MOSN-231

TO: Distribution

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SUBJECT: Operator's Guide to BOS

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Description

BOS (Bootload Operating System) is a set of programs for performing functions such as loading the Multics system; core, disk, and drum dumping; patching; and normal and emergency shutdown.

BOS consists of five parts:

1.	Loader	A program loaded from tape which loads the other BOS programs onto the disk or drum.
2.	toehold	A 300_8 (octal) word program permanently residing in core at location 0.
3.	control program	A program to perform administrative functions for BOS. These include saving and restoring machine conditions and loading command programs.
4.	command programs	A number of programs which perform the various functions of BOS.
5.	utility package	utility subroutines used by the command programs and accessed through a transfer vector.

Channel Requirements

BOS requires the following GIOC or IOM peripheral channels for proper operation:

Peripheral Device	GIOC Channel #	IOM Channel #
operator's console	44_8	20_8
magnetic tape	34_8	12_8
printer	42_8 or 50_8	15_8
card reader	46_8	16_8

In addition, if BOS is to reside on the DSU-270 disk, the disk channel number must be 27_8 for a GIOC. For the IOM, it must be less than 20_8.

BOS will use as much core memory as is available. It will access a calendar clock if it is configured in.

Loading BOS

The BOS loader is operated as follows:

1. Place the two card BOS GIOC bootstrap or the one card IOM bootstrap followed
    by the loader control cards into the card reader.

2. Mount a BOS system tape at loadpoint on drive 0.

3. **Press initialize and** reset console.

4. Press bootload

The BOS bootstrap card(s) reads the first program from the tape and transfers

control to it. This is the BOS loader, and it will read one or more of the

following loading control cards:

    WARM DRUM first last port

or

    WARM DISK first last channel area

This tells BOS the portion of the drum or disk where it is to store its various

files. first is the first 64 word sector to be used, last is the first sector

not to be used, port is the drum port number (0-7), channel is the DSU-270 channel

number (see restrictions above), area is the DSU-270 unit to use (0-16). All

numbers are octal.

    COLD DRUM first last port

or

    COLD DISK first last channel area

This card performs the functions of the WARM card plus it resets the command directory and clears the configuration deck. One of these four cards must immediately follow the card bootstrap.

LOAD n̲ or TAPE n̲

This causes the loader to read tape n̲. This tape, which is generated under Multics, must contain the BOS loader as the first segment on the tape. Each segment on that tape is written on the drum or disk and an entry is made in the command directory. If a segment is already in the directory, the newest copy will be used.

The segment name SETUP has special meaning. When it is encountered, it is placed where it will be used as the BOS toehold and control program.

RENAME old new

A RENAME card modifies the action of a later LOAD card. If a segment with the name old is read from tape, it is placed in the directory with the name new.

END

This card ends the loading. The toehold and control programs are read into memory and control passes to them. An end-of-deck condition at the card reader will act as an END card.

The switching between the different input sources will occur as follows:

When BOS receives a TTY command, input is switched to the operator's console. If a blank line is typed, input will revert back to the previous source.

When a CARDS command is received, input will be switched to the card reader. When the last card has been processed, input will revert back to the previous source.

The name of a runcom file as a command to BOS will switch the input to the runcom file. When the end of the file is encountered, input will revert back to the previous source.

When the request button is pushed on the operator's console, the current operation is aborted and a TTY command is forced. An asterisk is typed to indicate that this has happened.

When BOS is first loaded, input will come from cards. The previous sources are set to the operator's console. Up to five previous sources are remembered, but only one runcom file may be active at any time. Runcoms initiated by other runcoms return to the input source in use before the first runcom was executed.

After a QUIET OFF command is read, lines read from the card reader or runcom file will be printed on the operator's console. After a QUIET ON or QUIET command, neither these lines nor "BOS AT" messages will be printed.

Any character typed on the operator's console may be erased by following it with a #. Several #'s will erase several characters until the beginning of the line is reached. An entire line may be erased by pressing the input error button.

Any input lines which will be used as commands or control cards will be broken down into their various fields (often referred to as arguments). Fields are separated by one or more blanks. If the first character of a field contains a number, then that field is converted as both an octal and decimal number. Generally only the octal number is used. If a field begins with a non-numeric character, then it is interpreted as a character string. The scanning of fields ends with the first asterisk. The remainder of the line is ignored as a comment.

BOS Commands

There are two types of BOS commands: those executed within the BOS control

program and those loaded from the drum or disk.

Control Program Commands

CONTIN

Format: CONTIN

Purpose: To restore the machine state and continue running an interrupted

               activity (usually Multics).

Notes: When BOS is entered, the machine state is saved. CONTIN allows

               these saved conditions to be restored so that Multics can con-

               tinue running from the point at which BOS was entered.

GO

Format: GO

Purpose: Identical to CONTIN.

LIST

Format: LIST

Purpose: To cause a list to be printed which contains all the current

               drum or disk resident BOS command programs and runcoms and their

               device addresses.

Drum or Disk Loaded Commands

BLAST   print messages to terminals

BOOT   Multics bootload

CONFIG   Loads, prints, changes and appends to configuration deck

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CORE   saves and restores core onto tape

DIE   destroys BOS

DMP355   dumps DataNet 355 core storage

DUMP   segment dumper

ESD   restarts Multics to do an emergency shutdown

FDUMP   writes a system dump into the dump partition

FMT   writes format information on DSU-170

IF   conditionally executes BOS commands

LOADDM   loads additonal or replacement commands into BOS

LD355   loads DataNet 355 core storage

PATCH   core disk or drum patch

PRINT   print a tape

RESTOR   **restores contents of** secondary storage devices

RUNCOM   loads, prints and starts a runcom file

SALV   starts Multics salvager

SAVE   **saves contents of secondary** storage devices

TAPED   produces an octal dump of a tape

TEST   tests drum and disks

TIME   reads system clocks and does time conversions

TSTCHN   allows testing of an IOM channel

WRITE   causes output to be written on operator's console

BLAST

BLAST can be used from BOS to print messages to all consoles dialed into the
GIOC. (BLAST is not currently implemented for an IOM/355 system.)

Format: BLAST CRASH

Purpose: When Multics dies and BOS has been entered, this command will

                 cause the canned message MULTICS NOT IN OPERATION AT (time) to

                 be typed to all dialed-in consoles.

Format: BLAST

Purpose: The operator will be asked to type a message. If for some

                 reason Multics will not be up in a short length of time, this

                 command can be used to explain the situation to dialed-in users.

Format: BLAST HANGUP

Purpose: To hang up all consoles.

BOOT

Format: BOOT -number- -name-

Purpose: To initiate a bootload of Multics.

Notes: Additional arguments may be supplied to the boot command.

             If a number is given, it is the tape drive to boot from.

             If a name is given, it is the name of the secondary storage

             partition to be used (as described by a PART configuration

             card). Normally the MULT partition will be used.

Format: BOOT COLD

Purpose: This command should be used only by express instructions of

             the programming staff. It is used to initiate a complete reload

             of secondary storage.

CONFIG

Format: CONFIG L

                        (configuration deck)

                QUIT

Purpose: To load a configuration deck.

Format: CONFIG A

                        (additional configuration cards)

                QUIT

Purpose: To add more configuration cards to an existent configuration deck.

Format: CONFIG C

                        (changes to configuration cards)

                QUIT

Purpose: To change existent configuration cards. The configuration deck

                will be searched for each card in the deck of changes. The first

                card found matching <u>both</u> the first and second fields will be replaced.

                If no such card is found, the first card matching the first field

                will be replaced. If no such card is found, the change card will be

                added to the configuration deck.

Example: Configuration deck:

                    CPU   A   4
                    MEM   C   200   ON
                    MEM   D   200   OFF

                Changes:

                    CPU   B   5
                    MEM   D   200   ON
                    DRUM   0   1000   0 4 5 6 2

                New configuration deck:

                    CPU   B   5
                    MEM   C   200   ON
                    MEM   D   200   ON
                    DRUM   0   1000   0 4 5 6 2

CONFIG (continued)

Format: CONFIG P -arguments-

Purpose: To print the current configuration deck. If arguments are supplied,

only selected configuration cards will be printed.

Format: CONFIG D -arguments-

Purpose: To delete selected configuration cards. All occurrences of a speci-

field configuration card will be deleted.

Notes: Whenever a card is read, certain conversions are performed.

The results of each conversion are stored in one word of a 15 word

array. Any unused words are filled with -1.

The first field is stored as a four character ASCII string.

If a field contains a number, it is considered to be an octal number

and its binary equivalent is stored.

If a field contains a number followed by a period, it is considered

to be a decimal number and its binary equivalent is stored.

If a field is a single letter A through H, then the corresponding

number 1 through 8 is stored.

Otherwise, the field is stored as a four character ASCII string.

The 15 word array and a word indicating what conversions were per-

formed on each field are packed together to form the internal repre-

sentation of the configuration deck.

CORE

Format: CORE SAVE $\underline{n}$

Purpose: To write the machine registers and core image onto tape $\underline{n}$.

                 If $\underline{n}$ is not given, 1 is assumed.

Format: CORE RESTOR WAIT $\underline{n}$

Purpose: To read a tape produced by CORE SAVE. If WAIT is present the

                 machine image is restored but not restarted. The image may be

                 dumped or modified and restarted with a GO. If WAIT is not

                 present the core image is automatically started. $\underline{n}$ is an

                 optional tape number, the default is 1.

DIE

Format: DIE

Purpose: To require a subsequent cold boot of BOS. DIE destroys the data

             BOS has stored in core and on the disk or drum insuring that a

             test version of BOS will not accidentally be used.

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DMP355

Format: DMP355

Purpose: To dump on the online printer fault data, trace table contents,

                 and core image from the DataNet 355.

Format: DMP 355 ABS

Purpose: To dump only the core image from the DataNet 355.

Note: The DataNet 355 image is read into BOS and printed. Thus, the

                 printer should be configured to BOS, not to the DataNet 355.

DUMP

Format: DUMP

Purpose: To dump on the online printer or tape the current machine image.

Once the dumper is entered the following commands may be read

from the input stream (all numbers must be octal):

REG   ABS   SEG   STACK   CONT   DUMP CONFIG

PROC   DBR   FILL

DRUM   D270   D170

TAPE   PRT   EOF

QUIT   GO   PATCH

REG

Format: REG

Purpose: To dump machine conditions and descriptor segment.

Example: REG   *Comment

ABS

Format: ABS loc count

Purpose: The ABS request directs the BOS dumper to dump count locations

starting from absolute location loc.

Example: ABS 200   1160

SEG

Format: SEG n

where: n is a segment number

Purpose: To dump segment n only

Example: SEG 105

DUMP (continued)

STACK

Format: STACK <u>seg</u> <u>offset</u>

         where: <u>seg</u>   is a segment number (used as a base).

                <u>offset</u>   is an octal offset (used as a stack pointer).

Purpose: To dump segment <u>n</u> as stack frames (both forwards and backwards)

         starting from <u>offset</u>.

Notes: If offset is missing the location of the first set of bases is

         used. If no <u>seg</u> is specified, the stack base in the machine

         conditions will be used.

Example: STACK 205   1770

CONT

Format: CONT <u>n</u> <u>accesswords</u>

         where: <u>n</u> specifies a segment number. If null, 0 is assumed.

                <u>accesswords</u> are a string of paired fields. The fields

                are used to select the segments to be dumped. Each

                element of a paired field is a variable string of any

                logical combination of the following letters:

                      W = write permit   E = execute only

                      L = slave access   D = data

                      M = master procedure   A = all (WLMSED)

                      S = slave procedure   X = none

                These elements specify access bits in the segment des-

                scriptor word (SDW) access field. The first element

                of each pair specifies the SDW access bits which must

                be ON; the second element of each pair specifies the

                SDW access bits which must be OFF.

DUMP (continued)

Purpose: The conditions specified by all pairs are OR'ed to determine

whether a segment is to be dumped. If no accesswords are

specified then W is assumed. To dump all segments selected by

accesswords starting with segment n in the descriptor segment

specified by a DBR command, if given, or by the DBR value in the

machine conditions.

Example: CONT 200 Ws M * DUMP SLVACC, WPERMT BUT NOT MASPRC

DUMP

Format: DUMP accesswords

where: accesswords is an optional argument that is a string of

paired fields used to select segments to be dumped.

Purpose: To dump the segments specified by accesswords.

DUMP accesswords is equivalent to:

                  REG
                  CONFIG
                  CONT 0 accesswords
                  STACK

PROC

Format: PROC

Purpose: To dump all write permit segments and directories of all running

or stopped processes. Any segment common to more than one process

will be dumped only with the first process.

Format: PROC LONG

Purpose: To dump all existing processes.

DUMP (continued)

DBR

Format: DBR add bits

              where: add   is an address

                      bits   is an optional argument which, if supplied, will set

                             the bound and the paging bits.

Purpose: To define the location of the descriptor segment of the process

              being dumped to begin at address add. If this command is not given,

              the DBR in the machine conditions will be used.

Notes: The following bits are set:

              Bits 0-17 of the DBR represent the descriptor segment address.

              They are set by add.

              Bits 19-28 of the DBR are the bound bits. They indicate either

              the number of pages in the descriptor segment or the number of

              blocks in the descriptor segment.

              Bits 27 and 28 are the paging bits. Their values may be:

                      bit 27   bit 28

                      0 = paged   0 = 1024 page size

                      1 = unpaged   1 = 64 page size

              Bits 19-28 are set by bits; if missing, the old value is unchanged.

Example: DBR 273 770

DUMP (continued)

FILL

Purpose: To set important segment numbers and options within the dumper.

Format: FILL name value

                where: name is one of the following:

                HCDBR   value is the location of the descriptor to be used to find

                        hardcore segments. The default value is obtained from

                        absolute location 1777 in the Multics core image.

                COMSEG value is the segment number of xray-communications. The

                        default is 10. Xray-communications is used to find the

                        segment numbers of other hardcore segments.

                PAGE   value is ON to page in pages from the drum or disk;

                        value is OFF to turn this feature off.

                        The default is ON.

                BOS   value is ON to dump BOS in core; value is OFF to dump

                        core image saved on the drum or disk. The default is OFF.

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DRUM

Purpose: To print drum sectors.

Format: DRUM address count

                Prints count sectors beginning at the indicated Multics sector

                address.

Format: DRUM BOS address count

                Prints count 64 word sectors from the indicated 64 word sector

                address.

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DUMP (continued)

D270

Purpose: To print DSU-270 sectors.

Format: D270 address count

                Prints count sectors beginning at the indicated Multics sector

                address.

Format: D270 BOS area sector count

                Prints count 64 word sectors from the indicated area (0-17)

                and sector within that area.

Format: D270 PHY eu su sector count

                Prints count 64 word sectors from the indicated electronics

                unit (0-3), storage unit (0-4), and sector (0-4703) within that unit.

D170

Purpose: To print DSU-170 sectors.

Format: D170 address count

                Prints count sectors beginning at the indicated Multics sector

                address.

Format: D170 BOS area sector count

                Prints count 64 word sectors from the indicated area (0-37)

                and sector within that area.

Format: D170 PHY unit spindle cylinder track record count

                Prints count 64 word sectors from the indicated unit (0-3),

                spindle (0-7), cylinder (0-311), track (0-23), and record (0-21).

DUMP (continued)

TAPE

Format: TAPE n

                 where: n is a tape number.

Purpose: To direct dumper output to tape n. The 7-track tape is written in

                 BCD mode, one line per record. When the tape is full, it is un-

                 loaded. Dumping will continue with the same tape number.

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PRT

Format: PRT

Purpose: To direct output to an available printer.

_____

EOF

Format: EOF

Purpose: To write an end of file and unload the output tape if the dumper's

                 output was directed to tape. If the output was directed to the

                 printer, 10 page ejects are given.

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QUIT

Format: QUIT

Purpose: To return control to the BOS control program.

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GO

Format: GO

Purpose: GO causes the machine image which was being dumped to be restarted.

_____

DUMP (continued)

PATCH

Format: PATCH

Purpose: PATCH causes the BOS patcher to be entered.

CONFIG

Format: CONFIG

Purpose: To cause the current configuration deck to be printed.

[This concludes the BOS dumper commands.]

ESD

Format: ESD

Purpose: To start an emergency shutdown of Multics.

Operation: Sets the PBR to 11 and the ILC to 10. This new machine image

               is restarted.

FDUMP

Format: FDUMP

Purpose: To take a dump similar to the PROC command of DUMP.   Instead of printing

               segments, they are transferred as binary words into the DUMP parti-

               tion on the disk or drum.   A header to this partition is created

               which contains the length of the dump, a switch indicating that

               the dump hasn't been read, the time of the dump, its error report

               form number, the machine conditions and the segment directory.

               If the previous dump hasn't been read by Multics, the operator is asked

               if he wishes to overwrite the previous dump.

Format: FDUMP n

Purpose: To set the next error report form number to n.

FMT

Format: **FMT area1 area2...arean**

Purpose: To write format information on the DSU-170's. As many areas as

are listed will be formatted.   The header bypass switch on the

DSU-170 controller must be on for this operation.

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IF

Purpose: The IF command can be used to test the value of several variables

in the Multics and BOS environments. Another BOS command will

be executed conditionally on the results of the test. It is most use-

ful within BOS runcom files. It is used as follows:

FORMAT: IF $\left\{\begin{array}{l}\text{SHUT} \\ \text{SWITCH}\quad\underline{\text{mask}} \\ \text{FDUMP}\end{array}\right\}$ $\left\{\begin{array}{l}\text{EQ} \\ \text{NEQ}\end{array}\right\}$ <u>value</u> <u>command</u> <u>arg1...argn</u>

SHUT causes the Multics system shutdown state to be tested.

Possible values are as follows:

<u>code (octal)</u>	<u>meaning</u>
0	Normal Multics operation (no ESD)
1	ESD part 1 started
2	ESD part 1 completed
3	ESD completed with lock errors
4	ESD completed with no errors
5	Fast Salvager started
6	Fast Salvager finished with errors
7	Fast Salvager finished with no errors
10	(not used)
11	Active Salvager started
12	Active Salvager finished with errors
13	Active Salvager finished with no errors
14	(not used)
15	Regular Salvager started
16	Regular Salvager finished with errors
17	Regular Salvager finished with no errors
20	(not used)
21	Long Salvager started
22	Long Salvager finished with errors
23	Long Salvager finished with no errors

SWITCH <u>mask</u> reads the processor data switches and masks them with

the specified octal mask before comparison.

FDUMP tests the success of a previous fast dump. Possible values

are as follows:

> 0 - FDUMP was never called
> 1 - FDUMP was entered
> 2 - FDUMP was aborted because the dump partition already
>   contained an old dump
> 3 - the dump was successfully completed

value is specified as an octal number. It will be used in a test

for equality or inequality depending on whether EQ or NEQ was

specified. If the condition is met, command will be invoked with

the arguments arg1...argn

Examples: ESD   *TRY TO EMERGENCY SHUTDOWN

IF SHUTDOWN NEQ 4 EDUMP   *TAKE DUMP IF FAILURE

FDUMP   *TAKE FAST DUMP

IF FDUMP NEQ 3 TDUMP   *TAKE TAPE DUMP IF FAILURE

LD355

Format: LD355

Purpose: To load the DataNet 355 core image. The LD355 command should be

               issued prior to performing a Multics bootload if a DataNet 355 is

               configured into the system. The programs D355 and B355 will be

               loaded into DataNet 355 memory. These programs should have been

               loaded from the BOS tape as if they were BOS commands.

LOADDM

Format: LOADDM $\underline{n}$

Purpose: To read the segments from the BOS system tape on drive $\underline{n}$. These

segments become BOS commands and may be executed by typing their

name (6 characters or less). Only the last copy of a command will

be remembered.

PATCH

Format: PATCH

                 The PATCH command is used by the Multics programming staff or

                 under the direction of a member of the Multics programming staff.

Purpose: To provide a method of examining and modifying the contents of

                 machine registers, core locations, drum or disk sectors.

Notes: To call the PATCH program from BOS command level, type:

                           PATCH

                 The patcher will be brought into core and will read requests

                 from the input stream.

                 The two basic patterns for requests are:

                           address -count-

                 will examine count locations starting at address. If count is

                 missing, one location is printed.

                           SET address val1 -val2- ...

                 will place val1, val2 ... into successive locations starting with

                 address. If the input stream is in the QUIET OFF mode, then the

                 old and new contents are printed.

                 Address may take several forms:

                     1) an absolute address

                     2) segment number | offset

                         (blanks must surround the |)

PATCH (continued)

3) a machine register from the list:

A, Q, E, TR, X0, X1, X2, X3, X4, X5, X6, X7,

AP, AB, BP, BB, LP, **LB,** SP, SB, PBR, ILC, DSBR, INT

4) MCM <u>loc</u>

<u>loc</u> is the location divided by 64K where the memory con-

troller mask was read. If the memory controllers are

larger than 64K then the same mask will appear more than

once. When patching, be sure to change at least the

<u>last</u> within a controller.

5) <u>address request</u> offset

Will reference a secondary storage device. The possible

forms for <u>address request</u> are:

DRUM <u>multics device address</u>

D270 <u>multics device address</u>

D170 <u>multics device address</u>

DRUM BOS <u>sector</u>

D270 BOS <u>area</u> <u>sector</u>

D170 BOS <u>area</u> <u>sector</u>

D270 PHY <u>electronics</u> <u>unit</u> <u>storage</u> <u>unit</u> <u>sector</u>

D170 PHY <u>unit</u> <u>spindle</u> <u>cylinder</u> <u>track</u> <u>record</u>

A <u>multics device address</u> is in the form found in a file

map. <u>sector</u> is a 64 word address within an area. A D270

area is one storage unit. They are numbered 0 to 23

PATCH (continued)

with 0 to 4 in the 0th electronics unit, 5 to 11

in the 1st electronics unit, etc.

A D170 area is the disk drive unit number.

The <u>address request</u> is described in greater detail in

the section on Secondary Storage Device Addressing.

6)   BOS <u>command</u> <u>location</u>

This will reference a <u>location</u> in a BOS <u>command</u>.

The character "." may be used to represent the previous address

which was examined or set.   The operators "+" and "-" may be used

between any numbers or "." with the obvious effect.   All numbers

are octal and must be surrounded by blanks.

PATCH will also accept the following commands:

GO   causes the machine image to be restarted.

DUMP   enters the BOS dumper.

DBR   address -bound- -bits-.   The DBR value used in the

         simulated appending is changed.   (See the DUMP

         command for a more complete description.)

QUIT   return to BOS.

FILL   Changes various values and options.   (See the DUMP

         writeup for a complete description.)

PUNCH   An argument of ON will cause all patch requests to be

         punched onto cards.   OFF will suspend punching.

PRINT

PRINT will print **tapes** produced by the BOS dumper. The procedure for using

it is:

1) Type the BOS command PRINT.

2) If printer A is to be used, mount the tape on drive 1, for printer

   B use drive 2. If both printers are available mount tapes on both

   drives. (The IOM version will currently only drive one printer.)

3) Printing will continue until an EOF is read. The tape is then unloaded.

4) Additional tapes may be printed by mounting them on the appropriate

   drives.

5) After all tapes have been printed, pressing REQUEST on the **operator's**

   console will re-enter BOS.

Tape errors are retried and, if persistent, a comment is printed on the

operator's console. Printing will then continue.

RESTOR

Format: RESTOR -address extent- -TAPE n-

Purpose: To reload the drum and disks from a set of tapes written by SAVE.

               The arguments are the same as those for SAVE (except ALL has no

               meaning).   The tape headers contain the state of the ALL option

               along with a copy of the fsdct.   See the section on Secondary Storage Device

               Addressing for the format of address extent.   If address extent

               arguments of the RESTOR don't match those of the SAVE, the following

               actions take place:

               1) The record address ranges of this tape and all following

                   tapes are printed.

               2) The record address ranges of the RESTOR's address extent

                   are printed.

               3) The operator is asked if this is the correct tape.   If

                   answered NO, control is returned to BOS.

               4) If answered YES, the operator is asked if entire tape(s)

                   should be loaded.

               5) If answered YES, the RESTOR's address extent is changed

                   to equal the address extent of the tape resulting in all

                   of the tape being read.   Otherwise the RESTOR is executed

                   as originally indicated on the command line.

Examples: The input tapes in each example were produced by typing SAVE

               only.

                     RESTOR DRUM DEVICE

Will restore the drum only from tapes containing an entire

save if the two questions asked of the operator are answered

YES and NO respectively.

   RESTOR D170 1234 RECORD

will restore only DSU-170 record 1234

   RESTOR TAPE 3

will continue a restore from tape 3 if both questions are

responded to with a YES.

RUNCOM

Purpose: To manage BOS RUMCOM files. A runcom file contains a predefined

             sequence of commands which can be automatically executed.

Format: RUNCOM LOAD name

             This command will load card images containing command lines until

             a RUNCOM END card image is found. The file name is added to the

             BOS command directory and the runcom file is written on the drum

             or disk. A LIST command will list runcom files along with the

             regular BOS commands. (Runcom files may not be loaded from tape.)

Format: RUNCOM PRINT name

             The RUNCOM file name is printed.

Format: RUNCOM SKIP name

             Successive lines of the runcom file will be printed and the key-

             board unlocked after each. If the runcom line is not to be

             executed, press EOM and the next line will be printed. Once

             the correct line is reached, type GO and execute will begin with

             this line. The first line executed must be a command to BOS.

Format: name

             A runcom file may be executed by simply trying its name as a

             command to BOS. This forces the execution of RUNCOM RUN "name".

Format: RUNCOM PUNCH name

                  The runcom file will be punched out.

SALV

Format: SALV

Purpose: To start the salvager by forcing the execution of BOOT WARM

            SALV 2.

_____

SAVE

Purpose: To write the contents of the disks and drum onto tape. Unless

              told to do otherwise, SAVE will copy the DRUM the DSU-270 and

              the DSU-170 onto tapes 1, 2, etc. As each tape is started the

              device name (DRUM, D270, or D170) and the address of the first

              record is printed. This may be used to restart the save at the

              beginning of a tape or to find the tape which contains a particular

              record.

Format: SAVE -address extent- -ALL- -TAPE n-

              If present, the arguments must be in order given. See the section

              on Secondary Storage Device Addressing for a description of the

              address extent.

              Normally, SAVE will write onto tape only those secondary storage

              records which currently contain useful data. This is done by using

              a system-maintained table of assigned records called the fsdct.

              The fsdct will contain valid information only after a successful

              system shutdown or salvage. If for some reason a salvage cannot

              be performed, SAVE may be instructed to ignore the fsdct contents

              and save all secondary storage records by use of the optional ALL

              argument. If the ALL argument is not present, a successful

              shutdown or salvage must have preceded the SAVE.

SAVE (continued)

Examples: SAVE PART DUMP ALL

     will save the dump partition only.

    SAVE DRUM DEVICE

     will save the drum only.

    SAVE D270 AREA 5 AREA ALL

     will save all of the 5th DSU-270 unit.

    SAVE D170 5634 ON TAPE 5

     will continue a save starting with tape 5, DSU-170 address

     5634, and continue to the end.

TAPED

Format: TAPED n

Purpose: To dump the contents of tape n in octal. The tape must be

               written in binary mode. TAPED will print "EOF" and "ERROR"

               whenever they are read. TAPED recognizes no end of tape marks.

               TAPED may be stopped by pressing the request buttons.

_____

TEST

Purpose: To test the drum and disks for errors. The portion of the drum

             and disks tested can be specified as with SAVE and RESTOR.

Format: TEST -address extent- -keywords-

             The following keywords may be placed after a possibly absent address

             extent:

> CHECK   The records will not only be read, but the data
>
>   will also be verified.
>
> WRITE   The records will be written. If no word pattern is
>
>   specified, zeroes will be written.
>
> REWRIT   The records are read. If any errors are detected,
>
>   that record is rewritten, possibly correcting the
>
>   error.

             If neither CHECK, WRITE, nor REWRIT is included, then the records

             are only read. Any errors reported by the device will be printed.

> PATERN   n1 n2 n3 n4
>
>   Changes the data to be checked or written from
>
>   all zeroes. Depending upon the number of 12-digit
>
>   octal numbers given, one of the following sequences
>
>   will be used to fill each record:
>
>   n1 n1 n1 n1 ...
>
>   n1 n2 n1 n2 ...
>
>   n1 n2 n3 n1 n1 n2 n3 n1 ...
>
>   n1 n2 n3 n4 n1 n2 n3 n4 ...

TEST (continued)

               MARK   The first data word to be checked or written

                       will contain the device number and device

                       address. The remaining words of each record

                       will be zero.

Note: TEST may be stopped at any time by pressing the request button.

TIME

Purpose: To read the calendar clock(s) and do the time conversion necessary
             to set them.

Format: TIME

             The operator's console keyboard will be unlocked to accept data.

             Following the input of data, the time will be printed in three forms:

             1) a 52 bit octal integer as read from the clock.

             2) a 36 bit integer formed by shifting the 52 bits right
                 16 places. This is the number to place in the star
                 wheels to set the clock.

             3) the date and time as month/day/year hour:minute:second.

             The following data is accepted:

             R to read all clocks configured to the processor.

             number is assumed to be input in form 2 above. It will be con-
             verted and printed in all the three forms above.

             two numbers are the upper 16 bits and lower 36 bits of the 52
             bit form. All three forms are printed.

             If more than two numbers are typed then they are the month, day,
             year, hour, minute, and second. Missing numbers are assumed zero.
             All three forms are printed.

TSTCHN

Purpose: To test an IOM channel. This command is intended for special

             use by the programming staff. Its usage is described in the

             program listing.

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WRITE

Purpose: To write a line of text on the operator's console or to turn

on the audible operator alarm.

Format: WRITE <u>text</u>

Everything on the command line following the first six characters

is typed out.

Format: WRITE ALERT

The audible alarm is turned on.

Secondary Storage Device Addressing

The arguments supplied to the SAVE, RESTOR, or TEST commands which specify

secondary storage addressing are called an <u>address extent</u>.

An <u>address extent</u> is:

    <u>extent request</u>

    (In this case the default partition of MULT is used.)

or

    PART <u>partition name</u> <u>extent request</u>

_____

An <u>extent request</u> is:

    <u>address request</u> RECORD

        to handle one secondary storage record

or

    <u>address request</u> AREA

        to specify the rest of an entire area

or

    <u>address request</u> DEVICE

        to specify the rest of an entire secondary storage device (as specified on

        the appropriate PART card).

or

    <u>address request</u> ON

        to specify all secondary storage following a given point (as specified on the

        appropriate PART card).

or

    <u>address request</u> TO <u>address request</u>

        to specify lower and upper secondary storage address limits. (The upper

        limit and the first secondary storage address not desired.)

_____

An <u>address request</u> specifies a starting (or ending) point. It is a secondary

storage device address in one of the several following forms:

> <u>device name</u>

or

> <u>device name</u> AREA <u>area number</u>

> to specify a particular physical device area.

or

> <u>device name</u> <u>record number</u>

> to speci_y a Multics (1024 word) record number

or

> <u>device name</u> BOS <u>record number</u>

> to specify a BOS (64 word) record number.

or

> <u>device name</u> PHY <u>physical device address</u>

> to specify a physical device address. The format of <u>physical device address</u>

> is dependent on the particular device.

The currently acceptable <u>device names</u> are:

> DRUM

> D270

> D170

<u>physical device address</u>es are specified as follows:

for DSU-270:

> <u>electronics unit</u> <u>storage unit</u> <u>sector</u>

for DSU-170:

> <u>disk unit</u> <u>spindle</u> <u>cylinder</u> <u>track</u> <u>record</u>

Examples:

1. To save an entire partition:

    SAVE PART PAGE ALL

    This command will save all secondary storage records described by the PART

    PAGE configuration CARD.

2. To restore an entire device:

    RESTOR D170 DEVICE

    This command will restore (from tape) all records on the DSU-170 disk.

3. To test a physical device area:

    TEST D270 AREA 14 AREA

    This command will read all records on DSU-270 area 14.

4. To save all the records beyond a given record:

    SAVE D270 12345 ON   .

    This command will save all records starting from record 12345 on the DSU-270

    disks. It will also save all records on the DSU-170 disks.

6. To restore a group of records:

    RESTOR D270 1122 to D270 1127

    This command will restore DSU-270 records 1122 through 1126, inclusive.