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TECHNICAL MEMORANDUM

(TM Series)

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Users Manual for the Air
Force Computer Program
Development Center (AF/CPDC)

by

The CPDC Staff

1 April 1963

Approved

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TM-871/000/00
1 April 1963

Preface

PREFACE

The Air Force Computer Program Development Center (AF/CPDC) is established to provide data processing services to all individuals and/or organizations that are specified by the Air Force Space Systems Division (AFSSD), and who are associated with the Satellite Control Network. To help accomplish this mission, System Development Corporation (SDC) has prepared these procedures to give all users effective and efficient data processing service. The purpose of this document is to outline CPDC services and procedures.

If, at any time you feel that these services are inadequate for your planned application, or that any of these procedures are unsatisfactory for the accomplishment of your task, please contact the CPDC Group Head.

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CHAPTER 1

INTRODUCTION

1. CPDC ORGANIZATION

The Computer Program Development Center, supervised by the CPDC Group Head, consists of the following: The Data Processing Staff, the Analyst Staff, and the Computer Program Library. See Figure 1-1.

1.1 DATA PROCESSING STAFF

The Data Processing Staff, headed by the CPDC Group Head, is responsible for providing reliable and accurate data processing (1604 and 160-A computing, EAM work, keypunching, and clerical assistance) to CPDC users. Staff personnel have been thoroughly trained in the use of hardware and software employed in the Satellite Control Facility, and are of great assistance to CPDC users. The breakdown of this staff - Control and dispatch, Key punch, EAM Operations, and EDPM Operations - are described in chapters two and three.

1.2 ANALYST STAFF

The Analyst Staff is composed of specialists with extensive experience in many phases of computer and card-machine processing. The role of the analyst is to evaluate existing and contemplated requirements and to design, implement, and maintain procedures to provide positive control for all resulting conditions. To fulfill this role, the analyst is aware of the requirements of both the CPDC and the user. Regardless of magnitude of the user's task, the efforts of all users must be well coordinated within the CPDC, if it is to function efficiently. To insure this coordination, the analyst is the liaison man between the CPDC and its users. However, both the CPDC and its users must keep each other cognizant of all requirements that are to be met, so that the efforts of both are coordinated to afford a smooth operation. When requirements or conditions change, or if changes are being contemplated, the analyst must be notified as soon as possible, so that proper steps may be taken to accommodate the new requirements or conditions. In addition, the analyst, with his broad experience in data processing techniques, can frequently offer suggestions that will solve individual problems. Detailed analysis is his job and his services are available for all who use the CPDC.

1.3 COMPUTER PROGRAM LIBRARY (CPL)

The Computer Program Library is the official Air Force facility where all computer programs and documents for past flights and programs are kept for the Satellite Control Facility. The CPL also maintains documents and references to programs being developed in other areas for the 1604 and 160-A computers. Information regarding AF/CPL procedures is given in SDC TM(L)-694. A list of materials available in the CPL is published monthly in the Computer Program Library Catalog, SDC TM-(L)-836 series. Requests for these documents are filled according to the latest revision.

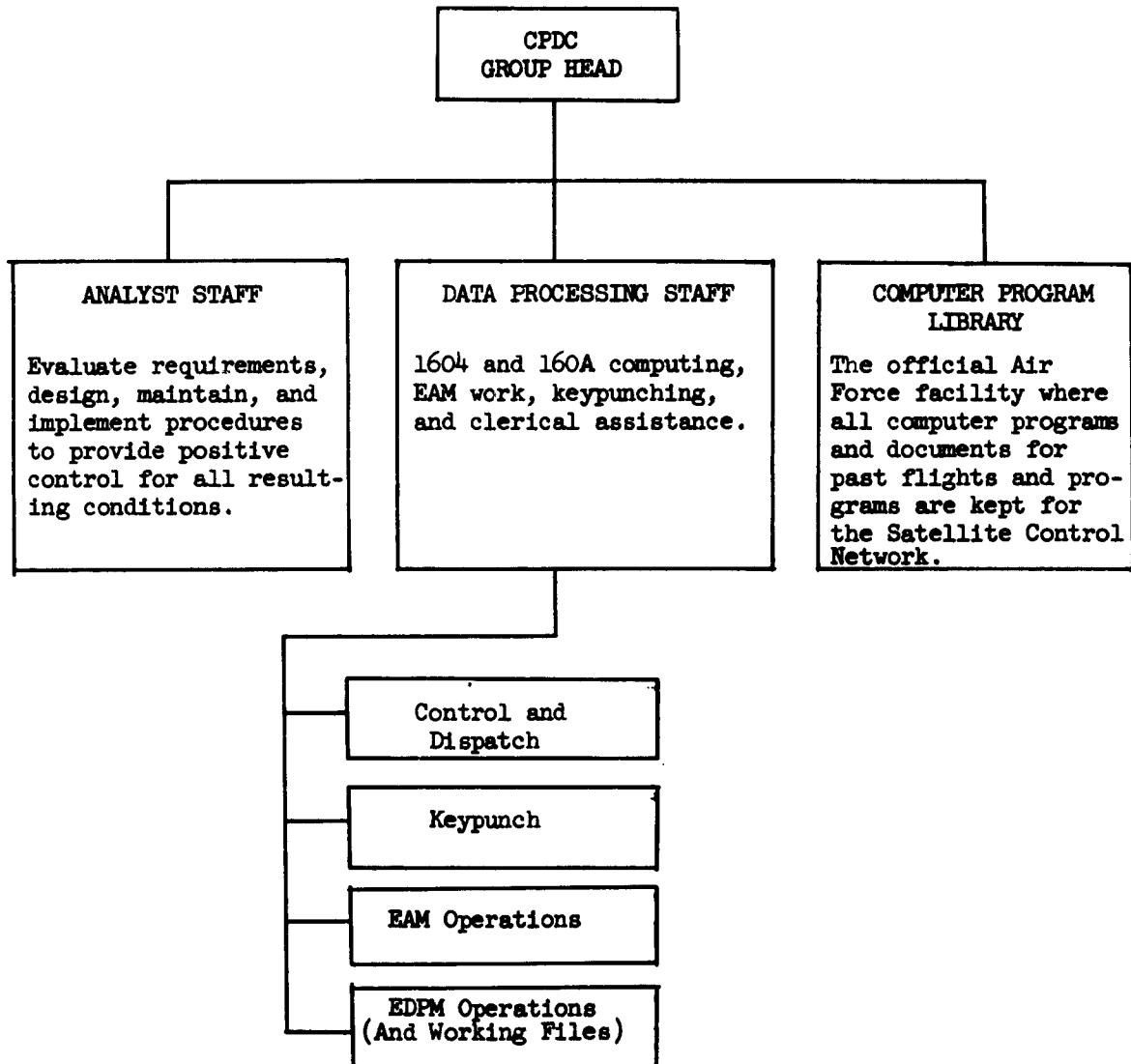


Figure 1-1. CPDC Functional Components

2. CPDC EQUIPMENT

2.1 EDPM EQUIPMENT

The CPDC contains a large-scale Control Data 1604 Digital Computer. Components of the CPDC are arranged in a configuration identical to that used by the Air Force Satellite Test Center. Thus, if the programming conventions established by Control Data Corporation for use of their equipment are followed, no machine compatibility problems between the two installations should occur.

In addition to the 1604, the CPDC also contains two 16K/160-A Computers and one 8K/160-A Computer with a complete complement of input/output equipments. Associated equipment includes two 166-2 CDC Printers, a 167-2 CDC Card Reader, sixteen 1607 Tape Units and a 163-4 Tape Transport. See Figure 1-2.

2.1.1 EDPM Equipment Maintenance. EDPM hardware is serviced by resident Control Data Corporation field engineers, who perform the following daily maintenance procedures:

1. Clean all tape units.
2. Run all available tape diagnostic tests.
3. Adjust, calibrate, and test paper tape punch and reader compatibility between all equipments.
4. Run diagnostic routines on the 160-A and related equipment.
5. Check condition of the 1612 Printer, IBM 523, and 088 Card Readers.

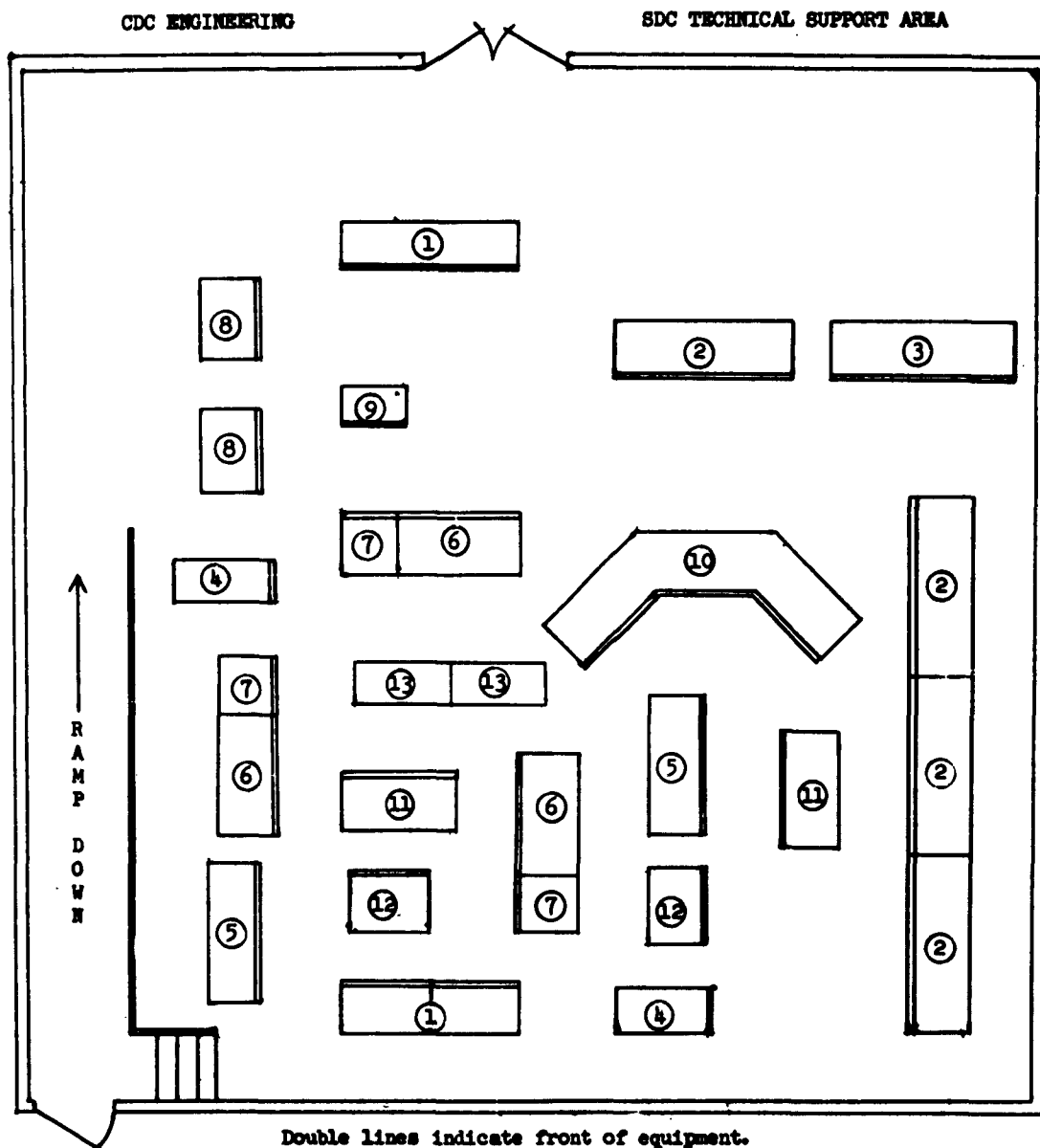
The following weekly maintenance procedures are performed:

1. Run all diagnostic routines on all equipment, under conditions of $\pm 10\%$ of normal voltage.
2. Calibrate all mechanical adjustments.

2.2 SUPPORT EQUIPMENT

To support the EDPM facility, an IBM Electric Accounting Machine (EAM) and Key punch facility are installed. Support equipment consists of the following:

1. 1 - 407 Accounting Machines
2. 4 - 026 Keypunches
3. 1 - 056 Verifier
4. 1 - 519 Reproducer



KEY TO CALLOUTS

- | | | |
|-------------------------|---------------------|----------------------------|
| 1 - 163 TAPE UNITS (4) | 5 - 1612 PRINTER | 9 - 167 CARD READER |
| 2 - 1607 TAPE UNITS (4) | 6 - 160A COMPUTER | 10 - 1604 CONSOLE |
| 3 - 1604 COMPUTER CORE | 7 - 161 TYPEWRITER | 11 - 088 CARD READER |
| 4 - 1610A ADAPTOR | 8 - 166 PRINTER (2) | 12 - 523 CARD PUNCH |
| | | 13 - 169-1 EXTERNAL MEMORY |

Figure 1-2. CPDC Equipment Layout

5. 1 - 557 Interpreter

6. 1 - 082 Sorter

7. 1 - 087 Collator

The EAM's primary function is to support the EDFM facility. If other applications are desired for a particular job, or if additional information is required, contact the chief analyst. Procedures for requesting EAM work are outlined in chapter three.

3. CPDC PROGRAMS

3.1 CONTROL FOR OPERATIONAL PROGRAMS (COP, COP II)

The COP system is used exclusively within the CPDC and was originated by the Space Vehicle Department of LMSC. Subsequent modifications and new features that originated within LMSC and SDC have effected derivation of the COP II system. The COP II system consists of Master Tape Control (MTC II), Prepare Master Tape (PMT II), the Lockheed Assembly Routine (LAR II), and other programs. All programming for this system is done in 1604 mnemonic code, and assembled into machine language by the LAR II assembler. See SDC TM-(L)-705/001/00 for program descriptions. The COP system is maintained by the Utility and Simulation Group at SDC, and inquiries regarding these areas are to be directed to this group. Instructions for submitting assemblies and COP runs are contained in chapter two.

3.2 FORTRAN

Up-to-date 1604 FORTRAN 60 and FORTRAN 62 compiler and monitor systems are available in the CPDC. Instructions for requesting FORTRAN runs are contained in chapter two.

3.3 JOVIAL-OASIS

The DASA OASIS utility system and Jovial 1604 compilers are also available in the CPDC. Documentation of these systems is available upon proper request through normal SDC channels.

3.4 NELIAC COMPILER

The NELIAC Compiler is not available in the CPDC.

CHAPTER 2

GENERAL PROCEDURES

1. GENERAL

This chapter contains detailed procedures for use of the Control and Dispatch and Project and Working Files units.

2. CONTROL AND DISPATCH

2.1 PURPOSE

Control and Dispatch is the focal point for CPDC users. It receives and distributes their work within the CPDC, maintains tape files, and provides information about computer scheduling. In addition, Control and Dispatch provides associate contractors with limited clerical assistance and message-distribution service.

2.2 CONTRACTOR CHECK-IN

All associate contractors are to check-in with CPDC Operations Section immediately after entering the building. After check-in, upon request the group secretary will provide information regarding office assignment, necessary request forms, paper supplies, and classified safes and file cabinets.

All Satellite Control Department personnel are automatically registered with the CPDC. Only those individuals and/or organizations registered with the CPDC and authorized by Aerospace Corporation are permitted to use the data processing facilities.

2.3 SUBMITTING JOB REQUESTS

Either the CPDC Operations Request Form (Figure 2-1) or the Augmentation Job Request Form (Figure 2-2) is required for all operations performed in the CPDC. No services are performed without submitting one of these forms. Use the Augmentation Job Request Form for 160-A runs, and if no 1604 time is needed.

Information on the first two lines of the request, except for the Work Order portion, must be completed by the associate contractor. SDC personnel must insert a work order number, but the Vehicle space may be left blank, if not applicable. In cases where the space provided on the form is insufficient, attach additional page(s).

NOTE

Do not write on the back of the form.

Chapter 2

YOUR PROGRAM:		OPERATOR RESPONSE			
☐ LOOPED ☐ HALTED/HUNG ☐ RAN SUCCESSFULLY AS REQUESTED					
INDEX REGISTERS		A. REG. LEFT		A. REG. RIGHT	
1 _____	4 _____	_____	_____		
2 _____	5 _____	_____	_____		
3 _____	6 _____	_____	_____		
FAULTS INDICATED: _____		PROGRAM ADDRESS		FUNCTION	
		_____		_____	
COMMENTS:		EXECUTION ADDRESS			

Figure 2-1. Example of Filled-In CPDC Operations Request Form

AUGMENTATION JOB REQUEST FORM 160A								IN
								OUT
NAME Joe Smith	ORGN. 8373	WORK ORDER 663.55	VEHICLE —	PRG./SYSTEM ID. KLUDGE	OP CODE 2:3	CONTROL NO.		
DATE 3/7/63	KEYPUNCH	EAM	160A X	YES X	NO	DEL. ROOM 20047	PHONE 7777	

160A ☒	ATTENDED YES ☒ NO ☐ APPROVAL	RERUN YES ☐ APPROVAL	ESTIMATED RUN TIME 1.0 HOURS	ACTUAL RUN TIME HOURS
---	--	--	--	--------------------------

SPECIAL INSTRUCTIONS:

- ① LOAD MASTER TAPE INTO CORE
- ② PLACE DECK INTO READER + READ IN
- ③ CLEAR + SET ALL BANKS TO ONE
- ④ START PROGRAM AT 0100₈
- ⑤ AT PROGRAM HALT, DUMP BANK 1, addresses 0100₈ - 8000₈
- ⑥ RETURN DECKS + LISTINGS TO REQUESTOR

PRINT WITH:

166/1612

PRESTORE:

167/088

PAPER TAPE:

4	2	1
3	X	1
2		1

4	2	1
3		1
2		1

163-4							
UNIT	1	2	3	4			
INPUT	5/111						
OUTPUT							
L (LIST)	L	R	L	R	L	R	L
R (RESERVE)							
REEL # OF RESERVE TAPE							

1607							
UNIT	16	17	18	19			
INPUT							
OUTPUT							
L (LIST)	L	R	L	R	L	R	L
R (RESERVE)							
REEL # OF RESERVE TAPE							

YOUR PROGRAM:

HUNG:

STATUS MODE

P

A

Z

BER

COMMENTS:

OPERATOR RESPONSE

BXR
BANK SETTINGS

I

D

R

B

MANUAL LOOP TRACE

PROGRAMMER TOOK:

☐ CARDS☐ LISTING☐ OTHEROPER #

--	--

160A²

Figure 2-2. Example of Filled-In Augmentation Job Request Form

If desired, more than one related operation can be requested on the same form, (for example, a program may be keypunched, listed on the 407, prestored on the 160-A, and assembled on the 1604 by use of one Operations Request form). If the 1604 box is checked, indicate all tape units that are to be used. Use a check (✓) to indicate a blank tape or insert a reel or slot number to indicate a library tape.

If a blank tape is to be listed or reserved at run completion, indicate disposition by circling the appropriate L or R on the request form. If a library tape is to be deleted after the run, indicate it on the request form, or submit a Tape Deletion Authorization (paragraph 2.4). Labels for tapes that are to be reserved are to be filled out in advance by the programmer. These labels may be obtained from the control receptionist.

Information regarding attended runs, re-runs, and scheduling is outlined in paragraph 2.8.

Include SLJ, SLS, and break-point settings on the form when applicable. The break-point setting is always set to -0 (77777₈), unless otherwise specified. Start location is always 10₈ for COP executed jobs.

Detailed information regarding the completion of the Operating Instructions and Operators Response portions of the request form is given in chapter three.

2.4 CPDC TAPE FILES

All tape reels within the CPDC are given a reel number (SCD #XXXX) before they are put into the system. As these tapes are reserved, they are assigned a slot number. The following tape slots now exist in the CPDC:

<u>SLOT</u>	<u>COMPANY</u>
A	Aerospace Corporation
G	General Electric
H	Hold File
K	Laboratory for Electronics, Inc.
L	Lockheed
M	Integrated Flight Support Master Tapes
P	Western Development Laboratory - Philco
S	SDC
T	Space Technology Laboratories, Inc.
W	6594th Aerospace Test Wing

A cross reference listing of all reserved tapes, giving SCD #, slot #, and description is published daily and posted on the CPDC bulletin board. When a reserved tape has outlived its usefulness, it is to be deleted from the tape library. This may be done by sending a Tape Deletion Authorization

C. P. D. C.
1604 COMPUTER

- TAPE DELETION AUTHORIZATION

The following tapes should be deleted from
the 1604 Computer tape files.

1. Slot Number 6. S-924
2. To be deleted 7. S-1055
3. S-XXX 8. _____
4. T-XXX 9. _____
5. K-YYY 10. _____

Authorized by: Author of tape

Figure 2-3. Example of Filled-In CPDC Tape Deletion Authorization

CPDC DISCREPANCY REPORT		AR-1080 CPDC	
Customer Name	Org.	Date	Control No.
JOE CARTER	83XX	1 APRIL 63	1234
☒ FAM FACILITY (includes Enigma)			
☒ KPM FACILITY			
☐ Pick up or Delivery of Material			
IMPORTANT: All Discrepancy Reports must be accompanied by the pink copy of the CPDC OPERATIONS REQUEST form. Also any additional material that pertains to the Discrepancy should be included.			

Use the space below to describe discrepancy:

Job was submitted for an assembly on the 1604 after deck was sequenced in FAM. Assembly listing showed that approximately 200 cards had been left out of deck. If I told you once I told you a hundred times it just won't work if 200 cards are left out.

SA #1

Figure 2-4. Example of Filled-In CPDC Discrepancy Report

(Figure 2-3) to the CPDC. Only the individual for whom the tape has been assigned, or his authorized designee, may delete the tape.

2.5 COMPUTER USAGE INFORMATION

The control receptionist normally has up-to-the minute information regarding computer usage. All inquiries regarding in-process work are to be directed to the control receptionist. A summary of computer usage is published monthly in the SDC Technical Status Report.

2.6 DISPATCH

Dispatch is responsible for picking up and delivering all jobs processed in the CPDC. The dispatch clerk picks up jobs daily at 0930, 1130, 1400, and 1600 at prearranged pickup points, and delivers all completed work directly to the requestor's office.

2.7 COMPUTER SCHEDULING

The CPDC data processing facilities are scheduled commensurably with current missions and projects active within the SCF. All jobs performed in the CPDC are under a closed-shop environment. That is, all jobs are run by operations personnel under the procedures outlined on the Operations Request forms. Exception to this is made only at the discretion of CPDC or programming group heads. The hours during which the CPDC facilities are normally available are posted on the bulletin board adjacent to the EDPM area in the CPDC. If it is necessary to use CPDC facilities beyond posted hours, notify the CPDC group head at least four hours in advance of the anticipated overtime.

All jobs, except for attended runs, re-runs, and designated integration and validation periods, are performed on a first-come, first-served basis.

To maintain adequate data processing facilities and to provide personnel to fill every need, it is imperative that the CPDC be kept informed of your forecasted usage.

2.8

If it is necessary to observe a computer run, the Attended Run box on the request form is to be checked. Attended runs for SDC personnel must be approved by the requestor's group head or his designee. Attended runs for associate contractors must be approved by the CPDC group head or his designee.

NOTE

Even when a run is attended by its own originator complete operating instructions must be given on the request form. An attended run does not give license to the requestor to operate any of the computing equipment.

2.9 RE-RUNS

Re-runs which are necessary due to operator, machine or system error are performed as soon as feasible. Feasibility and re-run schedules are determined by the CPDC group head or his designee. Before a job is accepted for re-run, a CPDC Discrepancy Report (Figure 2-4) must be completed and attached to the pink copy of the request form, and submitted to the CPDC group head for his approval. Re-runs due to programmer error do not have priority. Re-run procedures are applicable to all EAM and EDFM work processed in the CPDC.

2.10 PRIORITIES

A computer run or a job request is said to have priority if it is directly related to a mission or project within the Satellite Control Network which has been designated as priority by either the Air Force Space Systems Division and/or the Aerospace Corporation. Notification of priorities is forwarded, as necessary, to the CPDC by project coordinators and/or programming group heads for their cognizance. When submitting a priority job, write PRIORITY in the top right-hand corner of the request form. When the request is logged into the CPDC, the control receptionist will affix a colored flag to the top of the request form to indicate the priority job. Upon completion, the job will be immediately delivered to the requestor by Control and Dispatch, if desired.

2.11 INTEGRATION AND VALIDATION PERIODS

Blocks of computer time may be reserved for periods of integration and validation involving SDC personnel and/or personnel from other corporations. Integration and validation blocks of time must be scheduled with the CPDC group head at least 48 hours in advance and must not exceed two hours.

2.12 MAIL ORDER PROCESSING

The CPDC is equipped to handle data processing or computer runs on a mail-order basis. An Operations Request form (or facsimile thereof) and pertinent job materials may be sent to the CPDC at the following address:

AF Computer Program Development Center
C/O System Development Corporation
2500 Colorado Avenue Room 14039
Santa Monica, California

The results of the computer run and its job materials are returned to the requestor upon completion.

If desired, job materials may be filed at the CPDC in the requestor's name and maintained and/or updated for subsequent runs. One full day must be allowed for processing of mail-order work, in addition to estimated time for shipping.

The requestor is to indicate on the request form if he wishes to be telephoned when difficulties are encountered while processing the job. Also, indicate: Full name, organization, city, state, and telephone number where the requestor or an alternate can be reached. Indicate hours available at that number and a residential phone number or alternate person to be contacted, if desired.

3. CPDC WORKING FILES

3.1 GENERAL

The CPDC working file area provides, during program development, a control point for storage and maintenance of card decks and listings. The working file consists of six sections: Flight Specific, Standard Utility, General Purpose, Remote Station, 160A and Holding (not a part of the AF Computer Program Library).

3.1.1 Flight Specific Section. The flight specific section contains programs unique to a specific flight and currently being programmed by users of the CPDC.

3.1.2 Standard Utility Section. The standard utility section contains routines that do not use the COP RI Pool, but are common to all flights and projects. These routines are designated utility routines. If modification to an existing standard utility routine is necessary for a specific flight, that routine is assigned a new working ID number, duplicated from the standard utility section, and placed in the appropriate flight specific section of the working files.

3.1.3 General Purpose Section. The general purpose section of the working files contains programs which are not flight specific, yet cannot be classified as utility routines since they use the RI Pool. These programs are not to be included in the flight specific section of the working files unless they are to be altered for a specific flight. If this is the case, the routine must be duplicated with a new working ID number and placed in the flight specific section.

3.1.4 Remote Station Section. The remote station section of the working files contains the 1604 and 160A programs used to support augmented and unaugmented remote tracking stations. Access to this file is limited. Use of these programs or their modifications is restricted to personnel on the access list maintained by the analyst staff.

3.1.5 160A Section. The 160A section contains programs that have been and are being written specifically for the 160A computer.

3.1.6 Holding Section. The holding section contains programs that cannot be categorized due to insufficient information.

3.2 IN/OUT FLOW OF WORKING FILE MATERIALS

3.2.1 Issuance of Working ID Numbers. Prior to decks being submitted to the CPDC working files, they must contain a working ID number. Working ID numbers are issued after submitting a Working ID Request Form (Figure 2-5) to the CPL librarian. The librarian assigns a working ID number for that deck and forwards the request form to the appropriate section head for approval. After ID assignments, decks are processed in EAM and placed in the working files.

3.2.2 Flight-Specific Program Listings. Copies of listings of Flight-Specific programs are given out only after approval of the cognizant SDC project coordinator. The files are maintained by the working file controller only.

3.2.3 Working Files Index. An index for each section of the CPDC working files with detailed information on each program (such as modification designation) is reissued periodically as the CPDC Working Files Accessions List. It records all working file transactions for the indicated time period and lists routines available in the working files. If a requestor needs a routine not available in the CPL or the working files, the CPL will make a formal request through a project coordinator and/or the Aerospace Corporation.

CPDC WORKING ID REQUEST FORM

Name Herman J. Smith Date 25 February 1963
Requesting Installation Man-In-Space Corporation
6543 Mars Drive
Mercury, California
Program Identification (up to 8 characters, must be unique) MOONRAY
Program Type (executive, utility, tracking, etc.) Utility
Classification UNCLASSIFIED Satellite System _____
Milestone No. 5 Vehicle No. 1604
Computer Configuration (160A, 160k, etc.) 1604

FOR CPL USE

Working ID A10 CPL Catalogue No. 75010
Date of Receipt of Request 2/26/63 Date of Receipt of Approval 3/1/63
Authorizing Signature [Signature]

Figure 2-5. Example of Filled-In CPDC Working ID Request Form

CHAPTER 3
OPERATIONS

1. EAM OPERATIONS

The EAM shop is divided into two areas: Key punch and EAM.

EAM operations personnel prepare and maintain card decks and other items necessary for the successful support of the CPDC computer operations. In addition, they provide a variety of card processing services to meet the individual programmer needs.

1.1 KEYPUNCH

Key punch transcribes source data by punching information from transmittal sheets onto IBM cards for further processing. All keypunched data is verified as standard CPDC practice. The keypunch transmittal sheet is the basic source document on which the programmer indicates information which is to be transcribed onto punched cards. A supply of transmittal sheets is maintained in the keypunch room for your convenience. If this supply is exhausted, contact the CPDC control receptionist. The various kinds of keypunch transmittal sheets used in the CPDC have several common characteristics - they have headings provided for control information (for example, programmer's name, job number, and date), and they are ruled to show the columns in each special field, to simplify the task of filling in the data. Standard coding sheets available in the CPDC are listed in Figure 3-1.

NAME	FORM NUMBER (Use to order)	SIZE IN INCHES	FIGURE REFERENCE
1604 Assembly Coding Sheet	AR 4062	8½ x 11	3-2
1604 Assembly Coding Sheet	AR 4061	8½ x 14	3-3
1604 Assembly Coding Sheet	AR 2304	11 x 17	3-4
1604 Octal Coding Sheet	AR 4059	8½ x 11	3-5
1604 Generalized Load Coding Sheet	AR 4063	8½ x 14	3-6
1604 Fortran Coding Sheet	AR 4077	8½ x 11	3-7
160A Coding Sheet	AR 4060-1	8½ x 11	3-8
160A Coding Sheet	AR 4728	11 x 17	3-9

Figure 3-1. Standard CPDC Coding Sheets

1.1.1 Preparation Instructions. When preparing a keypunch transmittal sheet, fill in all control information at the top. Staple the transmittal sheets to the request form and forward both to the CPDC control receptionist.

[illegible]

Figure 3-2. 1604 Assembly Coding Sheet (8½ x 11)

1000 CODING SHEET

Name	Page	
	Date	
	Job No.	
	Remarks	
Address		
Quantity		
Location or symbol		

Figure 3-3. 1604 Assembly Coding Sheet (8½ x 14)

1604 CODING FORM

PROGRAMMER'S NAME _____

SECTION _____ ROOM _____ TEL _____ DATE _____ PAGE _____ OF _____

OPERAND OR M-TERM

COMMENTS

PROGRAM NAME

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

LOCN

OPN

B

4-2804

Figure 3-4. 1604 Assembly Coding Sheet (11 x 17)

[illegible]

Figure 3-6. 1604 Generalized Load Coding Sheet (8½ x 14)

1604 FORTRAN CODING FORM					NAME	SERIAL NUMBER
PROGRAM					PAGE	
ROUTINE					DATE	
STATEMENT NUMBER	SIZE	FORTRAN STATEMENT	72	73	80	
1	1					
2	2					
3	3					
4	4					
5	5					
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
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96	96					
97	97					
98	98					
99	99					
100	100					

Figure 3-7. 1604 Fortran Coding Sheet (8½ x 11)

System Development Corporation

Use shaded columns only if first symbol character is + or -, or for 4 character OP code

Figure 3-8. 160-A Coding Sheet (8½ x 11)

160-A CODING FORM

LOCATION		OP CODE		ADDRESS		ADDITIVE (INCREMENT)		COMMENTS (REMARKS)		IDENT		SEQUENCE NO.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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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	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	4														
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58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	4																																																								
72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	4																																																																						
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394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	4																																																																																																																																																																																																																																																																																																																																																																																																								
408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	4																																																																																																																																																																																																																																																																																																																																																																																																																						
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ALL FIELDS MUST BE LEFT JUSTIFIED

Figure 3-9. 160-A Coding Sheet (11 x 17)

As is done in most installations, the letters O and Z are slashed (Ø; Z), and the numerals zero and two are not slashed (0; 2). To differentiate an I from a 1, code an I with horizontal bars both top and bottom, and code a 1 without horizontal bars.

1.1.2 Use of Ditto Lines. Ditto lines are acceptable only when used with the entire field. Ditto lines are never to be used in individual columns within a field (Figure 3-10).

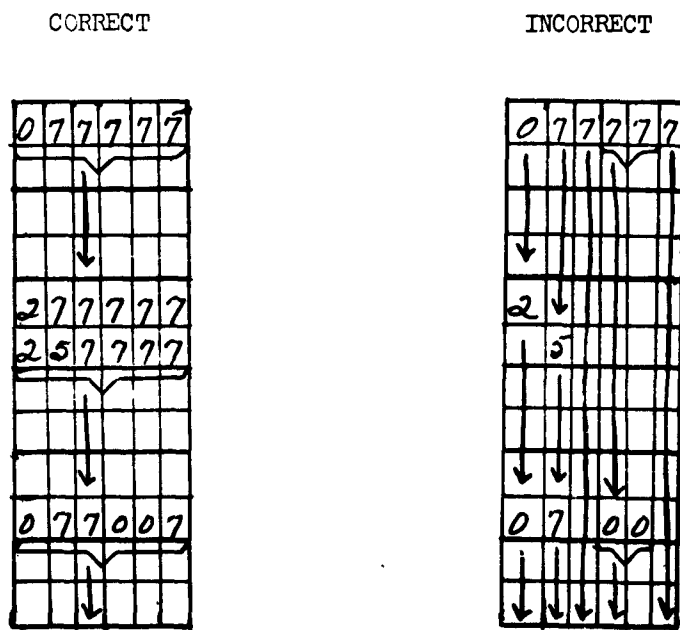


Figure 3-10. Correct and Incorrect Use of Ditto Lines.

When ditto information overlaps from the bottom of one page to the top of the next, insert ditto arrows to the bottom of the first page, and then write in the data at the top of the next page before continuing ditto arrows (Figure 3-11).

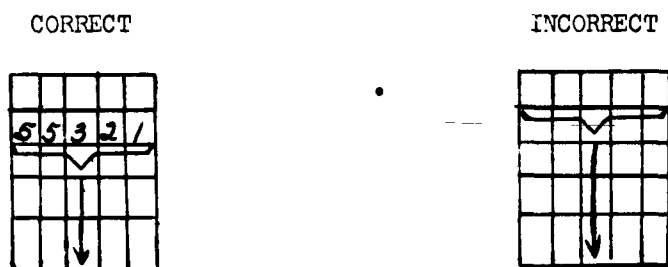


Figure 3-11. Correct and Incorrect Continuation of Ditto Lines.

In the card sequence field, use ditto lines only in the hundreds and thousands positions (Figure 3-12).



Figure 3-12. Correct and Incorrect Use of Ditto Lines in Card Sequence Field

To define absolute restrictions for 80/80 free coding is impractical; therefore, the programmer must consider possible keypunch problems when coding. In cases where the fields to be punched are not clearly defined by margins, or do not follow suit for an entire set of logically related instructions, do not use ditto lines to indicate duplications. Rewrite information on each line to maintain legibility and further eliminate the possibility of keypunch error.

1.1.3 Card Sequence and Insert Numbers. Symbolic cards are designed to use columns 75-78 and 79-80 for sequence and sub-sequence numbers respectively. At start, cards are to be coded with consecutive sequence numbers, starting at 0001, and sub-sequence numbers of 00. These numbers are used for subsequent changes and insertions to the deck, and to check the deck for correct order. When additional instructions are to be added to the deck, use columns 79 and 80 for insert numbers as shown in the following example:

CARD NUMBER COLUMNS

7777 78
5678 90

0001.00
0002.00
0003.00
0004.00

To insert several instructions between cards 2 and 3, number the new instructions 0002.10, .20, .30, ..., as necessary. The zero must appear in column 80. The sequence of the deck now appears like this:

CARD NUMBER COLUMNS

0001.00
0002.00
0002.10
0002.20
0002.30
0003.00
0004.00

Note, there is still room for as many as nine future insertions between each of the new cards, and the preceding and subsequent cards. For example, between cards 0002. and 0002.10, cards 0002.01, .02, .03, ... 0002.09 may be inserted.

To add two more instructions between 0002.20 and 0002.30, number the new cards 0002.23 and 0002.26. The sequence of the deck now appears like this:

CARD NUMBER COLUMNS

0001.00
0002.00
0002.10
0002.20
0002.23
0002.26
0002.30
0003.00
0004.00

Note, there is still room for more insertions before and after each new card. When no more insertions can be made using columns 79 and 80 in this manner, request that the deck be reproduced and re-sequence numbered. Request a new deck listing without insert numbers in columns 79 and 80, and begin making insertions on the basis of the new card number.

1.1.4 Card Changes. If you need to change a card, code the new card, using columns 75-80, the same as the card that is to be replaced. The transmittal will be keypunched to produce a change deck. EAM equipment is used to search through the deck until the card which contains the same card number is located. The old card is removed and the new one is put in its place.

1.1.5 Card Deletions. If you wish to delete a card from the deck, code a card with an R in column 9 and code columns 70-80 exactly as the card to be deleted. When the card numbers match, the old card and the R card are removed.

1.2 CHARACTERISTICS COMMON TO EAM

1.2.1 Logical Arrangement of Card Information. In all IBM machines, each of the 80 card columns is a separate unit, which can be handled independently of, or in various combinations with, the other 79 columns. In some applications, the individual column can be broken down further into its 12 component punching positions. Therefore, there is no theoretical restriction on the arrangement of the information on a card. However, common sense dictates that the arrangement of information on a card must follow a logical pattern having some obvious relationship to its use. This reduces confusion and errors, and increases efficiency.

1.2.2 Standard Job Control Panels/Flow-Charts. Every machine also has a control panel and/or set of control switches. By proper use of control panel wiring and switch settings, a variety of results that meet different requirements can be obtained from the same deck of cards. For recurring jobs, the CPDC keeps a flow chart with an identifying job number, and maintains permanently wired control panels. These panels enable the CPDC to respond quickly and efficiently to a programmer who requests a standard job, and specifies the Flow Chart Job Number on the request form.

1.2.3 Revised Standard Jobs. Whenever the requirements of a standard job change or a new standard job is required, existing flow charts and control panels are corrected, or new ones are prepared. Consult with a member of the Analyst Staff before requesting a standard job, to check current status of the flow charts/control panels.

1.3 EXPLANATION OF EAM FUNCTIONS AND THEIR REQUESTS

1.3.1 Card Counting and Group Counting. Used to count the total of all cards, or the total of specific cards in certain classifications or groups. The capabilities of each machine are:

1. Sorter. Can count all cards that pass through the machine. This may be done separately or in combination with sorting or selection.

2. 407. Can obtain the total in each of up to 20 groups or classifications as guided by information punched in the cards; however, it is not necessary to count all the cards in the deck.

1.3.2 Comparing

1.3.2.1 Definition. Comparing is performed by the 519 Reproducer on all or any columns of one card against all or any columns of another card to determine if differences exist between the two. The card column number need not correspond to the card column number being compared. For example, it is possible to compare column 5 of one card against column 27 of another card. If an error is detected, the machine stops and indicates the columns in question.

Comparing is independent of other 519 functions and is done as standard procedure when reproducing cards or performing interspersed master gang punching.

1.3.2.2 Request. To request, specify the column or columns to be compared in both decks. If the cards are to be compared column for column, specify 80 x 80 compare. For example, "Compare 80 x 80, except compare cols. 1-5 of deck I against 72-76 of deck II."

1.3.3 Emitting

1.3.3.1 Definition. Emitting is automatic punching of limited additional information into all cards passing through the machine. Emitting is advantageous to gang punching since information can be added to a column without dropping or carrying back through the deck, information that may already be in that column. This can be done independently or in combination with other 519 functions.

1.3.3.2 Request. To request, specify the information and the columns. If these columns already contain information and it is to be dropped, indicate it. For example: "Emit a '5' in col. 17. Column contains information; retain same."

1.3.4 End Printing

1.3.4.1 Definition. The 519 Reproducer is equipped with a print unit capable of printing up to 8 numeric digits. Printing takes place on one of two vertical printing lines on the card. This information may be read from the card itself, from a card in the read feed of the transcribing machine, or it may be emitted. A maximum of 16 digits may be printed, either separately or in combination with other 519 functions.

1.3.4.2 Request. End printing cannot be requested per written instructions. If you need end printing, contact a member of the Analyst Staff.

1.3.5 Gang Punching

1.3.5.1 Definition. Gang punching is automatic duplication of information from one card into the cards following the first card. A master card is key-punched with the information desired, and is placed on top of the deck to be gang punched. Master cards may be interspersed in a deck and provide a new set of gang-punched cards each time a new master card is reached.

Columns to be gang-punched must be blank. If they are not blank in the original deck, the deck must be reproduced to provide blank columns for gang-punching. Gang-punching can be done separately or in combination with other 519 functions.

1.3.5.2 Request. To request, specify the information and the columns to be gang-punched. If these columns are not blank, also specify reproduce instructions. For example, "Gang-Punch MGDA in cols. 70-73."

1.3.6 Interpreting

1.3.6.1 Definition. Interpreting is translation of Hollerith data punched on a card into printed characters on either of two horizontal printing lines near the top of the card. The upper line is just above the 12 row; the lower line is between the 12 and 11 rows, and each has 60 printing positions under wired panel control.

One of the standard Interpreter boards used in the CPDC contains the following:

<u>STANDARD 80 COL.</u>	<u>CARD COLS.</u>	<u>TYPE POSITIONS</u>
Interpreter	1-60 61-80	1-60 Upper line 41-60 Lower line

1.3.6.2 Request. To request a format different from the standard 80 column format shown above, contact a member of the Analyst Staff.

1.3.7 Listing

1.3.7.1 Definition. Listing is the preparation of a printed report that presents all data in each card in the deck. The 407 allows complete flexibility and control over arrangement, spacing, accumulation of values punched in the cards, card counting and group counting, spacing and positioning of the form itself, and the printing of headings at the top of each page.

1.3.7.2 Request. To request a format other than that normally used, or one for a non-standard card, contact a member of the Analyst Staff.

The EAM section maintains permanently wired control panels for listing all standard cards.

1.3.8 Matching

1.3.8.1 Definition. Matching is the comparison of two card decks to determine if a card or group of cards in one deck matches a card or group of cards in another deck. The cards are not merged and unmatched cards are selected and stacked in separate pockets.

1.3.8.2 Request. To request, specify the columns or fields for control, their order, and the type of information they contain (numeric or alphabetic). Also specify the unmatched cards to be selected. For example, "Match the headers against details, controlling on col. 7-12 (Num) Minor, 5-6 (Num) Intermediate, and 1-4 (Alpha) Major. Select unmatched cards from both decks."

1.3.9 Merging

1.3.9.1 Definition. Merging is collation of two or more card decks (which are already in the same sequence through use of up to 19 columns of numeric, alphabetic, or special character information) into a single group of the same sequence. If, during the merging process the collator detects cards with the same number in both the primary feed and the secondary feed, primary feed cards are placed ahead of secondary feed cards.

1.3.9.2 Request. To request, specify the columns for control, their order, and the type of information they contain. Also specify the cards to be selected. If necessary, specify deck to be placed in primary feed. For example, "Match-merge, headers in front of details, controlling on cols. 1-4 (alpha) Minor; select unmatched detail cards."

1.3.10 Merging with Selection (Match-Merge)

1.3.10.1 Definition. Merging with selection is merging and matching combined. Matched or unmatched cards from each deck are merged, and the remaining unmerged cards are routed to separate pockets.

1.3.10.2 Request. See par. 1.3.9.2.

1.3.11 Reproducing

1.3.11.1 Definition. Reproducing is duplication of all or part of a card deck into a new card deck, in either an identical or changed column arrangement. Each card in the original deck is re-read and compared to the card punched from it, to verify reproduction was performed correctly.

1.3.11.2 Request. To request, specify column(s) to be reproduced and where they are to be located in the new deck. If cards are to be duplicated column for column, specify an 80 x 80 reproduction. For example, "Reproduce 1-60 into 1-60, 64-67 into 70-73, and 74-80 into 74-80;" or as stated another way, "Reproduce 80 x 80, except 64-67 into 70-73."

1.3.12 Selection

1.3.12.1 Definition. Selection is pulling cards from a deck that require special handling.

1.3.12.2 Request. To request, state the type of selection involved, giving all pertinent information, such as columns, control fields, and specific data to be selected. For example, "Select all cards containing 1604-1 in cols. 9-19 and 02 in cols. 41, 42."

1.3.13 Sequence Checking

1.3.13.1 Definition. Sequence checking is performed on card decks to insure that the deck is in proper order according to a predesignated field (one or more columns) containing numeric, alphabetic, or special character information. The collator can sequence up to 19 columns of numeric, alphabetic, or special character information in either ascending or descending order.

1.3.13.2 Request. To request, specify the columns or fields to be sequenced, their order (minor or major), and their content (numeric or alphabetic). For example, "Sequence check cols. 7-12 (Num) Minor, 5-6 (Num) Intermediate, and 1-4 (Alpha) Major."

1.3.14 Sequence Numbering

1.3.14.1 Definition. Sequence numbering is automatic punching of a series of consecutive numbers, starting with any number, into a deck of cards. Several decks, each to start at a particular number, can be processed; as each master card is reached, the machine automatically resets and starts numbering per information from the master card. This is similar to interspersed master gang punching, and as in gang punching, columns to be sequence numbered must be blank.

1.3.14.2 Request. To request, specify the columns to be sequence numbered and the starting number. If the columns are not blank, also specify reproduce instructions. For example, "Sequence number cols. 75-78 starting at 0001."

1.3.15 Sorting

1.3.15.1 Definition. Sorting is the arrangement of a card deck in ascending or descending sequence, according to the numeric, alphabetic, or alphanumeric data punched in a fixed card location. Normally, cards are placed in an ascending sequence, unless a descending sequence is specified.

1.3.15.2 Request. To request, state columns to be sorted and if the data is numeric, alphabetic, or alphanumeric. If there is more than one field, identify each as to minor and major. Clearly state if special characters may be encountered. For example, "Sort 21-23 (Num) Minor, 44-48 (Alpha) Intermediate, and 1-4 (A/N) Major. There are special characters in col. 46."

1.3.16 Summary Punching

1.3.16.1 Definition. Summary punching is the punching of accumulated totals with the control fields used for use in further processing. The 407 first stores the information to be punched. Then, at a designated time, the information is transferred to a 519 Reproducer and punched on a card in any specified format. Summary punching can be done separately or in combination with listing or tabulating of card decks.

1.3.16.2 Request. Summary punching cannot be requested per written instructions. If you need summary punching, contact a member of the Analyst Staff.

1.3.17 Tabulating to Accumulate Totals

1.3.17.1 Definition. The 407 is equipped with 112 unit counters. These counters can be coupled together, or grouped as needed, to accumulate debits or credits to obtain totals for specific groups of cards. They may be used when listing cards, or when preparing a tabulated report that shows only control fields and totals desired.

1.3.17.2 Request. This function cannot be requested per written instructions. If you need tabulating to accumulate totals, contact a member of the Analyst Staff.

1.3.18 Double Punch and/or Blank Column Detection

1.3.18.1 Definition. This function consists of checking a card column to see if it is unpunched or has more than one punch. Either test can be made separately, or both tests can be made simultaneously.

1.3.18.2 Request. This function cannot be requested per written instructions. If you need this check, contact a member of the Analyst Staff.

2. EDPM OPERATIONS

EDPM operations center around the Control Data Corporation 1604 Digital Computer and the supporting 160-A Computer System. Several 1604 systems are available for use in the CPDC.

2.1 CONTROL FOR OPERATIONAL PROGRAMS (COP, COP II)

2.1.1 Use of COP. The COP II system is used exclusively in the SCF. Flight Support Tapes in the SCF contain numerous additional routines; however, all routines are brought into the computer via Master Tape Control (MTCII). For a complete description of the COP II system, refer to TM-745/000/00.

2.1.2 References to Other Routines. Since most Flight Support Tapes contain over 100 routines, this document describes only basic routines required for program development. Additional information on all routines is available in TM-(L)-705/001/00.

2.1.3 COP Operation. Routines are brought into the computer and operated upon by COP as directed by function cards or on-line typewriter function requests. Normally, the card mode is preferred and the programmer provides necessary cards for his computer run. However, the typewriter mode may be used if the programmer has not supplied the proper function cards.

The COP system references I/O units via special COP reference numbers. Figure 3-13 associates the COP reference numbers to I/O equipment unit numbers.

COP REFERENCE NUMBERS	INPUT	OUTPUT
1 through 4	Tape Drive 1,2,3 or 4 Channel 3 Cabinet 2	Tape Drive 1,2,3 or 4 Channel 4 Cabinet 2
5 through 8	Tape Drive 1,2,3 or 4 Channel 3 Cabinet 3	Tape Drive 1,2,3 or 4 Channel 4 Cabinet 3
9 through 12	Tape Drive 1,2,3 or 4 Channel 1 Cabinet 2	Tape Drive 1,2,3 or 4 Channel 2 Cabinet 2
13	(not applicable)	1612 Printer Channel 2
14	Typewriter Channel 1	Typewriter Channel 2
15	Paper Tape Reader Channel 1	Paper Tape Punch Channel 2
16 through 19	Tape Drive 1,2,3 or 4 Channel 5 Cabinet 2	Tape Drive 1,2,3 or 4 Channel 6 Cabinet 2

Figure 3-13. COP Numbers and Associated I/O Equipment

All program output from computer runs uses tape unit 3 for delayed output or the printer for on-line output (unit 13).

2.2 LOCKHEED ASSEMBLY ROUTINE (LAR, LAR II)

The Lockheed Assembly Routine (LAR and LAR II) is utilized on all flight support tapes. A detailed description of this assembler is contained in TM-(L)-705/001/00.

Before a deck can be assembled, it must be prestored (placed on symbolic tape in a certain format) with the 160-A. If no ORG card is supplied for LAR assemblers, an ORGR 10000B card will be inserted in the deck by CPDC personnel. The LAR II assembly program assembles all programs for 10000B relocatable if no ORG card is provided.

It is important that programs are assembled and tested using the Standard System Check (SUM) Master or the Flight Support Tape on which the program is to be placed. If the program is not to be used on a specific Flight Support Tape, specify assembly using the M-1 Sum (System Check & Utility) Master on the request form.

Several options, as outlined in TM-(L)-746/000/00, are available for assembling a program with LAR or LAR II. Unless otherwise specified, the CPDC assembles with the index option. One copy of the assembly is listed and one copy of the binary deck is punched and returned to the requestor. The magnetic output tapes are not saved.

2.2.1 Filling Out Request Forms for LAR Assemblies. To request a LAR assembly, fill in the following:

1. Check 160-A box, and specify card to tape.
2. Check 160⁴ box, and specify desired master on TD #1. If this is not done, M-1 is automatically used.
3. Specify PREST tape from 160-A on unit 2.
4. Under Instructions, specify if other than standard assembly is desired.

2.2.2 Parameter Tests. After a program is assembled, the binary deck can be parameter tested on the 160⁴. Since the deck must be read into core by MTC, certain control cards are required. See TM-(L)-745 for correct format and column usage. Figure 3-14 is an example of a deck which reads in and operates a program called TEST of 1000 core locations.

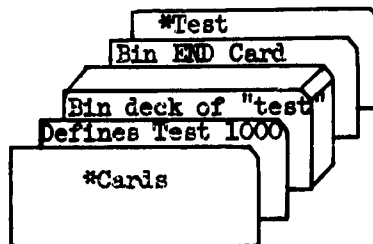


Figure 3-14. Example of Deck Format

If it is necessary to make octal corrections to a binary deck, the octal correctors are to be inserted in front of the binary end card.

If the control cycle portion of MTCII has been destroyed, the operator reloads MTC, and if a dump is desired, he will attempt to save that portion of core occupied by the program being tested. After a program has been read into core and successfully operated, control is returned to MTC. If unsuccessful, it will either hang, loop, or erroneously halt, and the operator will note the contents of the machine registers on the request form and manually return to the MTC control cycle. To obtain a core dump, a Dump function card must be included in the parameter test deck. If the situation warrants it, the operator may initiate core dumps using the on-line typewriter.

`*Dump 3 10000B 70000B`

Dumps core onto TD #3 in listable format.

`*SYMDUMP 3 TEST`

Gives a core dump of a relocatable program. Valuable when it is not known where the program will be brought into core.

`*EOT 3 Joe Smith`

Writes "End of Tape" plus end of file on TD #3 and rewinds it with interlock.

Figure 3-15. Examples of Dump Cards

In some cases, a program may write information on a magnetic tape which should be retrieved for debugging purposes. If the magnetic tape were written in BCD, it can be listed directly by the 160-A. If written in binary, it must be read into core and dumped in BCD to be listed. A tape dump function card must be included by the programmer.

*TAPEDUMP	4 3 1 0 0
-----------	-----------

Dumps TD 4 onto TD 3 in BCD, 1 file.
0 files and 0 records are skipped
before the dumping process begins.

Figure 3-16. Example of Tape Dump Card

Detailed capabilities, format of system debugging and utility routines are available in TM-(L)-705/001/00.

2.2.3 Filling Out Request Forms for Parameter Tests. To request a parameter test, fill-in the following:

1. Check 160-A box if card-to-tape operation is required to create an input tape for the 1604 run.
2. Check 1604 box.
3. Specify master tape on unit #1. If this is not done, M-1 is automatically used.
4. Specify all input and output tapes to be used.
5. Specify if resultant tape is to be listed and/or reserved.
6. Note if a jump key or stop key selection is to be made.
7. In the operating instructions section, list in order, the actions that the operator must take, including recovery steps as applicable. In the operator's response section, the operator indicates the performance of the computer run.

2.2.4 System Tests. After a program has been thoroughly debugged, and if a system test is desired, it is necessary to place it on the master tape. Information regarding replacement of a routine on the master tape can be obtained from the SDC Utility and Simulation Group or the Program Integration and Test Group. Official Flight Support Tapes are not to be constructed without the cognizance of the above groups. When a routine is on the Flight Support Tape, it may be called in and operated by a single function card, or corrected and subsequently operated by a group of function cards. Figure 3-17 is an example of a deck which corrects a routine after bringing it into core from the Master tape and before operating it.

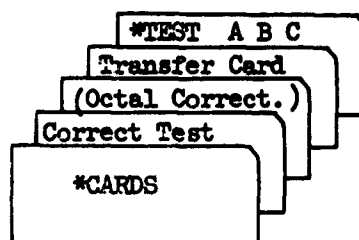


Figure 3-17. Sample Correction Deck

Since it is possible to system test a program with a number of other programs or routines from the master tape, a series of function cards may be necessary, (see TM-(L)-705/001/00 for details).

The SDC Program Integration and Test Group maintains a Satellite Subroutine Index that lists all routines currently being used on FSTs in the Satellite Control Network.

Request forms for system tests require the same information as parameter tests, par. 2.2.3.

2.2.5 Error Reporting. If machine trouble, operator error or system error is encountered, it is to be reported on the Discrepancy Report Form (Figure 2-4). If machine or operator error, return the completed form with a copy of the CPDC request form in question to the CPDC Operations Supervisor. If system error, return the form to the CPDC Staff Programmer.

2.3 FORTRAN

The CDC FORTRAN 60 and 62 Masters are contained in the CPDC, and operations personnel are familiar with their use.

2.3.1 Compilations. To compile a FORTRAN deck and determine if any format errors have been made, state "Compile Only" in the instruction section of the request form. To compile and operate, state "Compile and Operate" on the request form. (See FORTRAN System for 1604 Computer, Control Data Publication Number 087A and SDC FN-6737/000/00 for additional information.)

2.3.2 Filling Out Request Form for FORTRAN Runs. To request a FORTRAN run, fill in the following:

1. Check 1604 box.
2. Indicate FORTRAN Master on unit 1. (It will be M-23.)
3. Indicate Input and Output Tapes.
4. Indicate whether to compile, or compile and operate in the instruction section.
5. Indicate if a MPA Tape is necessary.

2.4 OSCON

The OSCON system is used exclusively on the CPDC 160-A's. All available 160-A routines are on the OSCON Master Tape and like COP II, are called into core by a function request. All OSCON function requests are made via the 161 On-line Typewriter or via function cards.

2.4.1 OSAS. The 160-A assembly routine (OSAS) is contained on the OSCON master in a number of I/O configurations. It is possible to receive an assembly listing through any of the following mediums:

1. On-line printer
2. Magnetic tape
3. Paper tape

and, the elections for binary object programs are:

1. Binary cards
2. Binary paper tape
3. Magnetic tape

All assemblies for the 160-A are originated at 0 (zero), unless otherwise specified. One copy of the assembly listing and binary paper tape of the program is furnished unless otherwise specified.

2.4.2 Peripheral Routines. The tape-to-card, card-to-tape, and tape-to-print programs are also on the OSCON Master. These programs are executed by the following function requests:

1. *TTC
2. *CTT
3. *TTP (166 printer routine)
4. *TTPA (1612 printer routine)

Binary and BCD tapes can be handled by the tape-to-card and card-to-tape programs. A mixture of binary and BCD information can be handled by the card-to-tape program. Only BCD tapes can be listed by the tape-to-print program.

The teletype translator routine on the OSCON master translates any teletype paper tape and prints the resultant translation either on the 1612 printer or 161 typewriter. The program is executed by a *TRNS function request.

The binary card load routine reads a 160-A program into core at a location specified by the binary card.

Instructions must be given to the operator if the program begins operation at any location other than 0.

3. SUGGESTIONS FOR SUBMITTING CPDC WORK

The following general suggestions are provided for 1604 users:

1. Always indicate maximum run time on the request form.
2. Use the proper IBM card stock for the proper use, i.e., use the standard octal card for octals, binary card stock for binary cards, blank card stock (5081) for function cards. Preprinted cards for computers or systems not used in the SCN will not be accepted.
3. Since most programs and functions called in from a Flight Support Tape are relocatable, give a storage analysis of all functions. (This is done by placing a COP I/O reference number immediately after the asterisk on the function card.) A storage analysis gives: a) Routine name, b) Subroutines used by main routine, and c) Core locations.
4. Do not program the use of Jump or Stop Key 1. These are used by the COP System.
5. A break point setting stops the computer before operating the instruction at that address.

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Chapter 3
Paragraph 3

6. Review the CPDC request form for clarity and completeness of information before submitting it. This will insure that the requested work will be performed accurately and efficiently.

CHAPTER 4

SECURITY PROCEDURES

1. HANDLING OF CLASSIFIED INFORMATION

Companies and personnel utilizing the CPDC facilities are provided with document and/or card safes upon request. These depositories are approved by DOD for storage of material up to and including the Secret classification. Combinations to these depositories are given only to the person to whom the depository is assigned. A duplicate copy is maintained in the SDC Lock and Key Office.

CPDC personnel assume responsibility for Secret material only if it is so designated, and only during the times it is being processed in the EAM, Key punch, or EDPM Shop.

All CPDC personnel are cleared for Secret work. Representative CPDC personnel are placed upon need to know rosters for all work currently being handled by the CPDC.

Associate contractors processing Secret work in the EDPM shop must do so on an attended run basis. (Mail order runs excepted, if they are accompanied by official Secret transmittal forms.) When submitting Secret materials to the CPDC for processing, they must be hand carried and picked up directly by the requestor.

The security classification of the run must be designated on the request form.

Detailed CPDC Security Procedures are available upon request from the CPDC analyst staff.

CHAPTER 5

GLOSSARY OF COMMON CPDC TERMS

Alpha	Short for alphabetic. Used to indicate the presence of alphabetic data in a card column or card field. On requests which specify card columns or card fields indicate presence of alpha data (e.g., Sort on cols. 13-15 (Alpha)).
Alphanumeric (A/N)	Used to indicate the presence of both alphabetic and numeric data in a card field. On requests which specify card columns or card fields, indicate presence of mixed alphanumeric data (e.g., Sort on cols. 13-15 A/N.)
Card Count	A count of the number of cards in a deck, or of those cards in a deck containing a specified identifying punch. (e.g., Supply Card Count or Supply Count of Cards containing 3 in col. 42.)
Card Field	A card column, or group of card columns, containing a specific type of data (see fields).
Column	A single vertical arrangement of 12 punch positions on a card. One hollerith column contains the punches signifying a single alphabetic, numeric, or special character.
Common X	Indicates that all cards in a deck have a punch in the 11 row (one row higher than the 0 (zero) row) of a given column. Usually used to distinguish a deck of cards in a particular format, or a deck used for a particular function from another similar deck which is associated with the job (see deck identification and identifying punch). If a request involves a deck so identified and the presence of the identifying punch is critical, refer to the common X (e.g., Sight check Deck I for an X in 80, then merge with Deck II on columns 12-17).
Control Field	A column, or group of columns, whose contents are used to control the operations of certain card machines.
Deck Identification	Common punches in particular columns in every card belonging to that deck. Since the CPDC is

responsible for well over a thousand individual decks of cards, deck identification is essential for efficient operation.

Detail Cards

An associated group of cards, each of which contains a unique piece of information. For example, each of the program cards in an assembly deck is considered a detail card.

EAM

Electric Accounting Machines (tabulators, collators, etc.)

EDPM

Electronic Data Processing Machines (computers and related peripheral equipment)

FIELD

A card column, or group of consecutive card columns, containing a specific type of data. Proper designation of fields are of critical importance in processing requests which do not follow a standard, procedurized flow chart. On all requests which specify card fields, show the title and card columns of each field.

NOTE: Special care must be taken when requesting card processing which involves more than one field. For example, if the desired sequence of a field of symbolic cards were by Mod within Ident, it would not be sufficient to say "Sort Working ID (70-72) and Mod (73-74)." Due to the nature of card sorting, the field sorted last is the one of major significance. Therefore, if the card-room operator sorted the Ident first and then the Mod field, the sequence of the cards would be opposite to that intended. To prevent confusion, list the cards filed in ascending or descending order of significance. Write the words "major" and "minor" beside the most and least significant field, respectively, to indicate their order (e.g., merge the two decks on Ident (70-72) Major, Mod (73-74), Card No. (75-80) Minor).

Flow Chart (Operational)

A detailed representation of the steps required to complete a given job. This type of job instruction shows the machine, or clerical operations in their proper sequence, and the processing of the cards from one operation to another.

Flow charts are used for recurring jobs, complex jobs, or those which have output formats of a critical nature.

Format Card

A card on whose face has been printed lines to show the location of fields which may be punched in the card.

Headers

(See Masters)

Hollerith

A code system used on punched cards to represent numeric, alphabetic, and special character information. It consists of one or more punches in each vertical column. In this system punches in the 12, 11, and 0 rows of a card column are called the 12, 11 and 0 zone punches respectively, and punches in rows 1 through 9 are called digit punches. A letter is represented by a zone punch and a digit punch in a single column; a number by a digit punch only; and special characters by various combinations of digit and/or zone punches.

Ident

The identification assigned to a program (or data) deck to distinguish it from other programs (or data) decks. The Working ID's used for 1604 decks consist of 3 alphanumeric characters.

Identifying Punch

A particular punch in a card, or in all the cards of a deck, which identifies the card, or cards, as being of a particular format or function. The most commonly used (and most desirable) identifying punch is the 11 punch. If the cards of a particular format contain an 11 punch in a given column, this would serve to distinguish these cards from all other associated cards during processing of the job. Another function of control punches is the selective control of the functions of EAM equipment processing the cards. The operation of all EAM equipment is susceptible to selective modification (within the natural limitations of each machine) upon recognition of control punches in a deck of mixed cards.

Intermediate

A term used to distinguish the field of a card whose significance (not location) is midway between the major and minor fields. For example,

if a group of cards were in the following sequence, Date would be the intermediate field.

<u>JOB NO.</u>	<u>DATE</u>	<u>PROGRAMMER</u>
751	10-06	Allen
751	10-06	David
751	10-06	Jones
751	11-06	Burke
751	09-06	Anson

The cards are in order by date and job number, and also in order by programmer and date.

Listing

A printed record (on continuous form paper) prepared from a deck of cards using a 407 tabulator (see printout).

Major

A term used to distinguish which one of two or more card fields has the greatest significance. (See example in Intermediate where Job No. is major to both date and programmer name.) When two or more fields are specified in a sorting or merging operation, indicate the major field clearly (see field).

Masters

Cards which contain descriptive or control information pertaining to a group of detail cards.

Minor

Used to distinguish which one of two or more fields has least significance. In the example under Intermediate, the programmer name is the minor field (i.e., it is minor to both Job. No. and Date). When two or more fields are specified in a single operation, indicate the minor field clearly (see fields).

Mod

The identification assigned to a revision of a program, or data deck, to distinguish it from the original deck and from any other revisions of that same program or data deck. On requests, be sure to show the Ident as well as the Mod of the deck to be processed.

Numeric

A term which indicates that the data in a column, or field, is strictly numerical. If a special

instruction specifies more than one field and the fields contain dissimilar data (numeric in some, alpha in others), the fields should be so distinguished (e.g., Sort Address (36-41, alphanumeric) minor and ident (1-4, numeric) major).

Off-Line Equipment

A computer-associated component which operates independently of direct computer control. Usually refers to card-to-tape equipment used to prepare prestored tapes for computer input and to tape-to-printer equipment used to print List Tape output prepared by the computer, sometimes called peripheral equipment.

On-Line Equipment

Any computer component whose operation is controlled directly by computers. Usually refers to card readers, printers, and other input-output components.

Paper Form

The specific type of paper to be used for listings. If a specific printed form is to be used, show the form title (i.e., Use 15 x 10 Multilith). If standard blank or lined paper is to be used, specify which of the two, and the size desired (i.e., Lined $8\frac{1}{2}$ x 11 long, or blank, 15 x 11 long). Also indicate the number of copies desired if it differs from the number specified for standard jobs, or if the listing is a special request.

Printout

A term generally used for listings made from magnetic tape or directly from the computer. List Tape is the preferable term for printouts from the magnetic tape. Listings made from data on cards should be indicated as Card Listing or 407 Listing.

Procedure

The sequence of steps in the processing of a job.

Row

A single horizontal arrangement across the 80 columns of a card. There are 12 such rows from the 12-row along the top of the card to the 9-row along the bottom.

Special Characters

Characters other than letters of the alphabet or numbers.

80/80

An instruction which indicates that the information from all 80 columns of the source card is to be transferred without change to the receiving medium (i.e., Reproduce 80/80 means to create an identical deck of cards; List 80/80 means to list the cards as is, with the information from card columns 1-80 being printed by type wheels 1-80 respectively; and Interpret 80 x 80, although a vague term and an impossibility, is generally used to mean interpret all 80 columns without rearranging or separating the data). When the last choice is specified, cols. 1-60 are printed on the first interpreting line and cols. 61-80 are printed (by type wheels 41-60) on the second interpreting line.

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