CAROT 2 — GENERIC 2, ISSUE 3

CRASH PROCEDURES

CENTRALIZED AUTOMATIC REPORTING ON TRUNKS (CAROT)

1. INTRODUCTION

1.01 This section describes the CAROT 2 controller crash procedures associated with generic 2, issue 3 of the operating system software. In addition, some error messages which represent serious problems with the controller are also presented.

1.02 Whenever this section is reissued, the reasons for reissue will be listed in this paragraph.

1.03   In this section, the terms *restore data base* and *recover data base* imply two different meanings. Note this usage as it applies to generic 2, issue 3 of the operating system software.This section is intended to provide additional detailed discussions of crash and recovery procedures which are contained in Section 190-102-301.

2.   **DATA BASE RESTORAL PHILOSOPHY**

A.   Introduction

2.01   The data base is the information which gives the controller the data used to test trunks and/or perform other data manipulations. In order to ensure that this information is not destroyed (due to power failures, equipment problems, etc), a process, called backup, allows data base information to be written onto magnetic tape. These magnetic tapes are called backup tapes. If the data base information is destroyed due to a controller failure, the information can be read into the controller from the backup tape. Thus, the CAROT controller can be restored to the same working condition as before the failure.

2.02   As previously indicated, the backup tapes play a very important part in the day-to-day operations of the controller. The backup tapes contain the most up-to-date data information associated with the telephone offices which the CAROT serves. Changes to telephone offices are a continuing process to add, delete, and change telephone circuits to meet the needs of the customers. Thus, the information in the CAROT controller must also be kept up-to-date by making additions, deletions, and changes to the data base information. The process used to input new data base information is called *update* and is discussed in more detail in Sections 190-102-201 and 190-102-202. The point of the above discussion is to show that the new update information has now changed the data base. Thus, the backup tape previously made is not exactly like the present data base. Therefore, a new backup tape should be made after each update.

2.03   CAROT uses a method of backup tape generation called the "two-week save" method. This method uses a series of backup tapes which are rotated in a sequence allowing a two-week interval for backup copies of the data base. This method ensures that a valid copy of the data base exists in the event the latest backup tape is bad. Although this is not a common problem, it does protect the investment of many hours of work inputting data base information (see Section 190-102-201).

2.04   Another magnetic tape used in restoring the data base is the transaction tape. The transaction tape is generated during the update cycle and contains a copy of the information used to update the data base. This tape may be required to restore part of the data base if a crash occurs during the update cycle and before a backup tape is made. A description of the update cycle process is discussed in Section 190-102-201.

2.05   Another magnetic tape which might be used in restoring the data base is the 710 tape. The 710 magnetic tape is used only by CAROTs associated with 4ESS switching machines. It contains a copy of Circuit Maintenance System (CMS) update requests sent to the CAROT.

B.   Magnetic Tape Usage During Data Base Restoral

2.06   The following is a discussion of example controller crashes and the type of magnetic tapes used to restore the data base to normal operation. The discussion is divided into two parts in order to distinguish between CAROTs with and without CMS interaction. This discussion assumes that one backup tape per day is generated and is made during the update cycle. See Part 2C for a discussion on the generation of backup tapes.

Restoring the Data Base After a Crash (Without CMS Interaction)

2.07   The method of restoring the data base to normal depends upon the time. That is, the operator must consider what the controller was doing at the time of the crash. Figure 1 shows a typical controller schedule without CMS interaction for two typical days. Crash times are included for explanation purposes only. The following paragraphs explain the time of the crash and which tapes must be read into the controller to restore the data base. The examples used assume that the backup tape is good and does not have a parity error. This possibility is discussed in Part 2C.

2.08   *Crash 1 or 2:* As shown in Fig. 1, crashes 1 and 2 occur during the demand testing period and update period. These crashes occur after the backup tape was made for Day N−1 but before a transaction tape is generated on Day N during the update period. In this case, the data base is restored using the backup tape made on Day N−1; that is, the last backup tape generated. This is because no new
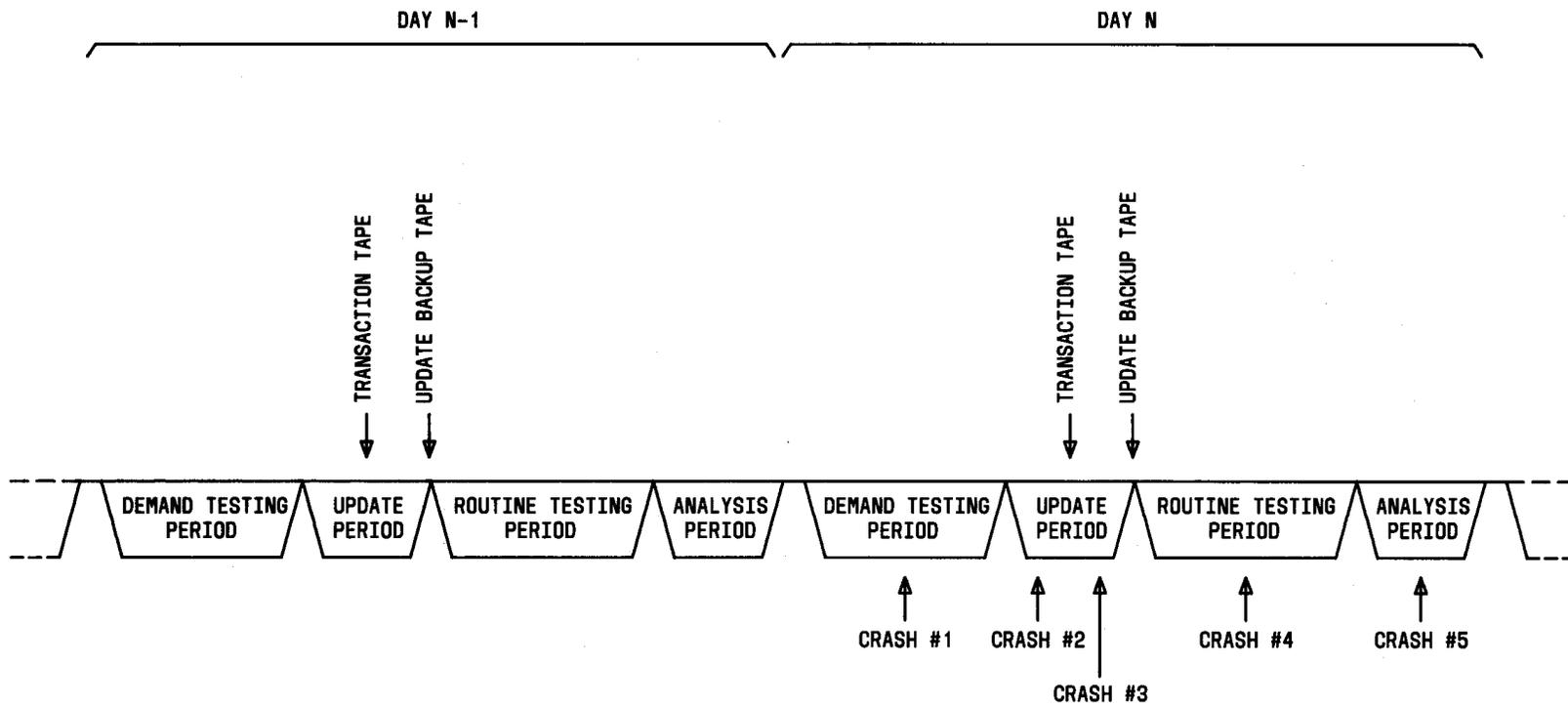
Fig. 1—Restore Data Base Without CMS Interaction

data base information has gone into the data base since the last backup tape was made.

2.09 *Crash 3:* As shown in Fig. 1, crash 3 occurs during the update cycle after the transaction tape has been generated but before the backup tape is made. In this case, the data base is restored using the backup tape for Day N−1. Now the update cycle can be rerun using the transaction tape as input (see Section 190-102-202 and the TRANDT and UPDIN parameters).

2.10 *Crash 4 or 5:* As shown in Fig. 1, crash 4 occurs during routine testing, and crash 5 occurs during analysis. The data base is restored using the backup tape generated on Day N. That is, the last backup tape generated.

2.11 A more complicated restoral procedure can occur in any of the above examples if the latest backup tape has a parity error. In this case, a previous backup tape must be loaded. Also, update must be run using all subsequent transaction tapes. Rotation of the backup tapes and the order in which the tapes should be used for restoral are discussed in Part 2C.

Restoring the Data Base After a Crash (With CMS Interaction)

2.12 CMS update data (sent via the data link) may be received by the controller during routine or demand testing period. The CMS information received by the controller is stored on disc, and a copy is also made on magnetic tape (710 tape). During the update cycle, all acceptable CMS update data (received during latest routine and demand testing period) is placed on the transaction tape with any other data during the same update cycle. Thus, the transaction tape contains the same CMS data as is on the 710 tape. A new magnetic tape should be mounted for 710 commands after each update cycle.

2.13 The method of restoring the data base to normal depends upon the time and date of occurrence. Figure 2 shows the controller schedule with CMS interaction for two typical days. Crash times are included for explanation purposes only. The following paragraphs explain the time of the crash and which tapes must be read to restore the lost information. The examples used assume that the backup tape is good and does not include a parity error. Rotation of the backup tapes and the order in which the tapes should be used for restoral are discussed in Part 2C.

2.14 *Crash 1 or 2:* As shown in Fig. 2, crashes 1 and 2 occur during the demand testing and update periods but before a transaction tape is generated. The data base is restored by using the last backup tape generated (Day N−1). However, the CMS update data on the 710 tape must also be restored. Otherwise, the CMS data base information cannot be used during the next update cycle.

2.15 *Crash 3:* As shown in Fig. 2, crash 3 occurs during the update cycle but after the transaction tape has been generated and before a backup tape is made. Since the transaction tape has been generated, the 710 data is on the transaction tape. In this case the data base is restored using the backup tape for Day N−1. Now the update cycle can be rerun using the transaction tape as input (see Section 190-102-202 and the TRANDT and UPDIN parameters).

2.16 *Crash 4 or 5:* As shown in Fig. 2, crash 4 occurs during routine testing and crash 5 occurs during analysis. The data base is restored using the backup tape generated on Day N; that is, the last backup tape generated. In addition, the CMS 710 tape data must also be restored. Otherwise, the CMS data base information cannot be used during the next update cycle.

2.17 A more complicated restoral procedure can occur in any of the above examples if the latest backup tape has a parity error. In this case, a previous backup tape must be loaded. Also, update must be run using all subsequent transaction tapes, and the latest 710 tape data must be restored (see Part 2C).

C. Backup Tape Rotation

2.18 As discussed previously, it is very important that a backup tape represents a good copy of the data base information. It is possible due to a magnetic tape problem or a system fault at the time the backup was made that the backup tape is bad. In some cases, the data base problem may not show itself for many days. For this reason, CAROT uses a method of backup tape generation called the "two-week save". The "two-week save" uses a set of 30 magnetic tapes (20 for non-CMS CAROTs) which are allocated as follows:

  10 tapes for data base backups

  10 tapes for transaction tapes

  10 tapes for 710 data from CMS.

DAY N-1

DAY N

RECEIVE
CMS UPDATE
DATA

TRANSACTION TAPE

UPDATE BACKUP TAPE

RECEIVE
CMS UPDATE
DATA

RECEIVE
CMS UPDATE
DATA

TRANSACTION TAPE

UPDATE BACKUP TAPE

RECEIVE
CMS UPDATE
DATA

DEMAND TESTING
PERIOD
UPDATE
PERIOD
ROUTINE TESTING
PERIOD
ANALYSIS
PERIOD
DEMAND TESTING
PERIOD
UPDATE
PERIOD
ROUTINE TESTING
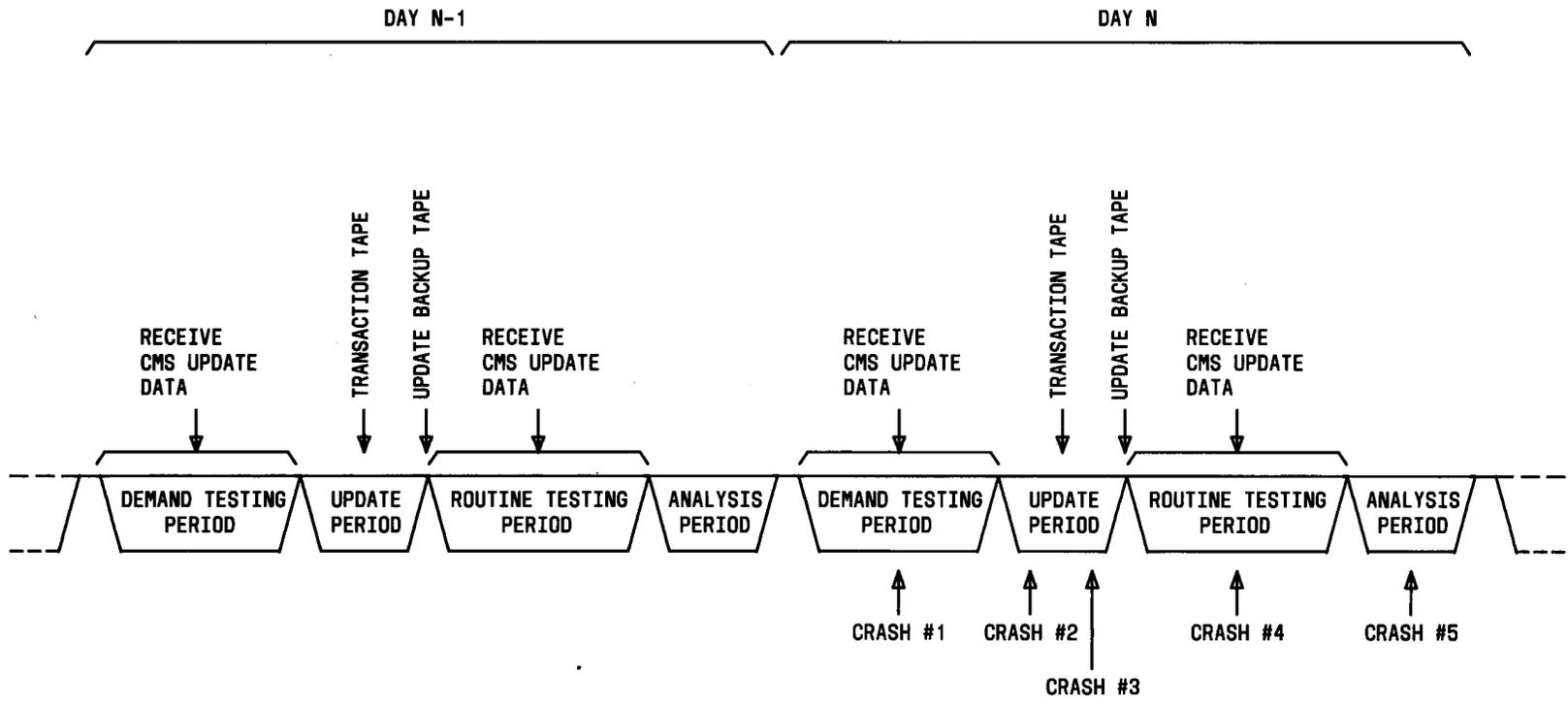PERIOD
ANALYSIS
PERIOD

CRASH #1   CRASH #2   CRASH #4   CRASH #5

CRASH #3

Fig. 2—Restore Data Base With CMS Interaction

Assuming a 5-day work week, this number of tapes will allow one backup, one transaction, and one 710 tape to be made each day (if required) for two weeks. At the start of the third week, the first tape written will be reused. In other words, each set of tapes for each task should be used in a sequencial order completing a full cycle of tapes before reusing the first tape.

2.19 Each set of tapes should be numbered 1 through 10. Whenever a new backup, transaction, or 710 tape is generated the next tape in the sequence is used. In addition, each tape should be labeled with the current date to ensure that the tapes are used properly. A record of magnetic tape usage can be made in a chart similar to that shown in Fig. 3. The chart is divided into backup, transaction, and 710 tape tasks. Each task has four rows of blocks which

allows eight weeks of magnetic tape usage records for each set of ten magnetic tapes.

2.20 An example of a partially filled out chart is shown in Fig. 4. Each time a magnetic tape is used, the date labeled on the tape should also be written on the chart. The chart can then be used as quick reference to which magnetic tapes are to be used for generating new data or restoring the data base. Notice in the example of Fig. 4, the backup tapes that were made on December 8. This is an instance where more than one backup tape was made in one day. As shown, use the letters A, B, C, etc, along with the date when more than one backup is made on the same date.

Fig. 3—Magnetic Tape Usage Chart

TAPE NUMBERS

	1	2	3	4	5	6	7	8	9	10
BACKUP TAPES	NOV 23	NOV 24	NOV 25	NOV 26	NOV 27	NOV 30	DEC 1	DEC 2	DEC 3	DEC 4
	DEC 7	DEC 8-A	DEC 8-B	DEC 9						
TRANSACTION TAPES	NOV 23	NOV 24	NOV 25	NOV 26	NOV 27	NOV 30	DEC 1	DEC 2	DEC 3	DEC 4
	DEC 7	DEC 8	DEC 9							
710 TAPES										

Fig. 4—Example of Partially Completed Magnetic Tape Usage Chart

D. Crash Recovery In Generic 2, Issue 3

2.21 Previously, it has been shown a failure of the controller (also called a crash) requires that the data base be *restored*. As of generic 2, issue 3, it is possible to *recover* the date base under certain conditions. That is, reboot the system without having to *restore* the data base. *Crash recovery* (as it is called) is possible only during the period from completion of analysis until the start of update cycle and from the completion of the update cycle until the start of routine testing. In addition, recovery is possible only for specific software crashes which are system errors and CAROT operating system errors. As will be shown later in this section, the operator need not know the condition of the system when the crash occurred. The system will tell the operator what action is required.

2.22 All files are not saved by a recovery. Neither are they saved by a data base restoral. The files not saved are as follows:

- 710 update requests (CMS)

- 710 results files (CMS)

- User batches

- Temporary daily testing lists.

The 710 update requests can be restored to the controller using the 710 tape, but the other files are lost. In addition, if a circuit order was being completed when the crash occurred, all items less than or equal to the item number printed on the terminal must be recompleted.

E. Use of Transaction Tapes When COTC is Implemented

2.23 In the preceding data base restoral philosophy, we assumed the data base contained a routine and demand testing (RDT) data base and possibly a test frame tape preparation (TFTP) data base. If the CAROT controller is ever implemented with a circuit order testing and completion (COTC) data base, the use and function of the transaction tape is different.

2.24 If the update transactions on the transaction tape are only for the RDT data base or TFTP data base, the transaction tape can be used to restore data base information exactly as described previously. If, however, the transaction tape contains any additions, deletions, or changes to the circuit order items, the tape may *not* be used to restore data base information.

2.25 The reason for this is the circuit order items are read from an update tape during the update cycle and have additional data stored on disc at the same time. That is, the transaction tape is not a complete record of the update transaction because update needs the data stored on the disc as well as the data on the tape in order to reproduce the transaction.

2.26 When the controller crashes or data base problems occur, the philosphy (of transaction tape usage with a COTC data base) gets complicated if it is necessary to revert to a backup tape made before the transaction tape was made. Here the transaction tape cannot be used because the information stored on the disk at the time the transaction tape was made no longer exists. Thus only the original update inputs may be used to restore the data base to its proper state. Also, all completions which were done after the backup used and prior to the crash must be completed again.

3. CAROT 2 CONTROLLER CRASHES

A. How to Recognize a Crash

3.01 A crash is when the CAROT 2 controller fails to operate in a prescribed manner. In general, the system will *not look right*. That is, a system that is running correctly should have the display register lights polling in both the data and test processors.

(This assumes that the system is up for remote users. If the MPBOOT command has not been given, then the test processor will not be polling. In some cases this is normal.)

3.02 The most obvious way in which the system will fail is to come to a halt or to print some system error message on the console.

B. Crash Recording and Reporting

3.03 A system crash may exhibit itself in many ways. A list of the known failure modes and the procedures to follow for each case are given later in this section. However, an operator may also notice *strange* behavior of the controller at some point in time which may or may not be symptomatic of a crash. In cases such as this, contact the WE—PECC center or the local maintenance organization. If this is impossible, reboot the system and do a data base restoral (or recovery). Be sure to write down all information relating to the *strange* behavior for later use by the maintenance people.

C. Bootup of Controller and Restoral of the Data Base

3.04 Bootup is a term used to describe the procedure used to bring the system software in the controller into a known operating condition. Whenever a crash occurs or the system is not operating properly, the bootup procedure must be performed to restart the system. As discussed in Part 2D, it may be possible to recover the data base. The recovery procedure is part of the bootup process, and the user will be told by the controller as to the status of the recovery process. If it is impossible to **recover** the data base, the data base must be **restored** using the backup tape process.

Bootup CAROT Controller—Procedure

3.05 Chart 1 contains the step procedures necessary to bootup the CAROT controller. This procedure assumes the data processor is an HP 2113 or HP 2112 and the test processor is an HP 2108 or HP 2109 and both processors contain disk read only memory (ROM) loaders. In addition, it assumes the user is familiar with octal numbering.

CHART 1

BOOT UP CAROT CONTROLLER

APPARATUS:

> None

STEP	PROCEDURE
1	Depress HALT switch on test processor.
2	Select the S-register and store octal 001300. Depress the STORE, PRESET, IBL, and RUN switches.
3	Depress HALT switch on data processor.
4	Select the S-register and store octal 111300. Depress STORE, PRESET, IBL, and RUN switches. CRT displays **SET TIME**. Both processors will halt with 102077. CRT displays **TPLOD DONE**.
5	Select the P-register on the test processor and store octal 000002. Depress the STORE and RUN switches on the test processor and the RUN switch on the data processor.
6	At this time, the CRT will display one of two messages. One CRT display is as follows:

WHEN PROMPTED WITH ! TYPE G

If this message is displayed, it indicates the controller had been previously brought to an orderly halt. Thus, the data base need not be restored. Go to Step 7.

The other message is as follows:

A CRASH HAS OCCURED. DO YOU WISH TO RECOVER? TYPE 1 FOR YES, 99 FOR NO

Typing a **99** here will bypass the recovery process. Go to Step 7.

Typing a **1** will start the recovery process. During the recovery process, the CRT will display one or more of the following messages:

CRT MESSAGE.

THE CRASH OCCURRED DURING UPDATE. THEREFORE, WE CANNOT RECOVER. THE DATA BASE MUST BE RESTORED.

THE CRASH OCCURRED DURING SUSPENDED ROUTINE TESTING. THEREFORE, WE CANNOT RECOVER. THE DATA BASE MUST BE RESTORED.

THE CRASH OCCURRED DURING ROUTINE TESTING AND CANNOT BE RECOVERED. THE DATA BASE MUST BE RESTORED.

CHART 1 (Contd)

STEP	PROCEDURE

FMP ERROR CODE = *xxx* **ON OPEN TO FILE** *xxx* **WE CANNOT RECOVER FROM THIS CRASH. REBOOT AND RESTORE DATA BASE.**

CRASH RECOVERY NOT POSSIBLE. REBOOT AND RESTORE THE LATEST DATA BASE. THEN FOLLOW NORMAL RECOVERY PROCEDURES FOR ANY CIRCUIT ORDER COMPLETIONS OR CMS 710 TAPES.

THE CRASH OCCURRED DURING A CIRCUIT ORDER COMPLETION. THE FOLLOWNG COMPLETION MUST BE REDONE AFTER BOOTUP.

WE HAVE SUCCESSFULLY FIXED THE CIRCUIT ORDER FILES AND THE UTILITY FILE. THE DATA BASE IS NOW WHOLE AGAIN. ENJOY!

CONTINUE THE NORMAL BOOTUP PROCEDURE. IF YOU HAVE A CMS 710 TAPE WHICH WAS BEING USED WHEN THE CRASH OCCURRED, RESTORE WITH IT BEFORE TYPING LUP TO ENABLE THE CMS DATA LINK.

THE TOTAL NUMBER OF UTILITY FILE EMPTY SECTORS=.

Observe each CRT message displayed for future use (eg, the circuit order completions).

7   Whether or not the bootup was successful, the CRT will display:

WHEN PROMPTED WITH ! TYPE G

Type **G** and return. The CRT will display:

PLEASE ENTER DATE & TIME and the data processor register display lamps will scan from right to left.

8   Set the system clock by typing:

NOW: *mm/dd/yy hr:mi:se*

Where:
    mm=month

    dd=day

    yy=year

    hr=hour of the day (Ø through 24)

    mi=minutes
    se=seconds

For example, **NOW:Ø4/18/81 14:28:ØØ** is April 18, 1981 at 2:28 p.m.

D. Restoring the Data Base

3.06 When it is not possible to *recover* the data base during the bootup of the controller, the data base must be *restored* using the backup, transaction, and 710 backup tapes. As discussed in Part 2, the operator must decide whether the transaction or 710 tapes are to be used.

3.07 Chart 2 is a general explanation of the restore process. It also includes procedures for restoring data base information. A detailed procedure is contained in Section 190-102-301.

CHART 2

PROCEDURE TO RESTORE THE DATA BASE

APPARATUS:

None

STEP	PROCEDURE

1 If necessary, inform CAROT users that the controller should not be used for testing, etc.

2 Enter the update utility system by typing **SET:UTIL=YES**. Now type **SLEEP**. Within 60 seconds, a list of utility programs will be displayed on the CRT.

3 Type the number corresponding to the BACKUP/RESTORE module. The CRT will display a message to mount the backup magnetic tape.

4 Mount backup tape and type **8** or **16** to indicate the number of bits-per-inch used by the tape drive (HP 7970B is 800 bits-per-inch while HP 7970E is 1600 bits-per-inch). The CRT will display the following message:

ENTER IN OR OUT AS TO THE DIRECTION OF THE DUMP.

5 Type **IN**. The magnetic tape will be read and rewound.

Note 1: It is possible that there is more than one backup tape. In that case, the CRT will display the appropriate message.

Note 2: If the message **CHECKSUM ERROR ON BACKUP TAPE** is displayed, start the restoral procedure again using the same backup tape. If the error occurs again, use an earlier backup tape to restore data base.

After the tape is read, the CRT will display a message to indicate that **BACKUP/RESTORE HAS FINISHED** and a list of utility programs. Type **DONE** to exit update utility system. Remove and store backup tape. At this point, the data base has been restored.

If it is necessary to use transaction tape, go to Step 6. If it is necessary to restore 710 tape, go to Step 11. Otherwise, go to Step 15.

CHART 2 (Contd)

STEP	PROCEDURE

6   In order to restore the transaction tape information, the CAROT must be put into the update cycle. Type **SET:TMODE=7, OPER=YES, UPDIN=UT, TRANS=YES, TRANDT=** (date of transaction tape).

7   Force the controller into the update cycle by changing the machine schedule update time to equal the current time plus 1 minute. (For example, if the present time is 12:30 p.m. Monday, type **SET:MON.UD=1231.**) Wait for the controller to go into the update cycle. The CRT will display **PREVIOUS ROUTINE TESTING RESULTS HAVE BEEN DELETED** and **DATA BASE UPDATE—LOAD UPDATE TRANSATION TAPE TO BE READ—TYPE 1 TO PROCEED—TYPE 99 TO STOP USING TRANSACTION TAPES.**

8   Mount the transaction tape and type **1** to proceed. The update process will begin and the magnetic tape is read. After the information has been processed, the CRT will display **LOAD THE NEXT UPDATE TRANSACTION TAPE TO BE READ.**

9   If another transaction tape is to be read, mount it on magnetic tape unit and type **1** to continue. If not, type **99**.

     Note: It is possible the transactions are contained on two magnetic tapes. After all transaction tapes are read, update will complete.

     If the CMS 710 tape data is not to be restored, go to Step 15.

10   Reset the machine schedule to the normal update time.

11   Type **MTCOPY=YES** and **LDOWN.**

12   Mount the 710 type to be read.

     Note: If more 710 data will be stored on this after restoral, install the write ring in the magnetic tape.

13   Type **RESTORE** to read the tape. After tape is read, the CRT will display *****RESTORE COMPLETE***.**

14   If more 710 data is to be written on this tape, type **LUP.**

15   Set the system clock to the current time and inform all users the CAROT controller is ready for use.

E.   Error Messages and Conditions Associated With Controller Crashes and Problems

3.08 The following information is intended as an aid in solving controller crashes. It is not intended to be a comprehensive list, but is provided for your information. The following paragraphs contain either an error message that is printed on the CRT console or a condition of the controller. After the appropriate information has been obtained, boot up and restore (or recover) the CAROT controller.

MP C.OS *xxxxx* or C.OS ABORTED Error Messages

3.09 These error messages and additional data will be printed on the CRT console and at the line printer. Write down what the controller was doing just before the error ocurred and all the messages printed at the CRT console. In addition, save the line printer output.

Errors of the type *xx nnnnn zzzzz* and *nnnnn* ABORTED

3.10 Write down what the controller was doing just before the error occurred. Be sure to record all the messages on the CRT console.

   Note 1: If *xx* is "MP" and *nnnnn* is "C.OS", refer to paragraph 3.09.

   Note 2: Other error messages included under this grouping are **DM VIOL=*nnnnn*, RQ *nn*, BAD SECTOR ADDRESS, SYSTEM ERROR.**

Halt Conditions

3.11 The definition of a halt as used here means the RUN lamp on either (or both) processors is not lighted. Write down what the controller was doing just before the halt occurred. Next, write down the contents of the following registers in the halted processor(s).

   T-register (or memory DATA)

   A-register

   B-register

   M-register

   P-register

   S-register

Finally, depress the DEC M button on the processor (only once) and write down the contents of the T- (or memory DATA) and M-registers.

ILL INT *xx* Error Message

3.12 Write down what the controller was doing just before the error message occurred. In addition, write down the CRT error message (eg, **ILL INT 10**).

TR *xxxx* EQT *xx* U *xx* S [or U] *Error Message*

3.13 This error message indicates a disk drive problem. Write down the error message just as it is printed. An example is **TR0004 EQT 1 U02 S.** Now, call the maintenance organization for your controller and inform them you are receiving "TR" errors from a system with RTE-IV software and with an HP 7905 (and/or HP 7920) disk drive. The data base should be considered damaged and must be restored.

DRIVE FAULT Indicator Lamp Lighted on Disk Drive

3.14 This disk drive problem should be reported to the maintenance organization for your controller. Also state the type of disk drive. The data base should be considered damaged and must be retored.

I/O *xx* L*xx* E1 S*x* Error Message

3.15 **E1** in the error message indicates equipment number 1 or the disk drive. This message may occur in conjunction with a DRIVE FAULT indicator. Report the error message along with the type of disk drive to the maintenance organization. The data base should be considered damaged and must be restored.

UPD1:PAUSE Error Messages

3.16 Occasionally, during the running of the update process, the controller may stop its processing and display a CRT error message such as **UPD1: PAUSE** xx, where xx may be one of the following numbers:

xx	Type of Trouble
4	File manager read error
5	File manager write error
6	Checksum error on read of file manager file
12	File manager file bit map error
13	File manager file bit map error
73	Scatter table does not point to right record
74	Scatter store algorithm points to last sector in table
75	Disc error
76	Disc error
77	Bad sector address.

3.17 PAUSE error messages are indications of either data base or disc hardware problems. In any event, the following action should be taken.

   (a) Halt both processors and reboot.

   (b) Dump completion notice file (program LICNF) to get a list of the circuit orders completed since the latest backup tape was made.

   (c) Run LFILE to get list of user files to be used by update.

   (d) Restore the data base using the latest backup.

   (e) Restore the users file using EDIT program to save the desired files for update.

   (f) Recomplete the circuit orders and items which had been completed since the last backup tape was made.

3.18 If a PAUSE 75 or 76 (which indicates a disc hardware problem) recurs, then disc diagnostics should be run and/or the maintenance organization notified. If any of the other PAUSE messages recur, the data base should be restored again; however, an older backup tape must be used to restore the data base. Continue trying older backup tapes until update can be run successfully. Then use update and transaction tapes to restore the data base to its latest form. If any circuit-order completions were done in the time betwen the backup and this update, they must be repeated. In all cases of recurring PAUSE messages, the PECC center should be notified.

3.19 In addition, it can be ascertained from the **PAUSE** messages and other update messages on the CRT and line printer whether the problem occurred during the analysis of completions, user files, update input tape, or whatever stage of update. This information will be of value to PECC in determining the location or cause of the problem.