount	-	2-6	
																											Applied Stress, ksi	-	2,3,4 & 6	Field 6.0
																											Time to Rupture or T.E.	-	2,3,4 & 6	
																											Multiplier	6.3A	3,4	
																											Gage Length	6.4A	3,4	
																											% Elong. @R.T.	-	2,3,4 & 6	
																											% Red. Area @ R.T.	-	2,3,4 & 6	
																											Ld.&Temp. Seq.	6.7A	3,4	
																											Type,Units,Basc	6.8A	3,4	
																											Deformation @ Test Med	-	2,3,4 & 6	
																											Time to Temp.	-	2,3,4,6	
																											Fail Desc.	6.11A	3,4	
																														7.2
																											Cond A Indica.	-	MA	

PROGRAM ETC-A PROGRAMED BY DATE CHECKED BY PAGE 62

APPENDIX A-2

Field	Column	Format	Item	Code	Rules
Field 1.0	1	000	Reference Number	M1.1A	1
	4	00	Test Type	M1.2A	-
	6	0	Mat. Type	M1.3A	-
	7	000	Material Identification	M1.4A	1
	10	0	Mat. Design.	M1.5A	-
	11	00	Unit No.	-	1
	13	00	Set No.	-	1
	15	00	No.Spec./set	-	1
	17	00	Specimen No.	-	1
Field 2.0	19	0	Melt. Pract.	M2.1A	3,4
	20	0	Prim. Cpn.	M2.2A	3,4
	21	00	Second. Cpn.	M2.3A	3,4
	23	00	Heat. Treat.	M2.4A	3,4
	25	00	Surf. Treat.	M2.5A	3,4
	27	00	Surf. Finish	M2.6A	3,4,6
	29	00	Spec. Config.	M2.7A	3,4
	31	00	Spec.Th. x 10	-	2,3,4
	33	00	Spec. Fabric.	M2.9A	3,4
	35	00	Notch Config.	M2.10A	3,4
	37	00	Notch Fac.	-	A,3,4
Field 3.0	39	00	Pre-test Condition	M3.1A	3,4
	41	000.	Pre-test Cond. Amount	-	2,3,4 5 & 6
	44	0	Units	M3.3A	3
	45	0.0	Pre-test Cond. Time	-	2,3,4 & 6
4.0	47	0	Type Hard.	M4.1A	3,4,6
	48	00	Hard./100	M4.2A	2,3,4 & 6
Field 5.0	50	00	Orient. - Ld.	-	3,4,6
	52	0	Rate Units	M5.2A	3,4
	53	000.	Test Rate	-	2,3,4 & 6
	56	00	Environ.& Unt.	M5.4A	3,4
	58	000.	Environ. Amount	-	2-6
Field 6.0	61	0	Ld.Meas.&Units	6.1A	3,4
	62	000.	Max. Load Measurement	-	2,3,4 & 6
	65	000.	Ld. Measurement @onset of Fract.	-	2,3,4 & 6
	68	00.	Deflection @Max. Load	-	2,3,4 & 6
	70	00.	Deflection @ onset of Fract.	-	2,3,4 & 6
	72	0	Index Desc&Un.	6.6A	3,4
	73	00.	Toughness Index	-	2,3,4 & 6
	75	0	Fract. App&Unts	6.8A	3,4
	76	00	Fract.App.Meas.	-	2,3,4 & 6
	78	0	Fail. Desc.	6.10A	3,4
7.0	79 80	0 0	Card A Indic.	/	NA

FORMAT MET-A ENCODED BY ____________ DATE ____________ CHECKED BY ____________ PAGE ______ OF ______

3 CARD

Cols	Reference Number	Code M1.1A	Note	Field
1-3			1	1
4-5	Unit No.	-	1	
6	Mat. Type	M1.3A	-	2
7-12	Material Identification	M1.4A	1	
13-15	Mat. Design.	M1.5A	-	
16-17	Mat. Form	M1.6B	3,4	
18-19	Element	M2.0B	1	3
20-24	% Weight	-	3,4 6	
25-26	Element	M2.0B	1,3	
27-31	% Weight	-	3,4 6	
32-33	Element	M2.0B	1,3	
34-38	% Weight	-	3,4 6	
39-40	Element	M2.0B	1,3	
41-45	% Weight	-	3,4 6	
46-47	Element	M2.0B	1,3	
48-52	% Weight	-	3,4 6	
53-54	% Red. Thick.	-	2-6	
55-57	Start Temp. Red. °F/10	-	2-6	
58-60	Fin. Temp. Red. °F/10	-	2-6	
61-62	Grain Size	M4.1B	A,3	4
63	O.M.P.A.	M4.2B	-	
72-73	Density x 10	-	2,3,4	5
74-75	Principal Test	M1.2A	-	6
76-77	Other Tests	M6.2B	-	
78-79	Card Indicator	-	-	7
80				

APPENDIX A-4

B₁ CARD

Field	Item	Code	Rule	Card Col.	Format
Field 1.0	Reference Number	M1.1A	1	1	000
	Unit Number	-	1	4	00
	Mat. Type	M1.3A	-	6	0
	Material Identification	M1.4A	1	7	000
	Mat. Design.	M1.5A	-	10	0
2.0	Ht. Treat Type	2.1B1	3,4	11	00
	As Rec. Cond.	2.1B1	3	13	00
Field 3.0	Medium	3.1B1	3	15	0
	1st Temp. °F/10	-	2,3,4 5,6	16	000.
	Time @ Temp.	-	3,6	19	0.0
	Multiplier	3.4B1	3	21	0
	Rate or Quench	3.5B1	3	22	0
	Medium	3.1B1	3	23	0
	2nd Temp. °F/10	-	2,3,4 5,& 6	24	000.
	Time @ Temp.	-	3,6	27	0.0
	Multiplier	3.4B1	3	29	0
	Rate or Quench	3.5B1	3	30	0
	Medium	3.1B1	3	31	0
	3rd Temp. °F/10	-	2,3 4 5,& 6	32	000.
	Time @ Temp.	-	3,6	35	0.0
	Multiplier	[illegible]	3	37	0
	Rate or Quench	3.5B1	3	38	0
	Medium	3.1B1	3	39	0
	4th Temp. °F/10	-	2,3 4 5 & 6	40	000.
	Time @ Temp.	-	3,6	43	0.0
	Multiplier	3.4B1	3	45	0
	Rate or Quench	3.5B1	3	46	0
	Medium	3.1B1	3	47	0
	5th Temp. °F/10	-	2,3,4 5,& 6	48	000.
	Time @ Temp.	-	3,6	51	0.0
	Multiplier	3.4B1	3	53	0
	Rate or Quench	3.5B1	3	54	0
	Medium	3.1B1	3	55	0
	6th Temp. °F/10	-	2,3,4 5,& 6	56	000.
	Time @ Temp.	-	3 6	59	0.0
	Multiplier	3.4B1	3	61	0
	Rate or Quench	3.5B1	3	62	0
	Opn. Name & No.	3.11B1	3	63	0
	Medium	3.1B1	3	64	0
	7th Temp. °F/10	-	2,3,4, 5,& 6	65	000.
	Time @ Temp.	-	3,6	68	0.0
	Multiplier	3.4B1	3	70	0
	Rate or Quench	3.5B1	3,6	71	0
	Opn. Name & No.	3.11B1	3	72	0
Field 4.0	Sp. Opns. & Units	4.1B1	3	73	0
	Amt. Sp. Opns.	-	3	74	0.0
	Sp. Opns. Seq.	4.3B1	3	76	0
				77	.00
5.0	Card Indicator	-	-	79, 80	0 0

FORMAT MB₁ ENCODED BY________ DATE________ CHECKED BY________ PAGE____ OF____

Field	Columns	Item	Reference	Notes
Field 1.0	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	Test Type	1.2A	.
	16 / 00	Unit No.	-	1
	18 / 00	Box No.	-	1
	10 / 02	Specimen No.	-	1
Field 2.0	12 / 000.	Applied Stress, ksi	-	2,3,4 & 6
	15 / 000.	Test Temp. °F/10	-	2,3,4 & 6
	18 / 0	Gage Length	2.3A3	3,4
	19 / 0	Instrument	2.4A3	3,4
	20 / 0	Time Units, Esc.	2.5A3	3,4
	21 / 00	Extension Load or Temp.	-	2,3,4 & 6
	23 / 000	Time	-	2,3,4 & 6
	26 / 0	Multiplier	2.7A3	3,4
	27 / 00	Deformation	-	2,3,4 & 6
	29 / 000	Time	-	2,3,4 & 6
	32 / 0	Multiplier	2.7A3	3,4
	33 / 00	Deformation	-	2,3,4 & 6
	35 / 000	Time	-	2,3,4 &6
	38 / 0	Multiplier	2.7A3	3,4
	39 / 00	Deformation	-	2,3,4 & 6
	41 / 000	Time	-	2,3,4 & 6
	44 / 0	Multiplier	2.7A3	3,4
	45 / 00	Deformation	-	2,3,4 & 6
	47 / 000	Time	-	2,3,4 & 6
	50 / 0	Multiplier	2.7A3	3,4
	51 / 00	Deformation	-	2,3,4 & 6
	53 / 000	Time	-	2,3,4 & 6
	56 / 0	Multiplier	2.7A3	3,4
	57 / 00	Deformation	-	2,3,4 & 6
	59 / 000	Time	-	2,3,4 & 6
	62 / 0	Multiplier	2.7A3	3,4
	63 / 00	Deformation	-	2,3,4 & 6
	65 / 000	Time	-	2,3,4 & 6
	68 / 0	Multiplier	2.7A3	3,4
	69 / 00	Deformation	-	2,3,4 & 6
	71 / 000	Time	-	2,3,4 & 6
	74 / 0	Multiplier	2.7A3	3,4
	75 / 00	Deformation	-	2,3,4 & 6
	77 / 0			
	78 / 0	Fail. Desc.	2.9A3	3,4
Field 3.0	79 / 0			
	80 / 0	Cl.Seq.Std.	-	3A

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ENCODERS CARD

APPENDIX A-6

REV. NO. _____ DEC. NO. _____

DOCUMENT DESCRIPTION -

Unit Number	Card Identity	Test Type	Field Number	Set Number	Specimen Number	See Report Page Number	Purpose

ENCODERS CARD ENCODED BY _____ DATE _____ CHECKED BY _____

ENCODERS CARD

REF. NO. _____ DEC.NO. _____

DOCUMENT DESCRIPTION -

Unit Number	Card Identity	Test Type	Field Number	Set Number	Specimen Number	See Report Page Number	Purpose

ENCODERS CARD

ENCODED BY _____ DATE _____ CHECKED BY _____

APPENDIX B

QUERY FORMATS

SEARCH REQUEST FORM

Search No._____

Requester_____ Date_____

Address_____ Reply by: Mail_____

_____ TWX_____

Phone_____ Extension_____ Phone_____

Material Description_____

_____

Material Fabrication_____

Test Type(s)_____

Specimen Description_____ Notched_____ Unnotched_____

Surface Treatment and/or Finish_____

Pre-test Conditioning_____

Test Environment_____ Temperature_____

Type Loading and/or Rate_____ Mean Stress_____

Additional Information and Suggested Displays_____

_____

_____

APPENDIX C

OUTPUT

TABLE VII

TABULAR OUTPUT - FATIGUE TEST DATA

SAE 4340 STEEL

REFERENCE NO.*	HEAT TREATMENT*	YIELD STRENGTH, KSI	ULTIMATE TENSILE STRENGTH, KSI	% ELONGATION IN 4 DIA.	SURFACE CONDITION*	SURFACE FINISH MICROINCHES, RMS	PRIMARY FABRICATION*	SECONDARY OPERATION*	SECONDARY OPERATION OR NOTCH FACTOR*	SPECIMEN TYPE*	CYCLIC SPEED, CPS	TEST TEMPERATURE °F ÷ 10	MEAN STRESS, KSI	ALTERNATING STRESS, KSI	FATIGUE LIFETIME	
009	19	147	159	15	68	10	4	51	51	11	038	008	075	075	4,500	
009	19	147	159	15	68	10	4	51	51	11	038	008	070	070	43,000	
009	19	147	159	15	68	10	4	51	51	11	038	008	065	065	120,000	
009	19	147	159	15	68	10	4	51	51	11	038	008	060	060	900,000	
009	19	147	159	15	68	10	4	51	51	11	038	008	058	058	2,500,000	
009	19	147	159	15	68	10	4	51	51	11	038	008	057	057	20,000,000	‡
009	19	147	159	15	68	10	4	51	51	11	038	080	065	065	2,200	
009	19	147	159	15	68	10	4	51	51	11	038	080	063	063	10,000	
009	19	147	159	15	68	10	4	51	51	11	038	080	060	060	18,000	
009	19	147	159	15	68	10	4	51	51	11	038	080	058	058	55,000	
009	19	147	159	15	68	10	4	51	51	11	038	080	055	055	140,000	
009	19	147	159	15	68	10	4	51	51	11	038	080	053	053	400,000	
009	19	147	159	15	68	10	4	51	51	11	038	080	051	051	1,500,000	
009	19	147	159	15	68	10	4	51	51	11	038	080	050	050	1,600,000	
009	19	147	159	15	68	10	4	51	51	11	038	080	047	047	2,800,000	
009	19	147	159	15	68	10	4	51	51	11	038	080	043	043	400,000	
009	19	147	159	15	68	10	4	51	51	11	038	080	041	041	18,000,000	‡
009	19	147	159	15	68	10	4	51	51	11	038	008	000	090	18,000	
009	19	147	159	15	68	10	4	51	51	11	038	008	000	090	25,000	
009	19	147	159	15	68	10	4	51	51	11	038	008	000	082	69,000	
009	19	147	159	15	68	10	4	51	51	11	038	008	000	076	85,000	
009	19	147	159	15	68	10	4	51	51	11	038	008	000	078	130,000	

‡ INDICATES RUNOUT

* CODED - SEE CODE SHEET

APPENDIX D

COMPUTER FILE STRUCTURE AND PROGRAM SYSTEM FLOW CHARTS

Remarks	Symbolic Address	1	5	10	15	20	25	30	35	40
						← CODE STRINGS				
						A	AF	A1	A2	A3
			000600		002600	003000	004600	005200	006800	007200
			CARD COLUMN HEADINGS		WORD MARK STRINGS					

TORAGE LAYOUT
11, 12, 21, 22, IBM 1311

Date

CODE DESCRIPTIONS

A2 A3 BB1

006 500
007 200
007 600
007 800
008 000

REF. NO. & TITLE DESCRIPTIONS

A CODE DESCRIPTIONS

AF " "

A1 " "

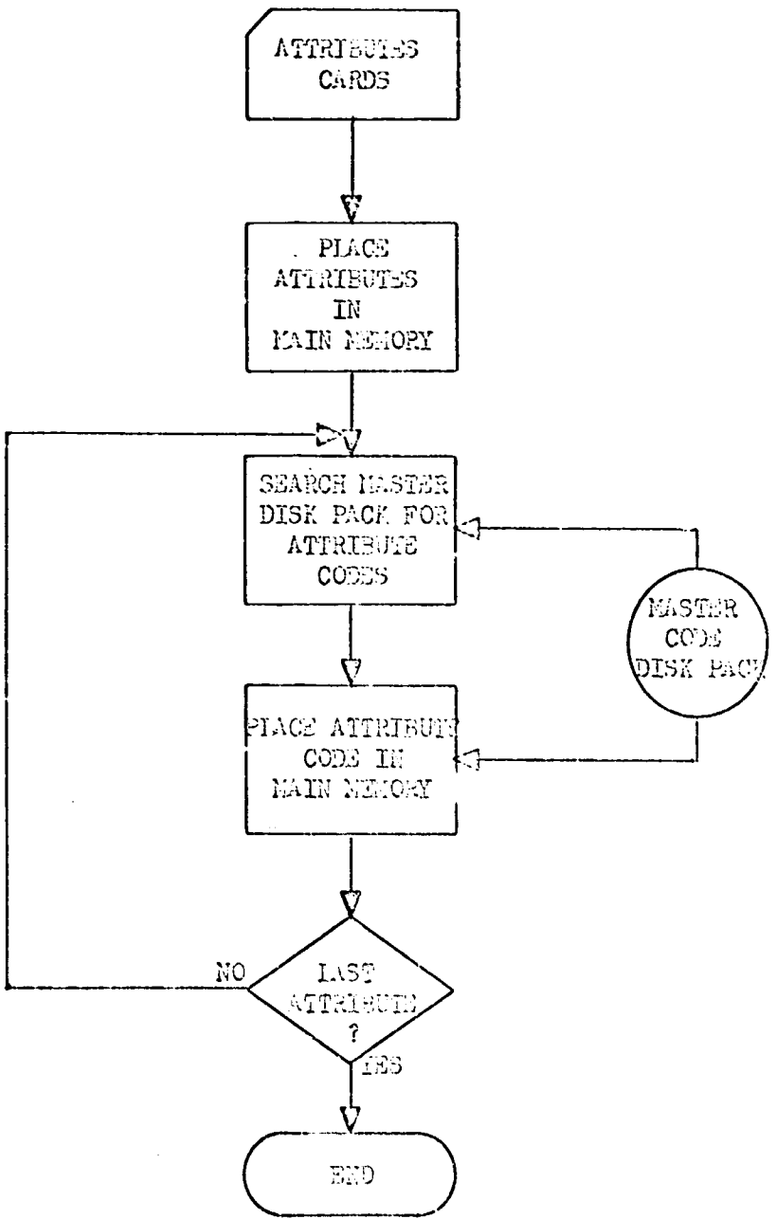
A2 " "

A3 " "

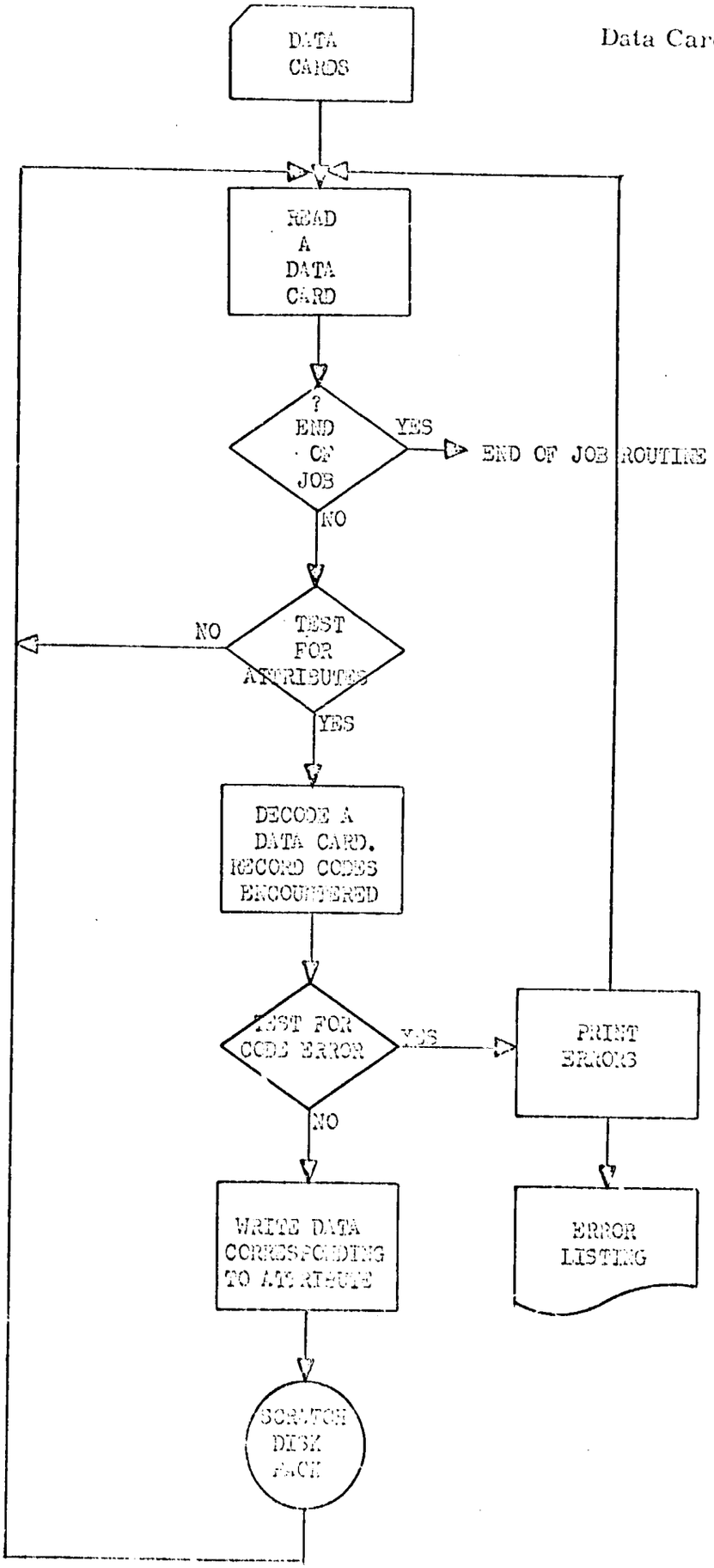
B " "

B1 " "

Attribute Card Input Routine

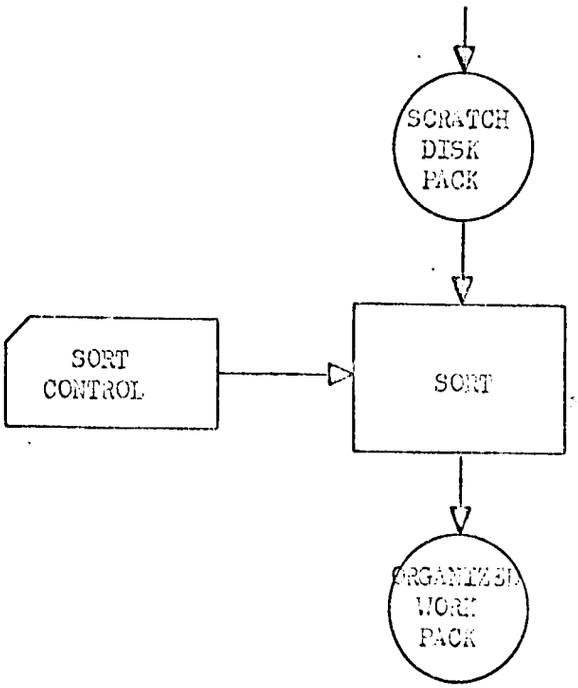


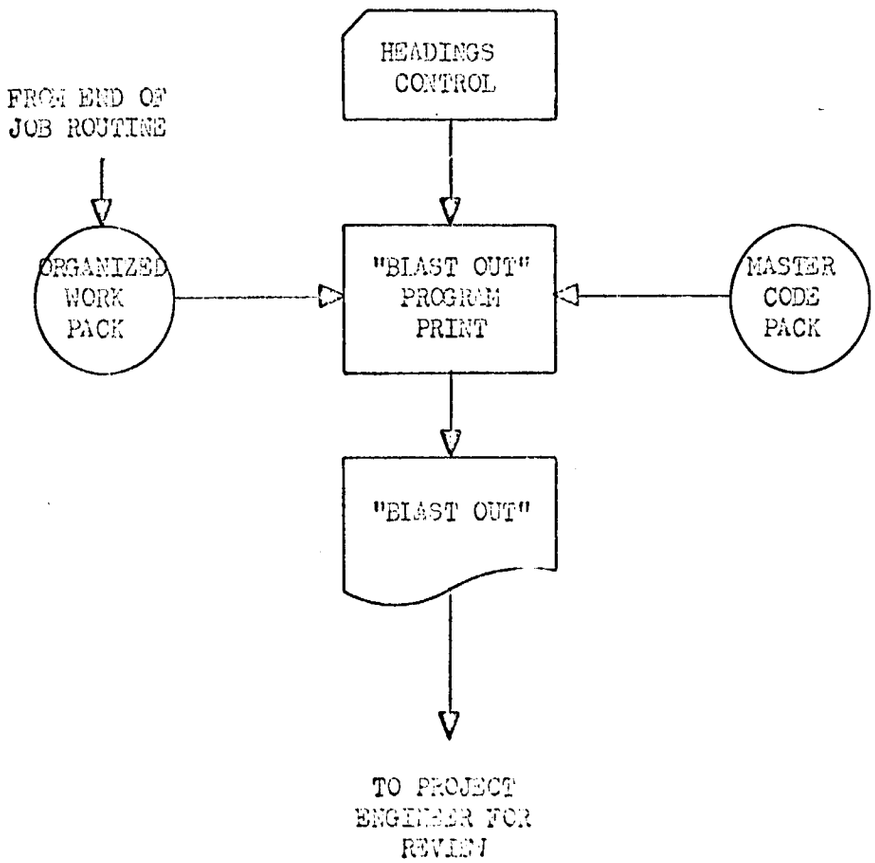
Data Card to Disk Routine

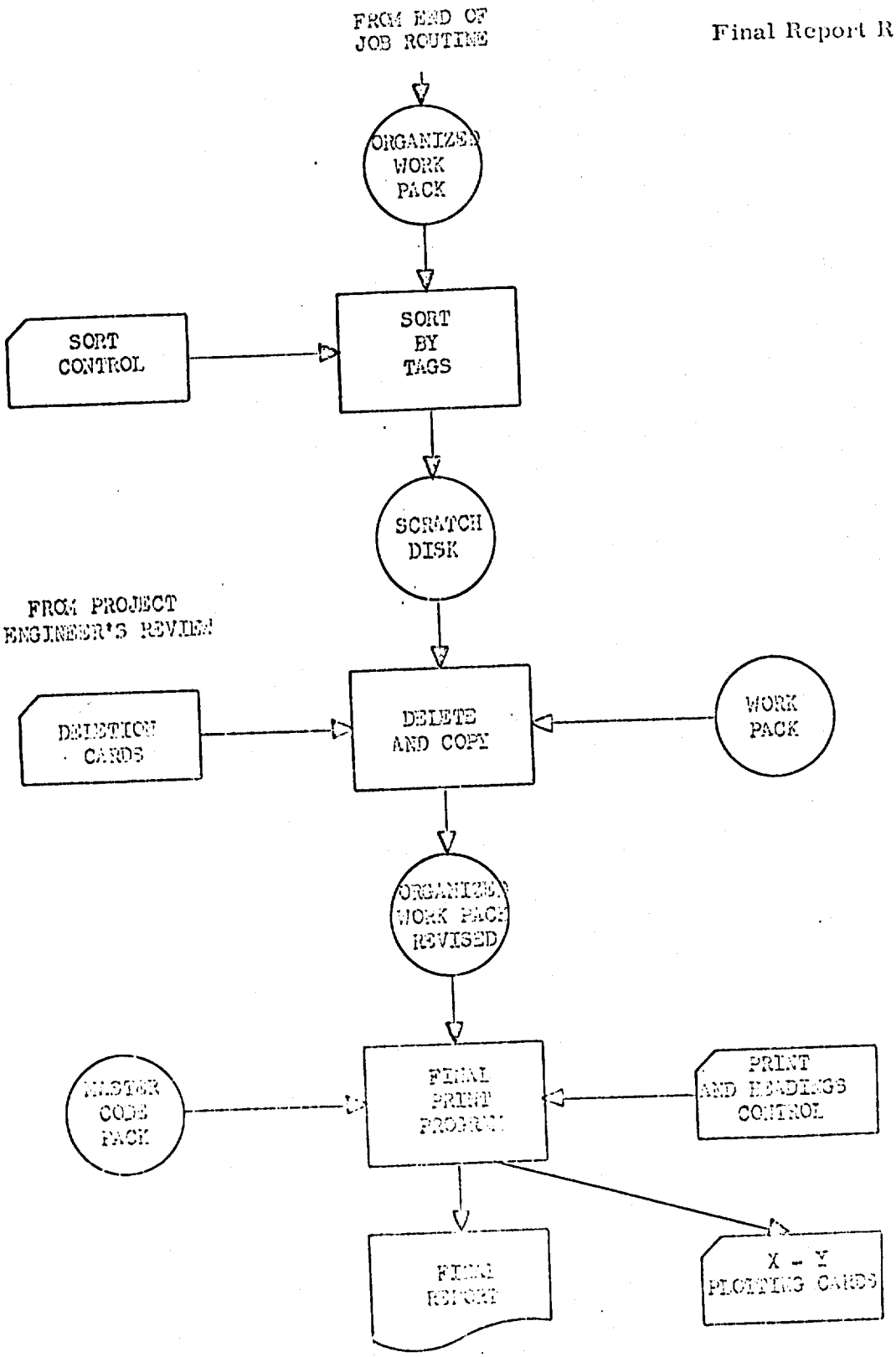


End of Job Routine

FROM CARD TO
DISK ROUTINE




HEADINGS CONTROL
FROM END OF JOB ROUTINE
ORGANIZED WORK PACK
"BLAST OUT" PROGRAM PRINT
MASTER CODE PACK
"BLAST OUT"
TO PROJECT ENGINEER FOR REVIEW


FROM END OF JOB ROUTINE
ORGANIZED WORK PACK
SORT CONTROL
SORT BY TAGS
SCRATCH DISK
FROM PROJECT ENGINEER'S REVIEW
DELETION CARDS
DELETE AND COPY
WORK PACK
ORGANIZED WORK PACK REVISED
MASTER CODE PACK
FINAL PRINT PROGRAM
PRINT AND HEADINGS CONTROL
FINAL REPORT
X - Y PLOTTING CARDS

Unclassified

Security Classification

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2b GROUP

3 REPORT TITLE

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4 DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final Report of on-site survey

5 AUTHOR(S) (Last name, first name, initial)

G. A. Kershaw, D. Crowder, J. E. Davis, E. G. Loges, E. Merendini, S. M. Thomas

6 REPORT DATE	7a TOTAL NO OF PAGES	7b NO OF REFS
September, 1966	48	6

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b PROJECT NO	
c	9b OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d	AD 489 998

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11 SUPPLEMENTARY NOTES	12 SPONSORING MILITARY ACTIVITY
None	Defense Supply Agency Defense Documentation Center Cameron Station, Virginia

13 ABSTRACT

The Data Center employs the IBM 1440 in the search and retrieval of its data files. The files are maintained on EAM cards but are to be converted to disk during a search. The Center formerly utilized the IBM 101 Statistical Machine and the IBM 870 Document Writing System. The Center has data relating to more than 1/2 million material tests of metals and plastics. Use of the computer has permitted the Center to cope with the increasing demand on its services without increasing its budget by the same order of magnitude.

DD FORM 1473

Unclassified

Security Classification

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Digital Computers						
Data						
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