

- 1. IDENTIFICATION
- 1.1 Digital-7-93-U
- 1.2 DEctape Retrieval System (DEctRIEVE-7)
- 1.3 December 17, 1965



## 2. ABSTRACT

The DECTape Retrieval System for the PDP-7 (DECTRIEVE-7) consists of a self-loading group of binary programs which include all of the subroutines necessary to operate the retrieval system itself plus PDP-7 systems programs or user programs desired for a particular installation. DECTRIEVE-7 allows quick access to a large library of programs on DECTape, permits easy modification of the system itself, and, except during the creation of the system, eliminates the necessity of handling paper tape for most operations.

The user receives the necessary programs for creation of a basic system tape plus a standard system tape containing many of the most used programs. The user can add or delete any programs in binary format.

For ease in access to the system a bootstrap program normally resides in memory and will not be destroyed except in rare instances. In those cases where the bootstrap is destroyed, a small paper-tape bootstrap is provided which can be loaded with the normal Read-In Mode Loader.

DECTRIEVE-7 is designed mainly for the retrieval of tested programs in binary format and is not designed to allow compiling, assembling, editing, etc., to or from DECTape. In addition, it is not compatible with the DECTape FORTRAN System (DECSYS).

## 3. REQUIREMENTS

### 3.1 Storage

The program requires an 8K PDP-7. DECTRIEVE-7 occupies locations 12600 - 15777, all of which can be used by a running program but cannot be overlaid during the loading of a program. The system bootstrap occupies locations 17500 - 17572 which should not be destroyed during the loading or running of any program.

### 3.2 Subprograms and/or Subroutines

The basic system uses the PDP-7 DECTape Subroutines and a slightly modified version of the Teletype Output Package, both of which are included as part of the system.

### 3.3 Equipment

The system requires an 8K PDP-7, with at least one DECTape drive, Teletype, and paper-tape reader. If any "copy" functions are to be used, a second DECTape drive is required. The basic system tape must always be mounted on a DECTape drive dialed to unit 1.

## 4. USAGE

DECTRIEVE-7 includes a variety of functions. For purposes of clarity, the use of the various functions is discussed in detail in paragraph 6, DESCRIPTION.

## 5. RESTRICTIONS

None except those shown under paragraph 3, REQUIREMENTS.

## 6. DESCRIPTION

The following paragraphs describe in detail the use of the various system functions. Paragraphs 6.1.1 and 6.1.2 describe the procedures necessary to create a basic system tape from scratch, and are not used unless some modification is necessary to the system itself or it is necessary to create a new binary paper tape of DECTRIEVE-7.

6.1 Discussion

6.1.1 Creating a Binary Paper Tape for the System Tape Creation

A series of twelve individual ASCII symbolic paper tapes are provided which should be assembled as separate programs (except where noted) to provide one, long, continuous binary output. The tapes must be assembled in the order shown using the standard PDP-7 Assembler, and to reduce the size of the binary output it is suggested that DDT symbols not be punched.

6.1.1.1 Assemble the tapes in the following order as separate programs creating a single output tape:

Tape 1 - Dummy Directory

Tape 2 - Selective Copy Routine

Tape 3 - Update Routine

Tape 4 - Print Routine

Tape 5 - Copy Routine

Tape 6 - Delete Routine

Tape 7 - Clear Routine

Tapes 8, 9, 10 (as one program) - Memory Portion, DECtape Routines, Teletype Routines

Tape 11 - Bootstrap Routine

Tape 12 - System Creation Routine

6.1.1.2 When used, the binary output tape should be loaded so that the System Creation Routine is the first one read.

6.1.2 Creating a DECtape System Tape

6.1.2.1 Place a certified DECtape on a drive dialed to unit 1, and enable writing.

6.1.2.2 Place the paper-tape binary version of the system in the paper-tape reader.

6.1.2.3 Set the ADDRESS Switches to 17770 and press START.

The tape will be read in, loading itself onto the DECtape. When complete, the system types "FUNCTION OR PROGRAM" and waits for the user to request a program. At this point, the entire system has been created and the DECTRIEVE-7 is ready for use. Any of the six basic functions described below can now be used.

6.1.3 Printing the Directory

6.1.3.1 When the computer types "FUNCTION OR PROGRAM," type in PNT followed by a carriage return.

6.1.3.2 DECTRIEVE-7 types the names of all files in its directory together with the DECtape block (in octal) on which they begin. The first six entries always indicate the basic DECTRIEVE-7 programs.

6.1.3.3 When the directory has been listed, the system types "END" and returns to the common wait loop after typing "FUNCTION OR PROGRAM."

6.1.4 Clearing the Directory

6.1.4.1 When the computer types "FUNCTION OR PROGRAM," type in CLD followed by a carriage return.

6.1.4.2 The directory is cleared and rewritten on the system tape. Note that all file names except the six basic DECTRIEVE-7 programs are cleared.

6.1.4.3 After the directory has been rewritten, the system types "END" and returns to the common wait loop after typing "FUNCTION OR PROGRAM."

### 6.1.5 Deleting a File From the Directory

6.1.5.1 When the computer types "FUNCTION OR PROGRAM," type in DEL followed by a carriage return.

6.1.5.2 The computer types "FILE TO DELETE." Type in the correct name of the file to be deleted followed by a carriage return.

6.1.5.3 If a correct name has been typed, the file is deleted from the directory, and the computer retypes "FILE TO DELETE." If additional files are to be deleted, type in the next file name and continue as in paragraph 6.1.5.2; otherwise type a single carriage return.

6.1.5.4 If a single carriage return is typed, DECTRIEVE-7 rewrites the new directory on the system tape, types "END," and returns to the common wait loop after typing "FUNCTION OR PROGRAM."

6.1.5.5 If the file name typed by the user is a nonexistent name or one of the names of a basic DECTRIEVE-7 program routine, the computer types "NO" and requests a correct name. Type in the correct name and continue as in paragraph 6.1.5.2.

6.1.5.6 If an incorrect key is typed inadvertently, press the RUB OUT key. The computer types "NO," after which type in the correct name and continue as in paragraph 6.1.5.2.

6.1.5.7 Note that though deletion of a file creates available space in the system tape directory, it does not make available the DECTape blocks occupied by the deleted file. The latter can only be recovered by copying the system tape (see paragraph 6.1.6).

### 6.1.6 Copying the Entire System Tape

6.1.6.1 In addition to the basic system tape mounted on unit number 1, mount a second certified DECTape on a drive dialed to unit 2. This second tape will contain the condensed system copied from the original tape. Writing must be enabled on unit 2.

6.1.6.2 When the computer types "FUNCTION OR PROGRAM," type CPY followed by a carriage return.

6.1.6.3 The routine copies the contents of the original system tape (including all of the basic DECTRIEVE-7 programs) in the order indicated by the original directory, placing the files in consecutive blocks on the new tape. This procedure makes available on the new tape all of the DECTape blocks used by files which have been deleted.

6.1.6.4 After the entire tape has been copied, the routine writes a revised directory on the new tape, reestablishes the bootstrap program in memory (which may have been destroyed by the copying process), types "END," and returns to the common wait loop after typing "FUNCTION OR PROGRAM."

6.1.6.5 Note that though the information contained on both tapes is the same, the blocks occupied by the various files may be entirely different.

6.1.6.6 To use the newly created system tape, dial out the current DECTape, dial the new tape to unit 1, place the tape in write lock status, and START at location 17500 (the bootstrap location). (See paragraph 6.1.9.)

The user cannot use the new tape without returning to the bootstrap since the directory currently in memory refers to the old and not the new tape.

### 6.1.7 Selectively Copying the Systems Tape

6.1.7.1 In addition to the basic system tape mounted on unit number 1, mount a second certified DECTape (which may be an unused tape or a previously created system tape) on a drive dialed to unit 2. The routine either copies a particular file onto a previously created system tape or creates a new system tape with the specific files desired. Writing must be enabled on unit 2.

6.1.7.2 When the computer types "FUNCTION OR PROGRAM," type SCP followed by a carriage return.

6.1.7.3 When the computer types "NEW TAPE," type YES followed by a carriage return if a new system tape is to be created. If the tape on unit 2 is a previously created system tape, simply type a carriage return. If YES is typed the routine creates a new directory and transfers all of the basic DECTRIEVE-7 programs and bootstrap. If a single carriage return is typed, the routine reads in the second directory.

6.1.7.4 When the computer types "FILE NAME," type the name of the file to be copied followed by a carriage return. The routine copies the desired file onto the new tape and enters its name in the first free space in the second directory.

6.1.7.5 When the file has been copied, the computer types "FILE NAME" again. If additional files are to be copied, continue as in paragraph 6.1.7.4 above. If there are no more files to copy, type a carriage return. The routine writes out the second directory, reestablishes the bootstrap program in memory (which may have been destroyed by the copying process), types "END" and returns to the common wait loop after typing "FUNCTION OR PROGRAM." To use the second system tape follow the directions outlined in paragraph 6.1.6.6 (q.v.).

6.1.7.6 If an incorrect key is typed inadvertently, press the RUB OUT key. The computer will type "NO," after which type in the correct information and continue.

6.1.7.7 If the second directory is full (4210 entries), the computer types "DIRECTORY FULL" and exits from the routine as described in paragraph 6.1.7.5 above.

6.1.7.8 If the name of the file to be copied already exists in the second directory, the computer types "PRESS CONTINUE TO DELETE PREVIOUS FILE." If the file name is correct and the old file is to be effectively deleted, press CONTINUE. If the file name is incorrect or the old file is not to be deleted, START at 14777 and a new "FILE NAME" will be requested. Never copy any of the six basic DECTRIEVE-7 programs (CLD, DEL, PNT, CPY, SCP, or UPD).

#### 6.1.8 Adding to the System Tape

6.1.8.1 The system tape to be added to will be the one currently in use on unit 1. Writing must be enabled. The routine adds binary versions of programs or data to the system tape either from core memory or from paper tape. Since files can be added from core memory, it provides a handy means of dumping an entire program or data for future use.

6.1.8.2 When the computer types "FUNCTION OR PROGRAM," type UPD followed by a carriage return.

6.1.8.3 When the computer types "FILE NAME," type the name to be given to the file followed by a carriage return. Only the first six characters typed are used; all other characters are ignored. Any characters having ASCII codes between 240 and 377 can be used in the name; however the name cannot begin with either three spaces (which would appear as an unused entry in the directory) or with three left arrows (which would appear as a deleted entry in the directory).

If the file name typed already appears in the directory the computer types "PRESS CONTINUE TO DELETE PREVIOUS FILE." If the file name typed is correct and the previous file of the same name is to be deleted, press CONTINUE. If a different name is desired, START at 14500 and type the correct name when requested. In no case should a file be added with the same name as one of the six DECTRIEVE-7 programs (CLD, DEL, PNT, CPY, SCP, or UPD).

If no room remains in the directory, the computer types "DIRECTORY FULL," rewrites the directory if necessary, reestablishes the bootstrap, types "END," and returns to the common wait loop after typing "FUNCTION OR PROGRAM." No additional files can be added until one or more files are deleted.

6.1.8.4 When the computer types "FIRST CORE ADDRESS," type the lowest core location used by the program or data on loading, followed by a carriage return. The address may not be in the range 0-20 or 12600 - 15777, but may be any other address in normal or extended memories.

6.1.8.5 When the computer types "LAST CORE ADDRESS," type the highest core location used by the program or data on loading followed by a carriage return. The address may not be in the range 0-20 or 12600 - 15777, but may be any other address in normal or extended memories. In addition, the program itself may start below 12600 and end above 15777 if that area itself is not required when loading the program. (The area may be used by the running program.) For example, all of the following pairs of first and last addresses are acceptable:

21 - 10000  
10000 - 13357  
21 - 12577  
16000 - 17777  
16000 - 35777  
21 - 17777  
12577 - 17777

In the last two cases, the file would actually be written as two separate records: the first section ending at location 12577 and the second section beginning at 16000. The user need not concern himself with this fact however, as both parts are read automatically whenever the file name is referenced.

Note that only one specification of range delimits the entire area used by the program or data.

6.1.8.6 When the computer types "STARTING CORE ADDRESS," type the location at which the program is to start running when loaded, followed by a carriage return. Here again, the address may not be in the range 0 - 20 or 12600 - 15777 but may be any other address in normal or extended memory and need not necessarily be within the program area defined. If the program is not designed to start automatically, the address given should be the address of a HLT instruction within the program. If a second program must be read in, the address given might be 17500, the start of the system bootstrap. If the program normally would have set up registers below location 21 on loading, the starting address given should reference some free area in memory where instructions are placed to set up the required registers by programming.

6.1.8.7 After accepting the starting address, the computer types "MEM or TPE." Type MEM followed by a carriage return if the information is already in core memory; otherwise type a carriage return to read in any Assembler-produced binary paper tape. The information should be assembled so that the last tape ends with a "START 14777" statement. If the program is assembled without such a statement, follow the directions in paragraph 6.1.8.8 below, after the tape has been read.

6.1.8.8 After the above operation the routine adds the file to the system tape (if already in memory) or reads in the binary paper tape and adds the program to the system tape. If the information being read did not end with a START 14777 instruction, the computer either halts or begins executing the program. To continue the loading process, stop the computer and START at 14776.

6.1.8.9 When the file has been added to the system tape, an appropriate entry is made in the directory and the routine requests the next "FILE NAME." If additional files are to be added, repeat the steps beginning with paragraph 6.1.8.3. If no more files are to be added, type a carriage return. The routine writes the updated directory, reestablishes the bootstrap, types "END," and returns to the common wait loop after typing "FUNCTION OR PROGRAM."

6.1.8.10 If an incorrect key is typed inadvertently, press the RUB OUT key. The computer types "NO" after which type in the correct information and continue. If any of the addresses typed fall within the prohibited ranges, the computer types "NO" and waits for the correct information to be typed.

#### 6.1.9 Recalling DECTRIEVE-7 with the Memory Bootstrap

6.1.9.1 If the bootstrap in memory between locations 17500 and 17572 has not been destroyed, START at 17500 with the system tape mounted on unit number 1.

6.1.9.2 The routine rewinds the system tape, reads in the memory portion of DECTRIEVE-7 and the directory, and requests a "FUNCTION OR PROGRAM." Type the name of the file desired followed by a carriage return.

#### 6.1.10 Recalling DECTRIEVE-7 with the Paper Tape Bootstrap

6.1.10.1 If the memory bootstrap has been destroyed, place the binary paper tape version of the bootstrap in the reader, set the ADDRESS switches to 17770, and press START.

6.1.10.2 The paper tape is read and DECTRIEVE-7 is recalled from the system tape as described in paragraph 6.1.9.2 above.

6.1.10.3 Note that certain programs (for example, the Assembler) always destroy the bootstrap in memory because of the areas reserved for symbol tables, etc.

## 7. METHODS

### 7.1 Discussion

7.1.1 DECTRIEVE-7 is designed mainly to facilitate use of the computer during both testing and production runs of a program. It allows faster recall of data or programs used most often and eliminates the need for much of the paper-tape handling. It does not in itself provide a means of assembling, compiling, editing, etc., to or from DECTape but provides merely a handy, fairly efficient, storage medium. In addition, DECTRIEVE-7 is incompatible with the paper tape and DECTape FORTRAN systems (DECSYS) and with DDT because of space limitations. If DDT is used manually (i.e., using the normal paper tape procedure) DECTRIEVE-7 must be reentered beginning with the paper tape bootstrap.

7.1.2 DECTRIEVE-7 contains three major parts as described below:

1. The bootstrap - Allows quick automatic recall of the Retrieval System.
2. The Memory Portion - Consists of the basic control functions, the Teletype input and output subroutines, the DECTape subroutines, and a constant dispatch table to allow the six basic DECTRIEVE-7 programs to communicate with the subroutines in memory. The directory can also be considered as part of the memory portion since it is kept in memory whenever the DECTRIEVE-7 is called.
3. The six basic programs which allow user manipulation of the system itself.

7.1.3 In essence, the memory portion monitors the Teletype keyboard, transfers data to and from DECTape, and types control messages. If a file is requested, the name is found in the directory, the correct block or blocks are read, and a transfer is made to the starting address of the program. In the case of the six DECTRIEVE-7 programs, all are read into the same memory area and communicate through the dispatch table with the various subroutines in memory.

7.2 Algorithms (Not Applicable)

7.3 Accuracy (Not Applicable)

7.4 Error Table

Other than the halt instructions which occur in conjunction with the control messages described previously, only the following halts exist:

Memory Location	Meaning	Procedure
13255	Repetitive DECTape error. Message indicates type of error as follows: 100: Illegal format 200: Block not found 300: Error flag during searching; not end of tape 400: Error flag during reading 500: Sum check error reading 600: Error flag during writing 700: Block mark error during writing	Error has occurred three times. Press CONTINUE to try three additional times. If error is persistent use a new DECTape.
13306	Interrupt occurred from a device other than DECTape or Teletype. Accumulator indicates result of IORS command.	Clear the offending device flag and continue if possible. If the program will not continue, be sure the device is cleared and transfer to the bootstrap at 17500 to start over.

8. FORMAT

8.1 Input Format

The only input required by DECTRIEVE-7 is that required when adding to the system tape. In this case the tape must be an Assembler produced binary tape with or without DDT symbols. The tape is read with the normal RIM Loader at 17762-17776 in memory. This RIM Loader should never be destroyed.



## 8.2 Core Format

The following table indicates the areas used by DECTRIEVE-7:

Area	Use	Comments
12600-1477	Housekeeping, keyboard monitor, DECTape, Teletype, and error routines.	Can be destroyed by any running program, but cannot be destroyed during the loading of that program.
14500-14777	Used as the common readin area for the six basic DECTRIEVE-7 programs.	Same as above.
15000-15377	System tape directory area.	Same as above.
15400-15777	Directory area for second tape during copy functions. Also used by System Creation subroutine.	Same as above.
17500-17572	Permanent DECTRIEVE-7 bootstrap routine.	Should not be destroyed during the loading or running of any program, but can easily be restored with the paper tape bootstrap provided.
17762-17776	Normal RIM Loader	Should never be destroyed.

## 8.3 Output Format

8.3.1 The organization of the basic DECTRIEVE-7 system tape is as follows: (Block numbers indicated in octal.)

Block 0:	Not used
Block 1-4:	Memory portion of system
Block 5:	Directory
Block 6:	Bootstrap
Block 7:	Clear Directory Routine (CLD)
Block 10:	Delete Routine (DEL)
Block 11:	Copy Routine (CPY)
Block 12:	Print Directory Routine (PNT)
Block 13:	Update Routine (UPD)
Block 14:	Selective Copy Routine (SCP)
Blocks 15 - 1100:	Any additional files added
Block 1101:	Not used

8.3.2 The format of the directory is as follows:

Register 0:	Next free block	}	One file entry
Register 1:	Name of file (first three letters)*		
Register 2:	Name of file (last three letters)		
Register 3:	Starting DECTape block number		
Register 4:	First core location		
Register 5:	Last core location		
Register 6:	Starting address of the program	}	10 additional entries repeating registers 1 - 6
Registers 7 - 252:	Space for 41		
Registers 253 - 255:	Not used		

9. EXECUTION TIME (Not Applicable)

10. PROGRAM

10.1 Core Map

See paragraph 8.2

10.2 Dimension List (None)

10.3 Parameter List

See complete listing of DECTRIEVE-7 provided in Digital-7-93L-U.

10.4 Program Listing

See Digital-7-93L-U for a complete listing of the program and symbol tables.

11. DIAGRAMS (None)

12. REFERENCES (None)

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\*If the first register of an entry is equal to 777777, a deleted file is indicated and additional entries may follow. If the register is equal to 000000, the end of the used portion of the directory has been reached and no further entries follow.