Addendum to How to Generate and Run AOS/VS

086-000128-00

This addendum updates manual 093-000243-07, see the Updating Instructions.

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Revision 00, May 1989
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Addendum to
How to Generate and Run
AOS/VS
086-000128-00

Revision History:

Original Release - May 1989

Effective with:

AOS/VS Rev. 7.65

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Updating Instructions

This addendum (086-000128-00) to *How to Generate and Run AOS/VS* (093-000243-07) introduces material on the new devices supported by AOS/VS, and adds material on security for conformity to the U.S. government's C2-level security standards. It also includes minor corrections.

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The addendum number appears on all pages in this addendum.

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How to Generate and Run AOS/VS

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For the latest enhancements, cautions, documentation changes, and other information on this product, please see the Release Notice (085-series) supplied with the software.

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Revision 07, September 1986
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How to Generate and Run
AOS/VS
093-000243-07

A vertical bar in the margin of a page indicates substantive technical change from the previous revision.

Revision History

Revision History:	Effective with:
Original Release — November 1980	
First Revision — December 1981	
Second Revision — February 1983	
Addendum 086-000047 — April 1983	
Addendum 086-000064 — August 1983	
Third Revision — March 1984	
Fourth Revision — September 1984	
Fifth Revision — June 1985	
Sixth Revision — February 1986	
Seventh Revision — September 1986	
Addendum 086-000128-00 — May 1989	AOS/VS Rev. 7.65

Preface

AOS/VS, the Advanced Operating System/Virtual Storage, is one of Data General's (DG's) operating systems for ECLIPSE® MV/Family and DS-series computer systems.

This manual tells how to generate and run an AOS/VS system on your ECLIPSE MV/Family computer.

Generating includes formatting one or more blank disks, installing a starter system, bringing it up, generating a tailored system, then creating the AOS/VS multiuser environment. The whole generation procedure is usually done only once (often by a DG engineer); then parts of it may be repeated for new devices and for new revisions of AOS/VS. Whatever your role, Chapters 1 through 5 lead you through the generation procedure.

Running includes day-to-day operation: bringing up the AOS/VS system, shutting it down, making sure it runs smoothly for users, files for safekeeping, and making decisions that help the system run most efficiently. Whatever your role, Chapters 6 through 17 and the appendixes describe the tools and concepts needed to run AOS/VS.

Chapters 1 through 5 take a cookbook approach: they tell you what to do without detail. Chapters 6 through 17 are designed for reference; they describe the tools available, with details, and let you choose what you want.

The book is organized as follows:

Chapter 1 is an overview of system software, MV/Family hardware, and the steps involved in generating and running on an AOS/VS system. It also describes keyboard control keys.

Chapter 2 tells how to bring up your first AOS/VS system on ECLIPSE MV/4000® DC (departmental cluster), ECLIPSE MV/4000® SC (small cluster), or Data General DS/4000-series (distributed system) computers. It assumes you are starting with blank disks. Read it when you are starting from scratch with an ECLIPSE MV/4000 DC, ECLIPSE MV/4000 SC, Data General DS/4000, or Data General DS/4200 computer (but not with an ECLIPSE MV/4000 computer).

Chapter 3 tells how to bring up your first AOS/VS system on the following ECLIPSE MV/Family computers: ECLIPSE MV/20000™ Model 2, ECLIPSE MV/20000™ Model 1, ECLIPSE MV/20000™ C, ECLIPSE MV/10000™ SX, ECLIPSE MV/10000™, ECLIPSE MV/8000®, ECLIPSE MV/8000® II, ECLIPSE MV/8000® C, ECLIPSE MV/7800™, ECLIPSE MV/7800™ C, ECLIPSE MV/7800™ U, ECLIPSE MV/6000®, and ECLIPSE MV/4000 computers. It assumes you are starting with blank disks. Read it when you are starting from scratch with any computer above.

Chapter 4 tells how to run VSGEN to generate a tailored AOS/VS system. Read it whenever you want to generate or modify an AOS/VS system.

Chapter 5 tells how to bring up the multiuser environment, which supports many timesharing and batch users concurrently. It leads you through creating user profiles, initializing the EXEC program, editing some macros to make things easier, and creating a tailored error message file. Read this chapter after you generate your first tailored system — later, you may want to

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reread selected parts of it. This chapter ends the generating part of the book.

Chapter 6 details system startup, normal shutdown, and abnormal shutdown. You'll follow the steps described here quite often. It includes several tab dividers (Startup-Shutdown and Memory Dump, ESD-FIXUP) for easy reference.

Chapter 7 explains the user profile editor, PREDITOR. You may want this information when you create, edit, or delete a user profile.

Chapter 8 details the EXEC multiuser management program: user logon, batch, spooling, user mount requests and labeled tapes, and all EXEC commands. Because EXEC manages so many important multiuser functions, this is the biggest chapter in the book.

Chapter 9 explains runtime tools other than EXEC: the Command Line Interpreter (CLI), access control, display utilities, and system logging. It includes the tab divider PED-SYSLOG/REPORT.

Chapter 10 tells how to back up and restore disk-based material. You can choose from several backup utilities. It includes the tab divider Backup.

Chapter 11 explains how to handle unusual system conditions, using diagnostic messages and diagnostics.

Chapter 12 details the Disk Formatter program, which formats physical disks into logical disk units for use with AOS/VS.

Chapter 13 explains the Installer program, which installs an AOS/VS system on a logical disk unit.

Chapter 14 offers some basic cautions and pointers: things to avoid and things to remember.

Chapter 15 outlines system management considerations, excluding security: concepts and procedures that can help you make the system do what you bought it to do.

Chapter 16 explains system management security issues — how to safeguard user privacy, sensitive material, and hardware from unauthorized access. It also explains how to make your system conform to the U.S. government C2-level of security.

Chapter 17 lists important error messages and recovery steps — from errors in all programs. It includes the tab divider Errors and Error Messages.

Appendix A summarizes peripheral device names and codes.

Appendix B is a fast-reference alphabetical summary of all EXEC commands.

Appendix C lists and briefly describes files shipped with AOS/VS.

Appendix D no longer applies. Please remove and destroy this appendix.

Glossary defines pertinent terms, like *process* and *SCP*. When you see a term you don't know, check the glossary.

Reference cards summarize the operation and commands for startup-shutdown and FIXUP, and for the CLI and EXEC.

For fast reference, insert and use the *tab dividers*.

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What About Peripherals?

Before you can begin, at least one appropriate disk unit, tape or diskette unit, and a system console (DASHER® terminal) must be connected to your computer, and all must have adequate power.

A DG engineer usually installs the hardware, so you need no information on this. In fact, a DG engineer often brings up the first system. But we include this material because you may want to do it.

Peripheral Operation and Manuals

Peripherals include disk units, tape and/or diskette units, terminals (called consoles in this book), and line printers.

Operating disk units is not difficult; but if you need details, they are in the 014-series booklets supplied with each disk unit. (For older disk drives, see *DGC Disc Drives*, number 014-000099.

Operating a tape unit is sketched in this book, and detailed in the Operator Reference Series book *Magnetic Tape Transports*, number 014-000095.

You will be using a terminal (called the system console) to communicate with the computer. If the system console is a DASHER terminal, see the appropriate DASHER® Operator Reference Series book.

A line printer isn't absolutely *required*, but it you have one, you will want to know how to turn it on, change the paper, and so on. The operation of line printers is covered in *DGC Line Printers*, number 014-000089.

For device status errors and other information, you may want the manual for the device you are running.

Principles, Diagnostics, and SCP Manuals

For each computer there is a Principles of Operation manual. For example, *ECLIPSE MV/20000™ Principles of Operation*, 014-001169.

A group of CPU diagnostic tests called FRUs (Field Replaceable Units) is shipped with most MV/Family computers. These FRUs are specifically designed to test and identify problems with the CPU, IACs, and memory. This book tells how to run them. Some computers (like the MV/20000™ Series computers) rely instead on the complete system of diagnostics, including diagnostics for peripherals, provided by MV/ADEX (Advanced Diagnostic EXecutive System). MV/ADEX is described in the *ADEX Operator's Manual*, 014-000744 and in *Installing and Running Coresident Diagnostics on the ECLIPSE MV/2000™ DC and DS/7000-Series Workstations*, 015-000257. Finally, many of the MV/Family computers allow remote diagnostic testing. If your computer permits this — and you have a contract with DG that supports it — you should read *Communications Switch-II User Operation and Installation Guide*, 015-000207.

The SCP (System Control Program) features that you need for routine operation are covered in this manual. You can find more on the SCP for your machine in the following manuals: *ECLIPSE MV/20000™ Series System Control Program*, 014-001171; *ECLIPSE MV/10000™ System Control Processor User's Manual*, 014-000740; *ECLIPSE MV/8000® System Control Processor*, 014-000649; *ECLIPSE MV/8000® II, ECLIPSE MV/8000® C, ECLIPSE MV/7800™-Series System Control Program*, 014-001182 and *ECLIPSE MV/6000® System Control Processor*, 014-000781; or *Data General 4000-Class System Control Programs Operator's Reference*, 014-001060.

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If, in spite of running diagnostics, things go wrong and you get power-up or power supply faults, you can read about them in tables in Chapter 17 in this manual or in the following manuals: *Starting ECLIPSE MV/20000™ Series Systems* (014-001168); *Starting ECLIPSE MV/15000™ Series Systems* (014-001296); *ECLIPSE MV/10000™ System Control Processor*, (014-000740); *Starting ECLIPSE MV/7800™ Series Computers* (014-001179); *ECLIPSE MV/4000™-Class System Control Programs* (014-001060); *Starting Your ECLIPSE MV/1400™ DC, ECLIPSE MV/2000™ DC, or ECLIPSE MV/2500™ DC Computer System* (014-001467); *Starting Your DS/7500 Computer System* (014-001508); and *Starting and Updating Preinstalled AOS/VS* (069-000293).

Other Software Manuals

To create the multiuser environment, you will need to use a text editor. This book gives a brief sketch of DG's SED text editor, enough to start editing. SED is further described in *Learning to Use Your AOS/VS System*, 069-000031, and in the *SED Text Editor User's Manual*, 093-000249. If you like SED, you may want to look at these books later on.

Reader, Please Note:

We call terminals consoles in this manual.

We use these conventions for command formats in this manual:

COMMAND required *[optional]* ...

Where	Means
COMMAND	You must enter the command (or its accepted abbreviation) as shown.
required	You must enter some argument (such as a filename). Sometimes, we use:  which means you must enter one of the arguments. Don't enter the braces; they only set off the choice.
[optional]	You have the option of entering this argument. Don't enter the brackets; they only set off what's optional.
...	You may repeat the preceding entry or entries. The explanation will tell you exactly what you may repeat.

Additionally, we use certain symbols in special ways:

Symbol	Means
↵	Press the NEW LINE on your console's keyboard. If there is no NEW LINE key, press the carriage return (RETURN) key.
)	Is the AOS/VS operating system CLI prompt.
□	Be sure to put a space here. (We use this only when we must; normally, you can see where to put spaces.)

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All numbers are decimal, except for device codes and numbers marked octal. For example

...27 buffers...	means 27 decimal.
...device code 27...	means 27 octal.
...say 27 octal...	means 27 octal.

We show commands in UPPERCASE; but you can type them in lowercase, uppercase, or any combination. Finally, in examples we use

THIS TYPEFACE TO SHOW YOUR ENTRY ↵
This typeface to show system queries and responses.

Contacting Data General

- If you have comments on this manual, please use the prepaid Remarks Form that appears after the Index. We want to know what you like and dislike about this manual.
- If you need additional manuals, please use the enclosed TIPS order form (USA only) or contact your Data General sales representative.

End of Preface

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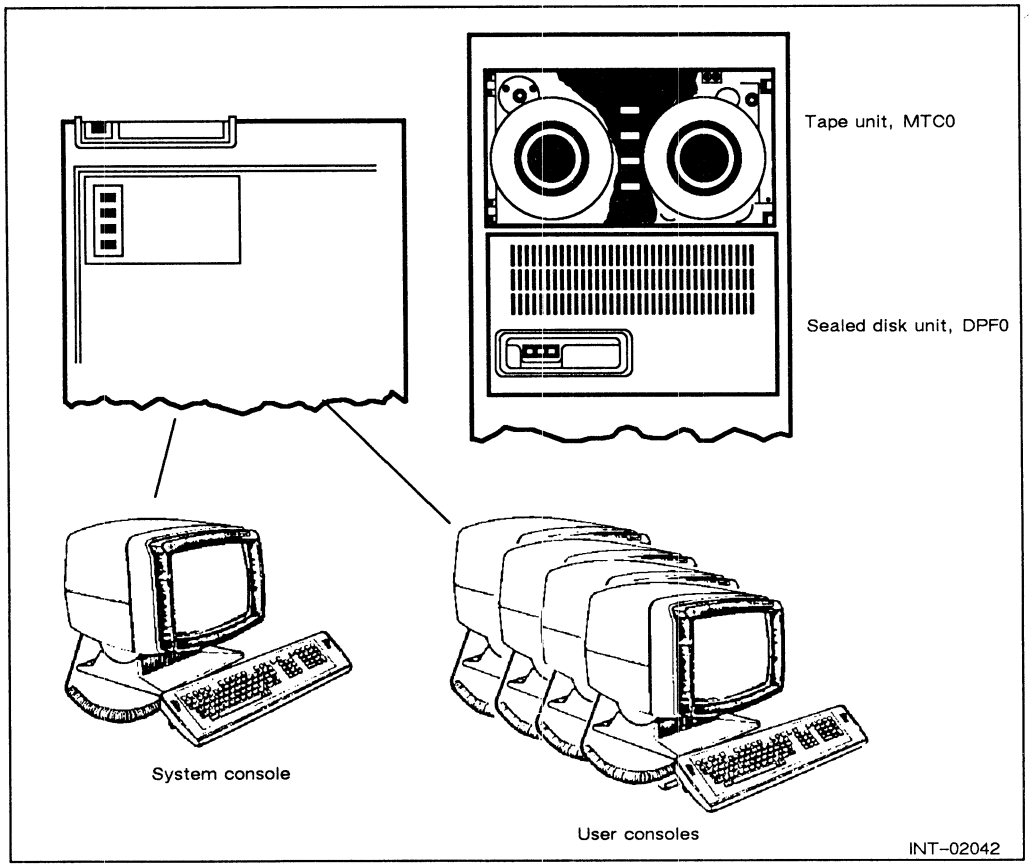


Figure 1-3. Sample AOS/VS ECLIPSE MV/8000 II or MV/4000 System Hardware Configuration

The MV/Family Computers

Data General's MV/Family has a broad range of 32-bit systems, including the ECLIPSE MV/20000™ Model 2, MV/20000™ Model 1, MV/20000™ C, ECLIPSE MV/15000™ (Models 20, 10, 8), MV/10000™ SX, MV/10000™, MV/8000®, MV/8000® II, MV/8000® C, ECLIPSE MV/7800™, ECLIPSE MV/7800™ C, ECLIPSE MV/7800™ U, ECLIPSE MV/7800™ XP, ECLIPSE MV/6000®, ECLIPSE MV/4000®, MV/4000® DC, MV/4000® SC, MV/2000™ DC, Data General DS/4000-series, Data General DS/7500-series, and Data General DS/7700-series computers.

In all MV/Family computers, AOS/VS runs in the main processor. Another operating system, called the System Control Program (SCP or SCP-OS) serves to load vital microcode into the main processor(s), and boot (load) AOS/VS into main processor memory. The SCP also coordinates power-up and monitors system error conditions.

Physically, MV/Family computers range from the meter-high, two-bay MV/20000 Model 2 with separate peripherals to the compact, self-contained MV/2000 DC.

Operationally — after your first AOS/VS system is generated — procedures are similar for all MV/Family computers that have magnetic tape. Backup and update procedures differ, depending on whether you have magnetic tape. If you don't have a tape unit, you'll use diskettes.

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NOTE: Although their names are similar, the ECLIPSE MV/8000 differs significantly from the MV/8000 II and MV/8000 C machines. Operating an MV/8000 II or MV/8000 C is more like operating an MV/10000 or MV/6000. In this book, "MV/8000" means the shoulder-high, blue and white machine; "MV/8000 II" and "MV/8000 C" describe the pertinent meter-high, earth-tone machine.

Similarly, the ECLIPSE MV/4000 differs from ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-series computers. The ECLIPSE MV/4000 is a meter-high computer with one or more peripheral bays. The ECLIPSE MV/4000 DC, MV/4000 SC and Data General DS/4000-series (outwardly identical) are quite compact, with integrated disks and diskettes, designed to fit under a desk if needed. In this book (and generally) the name "MV/4000" represents the first type of machine; the phrase "MV/4000 DC, MV/4000 SC, and Data General DS/4000-series" represents the second type of machine.

AOS/VS File Structure

AOS/VS manages many parts of its file structure, but you need to understand the options that are under your control. A typical AOS/VS file system looks something like Figure 1-4.

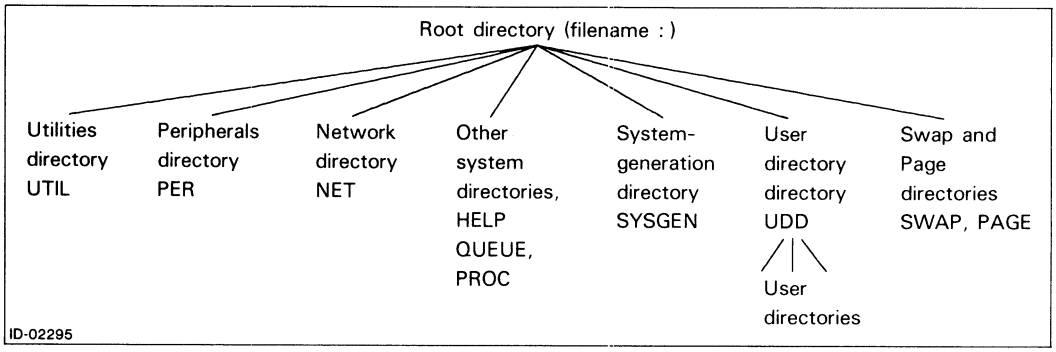


Figure 1-4. AOS/VS System File Structure

The root directory (:) and other system directories are created and managed by AOS/VS or its utility programs. The AOS/VS system program file is usually in directory :SYSGEN. It can be copied (installed) onto an "invisible" part of the disk, dissociated from the directory structure.

Directory :UDD has an entry for each timesharing *user* directory. A user is an authorized person who can execute other programs — often application programs. So UDD often has many subordinate directories and uses a lot of storage space.

All these directories, and their subordinate directories, can reside on one logical disk unit *(LDU)*. Or one or more directories can reside on *its own* LDU. An LDU is one or more physical disks, created by the Disk Formatter.

Generally, for the most versatile system, you will make each physical disk a single-disk LDU. The system disk is nearly always a single-disk LDU. (If you set up a multiple-disk LDU, all disks must be on line before you can even access the LDU.)

With the Disk Formatter, you can set up a structure in which everything will be on one LDU. Or, you can set up a system LDU with a separate database LDU, UDD LDU, swapping/paging LDU, or any combination — depending on your needs and number of disk units.

You might set up a multiple-disk LDU if you need to handle a very large file — perhaps a database file — that won't fit on a single disk. The system will then access the multidisk LDU as one directory file, providing enough space for the large database file.

Chapter 2
Bringing Up AOS/VS on a Blank Disk — ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Computers

Read this chapter

- when your computer hardware has just been installed and you want to bring up AOS/VS on it
- whenever you want to format a new disk, install an AOS/VS system on it, load system files onto it, and bring up the installed system.

This chapter explains the steps needed before you run the VSGEN program to generate your first tailored system. It applies to ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-series systems only. For other MV/Family computers, including MV/4000s, see Chapter 3.

The major sections in this chapter are

- About Your Media
- Powering Up and Loading Microcode
- Running the Disk Formatter
- Installing the AOS/VS Starter System
- Bringing Up the AOS/VS Starter System

About Your Media

All ECLIPSE MV/4000 DC, MV/4000 SC, and DS/4000 computer systems include at least one 737,000-byte diskette unit. An optional extra is a cartridge tape unit, model 6311.

If your system doesn't include a tape, all the system components you need to build AOS/VS were supplied on diskettes, in the following groups:

- I/O CB emulator, on one diskette
- System media and microcode file, on two diskettes
- AOS/VS system programs, the latest revision, on diskettes
- an AOS/VS update (updates for programs in the latest revision), on one or more diskettes. You get the update diskette(s) only if an update has occurred since the last AOS/VS revision.

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If you have a tape unit, you may receive AOS/VS software programs and updates on one cartridge tape; and you may receive system media and microcode on another cartridge tape. This depends on your contract with DG. It's important to identify your media and understand the order in which you'll use it. The order is as follows.

1. The I/O CB emulator, on one diskette. The diskette label, second line, includes the words "I/O CB EMULATOR."
2. System media and microcode, on two diskettes or a cartridge tape. If you received system media on diskettes, one of the diskette labels includes, on its second line, the words "... SYSTEM MEDIA;" this is the first diskette. On the other diskette, the second text line includes the words "MV4000xxx.MCF" and the last line includes "AOS FMT." You'll use the first diskette early and the second one much later.

   If you received system media on tape, the tape label has the words "xxxxx SYSTEM MEDIA" on its second line.
3. AOS/VS programs (14 or so diskettes or one cartridge tape). The paper labels on AOS/VS diskettes/tapes have "AOS/VS n" printed on them.
4. AOS/VS update, if any (one or more diskettes or one cartridge tape). The paper labels on AOS/VS update diskettes/tapes have "UD" and "AOS/VS n" printed on them.
5. System media and microcode diskette set, again. This time, you'll use the second diskette, which has "AOS FMT" on its label. Or, with tape, you'll use the original "xxxxx SYSTEM MEDIA" cartridge tape again.

Software media products other than AOS/VS, like CEO® or FORTRAN 77, must wait until you have AOS/VS up and running.

After checking your media and reviewing the order given above, proceed.

Powering Up and Loading Microcode

The following numbered steps lead you through the entire "from blank disks" procedure. The steps cover both tape and diskettes, and you'll be skipping the ones that don't apply.

The steps assume that CPU power is off.

1. Turn on the system console. The switch is an on/off rocker behind the console or a push switch on the front. The console may display a test message and beep. If there is an ON LINE light on the keyboard, it should glow. (If the light doesn't glow, press the CMD key, hold CMD down, and press the ON LINE key. The ON LINE light should glow.)

1a. If your keyboard has an ALPHA LOCK key (next to the space bar), press it to make the ALPHA LOCK light glow. You need to set ALPHA LOCK because one of the programs you'll use doesn't accept lowercase letters.

2. If you have a cartridge tape unit, turn it on now — by moving its switch to ON-1. (To use the tape unit, you must turn it on before turning computer power on.)
3. Find the diskette labeled "I/O CB EMULATOR." Insert it in unit 0 as follows. If you have two diskette units, the right one is unit 0.

3b. Turn the latch beside the slot to the vertical position.

3c. Remove the diskette from its outer envelope. Don't try to remove the inner envelope — the diskette must remain in this.

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74. Press

    ⤸

    The system copies files from diskette to the LDU. (If you see the message *PHYSICAL UNIT OFFLINE*, this means that the diskette was misinserted in the unit or that no diskette was inserted. If needed, remove the diskette; then insert the correct diskette properly, as shown in Figure 2-1 and press ⤸ again to retry. If you see *THE LABEL ON THE DISKETTE IS NOT THE ONE REQUESTED*, this means you've inserted the wrong diskette. Find the correct diskette, which has the number displayed after *REQUESTED:*, less 5. Then retry.)

75. Return to step 73 and repeat the sequence until you see

    PLEASE REMOVE THE DISKETTE
    *)

    You've loaded all the AOS/VS software from diskettes. During the process, several directories were created: directory :UTIL (with utilities), directory :SYSGEN (for system generation), and directory :HELP (for help).

    You still need to load the AOS/VS update (if any) and the microcode file.

76. Remove the last AOS/VS diskette from the unit and insert the AOS/VS update diskette, with UD on its paper label (described near the beginning of this chapter). If there is more than one UD diskette, use the first one.

77. Type the LOAD command again, using the labeled diskette pathname @LFD:VOL1:UPDATE, as follows:

    ```
    *) LOAD/V/R   @LFD:VOL1:UPDATE ⤸
    ```

    PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED
    UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y]

78. You want the defaults, unit DPJ10 and volume ID VOL1. So confirm by pressing

    ⤸

    The system now copies the contents of the update diskette to the LDU. If it prompts for a second diskette, remove the diskette, insert the next update diskette, and repeat this step. Generally, though, there will be just one update diskette. When all update files have been loaded, you'll see

    PLEASE REMOVE THE DISKETTE
    *)

    You're almost done. Next, you'll load a microcode file onto your hard disk.

Loading the Microcode File from Diskette

79. Remove the diskette from unit 0. Get the *second* diskette in the system media set. The paper label of this diskette has the words "AOS FMT" on the last line of text. Insert this diskette in unit 0.

80. Load the microcode files from the diskette by typing

    ```
    *) LOAD/V/R @DPJ10 ⤸        (Load from physical diskette.)
    MV4000....MCF                (After 30 seconds or so, CLI verifies load of microcode
                                  file(s).)
    *)
    ```

    This puts the microcode file(s) on your LDU.

81. Remove the diskette from unit 0.

82. If your computer has *neither* hardware floating point *nor* the graphics instruction set (GIS), you're done! Skip to step 94.

    If your computer has *either* (or *both*) hardware floating point or the GIS, the next step is to choose the correct microcode filename. Skip to section "Choosing the Default Microcode Filename," step 93.

Loading AOS/VS System Files from Tape

83. With tape, the next steps are to load all the system programs and files that are part of the AOS/VS system. These programs and files are in tape file 7. First, turn on Superuser to provide write access.

```
) SUPERUSER  ON ↵
*)
```

84. Load the files in tape file 7 by typing

```
*) XEQ  LOAD_II/V/R  @MTC0:7 ↵          (Use the LOAD_II program.)
...
```

    The LOAD_II program verifies (/V switch) the filenames loaded by displaying their names. The whole directory structure on the tape is copied, creating directory :UTIL (with utilities) directory :SYSGEN (for system generation), and directory :HELP (for help). The /R switch ensures that the most recent version of each file remains on the LDU. This load takes quite awhile.

    After all the files have been loaded, the CLI Superuser prompt returns:

```
*)
```

85. Rewind the tape by typing

```
*) REWIND  @MTC0 ↵
```

86. Now, if you received an AOS/VS *update* tape, get it. If not, skip to step 88. Updates have revision numbers with the last two digits greater than 00. For example, 7.01 is an update number. Remove the tape from unit 0, insert the update tape in unit 0, and type

```
*) LOAD/V/R   @MTC0:0 ↵
... (CLI verifies files loaded.) ...
*)
```

    This puts AOS/VS update and patch files on the LDU, for access later on.

87. Rewind the tape by typing

```
*) REWIND   @MTC0 ↵
```

88. Remove the tape from the unit.

    If you received system media on tape, continue. If you received them on diskette, not tape, return to "Loading the Microcode Files from Diskette," and do steps 79, 80, and 81.

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94. Well done! You've powered up, formatted an LDU, installed an AOS/VS system on it, brought up AOS/VS, and loaded all files you need to generate and use your tailored system.

If you're interested in the files as shipped on the system diskettes, see Table 2-3. For files on the system tape, see Table 2-4. All these files are now on your LDU. The LDU also contains directory :PATCH, with current patch files (if you loaded an AOS/VS update). Also, the LDU contains the microcode file, MV4000xx.MCF.

Figure 2-2 is a summary of all the steps you've taken — from turning on the system console to locking the computer.

Table 2-3. AOS/VS System Diskettes File Format

Diskette Number	Program Filename	Tape File Contents
1	DFMTR	Disk Formatter utility, which formats physical disks into LDUs. You run this by typing DFMTR ↵ in response to the *Pathname?* query.
	INSTL	Installer utility, which installs an AOS/VS system from a system tape. You run this by typing INSTL ↵ in response to the *Pathname?* query.
	FIXUP	Disk Fixer utility, which finds and can correct (fix) disk file errors if abnormal AOS/VS shutdown occurs. You run FIXUP by choosing option 7, "Run FIXUP" from the Technical Maintenance Menu.
	PCOPY	Physical disk copier utility, which copies an LDU to or from a tape or diskette. You can run this utility by typing PCOPY in response to the *Pathname?* query.You would do this to recover your disk structure after a disk crash — if you used PCOPY to create a backup of your disk in the first place.
2	SYSBOOT	SYSBOOT is the system bootstrap program. This diskette has SYSBOOT on it in a form that the Installer can read. The Installer then installs it on an LDU.
3	AOS/VS system	On the DG-supplied AOS/VS diskette, this is the AOS/VS starter system. Use the Installer to install the starter system on an LDU. On a system diskette you make yourself, it is your tailored AOS/VS system. Use SYSBOOT's Technical Maintenance Menu to make the tailored system the default system.
4 - n	First Dump File	The CLI and other system program files, including the system Agent, peripheral manager (PMGR), and copies of programs in diskette 1. AOS/VS copies the contents of these diskette into the LDU root directory when you specify Initial load; then type the labeled diskette pathname.

(continued)

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Table 2-3. AOS/VS System Diskettes File Format (continued)

Diskette Number	Program Filename	Tape File Contents
n+1 - m	Second Dump File	You copy the contents of this file onto the LDU using the LOAD command. This file contains nearly all AOS/VS system programs, including the - CONTEST system exerciser - Disk File Editor (FED) - DISPLAY file display - Error message (ERMES) and message object files (.OBs) - EXEC and PREDITOR - HELP directory and files - LABEL tape labeler - Link - Library File Editor - Macroassembler (MASM) - Process Environment Display (PED) - Release Notice (latest on software) - SED and SPEED text editors - System macros - Utility program symbol table files (.ST) - SYSGEN directory with VSGEN system generation program and libraries

(concluded)

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Table 2-4. AOS/VS System Tape File Format

Tape File Number	Program Filename	Tape File Contents
0	TBOOT	Tape bootstrap; a short program that can load files 1, 2, and 3 from this tape.
1	FIXUP	Disk Fixer utility, which finds and optionally corrects disk file errors if abnormal AOS/VS shutdown occurs. TBOOT loads this program into memory and executes it after you type 1 ↵ to the Tape file number? query.
2	DFMTR	Disk Formatter utility, which formats physical disks into LDUs. TBOOT loads DFMTR into memory and executes it after you type 2 ↵ to the Tape file number? query.
3	INSTL	Installer utility, which installs an AOS/VS system from a system tape. TBOOT loads INSTL into memory and executes it after you type 3 ↵ to the Tape file number? query.
4	SYSBOOT	The system bootstrap program loads an AOS/VS system or other program into memory *from disk*, then executes the program. The Installer installs SYSBOOT on an LDU.
5	AOS/VS system	On the DG-supplied system tape, this is the AOS/VS starter system. Use the Installer to install the starter system on the disk. On a system tape you make, it is your tailored AOS/VS system. Use SYSBOOT's Technical Maintenance Menu to make the tailored system the default system.
6	First Dump File	The CLI and other system program files, including the system Agent, peripheral manager (PMGR), LOAD_II program, and copies of programs in tape files 0 though 4. AOS/VS copies the contents of this tape file into the LDU root directory when you specify *Initial load*.
7	Second Dump File	You copy the contents of this file onto disk using the LOAD_II program, as part of the initial load procedure. This tape file contains nearly all AOS/VS programs, including the - CONTEST system exerciser - Disk File Editor (FED) - DISPLAY file display - Error message (ERMES) and message object files (.OBs) - EXEC and PREDITOR - HELP directory and files - LABEL tape labeler - Link - Library File Editor - Macroassembler (MASM) - Process Environment Display (PED) - Release Notice (latest on software) - SED and SPEED text editors - System macros - Utility program symbol table files (.ST) - SYSGEN directory with VSGEN system generation program and libraries

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77. Type

```
*) LOAD/V/R   @LFD:VOL1:UPDATE ↵
```

PLEASE INSERT A DISKETTE IF NOT ALREADY INSERTED

78. *UNIT [@DPJ10] VOLUME ID [VOL1] ? [Y]* ↵
... (It copies from diskette) ...
*)

Loading the Microcode File from Diskette

79. Remove any diskette from unit 0. Get the *second* diskette in the system media set (with "AOS FMT" on the last line of its paper label). Insert this diskette in unit 0.

80. *) LOAD/V/R @DPJ10 ↵
... (It verifies load) ...
)

81. Remove the diskette from unit 0.

82. If your computer doesn't have hardware floating point or GIS, you're done; skip to step 94. If you *do* have hardware floating point or GKS, choose the microcode filename as shown in step 93.

Loading AOS/VS System Files from Tape

83.) SUPERUSER ON ↵
*)

84. *) XEQ LOAD_II/V/R @MTC0:7 ↵ (Use the LOAD_II program.)

... (CLI displays file and directory names loaded.) ...

85. *) REWIND @MTC0 ↵

86. Now, if you received an AOS/VS *update* tape, get it and mount it on unit 0.

87. Type

```
*) LOAD/V/R   @MTC0:0 ↵
... (CLI verifies patch files loaded.) ...
*) REWIND @MTC0 ↵
*)
```

88. Dismount the update tape from unit 0.

If you received the microcode/SCP files on tape, continue. If you received them on diskette, not tape, return to and do steps 79, 80, and 81.

Loading the Microcode File from Tape

89. Get the system media tape (used earlier) and insert it in the tape unit.

Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continued)

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90. Type

```
*) DIR :⤸
*) LOAD/V/R @MTC0:1⤸
. . . (CLI verifies microcode filename(s).) . . .
```

91. `*) REWIND @MTC0⤸`

92. Remove tape from unit and store tape.

Changing the Default Microcode Filename

93. To choose a microcode filename other than the default:

93a. `) BYE⤸`

93b. *Do you really want to shut the system down?* `Y⤸`

System shutdown
SCP-CLI>

93c. Turn computer POWER switch off and on.

MV4000 READY
. . .
@

or

MV4000 READY
. . .

Operating System Load Menu

. . .

93d. *Enter choice [1]:* `2⤸`

93e. If you see the @ prompt (not *Operating System Load Menu),* type `24L` and then type `2⤸`.

Technical Maintenance Menu

. . .

93f. *Enter choice [1]:* `9⤸`

93g. *Default microcode filename [default]:*

Type the name of the *correct microcode file* as follows:

Without hardware floating point, without GIS, file is MV4000.MCF
With hardware floating point, without GIS, file is MV4000FP.MCF
Without hardware floating point, with GIS, file is MV4000G.MCF
With both hardware floating point and GIS, file is MV4000GFP.MCF

For example, with an MV/4000 SC with hardware floating point, without the GIS, you'd type `MV4000FP.MCF⤸`

DG-27021T

Figure 2-2. Step Summary, Bringing Up AOS/VS on Blank Disk(s), ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series Systems (continued)

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Chapter 3
Bringing Up the Starter System on Blank Disks — ECLIPSE MV/20000, MV/15000, MV/10000, MV/8000, MV/7800, MV/6000, and MV/4000 Computers

Read this chapter

- when your computer system hardware has just been installed and you want to bring up AOS/VS on it;
- whenever you want to format a new disk, install an AOS/VS system on it, load system files onto it, and bring up the installed system.

This chapter tells you how to execute all steps needed before you run the VSGEN program to generate your first tailored system. It applies to ECLIPSE MV/20000 Model 2, MV/20000 Model 1, MV/20000 C, MV/15000 (all models), MV/10000 SX, MV/10000, MV/8000, MV/8000 II, MV/8000 C, MV/7800, MV/7800 C, MV/7800 U, MV/6000, and MV/4000 computers. The major sections are

- Powering Up and Loading Microcode
- Running the Disk Formatter
- Installing the AOS/VS Starter System
- Bringing up the AOS/VS Starter System

(Data General DS/7000-series and ECLIPSE MV/2000 DC systems usually arrive with an easy-to-use model of AOS/VS already installed on the disk. Managing such a system is explained in the manual *Starting and Running AOS/VS on ECLIPSE MV/2000™ DC and DS/7000-Series Systems*. It is possible, however, to acquire standard AOS/VS on one of these systems. To bring up standard AOS/VS on one of these systems — starting with blank disks — see Appendix D.)

Powering Up and Loading Microcode

The following steps assume that CPU power is off.

1. Ready the system console. If this is a hard copy (printing) console, turn it on using the power switch under the keyboard or behind the unit, near the floor. Press the ON LINE switch and the READY light will glow. Set ALPHA LOCK on.

   If the system console is a CRT display, turn it on. The switch is a rocker switch behind the console or a push-pull knob on the front lower right corner. The console may display a self-test message and beep. Check the ON LINE light. If this light glows, fine. If it doesn't glow, depress the CMD key, hold CMD down, and press the ON LINE key. The ON LINE light should glow. (If there is no ON LINE key, check the ON LINE switch behind the console.)

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1a. If your primary disk unit is a sealed unit, press ON-1 (or READY or START). Soon, the READY light will glow.

If your primary disk uses a removable disk pack (multiple platters), make sure a pack is inserted in the unit. Doing this is described in the illustrated disk instruction booklet. First press DC POWER ON, WRITE ENABLE, and then DRIVE START; soon, the READY lamp will light.

If you want to format multiple disks, make sure they are ready as above.

2. With any machine except a blue and white MV/8000, skip to step 3.

With a blue and white MV/8000, proceed as follows.

2a. If the MV/8000 system diskette (supplied with the computer) is not in the computer's diskette slot, insert it. Then close the diskette door.

2b. Press the computer POWER switch to ON. The computer then runs some power-up tests, and prompts

CONSOLE READY
...
STARTING POWER UP SEQUENCE

ENTER DATE (MO DAY YR)

If this message doesn't appear, make sure the diskette is correctly inserted; and turn power off and on again.

2c. Type the date, separating month, day, and year by a space, followed by a NEW LINE character (⤸). For example:

```
5  23  86⤸
```

ENTER TIME (HR MIN)

2d. Type the time, based on a 24-hour clock. For example, for 1:30 p.m., type

```
13  30⤸
```

MICROCODE(1= STD, 2= C350/MMPU[1])?

2e. Accept the default microcode by pressing ⤸.

The SCP now loads its operating system and the MV/8000 microcode from the diskette. This takes a few moments. It displays

LOADING FROM FILE ...
LOADING COMPLETE
...

END SYSTEM INITIALIZATION
SCP-CLI>

The whole load takes a little over a minute. The SCP operating system, which allows you to run other programs, now has control. Skip all the way to step 13.

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3. With any machine except a blue and white MV/8000, do the following.

   On the computer's front panel, press the LOCK switch (if there is one) to the OFF or to the unlock position. Then press the computer POWER (or PWR) switch to ON. The computer then runs power-up tests. Then, depending on model, the system console displays either

*** POWER UP TESTING COMPLETE ***	(on MV/20000s and MV/15000s)
...	
SCP-CLI/Jpn>	(n is 0 or 1 on MV/20000s, 0 on MV/15000s)

   or

*** POWER UP TESTING COMPLETED ***	(on MV/7800s)
SCP-CLI>	

   or

*** POWER UP TESTING COMPLETED ***	(on everything else except for MV/4000)
BOOT ...	

   or

MV4000 READY	(on MV/4000)
@	

   If you see an incomplete *POWER UP/READY* message, or *POWER UP TESTING - FAILED*, or nothing, press power off and on again. If the message remains incomplete, or if the failure occurs again, consult Chapter 17 for the pertinent "Powerup Error Codes" table.

4. Now for a tape. There are several tapes involved in bringing up your first system. One is the *MV/n* system tape (for example, the MV/4000 system tape). This usually contains a diagnostic program, diagnostic operating system (SCP-DTOS or SCP-ADES), CPU diagnostics, microcode, and the SCP operating system.

   The second tape is the *AOS/VS* system tape, which contains all AOS/VS system software. There may also be an AOS/VS *update* tape. (There will also be tapes with other DG software, but these must wait until you get AOS/VS up and running.)

5. Select a tape unit and turn power on to it.

   If the unit's control panel has a SELECT thumbwheel, it is a type MTB unit. The starter system requires that the MTB controller be connected to the first tape controller device code, 22. Dial 0 on the thumbwheel and make sure that no other unit that is ON LINE has the same number. Then press the MTB's panel switch to HIGH DENSITY.

   If the tape unit has no SELECT thumbwheel and its reels are side by side, it is a type MTC unit. If it has no reels and accepts a tape *cartridge*, it is also a type MTC unit. Always, the MTC you use must be unit 0 on its controller. And the starter system requires that the MTC controller be connected to the first tape controller device code, 22.

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If the tape unit has switches at the top, or if it has a touchsensitive switch panel, it is a self-threading 1600/6250 bpi unit, type MTD. The MTD must be unit 0 on its controller, and *the controller must be connected to the second tape controller device code, 62*. (The starter system supports an MTB or MTC controller on device code 22 and an MTD controller on device code 62. This means that, if you want the starter system to operate an MTD unit, the unit must be connected on device code 62.)

If the tape unit accepts a cartridge (a 4- x 4-inch, 130-Mbyte cartridge with half-inch tape or a small, tape-cassette size, 21-Mbyte cartridge), it's a type MTJ unit. The starter system requires that the MTJ controller be connected to the first tape MTJ controller device code, either 23 or 63 for MTJ0 or 63 for MTJ10.

6. Mount and thread the *MV/n* system tape (on an MTD unit, just mount the tape), or insert the tape cartridge, on tape unit 0. Then close the tape unit door. (Some units won't operate with the door open.)

7. Press the tape UNLOAD/BOT switch to BOT; then press ON LINE. The tape will move forward and stop. (On an MTD unit, press Reset, Load, and On Line.)

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8. Now, you must tell the computer to program load from the tape:

- With an MV/20000 Model 2, MV/20000 Model 1, or MV/20000 C, or MV/15000 Models 20, 10, or 8, continue with step 9;
- With an MV/10000 SX or MV/10000, skip to step 10;
- With an MV/8000 II, MV/8000 C, or MV/6000, skip to step 11;
- With an MV/4000, skip to step 12.

9. With an MV/20000, the system console displays

SCP-CLI/Jpn> (where n is 0 or 1, depending on in which slot the primary CPU board is inserted)

In the next lettered steps, you will

- Enable SCP automatic program loading (bootstrapping)
- Set the battery-powered boot clock's date and time
- Optionally run diagnostics
- Load and verify microcode

Type the command FLAGS AUTO YES and set the startup device as follows:

9a. *SCP-CLI/Jpn>* FLAGS AUTO YES ↵

9b. *Boot from what device? [0]* 24 ↵ (Type the device code of your primary disk unit; this is 24 for a DPJ-type disk or 27 for a DPF-type disk.)

9c. *Channel number? [0]* ↵
SCP-CLI/Jpn> (Skipped if your computer has only one IOC. If asked, press ↵ .)

From now until you change it, the autoboot device will remain your primary disk unit.

9d. Turn computer power off, then on again. You'll see the power-up message as before, and — having set the default device -- you'll see the Automatic Program Load Menu:

*** POWER UP TESTING COMPLETED ***

Automatic Program Load Menu

1 Continue immediately with preset values
2 Change preset values
. . .

9e. *Enter choice [1]:* 2 ↵ (Type 2 ↵)

Change Preset Values Menu

1 Continue the powerup
2 Change the system date or time
3 Start from a different device
4 Change the default device
5 Change the time delay before the automatic loading continues
6 Enter the SCP CLI
. . .

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10c. Type the date, separating the month, day, and year by a space, followed by a NEW LINE character (⤸). For example, for May 23, 1986, you'd type

```
5  23  86⤸
```

ENTER TIME (HR MIN)

10d. Type the time, based on a 24-hour clock. For example, for 1:30 p.m., type

```
13  30⤸
```

BEGIN SYSTEM INITIALIZATION
NUMBER OF ... MEMORY MODULES n
MICROCODE REV.n
END SYSTEM INITIALIZATION

SCP-CLI>

Go to step 13.

11. On an MV/8000 II, MV/8000 C, or MV/6000, the system console prompts *BOOT DEVICE?* Type

BOOT DEVICE? 22⤸ (Or type 62⤸ if tape is on a type MTD tape unit.)

The loader program reads the diagnostic operating system from the tape. It displays

TOP OF MEMORY = n
HIDTOS REV n
TESTOK
COPYRIGHT DATA GENERAL ...
ALL RIGHTS ...

*

(If this message doesn't appear after a minute or so, retry by turning CPU power off and returning to step 4. If the message still doesn't appear, the MV/n tape may be low density. On the tape unit, press OFF LINE, press the DENSITY switch to LOW DENSITY — if this applies — and leave it on LOW DENSITY. Press the CPU POWER switch to OFF and return to step 4.)

11a. Tell the diagnostic operating system to load the SCP operating system from tape, by typing

```
*  LOAD  SCPOS⤸
```

SCPOS REV n

Now wait. After about 70 seconds or so, you'll see the messages

MV/n000 SYSTEM CONTROL PROGRAM REVISION n
COPYRIGHT DATA GENERAL...
CHECK-SUM OK

ENTER DATE (MO DAY YR)

11b. Type the date, separating the month, day, and year by a space, followed by a NEW LINE character (⤸). For example, for May 23, 1986, you'd type

```
5  23  86⤸
```

ENTER TIME (HR MIN)

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11c. Type the time, based on a 24-hour clock. For example, for 1:30 p.m., type

13 30 ↵

BEGIN SYSTEM INITIALIZATION
 # OF 256 KB MEMORY MODULES - n
MV/n000 MICROCODE REVISION n
END SYSTEM INITIALIZATION

SCP-CLI>

Go to step 13.

On an MV/7800, the system console displays

SCP-CLI>

To enable automatic program loading, type

FLAGS AUTO YES ↵

The system prompts

Load from what device? [22]

Type

24 ↵

(Type the device code of the primary disk unit, 24 for a DPJ-type disk or 27 for a DPF-type disk. The device code you enter now becomes the new default device code.)

Press the SYSTEM switch to BOOT (or press the PR LOAD switch). This displays the Automatic Program Load Menu:

MM/DD/YY HH:MM:SS

Automatic Program Load Menu

1 Continue immediately with preset values
2 Change preset values

Loading with preset values will continue automatically unless you respond within 45 seconds.

The default device is 24.

Enter choice [1]:

Type 2 ↵ , which displays the Change Preset Values Menu:

Change Preset Values Menu

1 Continue the powerup
2 Change the system date or time
3 Start from different device
4 Change the default device
5 Change the time-out delay before the automatic loading continues
6 Enter the SCP CLI

Enter choice [1]:

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Choose option 2

2 ↵

Answer the date and time questions as follows

Date [MM-DD-YY]

Type the current date and press NEW LINE. For example,

09/15/86 ↵ (Type the current date.)

Time [HH:MM:SS]

Type the correct time and press NEW LINE. For example,

13:30:00 ↵ (Type the correct time.)

Offset to GMT [+00:00]

Accept the default for now by pressing NEW LINE

↵

When you finish setting the date and time, the prompt returns

Enter choice [1]:

You want to load tapes via the SCP, so choose option 6 by typing

6 ↵

SCP-CLI>

Mount the MV/7800 SCP SYSTEM MEDIA tape or the MV ADEX Model 30200 tape on tape unit 0. Put the tape unit on line, and make sure the tape is ready to load (the BOT light is lit). Type

BOOT 22 ↵

If you just loaded from the SCP SYSTEM MEDIA tape, rewind the tape and skip to step 13.

If you are loading from the MV ADEX tape, select the menu option to load microcode. The system performs an extended powerup sequence, and displays a message. (If there is a failure, it will display a message, and you should call 1-800-DGHELPS.) Once microcode is loaded, select the menu option "Enter the SCP" and skip to step 13.

12. With an MV/4000, the system console shows @. Type 22L.

@ 22L

The loader program reads the diagnostic operating system from the tape. It says

TOP OF MEMORY = n
HIDTOS REV n
TESTOK
COPYRIGHT DATA GENERAL ...
ALL RIGHTS ...

*

(If this message doesn't appear after a minute or so, retry by turning CPU power off and returning to step 4. If the message still doesn't appear, the MV/n tape may be low density. On the tape unit, press OFF LINE, press the

DENSITY switch to LOW DENSITY — if this applies — and leave it on LOW DENSITY. Press the CPU POWER switch to OFF and return to step 4.)

12a. Tell the diagnostic operating system to load CPU microcode. For an MV/4000 with a hardware floating-point unit (FPU), the filename is MV4000FP; for an MV/4000 *without* FPU, the filename is MV4000. Type the LOAD command, followed by the appropriate filename for your machine. For example,

```
*LOAD  MV4000 ↵                    (or LOAD MV4000FP ↵ )
```

After a few moments, you'll see the message

```
MV4000 MICROCODE REV n LOADING
...
MV4000 MICROCODE REV n LOADED AND VERIFIED
*
```

12b. Exit from the diagnostic system by typing

```
EXIT ↵
CPU HALTED

SCP-CLI>
```

CPU microcode has been loaded; and the SCP CLI, which allows you to start other programs, has control, as you can tell by the prompt.

13. You're done with the MV/n system tape, so use the tape switches to take it off line, unload it, and remove it from the tape unit. You'll need it again later.

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19h. The Disk Formatter wants to know which access privileges to give the username(s) you just specified. There are five types of privileges: Owner, Write, Append, Read, Execute (OWARE). A NEW LINE gives the user no access. Execute (E) access will suffice for most disks. So type

E ⤸

Username or template (1 to 15 characters)?

19i. The Disk Formatter will repeat the *Username and Access* questions, allowing you to give very specific user and access information, until you answer ⤸ to *Username...* You can change the access control list of any LDU when AOS/VS is running — so the answers you give in steps 19g and 19h are not critical. Generally, answer + ⤸ to question 19g, answer E ⤸ to question 19h, and answer ⤸ to this question. Later, if needed, you can change access to the LDU. So type

⤸

Surface analysis? [N]

20. This step starts a series on surface analysis for this LDU. (The value in brackets is the default, which the Formatter will use if you answer with ⤸.)

For each new disk, you should answer Y ⤸ to this question. During analysis, the Formatter writes a pattern to each 16-bit word on the disk and reads it back. This destroys all existing information on the disk — but a new disk has no information. Answer yes by typing

Y ⤸

Disk number?

20a. The Formatter wants the number of the disk to analyze. For a single-disk LDU, press

⤸

You may run up to five (5) patterns. How many would you like to run?

20b. The Formatter can run up to five bit patterns on the disk to check for bad blocks. You can specify any number, 1 through 5. It's very important for the Formatter to identify all bad blocks so that AOS/VS will bypass them. We recommend that you run all five patterns on each disk you format.

Each pattern takes between 8 and 60 minutes, depending on the disk model, as shown in Table 3-2. So five patterns may take a while. To run five patterns, type

5 ⤸

Analyzing disk # n

-- Running pattern n

The Formatter runs the patterns you specified, one by one. If it finds too many bad blocks, it aborts. This may mean that the disk heads are misaligned. But in most cases, it's simply a matter of waiting.

When the Formatter has finished the patterns, it describes the bad blocks on the disk.

20c. If the Formatter found no bad blocks, it displays *0 bad disk blocks*. Skip to step 20e, *Additional bad block number?* question.

If it found any bad blocks, it displays

n bad disk blocks
Display bad block statistics? [N]

Table 3-2. Surface Analysis Times for Popular Disks

Disk Model	Capacity (megabytes)	Time per Test Pattern
6060	96	13 minutes
6061	190	17 minutes
6122	277	26 minutes
6160	73	11 minutes (approximately)
6161	147	22 minutes (approximately)
6214	602	52 minutes
6234	50	8 minutes (approximately)
6236, 6237	354 per unit	35 minutes per unit (approximately)
6239, 6290, 6240	592 per unit	50-60 minutes per unit (approximately)

20d. The Formatter is asking if you want to see the bad block statistics. These statistics may be useful, so answer yes.

Y ↵

The Formatter now displays the bad block statistics on the console. If there are bad blocks, you might want to note them. There should be few, if any, bad blocks on a new disk (but over a thousand bad blocks are allowed on a 602-megabyte model 6214 disk).

Additional bad block number (press NEW LINE when done):

20e. You have no additional bad blocks to enter, so press

↵

Display bad block statistics? [N]

20f. Press ↵

Bitmap size: n
Bitmap address? [default]

The bitmap is a system table that describes which blocks are in use and which are free for data storage.

21. Select the default by pressing

↵

System LDU? [Y]

22. This step starts a series that determines whether and where an AOS/VS system will reside on the disk. The Formatter skips this question if you allocated a diagnostic area earlier, in step 19c.

Your first LDU must be a system disk. Other LDUs need not be system disks. For your first LDU, answer for the default.

↵

Overlay area size? [default]

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With AOS/VS running, you are subject to file access controls — which means that you would get an error message if you tried to to load files into the root directory. Superuser allows you to bypass all file access controls. The asterisk before the) prompt means that Superuser is on.

47. Load the files in tape file 7 by typing

```
*) XEQ LOAD_II/V  @MTC0:7 ↵      (Or @MTD0:7 ↵ if tape is on an
                                  MTD unit, or @MTJ0:7 or
                                  MTJ10:7 for 21-Mbyte cartridge
                                  tapes.)
. . .
```

Even if the tape is mounted on an MTB unit, you must specify MTC to the starter system.

The CLI verifies (/V switch) the filenames loaded from tape by displaying their names. (Don't be surprised to see warning messages about files already loaded; some files in tape file 7 also exist in tape file 6.) The whole directory structure on the tape is copied, creating directory :UTIL (with utilities), directory :SYSGEN (for system generation), and directory :HELP (for help).

All these directories (along with files like DFMTR, the Disk Formatter) are copied into the "root" directory. The root directory's name is : (colon), so the pathname to any of these newly-created directories is

```
:directory-name
```

for example, :UTIL.

After all these files have been loaded, the CLI Superuser prompt returns

```
*)
```

48. Rewind the tape by typing

```
*) REWIND  @MTC0 ↵               (Or REWIND @MTD10)
```

49. Now, if you received an AOS/VS *update* tape, get it. If not, skip this step. Updates have revision numbers with the last two digits not 00. For example, 7.01 is an update number. Mount the tape on unit 0, and type

```
*) LOAD/V/DEL  @MTC0:0 ↵         (Or LOAD/V/DEL @MTD0:0)
... (CLI verifies load of update notice and patch files.) ...

*) REWIND  @MTC0 ↵               (Or REWIND  @MTD0)
```

This puts AOS/VS update and patch files on the LDU, for access later on. Dismount the update tape from unit 0.

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50. Get the MV/n system tape that you used earlier and mount it on the tape unit. (For MV/8000, skip this step.) Load the microcode/SCP-OS file into the LDU root directory by typing

*) DIR : ↵	
*) LOAD/V/R/NACL @MTC0:1 ↵	(Load from tape file 1. Use LOAD/V/R/NACL @MTD0:1 if tape is on an MTD unit.)
MVn.MCF	(CLI verifies load of microcode file; for example *MV8000_II.MCF*. With some machines there are two files: one with floating-point microcode and one without. For example, you might see names MV4000.MCF and MV4000FP.MCF.)
*) REWIND @MTC0 ↵	(Or REWIND @MTD0)

This puts the microcode/SCP-OS file(s) on the LDU. In future, SYSBOOT will load the correct file automatically as needed.

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51. You're done with the DG-supplied tapes. Remove the tape from the unit, clip the cover ring around it, and store it safely. You may need it again if you want to run diagnostics on the CPU. Clip cover rings on all DG-supplied tapes and store them safely too.

52. Turn Superuser off by typing

```
*) SUPERUSER OFF ⤸
)
```

The) is the standard CLI prompt.

53. Now, for any machine *except* an MV/4000 with hardware floating point, skip to the next step, step 54.

For an MV/4000 with hardware floating point, you should identify the correct microcode file to SYSBOOT so SYSBOOT can load it in the future. (SYSBOOT can identify the proper file for all computers except MV/4000s with hardware floating point.) To do this, shut the system down and bring it up again as follows:

53a. Type

```
) BYE ⤸
```

53b. *Do you really want to shut the system down?* Y ⤸ (Type Y ⤸)
System shutdown
SCP-CLI>

53c. Press the computer panel POWER switch to OFF. Then press the panel LOCK switch ON; and press POWER ON. This program loads from the primary disk device code (selected inside the machine with hardware jumpers).

Operating System Load Menu

1 Continue immediately with operating system load
2 Enter the Technical Maintenance Menu

. . .

Enter choice [1]:

53d. You want to enter the Technical Maintenance Menu, so type 2 ⤸.

Technical Maintenance Menu

. . .

9 View or change the microcode filename
. . .

Enter choice [1]:

53e. You want option 9, so type

9 ⤸

SYSBOOT prompts

Default microcode filename [default]:

53f. Type the name of the *floating-point microcode file,* which is MV4000FP.MCF:

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43. *Page directory definition [default]?* ↵

44. *Initial load [N]?* Y ↵

45. *Filename [@MTC0:6]?* ↵ (Or MTD0:6)
(Tape file 6 is loaded)
AOS/VS CLI Rev n date time
)

46.) SUPERUSER ON ↵

47. *) XEQ LOAD_II/V @MTC0:7 ↵ (Or @MTD0:7 if tape is on an MTD unit, or @MTJ0:7 or MTJ10:7 for 21 Mbyte tapes.)

... (CLI displays file and directory names loaded.) ...

48. *) REWIND @MTC0 ↵ (Or REWIND @MTD0 with an MTD unit.)

49. Get and mount AOS/VS update tape (if any). Type

*) LOAD/V/DEL @MTC0:0 ↵ (Or LOAD/V/DEL @MTD0:0 with MTD unit.)

... (CLI verifies patch files loaded.) ...
*) REWIND @MTC0 (Or REWIND @MTD0)

Dismount AOS/VS update tape.

50. Mount MV/n system tape (skip for MV/8000). Type

*) DIR : ↵
*) LOAD/V/R/NACL @MTC0:1 ↵ (Or LOAD/V/R/NACL @MTD0:1
)

MVn.MCF (CLI verifies microcode file name(s).)
*) REWIND @MTC0 (Or REWIND @MTD0)

51. Dismount tape; store all tapes safely.

52. *) SUPERUSER OFF ↵

)

53. For any computer *except* MV/4000 with hardware floating point, go to step 54.

53a.) BYE ↵

53b. *Do you really want to shut the system down?* Y ↵

System shutdown
SCP-CLI>

53c. Press computer POWER switch OFF. Then press LOCK switch ON and POWER switch ON.

Operating System Load Menu
. . .

53d. *Enter choice [1]:* 2 ↵

Technical Maintenance Menu

Figure 3-1. Step Summary, Bringing Up AOS/VS on Blank Disk(s), Systems Other Than MV/4000 DC, MV/4000 SC, and Data General DS/4000-Series (continued)

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53e. *Enter choice [1]:* 9 ↵

53f. *Default microcode filename [default]:* MV4000FP.MCF ↵

Technical Maintenance Menu

53g. 1 ↵ (Loads and starts the starter system *and* the new microcode file)

AOS/VS Rev n

53h. *Date (MM/DD/YY)?* 5 23 86 ↵ (Current date. Skipped if you have a boot clock.)

53i. *Time (HH:MM:SS)?* 14 40 ↵ (Current time. Skipped if you have a boot clock.)

53j. *Override default specs [N]* ↵ (Press ↵ to say no.)
AOS/VS CLI REV n date time

54. On computer front panel, press LOCK switch to ON or LOCK position (if not already at ON). On an MV/20000, press DISPLAY switch (if other switches are lit).

DG-27022T

Figure 3-1. Step Summary, Bringing Up AOS/VS on Blank Disk(s), Systems Other Than MV/4000 DC, MV/4000 SC, and Data General DS/4000-series (concluded)

What Next?

If you want to stop for a while, fine. To shut down AOS/VS, you can type BYE ↵, then Y ↵. To bring it up again, type BOOT device code (24, 27, or 33) wait for the time outs; then accept the default values for each question except the DATE and TIME if prompted by pressing ↵.

If this is your first system, and you want to generate a tailored system now, go to Chapter 4.

If you are rebuilding/restoring a tailored system, the next steps are to start EXEC (Chapter 5) and load user and application directories and files from backup media.

End of Chapter

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VSGEN Switches

A *switch* modifies the meaning of a command. It is a slash followed by a value. If this is your first system, omit switches. If it is not your first system, you have a spec file and will probably want to use the /BATCH= or /DEFAULT= switch.

You can include the following switches in the X VSGEN command.

/BATCH=sys	Do not run an interactive session: build a system from the specification in file sys.SSF, which must already exist. Omit the suffix .SSF from the system name. This switch is useful when you have received a new revision of AOS/VS and want to build a tailored system with all the specifications of the old system. You cannot use this switch for your first system because there is no valid .SSF file. But you can use it for later systems.
/DEFAULT=sys	Run an interactive session, but use specs in file sys.SSF for default values (displayed in brackets). File sys.SSF must already exist. This switch is handy when you have a tailored system and want to generate another one; often you need to add or edit only one or two devices.
/SAVE	Save temporary files. When you use the /BATCH switch, VSGEN will delete the temporary files — unless you also use this switch.

If you use a switch, put it next to the VSGEN command, without a space — for example

```
) X  VSGEN/DEFAULT=OLD_SYSTEM ↵
```

Note that if you omit switches, VSGEN uses its default spec of a DPF disk controller (not 6214), MTB tape controller, CRT3 system console, and battery backup (BBU). If you have different controllers, edit the default controllers or delete and replace them. Or, if you don't have battery backup or don't have or want auto restart, delete or edit that option.

Updating Your System Files Before Running VSGEN

Before you create or update your tailored system, you should make sure that your system programs — including VSGEN — are as up-to-date as possible. Do this by running the update tool. (If you've installed AOS/VS updates before, you probably used the autopatch macros, which installed patches (corrections) to VSGEN and other system files. The update tool replaces the autopatch macros and introduces a new procedure.) This tool installs system patches, including VSGEN patches, and you should run it now before running VSGEN. You will also run the update tool to patch your tailored system, after creating it.

For information about using the update tool, type

```
) HELP/V *UPDATE ↵
```


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Using an Old VSGEN Spec File

You can use any AOS/VS Revision 6.00 spec file as a default base for a Revision 7.00 system. For example, Revision 7.00 supports big PIDs (PIDs above 255). To take advantage of these new features, you must tell VSGEN about them. To do this, start VSGEN using the /DEFAULT switch to specify the old spec file. In the VSGEN session, update all devices and parameters as desired, give a new spec filename (like SYS_7.00), and generate a system with the new values. You can also use the new spec file as a default base for other systems if needed.

Spec Files Supplied with AOS/VS

If you have an MV/4000 DC, MV/4000 SC, MV/2000 DC, or a DS/7000-series system, DG supplied a spec file to use as a basis for your tailored system. (You can also use one the MV/4000 spec files as a basis for a DS/4000-series system — just delete the IAC or MCP1 and any other devices you don't have from the spec file.)

The spec filenames and the devices they define are as follows:

File MV2000DC.CSF

MV/2000 DC (and DS/7000 series) computers

DPJ disk controller on device code 24

DPJ1 diskette controller on device code 64

MTJ tape controller on device code 23

LPJ printer on device code 17

IAC-12, 12 console lines, on device code 65

File MV4000SC.CSF

MV/4000 model computer

DPJ disk controller on device code 24

DPJ1 diskette controller on device code 64

MTC tape controller on device code 22

LPE printer on device code 17 (IOC)

MCP1, 8 console lines (specified as IAC-8) device code 65

Parameters: defaults except for dump device (DPJ1)

File MV4000DC_MCP1.MCF

MV/4000 model computer

DPJ disk controller on device code 24

DPJ1 diskette controller on device code 64

MTC tape controller on device code 22

LPE printer on on device code 17 (IOC)

LPB1 printer on device code 57 (MCP1)

MCP1, 8 console lines (specified as IAC-8) device code 65

Parameters: defaults except for swap file truncation (Yes) and dump device (DPJ1)

File MV4000DC_IAC.CSF

MV/4000 model computer

DPJ disk controller on device code 24

DPJ1 diskette controller on device code 64

MTC tape controller on device code 22

LPE printer on device code 17 (IOC)

IAC, 16 console lines, device code 65

Parameters: defaults except for swap file truncation (Yes) and dump device (DPJ1)

To use a supplied spec file, start VSGEN with /DEFAULT=name switch, where name is the spec filename without suffix. For example

```
*) X VSGEN/DEFAULT=MV4000DC_MCP1 ↵
```

Then list the current system (C command), edit any specification that's wrong (E command), and build a system with the B command. Of all devices in the supplied spec file, the most likely

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to need editing is the MCP1 or IAC console lines description — and this needs changing only for things like data flow control (Table 4-3) or if there is a letter-quality printer attached to a line (identify the console line as console type TTY).

VSGEN Session

This section leads you through a VSGEN session in which you create a system tailored for your

- model of CPU
- disks
- tapes
- system console
- user consoles
- line printers
- card readers and plotters
- communications hardware
- battery backup unit
- software parameter requirements

Simple session summaries are shown in Figures 4-6 and 4-7, later in the chapter.

If you are working with an existing tailored system (/DEFAULT= switch), simply list the current specs with CURRENT or LIST, and edit or add the ones you want.

First, type

```
) SEARCHLIST :UTIL ⤸
) SUPERUSER ON ⤸
*) DIR :SYSGEN ⤸
*)
```

The SEARCHLIST command makes directory :UTIL your search list. (A search list is a list of directories the system scans when it can't find a file in the working directory.) The DIR (DIRECTORY) command makes :SYSGEN the working directory. SUPERUSER is needed to allow VSGEN to create files in this directory.

Execute VSGEN as follows for your first system, or with the switches of your choice for subsequent systems:

```
*) X VSGEN ⤸
```

Welcome to VSGEN -- Type H for help

Enter a command:

Getting Help

Type

```
H ⤸
```

VSGEN says

The following are legal commands to VSGEN:

A — Add a system device	*M — Change system model*
B — Build a system	*N — Change system name*
C — List current configuration	*P — Change system parameters*
D — Delete a system device	*Q — Quit this session*
E — Edit a system device	*S — Create a spec file*
L — List a system device	*V — Verify current configuration*

(To receive further information about any of these commands, type H <SPACE> X, where X is any of the above commands.)

Note —

Typing "?" in response to any question will list possible responses....

Enter a command:

Get help on Add:

H A ↵

A - Add a controller to the current system

Routine asks for the name of the controller....

Give the ADD command and ask for help again:

Enter a command: A ↵

Name of device to be added? ? ↵

ATI	*CPI*	*CPI1*	*CPI2*	*CPI3*	*CPI4*	*CPI5*	*CPI6*	*CPI7*
CPI8	*CPI9*	*CPI10*	*CPI11*	*CPI12*	*CPI13*	*CPI14*	*CPI15*	*CRA*
CRA1	*DKB*	*DKB1*	*DKB2*	*DKB3*	*DKB4*	*DKB5*	*DKB6*	*DKB7*
DPD	*DPD1*	*DPF1*	*DPF2*	*DPF3*	*DPF4*	*DPF5*	*DPF6*	*DPF7*
DPG	*DPG1*	*DPI*	*DPI1*	*DPJ1*	*DPJ2*	*DPJ3*	*DPJ4*	*DPJ5*
DPJ6	*DPJ7*	*DPM*	*DPM1*	*DRT*	*IAC*	*IAC1*	*IAC2*	*IAC3*
IAC4	*IAC5*	*IAC6*	*IAC7*	*IAC8*	*IAC9*	*IAC10*	*IAC11*	*IAC12*
IAC13	*IAC14*	*IAC15*	*IAC16*	*IAC17*	*IAC18*	*IAC19*	*IAC20*	*IAC21*
IAC22	*IAC23*	*IAC24*	*IAC25*	*IAC26*	*IAC27*	*IAC28*	*IAC29*	*IAC30*
IAC31	*IAC32*	*IAC33*	*IAC34*	*IAC35*	*IAC36*	*IAC37*	*IAC38*	*IAC39*
IAC40	*IAC41*	*IAC42*	*IAC43*	*IAC44*	*IAC45*	*IAC46*	*IAC47*	*IAC48*
IAC49	*IAC50*	*IAC51*	*IAC52*	*IAC53*	*IAC54*	*IAC55*	*IAC56*	*IAC57*
IAC58	*IAC59*	*IAC60*	*IAC61*	*IAC62*	*IAC63*	*LPB*	*LPB1*	*LPB2*
LPB3	*LPB4*	*LPB5*	*LPB6*	*LPB7*	*LPD*	*LPD1*	*LPE*	*LPE1*
LPE2	*LPE3*	*LPE4*	*LPE5*	*LPE6*	*LPE7*	*LPJ*	*LPJ1*	*LPJ2*
LPJ3	*MCA*	*MCA1*	*MTB1*	*MTB2*	*MTB3*	*MTC*	*MTC1*	*MTC2*
MTC3	*MTD*	*MTD1*	*MTD2*	*MTD3*	*MTJ*	*MTJ1*	*MTJ2*	*MTJ3*
MTJ4	*MTJ5*	*MTJ6*	*MTJ7*	*PLA*	*PLA1*			

Typing ? ↵ in response to any VSGEN question gives you a list of legal answers.

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The peripheral names used by VSGEN are *controller* names. For example, if you have two disk units on the first DPJ controller, their unit names are DPJ0 and DPJ1 — but the controller name is DPJ. This list of devices reflects the VSGEN default system, which includes a DPF, a DPJ, and an MTB controller, a system console (CON0), and battery backup (BBU). Since the system already includes these controllers, they can't be added, so their names are not shown in this ADD list. The controller names and meanings are explained in each section.

For a description of any device, type the List command, then the device name; e.g., L ↵, BBU ↵. VSGEN will display the current (or default) device specifications. It will also show how many data channel slots on the A or B map the device is using (these are used by tapes, line printers, DPI disk units, and some other disk units). Get out of the ADD command by pressing

↵

Enter a command:

Model of CPU

To specify the Model of CPU, use the M command:

M ↵

Enter new model [MV/8000]:

Type the model of the computer on which the new system will run. Or, for an MV/8000 II, MV/8000 C, or MV/8000, press ↵ to select the default. For an MV/20000 Model 2, MV/20000 Model 1, or MV/20000 C, type MV/20000 ↵. For an MV/15000 Model 20, 10, or 8, type MV/15000 ↵. For an MV/10000 SX or MV/10000, type MV/10000 ↵. For an MV/7800, MV/7800 C, MV/7800 U, or MV/7800 XP, type MV/7800 ↵. For an MV/4000, MV/4000 DC, MV/4000 SC, or Data General DS/4000-series, type MV/4000 ↵. For an MV/2000 DC, type MV/2000 ↵. For a DS/7700 or DS/7500, type DS/7700 ↵ and DS/7500 ↵ respectively. For example,

MV/20000 ↵

Enter a command:

Having described the computer, you can add or edit devices. The default system has a DPF and a DPJ controller, an MTB tape controller, the system console (CON0), and Battery Backup (BBU). You may have one of these disk controllers and this tape controller, and/or other device controllers.

Most systems also have *user* consoles, attached to their own device. There may be one or more line printers, communications devices, and a backup battery. Each of these is described in its own section.

You can add or edit devices in any order, but let's do the disks first.

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Disks

An AOS/VS system can support up to eight DPF controllers, eight DPJ controllers, and up to two of any other model disk controller. All the controller types and models are shown in Table 4-2.

The original DG default system supports a DPF disk controller on device code 27 and a DPJ controller on device code 24. Disk unit names on the first DPF controller are DPF0, DPF1, DPF2, and DPF3. Likewise, disk unit names on the first DPJ controller are DPJ0, DPJ1, DPJ2, and DPJ3. But if you are using a spec file (/DEFAULT= switch), the controllers named in the spec file are the defaults. If you're using one of the DG-supplied spec files described earlier (for example, MV/4000DC_IAC, it already describes the correct controllers for your system.

If you want DPF disk controller support, you need not add a DPF to the original default system. Check the DPF definition by typing E ⤸ and DPF ⤸; then run though the dialog. If the device code and number of 6214 controllers are correct for your DPF, press ⤸ for the default; otherwise, type the correct answer. When done, if you want the new system to support other controllers, add them by typing A ⤸ and the controller name from Table 4-2. Take the default device code unless you know that a controller is connected to a nonstandard code.

If you *don't* want the new system to support a DPF or DPJ controller, delete the one you don't want (type D ⤸, then DPF ⤸ or DPJ ⤸). For example, if your primary controller is DPJ,

Enter a command: D ⤸

Name of device to be deleted: DPF ⤸
DPF has been deleted

Enter a command:

If you want the new system to run an additional controller, add it using the A ⤸ command and controller name from Table 4-2. Take the default device code, if any, unless you know the controller is connected to a nonstandard code. For a DPF controller, answer the question about 6214 units.

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Table 4-2. Disk Controller Names and Device Codes

Disk Description	Controller Name	Default Device Code
DPF-type. Free standing with removable packs (6060, 6061, 6067, 6122); or free standing and sealed (6214); or rack-mounted and sealed (6160, 6161). Capacity ranges from 50 to 277 Mbytes. A 6160, 6161, or 6214 supports two units; others support four units.	DPF (1st) DPF1 (2nd) DPF2 (3rd) DPF3 (4th) DPF4 (5th) DPF5 (6th) DPF6 (7th) DPF7 (8th)	27 67 None; chosen at installation. None; chosen at installation. None; chosen at installation. None; chosen at installation. None; chosen at installation. None; chosen at installation.
DPJ-type. Sealed, rack-mounted, with digital display. Model 6236 (354 Mbytes), 6239 (592 Mbytes), and 6357 (862 Mbytes). A controller supports four units. Model 6237 is three 6236 units in one cabinet on one controller. Model 6290 is two 6239 units in one cabinet on one controller; model 6240 is three 6239 units in one cabinet on one controller. Model 6398 is two 6357 units in one cabinet on one controller. Model 6399 is three 6357 units in one cabinet on one controller. Model 6400 is six 6357 units in two cabinets on two controllers.	DPJ (1st) DPJ1 (2nd) DPJ2 (3rd) DPJ3 (4th) DPJ4 (5th) DPJ5 (6th) DPJ6 (7th) DPJ7 (8th)	24 64 3rd through 8th have none; chosen at installation.
DPJ, 5-1/4 inch disk controller, unit capacity 120, or 71, or 38.6 Mbytes. DPJ1 is a 5-1/4 inch minidiskette controller, unit capacity 737,000 bytes. The disk and diskette controller — and one disk and diskette unit — are built into the cabinet of an MV/4000 DC, MV/4000 SC, MV/2000 DC, Data General DS/4000-series or DS/7000-series computer. Additional disk units, models 6363, 6329, 6328, or 6310, and diskette unit model 6309, are available.	DPJ (disk) DPJ1 (diskette)	24 64
DPJ, 5-1/4 inch Winchester disk with controller. Unit capacity is 234 Mbytes, but up to four of these disks can be combined for a total of 936 Mbytes per support chassis. Some of these Combined Storage Subsystems (CSS) models include a 21-Mbyte and/or a 130-Mbyte cartridge tape drive. The base model for this disk unit is 6446.	DPJ (1st) DPJ1 (2nd)	24 64
DPI-type. Rack-mounted. Models 6234, 6227, 6225, 6098, 6099, 6100, or 6103. Each runs a hard, sealed disk, range 50 down to 5 Mbytes. Model 6097 runs one or two 1.26-Mbyte diskettes.	DPI (1st) DPI1 (2nd)	33 73
Fixed-head disk, models 6063, 6064, 6066.	DKB0 (1st) DKB1 (2nd) DKB2-DKB7	26 66 None; chosen at installation.
Two-disk rack-mounted unit; top disk removable, bottom disk sealed, 5 Mbytes per disk; total 10 Mbytes. Controller can also run 0.3-Mbyte diskettes. Models 6045-6050.	DPD (1st) DPD1 (2nd)	33 73

(continued)

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Table 4-2. Disk Controller Names and Device Codes (continued)

Disk Description	Controller Name	Default Device Code
Two-disk unit as above but 10 Mbytes per disk; total 20 Mbytes; no diskettes. Model 6070.	DPG (1st) DPG1 (2nd)	33 73
Minidiskette unit, 5-1/4 inch, 368-Kbyte diskettes, Model 4514. This is used in DESKTOP GENERATION™ and other systems.	DPM (1st) DPM1 (2nd)	20 60
Diskette (0.3 Mbyte). Model 6030.	DPD (1st) DPD1 (2nd)	33 73

(concluded)

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The Current (C) Command

The C command displays the current system configuration. You may want to use it to check after you add a controller. For example,

Enter a command: C ↵

Current system: none *Default system: name or <system defaults>*

System parameters:

	x
Model:	*MV/nnnn*
Swap:	*2147483647*
Page:	*2147483647*
Cache size:	*128*
Minimum number system pageable pages:	*10*
Default file element size:	*4*
Frequency:	*10*
Access enabled:	*YES*
Initial program for PID 2:	*CLI.PR*
Initial IPC message for PID 2:	
Max program load pages -noncontention:	*0*
Max program load pages -contention:	*0*
Fault time prepaging maximum:	*0*
Variable swapfiles enabled:	*N*
Maximum swapfile size:	*126*
Default swapfile size:	*126*
Truncate page files after use:	*Y*
Size above which truncation will occur:	*2048*
Lowest priority for group 1 processes:	*255*
Lowest priority for group 2 processes:	*258*
Soft tape errors suppressed:	*N*
Default system dump device:	*MTB*
Maximum number of processes:	*255*
System Management Interface:	*N*

Current system devices:

... (all current devices) ...

Optional system devices:

... (all devices not part of configuration) ...

Number of data channel A map slots available: n
Number of data channel B map slots available: n

Enter a command:

The new system has no name yet, but its parameters and devices are shown. If, at any point, you want to change a device spec, use the Edit command. You can verify the system — to see if it is valid — with the V command.

There are five data channel maps, but VSGEN describes only the A and B maps. The A and B maps have 32 2-Kbyte slots each. Usually, each line printer takes two slots on the A map. Each non-BMC disk controller (DPI, etc.) takes five slots on the A map. Each MTB or MTC tape controller takes five slots on the B map (but an MTB or MTC will use more B slots if it has a larger max byte transfer buffer than the VSGEN default).

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The *Buffer byte length* questions relate to buffers used by the system to communicate with the device; you can usually default them. *Characteristics word 0*, *1*, and *3* relate to things like echoing, lower-to-uppercase conversion, modem interfaces, and flow control. For the system console, you will usually want to take the defaults on these — as above. The same applies to *Lines per page* and *Chars per line.*

If you *do* want to select nondefault console values, Table 4-3, later on, describes the mnemonics you can use.

If the System Console is a Pixel-Mapped Terminal

Some computers, like the DS/7000-Series, support pixel-mapped (graphics) terminals. If the system console is a pixel-mapped terminal, you don't have to edit the CON0 specification. The reason for this is that it is the peripheral manager, not the AOS/VS system, that contains the code for communicating with this kind of system console. Consequently, you can delete CON0 from the tailored system if your computer has a system console that is a bit-mapped terminal. See also "DRTs," later in this chapter.

User Consoles (IACs, LACs, MCP1s, CPI/24s, DRTs, and ATIs)

You don't specify user consoles directly; instead, you describe the device that handles them. Then you describe the consoles connected to the *lines* of the device. User consoles are handled by one or more of the following devices:

- Intelligent Asynchronous Controllers (IACs);
- Local-bus Asynchronous Controllers (LAC, but identify it to VSGEN as an IAC-12);
- Multicommunications Processors (MCP1s, but identify it to VSGEN as an IAC-8);
- Computer-PBX-Interface controllers (CPIs);
- Dual Receiver/Transmitters (DRTs); or
- an Asynchronous Terminal Interface (ATI).

You'll tell VSGEN which device(s) you have, then describe the console lines attached to each device.

Note: If the consoles are not labeled, someone should label them — preferably with the console name, @CONn. You can use sticky-backed tape for this. If you don't know a console's name, you can figure it out from the line number, as described in each section below. Labeling the consoles will make things a lot easier later on.

Ranges of Lines

You can describe console lines individually or in groups. VSGEN will ask questions about each entry — so, if you choose a group of lines, all consoles in the group will be treated the same way, even if the consoles are different. After you describe one or more groups of lines, VSGEN asks if you want to describe more lines — so you can proceed sequentially to describe them all. You need not specify groups sequentially, but we do so here for clarity.

To specify individual lines, separate the entries with one or more spaces. To specify a range of lines, separate the first and last number with a space-dash-space. For example,

0 12	Specifies lines 0 and 12
0 - 12	Specifies lines 0 through 12

MV/Family computers can have different console-handling devices, as follows:

Computer	Console-Handling Devices
MV/20000 Model 2, MV/20000 Model 1, or MV/20000 C	IAC, MCP1, and/or CPI/24.
MV/15000 Models 20, 10, 8	IAC and MCP1
MV/10000 SX or MV/10000	IAC, MCP1, and/or CPI/24.
MV/8000	IAC (model numbers beginning with 96) or ATI (model numbers beginning with 93).
MV/8000 II or MV/8000 C	IAC, MCP1, and/or CPI/24.
MV/7800, MV/7800 C, MV/7800 U, or MV/7800 XP	IAC and MCP1
MV/6000	IAC only.
MV/4000	IAC, MCP1, and/or CPI/24.
MV/4000 DC	MCP1 or IAC.
MV/4000 SC or Data General DS/4000-series	MCP1.
MV/2000 DC	IAC-12 or DRT.
DS/7000-series	DRT.

Letter-Quality Printer

If your system has one or more letter-quality printers, you must identify these to VSGEN as user consoles, type TTY. For each line connected to a letter-quality printer, specify TTY and default all characteristic words. In the initialization word, specify a small input buffer and about 256-byte output buffer, data rate of 1200, eight data bits, and one stop bit. An example of a letter-quality printer spec appears in Figures 4-1 and 4-2, console line 13.

Mouse

If your system has a mouse, do not identify it to VSGEN. Software support for the mouse is provided by the GKS (Graphics Kernel System) software; GKS defines and handles the mouse device.

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IACs

Each IAC is one circuit board and has its own device code. The sequence of lines from board to board is established during VSGEN. You specify a base-line number for each board; then describe the lines from 0 to n, where n is the number of lines attached to consoles (up to a maximum of 15, 11, or 7, depending on whether the IAC has 16, 12, or 8 lines). At a small price in memory, you can specify *all lines* attached to an IAC, even if all lines aren't currently attached to consoles. An IAC-16 can handle up to 16 local lines; an IAC-8 can handle a total of 8 *local and modem* lines. An IAC-12 can handle 10 local lines and 2 modem lines. Model 5916G supports 16 modem lines; when specifying it to VSGEN, treat it as two IAC-8s. LMC (Model 31133 only) is also an IAC-8.

Note that you must specify your IAC types and their sequence correctly — the new system may fail if you don't.

IAC Dialog

To add an IAC, Add a device, then specify IAC:

A ↵

Name of device to be added: IAC ↵
Device code [65]:

The default device code for IAC is 65; for IAC1 it is 50; for IAC2 it is 51, and so on. On an MV/2000 DC, an ICA-12 (also called an LAC) can fit in the top row (row A) or the bottom row (row B) of the chassis. You must select the nonstandard device code 40 for row A or 41 for row B. Unless you know that this IAC is connected to a nonstandard device code, type ↵ to select the default:

↵

Base line number [0]:

You can select any valid base line number for this IAC. The number must be 0 or a multiple of 2. The names of its consoles will depend on the number, as described below. For the first IAC, you might choose the default:

↵

and go on to the next question.

For the second IAC and each subsequent IAC, you could type the number

base-line-of-preceding-IAC
+
total-number-of-lines-on-preceding IAC (8, 12, or 16)

For example, if the base line of the preceding IAC is 0 and it can support 16 lines, type 16 ↵. The base line for the next IAC could be 16.

You need not make the base lines sequential. For example, you might choose to make your modem base line 80. But each base line must be larger than the preceding IAC's base line and each must be divisible by 2. (VSGEN imposes this to ensure unique console names, so that your multiuser system will work properly.)

IAC device type [??]:

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If this is a 16-line IAC, type 16 ↵; if this is a 12-line IAC, type 12 ↵; if it is an 8-line IAC, type 8 ↵. If you enter 8 ↵, VSGEN asks about split baud rates. Answer ↵ for the default unless the console on this line has an attached slave printer. Then VSGEN will respond

Console lines [??]:

Now you need to describe the lines on this IAC — individually, or in groups. The line numbers you enter are specific to this IAC — ranging from 0 through 15, 0 through 11, or 0 through 7, depending on the IAC.

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IAC Console Names

When the new system runs, each console on an IAC will have the console name of

CON (base-line-number + line-number-on-this-IAC + 2)

For example, assume that the first IAC is an IAC-16, for which you have specified base line number 0 and lines 0-12. The console names on these lines will be CON2 through CON14. The second IAC, IAC1, is an IAC-8. You give IAC1 the base line number of 16; then you describe line 1 of IAC1. The console on line 1 (second line) of IAC1 will be CON(16+1+2), or

CON19

Input and Output Buffers

The prompts *Input buffer byte length* and *Output buffer byte length* ask for the size of two memory areas in an IAC. An input buffer holds data from a keyboard or communications line until the system is ready for it. An output buffer holds data to be displayed on a screen or sent to a printer. The default values work fine for most situations. Accept the default by pressing ⤵

You may have to change buffer sizes in some cases. For example, lines used for data communications and block-oriented terminals can produce data overrun errors when they fill an input buffer faster than the system can empty the buffer. Here, increase the size of the input buffer, and decrease the size of the output buffer, the size of which is not crucial, choosing even numbers for buffer sizes. Because total IAC memory is limited, however, be careful not to specify too much IAC memory: if you generate a system that uses more space than actually exists, the system will not come up; during system initialization, the system will print the message *IAC REQUEST FAILURE - IRRECOVERABLE ERROR*, and then panic with panic 12300, subcode 310. You will have to bring up another system — such as the Starter system — and generate a new system with permissible sizes for input and output buffers.

In planning how to allot available space for input and output buffers, read the latest AOS/VS Release Notice or AOS/VS Update Notice, which give the total space available for input and output buffers (also called *ring buffers*), and the average space for each buffer. These numbers change from revision to revision and update to update as the size of IAC programs and the size of patches to these programs vary. After you have these numbers, you can divide the total space among the lines you are defining. For example, in AOS/VS Rev. 7.57, the total ring buffer space for an IAC-16 is 4146 bytes and the average space per ring buffer is 128 bytes (4146 divided by 32 buffers, rounded down to an even number). The VSGEN default is 128 bytes, and the maximum is 2048 per buffer. However you decide to change the size of each buffer, you must not exceed the total. VSGEN enforces the maximum size per ring buffer, but does not ensure that the total space is valid.

IAC Console Lines Example

The following example, Figure 4-1, shows you how to handle all common line-console configurations. It assumes that your first IAC is an IAC-16 and your second IAC (IAC1) is an IAC-8.

And it assumes that the lines are arranged as follows:

- IAC lines 0 through 2 are attached to local CRTs;
- IAC line 3 is attached to a local TTY;
- IAC lines 4 through 12 are attached to local graphics CRTs;
- IAC line 13 is attached to a letter-quality printer;
- IAC lines 14 through 15 are not used;
- IAC1 lines 0 and 1 are attached to modems.

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The master CLI (PID 2) can change the default characteristics (but not the mode) of a console, with the /DEFAULT switch and console name, *before* the console is enabled by EXEC. For example, the command CHARACTERISTICS/DEFAULT/ON/8BT @CON22 ↵ sets /8BT on at console 22. If need be, you can put such commands in the system UP macro.

Output Flow Control

Some programs (notably CEO, and also programs your site may choose to write) use binary mode to handle data on most consoles — including DASHER D210, D211, D220, D400, D410, D450, D460, and G300). If a program that uses binary mode will write to any of these consoles, the output flow control characteristic must be selected on the console line. You can do this during VSGEN by specifying the mnemonic ?MOFC (software output flow control) in characteristic word 3 (add other mnemonics desired). Or, you can do it via the characteristics command switches /ON/OFC, in the UP macro, or via a user log-on macro (Chapter 5).

Some console controllers (EIA-RS232 standard) support output flow control through hardware, not software. Most DG controllers either always support hardware flow control or never support it. But some controllers *allow* you to choose hardware flow control for certain lines and modems and some printers *require* that you select it. For example, MCP1 lines 0 and 1, LAC (IAC-12) lines 10 and 11, and DRT line 0 (on MV/2000 DC and DS/7000-series computers) allow selecting hardware flow control. If you use an EIA-RS232 cable and terminal on these lines, we recommend selecting hardware flow control. Note, however, that if you use an EIA-RS422 cable, you must *not* select hardware flow control (or you must turn it off). You can select hardware flow control during VSGEN by selecting the mnemonic ?HRDFLC in the line initialization word. Or, you can use the CLI characteristics switches /ON/HOFC or /OFF/HOFC to turn hardware flow control on or off, respectively, in the UP macro or via a user log-on macro (Chapter 5).

Break Sequence Handling on User Consoles

On the system console, a break sequence gives control to the SCP-CLI. On *user consoles*, you can define a break to do *one* of the following things:

- A break sequence can break binary mode (used by certain programs when they write to the console) and restore normal CTRL character handling. In binary mode, the console ignores CTRL sequences like CTRL-C CTRL-A. The VSGEN mnemonic for this (in word 3) is ?MBBM; the CHARACTERISTICS switch for it is /BREAK=BMOB. Break binary mode is the default effect of a break sequence.
- A break sequence can terminate the user process on the console, and log the user off, and cause a modem disconnect. You might use this if you want users to be able to log off quickly and simply, regardless of the process running on their consoles. The VSGEN mnemonic for this (in word 3) is ?MBDS; the CHARACTERISTICS switch for it is /BREAK=DCOB.
- A break sequence can generate a CTRL-C CTRL-A or CTRL-C CTRL-B sequence. You might use this if you want users to be able to use the break sequence to produce the pertinent kind of interrupt. For CTRL-C CTRL-A, the VSGEN mnemonic in (word 3) is ?MBCA; the CHARACTERISTICS switch is /BREAK=CAOB. For CTRL-C CTRL-B (which aborts the issuing process), the VSGEN mnemonic (word 3) is ?MBCB and the CHARACTERISTICS switch /BREAK=CBOB.
- A break sequence can generate a CTRL-C CTRL-F sequence. This sequence has no meaning to AOS/VS, but your site can use it in application programs to redirect control or do anything you like. The program must issue a ?KWAIT system call (or higher level language equivalent) to receive notice that CTRL-C CTRL-F was entered. The VSGEN mnemonic (word 3) is ?MBCF; the CHARACTERISTIC switch is /BREAK=CFOB.

Table 4-3. AOS/VS Console Line Characteristics

Word	Characteristic	Bit Mnemonic	CRT3 and CRT6	TTY
0	Simulate Tabs: tab key moves cursor right 8 columns.	?MST	S	S
	Simulate Form Feeds: new screen (CRT) or form feed (TTY).	?MSFF	A	A
	8 data bits per character.	?M8BT	A	A
	Rubout after form feed. Sends 17 rubout characters after each form feed, unless the form feed is simulated. Use to prevent losing characters sent to a slow console, like a hardcopy console.	?MRAF	A	A
	Rubout after tab. Sends two rubout characters after each tab, unless the tab is simulated (through ?MST). Use to prevent losing characters sent to a slow console, like a hardcopy console.	?MRAT	A	A
	Rubout after carriage return. Sends two rubout characters after each carriage return or NEW LINE. Use to prevent losing characters sent to a slow console, like a hardcopy console.	?MRAC	A	A
	Non-ANSI Standard console. Such consoles have a small LF key and large RETURN key (ANSI standard consoles have a large NEW LINE key and small CR key).	?MNAS	A	S
	Enforce End Of Line: truncate any line longer than that given in word 1. The alternative is ?MWRP (word 1).	?MEOL	A	A
	Uppercase Only: convert lowercase to uppercase. The alternative (word 1) is ?MULC.	?MUCO	A	A
	Monitor Ring Indicator on modem control line(s).	?MMRI	A	A
	Form Feed: send form feed to console(s) when it is opened for I/O.	?MFF	A	A
	Echo control. If you specify ?MEB0 and omit ?MEB1, all characters will echo as typed except CTRL will echo as ^ and ESC as $. This is the default. If you specify both, CTRL and ESC won't echo.	?MEB0 ?MEB1	S A	S A
	Echo control. ?MEOC is equivalent to ?MEB0; ?MEOS is equivalent to ?MEB1.	?MEOC ?MEOS	S A	S A
1	Teletypewriter: line is attached to a TTY.	?TTY	—	S
	CRT3: line is attached to a D200-compatible console. D200-compatible consoles include D2, D200, D210, D211, and G300.	?CRT3	S (CRT3) A (CRT6)	—
	CRT6: line is attached to a D400, D450, or D460 graphics CRT. This enhances screen editing, over ?CRT3, on graphics CRTs.	?CRT6	S (CRT6)	—

(continued)

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Table 4-3. AOS/VS Console Line Characteristics (continued)

Word	Characteristic	Bit Mnemonic	CRT3 and CRT6	TTY
1 (cont.)	Upper- and Lowercase: accept both upper- and lowercase characters as input. If you default word 1, ?MULC is the default. But if you specify characteristics for this word and omit ?MULC, the system converts lowercase to uppercase.	?MULC	S	A
	Page Mode: console will display LPP (Lines Per Page) lines, then wait for CTRL-Q before displaying next sequence of LPP lines.	?MPM	A	A
	Do Not Receive Messages; prevents console from receiving SEND messages. (Messages from PID 2 override this.)	?MNRM	A	A
	Modem: line is attached to a modem interface. Do not select this characteristic for local lines. If you do, the system will redisplay the logon banner every 30 seconds until a user logs on.	?MMOD	A	A
	Type of Device is n: ignore this characteristic; omit it.	?MTD0-3	n/a	n/a

(continued)

Proceeding

When you have described the lines for an IAC, MCP1, DRT, or ATI, you might want to examine the spec file with the Current command. If there is another IAC or MCP1 to describe, return to "IAC Dialog," or "MCPs" above. If you have finished describing your console-handling device(s), continue to the next section.

Line Printers

If a letter-quality printer is attached to a multiplexor line (IAC or MCP1 asynchronous line), identify it to VSGEN as a user console, as described earlier in this chapter.

There are several types of data channel printers that you specify:

LPB — An LPB is a commercial I/O printer, with a vertical forms unit. AOS/VS supports up to eight LPB printers, device names LPB, LPB1, LPB2, ..., LPB7.

LPD — An LPD is a DASHER model 4325 through 4328 printer. AOS/VS supports up to two LPD type printers, device names LPD and LPD1.

LPE — Type LPE includes laser document printers (model 4225) and any data channel printer that doesn't need system initialization (LPB and LPD do need initialization). AOS/VS can run up to 8 LPE printers, device names LPE, LPE1, ..., LPE7.

LPJ — An LPJ printer on MV/1400 DC, MV/2000 DC, and DS/7500 systems. VSGEN shows four controllers (LPJ, LPJ1, LPJ2, and LPJ3), but you can add only LPJ, device code 21, when building a system to run on MV/1400 DC, MV/2000 DC, or DS/7500 computers. The printer connected to the LPJ controller is LPJ0.

For 4000-class integrated systems: If a printer is connected to the MIOC printer controller, specify it as LPE, with device code 17 (default).

If a printer is connected to an MCP1 printer controller, you can specify it as either LPB or LPB1, but must specify its device code as 57. The name you specify (LPB or LPB1) will become the printer device name needed to start and stop queues on the printer via EXEC.

Determine which type your primary printer is. Then — when VSGEN asks for a command, add it:

```
                    A ↵
    Name of device to be added:  LPB ↵        (Or LPE, or LPD, or LPJ)
    Device code [17]:
```

Generally, take the default unless you know the printer is on a different device code, or the printer is on an MCP1 printer controller (explained above).

```
    ↵
Enter a command:
```

For 8-bit character handling through EXEC, you will need to specify 8-bit handling when you start the printer (described in Chapter 8, START command).

If you have a second line printer, type A ↵ and specify the name. If the second printer is the same type as the first, its name is name1 — e.g., LPB1. For example

```
                    A ↵
    Name of device to be added:  LPB1 ↵
    Device code [57]:  ↵
Enter a command:
```


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If the type of the second printer *differs* from the first (for example, the first printer is an LPB and the second an LPE), you can enter the name of the second printer as primary (e.g., LPE). But if you do this, be sure to specify the correct device code for the secondary printer. The default secondary printer device code is 57. For example,

```
                    A ↵
Name of device to be added:     LPE ↵
Device code [17]:     57 ↵

Enter a command:
```

If you want any printer device to handle 8-bit characters, arrange this through EXEC (Chapter 8, EXEC's START command). VSGEN does not configure AOS/VS for 8-bit character handling on printers.

Plotters

AOS/VS supports up to two digital plotters, device names PLA and PLA1. Only MV/8000 systems of the 9300 series can run a plotter as an individual device. Thus you should specify a plotter *only* for a system that will run on an original MV/8000, 9300 series. A different computer *may* be able to handle a plotter (like the model 4435) connected via asynchronous line to an IAC or MCP1; if so, specify the plotter to VSGEN as a console line, like a letter-quality printer (earlier). A slave printer attached to a console is treated as part of the console by the system; do not tell VSGEN that a slave printer is a plotter. To have the new system support a plotter, add a device, then specify the name, and, unless the plotter is connected to a nonstandard device code, default the device code. For example

```
                A ↵
Name of device to be added:     PLA ↵
Device code [15]:     ↵
Output buffer byte length [64]:     ↵
Characteristic word 0 [STANDARD]:     ↵
Characteristic word 1 [STANDARD]:     ↵

Enter a command:
```

There are no standard characteristics for plotters. The nonstandard characteristics you can specify are shown in Table 4-6.

Card Readers

AOS/VS supports up to 2 model 4016 card readers, device names CRA and CRA1. To have the new system support a card reader, add a device, then specify the name, and, unless the reader is connected to a nonstandard device code, default the device code. For example

```
                A ↵
Name of device to be added:     CRA ↵
Device code: [16]:     ↵
Input buffer byte length [164]:     ↵
Characteristic word 0 [STANDARD]:     ↵
Characteristic word 1 [STANDARD]:     ↵

Enter a command:
```

The default buffer holds the images of two cards. There are no standard characteristics for card readers. The nonstandard characteristics you can specify are shown in Table 4-6.

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Parameter	What it Specifies
Swap [default]	Swap directory size in 512-byte disk blocks. The default is 2,147,483,647, larger than AOS/VS can ever use. We recommend the default. Details are below.
Page [default]	Page directory size in blocks. The default is the same as for SWAP. We recommend the default. Details are below.
Cache [128]	Number of 512-byte buffers allotted for the system to do its I/O. The default is okay. Details are below.
Minimum number system pageable pages [10]	Number of 2,048-byte pages that the system will try to retain in memory during operation. The default is okay. Details are below.
Default file element size [4]	Size of the default file element. A file element is a set of contiguous 512-byte disk blocks. This parameter sets the minimum element size for every file created. The default of 4 blocks is a good general-purpose choice. Any user can choose an element size other than the default when he creates a file via the CLI command CREATE. So, in most cases, you will not want to change the default size. Valid responses are ⤶, 1 ⤶, or a multiple of 4 between 4 and 65,532.
Frequency [10]	The frequency, in cycles per second (Hz), of the CPU real-time clock. The default is 10 Hz. Other choices are 100 Hz, 1000 Hz, or the ac line frequency (which is either 50 Hz or 60 Hz). If you choose line frequency, ask your electric company what line frequency is; if you set Frequency to 50 and line frequency is actually 60, your clock will run fast. If the new system must check something often — as in some kind of process control situation — you might choose 1000 ⤶ (despite the overhead involved in 1000 RTC interrupts per second).
Access [YES]	This parameter enables (⤶) or disables (N ⤶) the AOS/VS file access control mechanism. All file security — very important in a multiuser system — depends on access control. If you disable control (N ⤶), the multiuser environment will work, but every user will be able to access, modify, and delete every file in the system. So you will probably want to take the default on this.

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Parameter	What it Specifies
Initial program for PID 2 [CLI.PR]	Normally, when AOS/VS starts up, it runs a CLI process (called the master CLI process) as PID 2 on the system console. This question allows you to specify another program for PID 2. If this AOS/VS system will support multiple users, the CLI is your best choice, since it can create the multiuser environment (EXEC) easily. But for a special application, you might want to specify one of your own programs, perhaps one that creates other processes. Or, on a single-user system, where PID 2 needn't create any processes, you can choose any program you want (for example, CEO). For any program other than the default, you must specify the full pathname, with the .PR suffix, from the root directory. The file you specify must exist when you try to start up this system; if not, the system won't run. Whenever you shut down the PID 2 process, and confirm, the whole system will shut down.
Initial IPC message for PID 2 []	This allows you to specify a file of commands to be executed by the PID 2 (master) process when it comes up. The default is no IPC message. If you want the initial program for PID 2 to be CLI.PR (default), you might want to specify the system UP macro (:UP.CLI) to start EXEC automatically. Or, if you choose the System Management Interface, specify the macro that starts it up (pathname :UTIL:UP_EXEC.CLI). To change the default to none, type [] ⤵.
Max program load pages - noncontention [0]	This question, and the next one, can enable loading of multiple memory pages when a process is created. A nondefault answer doesn't *do* anything. It just enables multiple page loading for a program if specified by the SPRED utility. Details follow, in the section "Program Load Pages".
Max program load pages - contention [0]	This question, and the previous one, can enable loading of multiple memory pages when a process is created while processes are competing for memory. Details follow, in the section "Program Load Pages".
Fault time prepaging maximum [0]	This allows you to specify the maximum number of pages a process can read when it needs data or code that isn't in memory. If you take the default, a process can read (fault in) only one page at a time. Details follow, in the section "Multiple Pages on Faults."

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Parameter	What it Specifies
Do you wish to use variable swapfiles [N]	This question can enable variable swap files, which may shorten swapping time for large processes. If you say Y ⤶, it asks about the maximum and default sizes. Details follow in "Variable Swap Files."
Do you with to truncate swap files after use [N]	Truncating swap files can (temporarily) save disk space by reducing each process's swap file to 0 bytes when the process terminates. However, the swap file will grow to its standard size when any process that's using it swaps. Generally, if you have more than 100 Mbytes of disk storage, take the default (⤶). If you have less than 100 Mbytes, type Y ⤶.
Do you wish to truncate page files after use [Y]	Truncating page files can save disk space by reducing a process's page file to 0 bytes when the process terminates — if the page file has grown larger than a specific size (next question). The space saved by truncating page files may last for hours or even days, since page files grow only as needed by the process using them. You should answer N ⤶ only if you have ample disk space, *and* if paging performance is critical. With less than 100 Mbytes of disk space, always take the default with ⤶.
Size above which page files will be truncated [2048]	VSGEN asks this only if you wish to truncate page files. The answer sets the upper limit of page file size. If, when a process terminates, its page file exceeds the specified size, the system will truncate the page file to 0 bytes. The default size (2048 blocks), is a good general-purpose answer. If you have less than 100 Mbytes of disk storage, type 0 ⤶. With more than 100 Mbytes of disk, if disk space is not a critical issue, take the default (2048 blocks) by pressing ⤶. If you want to fine-tune page file size, or if disk space *is* a critical issue, try the following. Run the system for a while, then check the page file size in :PAGE (F/AS :PAGE:+ ⤶). Take the average page file size, divide by 512 to convert bytes to disk blocks, and run VSGEN again to specify this average number. (Although the default page file limit, 2048 blocks, appears very large, it's deceiving. The F/AS command shows byte length to the *end of file mark,* in the highest block number in the file. Many disk blocks before the end of file are not occupied. A page file that appears to use — say — a Mbyte, is actually using much less space.)

Parameter	What it Specifies
Lowest priority for group 1 processes [255]	Process types are independent of process priority. There are three process groups: group 1, high priority; group 2, medium priority (includes user processes); and group 3, low priority. Your answers to this question, and the next one, determine the group in which a process of a given priority falls. The details of all this are fairly complex (described in Chapter 15). In most cases, you don't need to know the details. Things will be simpler if you take the default on both of these *Lowest priority* questions.
Lowest priority for group 2 processes [258]	This question sets the range for group 2 processes (between the number in the previous question and this number). We suggest the default.
Suppress soft tape error reporting [N]	A soft tape error is an I/O inconsistency that disappeared in fewer than 13 retries. (If it persisted for 13 retries, it would be a hard error.) Normally, soft errors are reported to the system console and AOS/VS error log (:ERROR_LOG). Certain brands of magnetic tape can produce many soft error messages. On a hard copy console, printing these messages can slow system response. And the messages can be quite annoying if you're trying to use this console. To disable soft tape error reporting on the system console (and to the log file), type Y ⤶; otherwise press ⤶. A Y ⤶ answer disables *only* soft tape error reporting on the system console. (More than 3 soft tape errors will be reported to the log file.) All disk errors will still be reported on the system console and error log. You can control soft tape error logging at runtime, with SYSLOG commands.
Default system dump device [MTB]	If serious system errors recur, you may want to ask for help from DG. To get help, you might need to submit a dump of computer memory to DG. The default device for this dump is MTB — but, if you don't have an MTB tape unit, you can specify a different device now or when the system panics. You can specify any tape controller you have (for example, MTC, MTD, or MTJ). If you don't have tape or have both diskette and tape, and want to use a diskette for memory dumps, specify a diskette controller, usually DPJ1.
Maximum number of processes [255]	On most systems, the default of 255 processes is enough. But, on an MV/20000 or MV/10000, you might want to specify more than 255. Details follow in the section "Maximum Number of Processes."
Do you wish to use the System Management Interface [N]	The System Management Interface is an easy-to-use, menu-driven interface for managing AOS/VS. If you answer Y, you will also need to specify an initial IPC file for PID2, like :UTIL:UP_EXEC.CLI. Details are in the section "System Management Interface," later in this chapter.

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```
Characteristic word 1 [STANDARD]:  ?CRT3 ?MMOD ?MULC ?MWRP ↵
Characteristic word 2
  Lines per page [STANDARD]:  ↵
  Chars per line [STANDARD]:  ↵
Characteristic word 3 [STANDARD]:  ?MBBM MOFC ↵
Initialization word [STANDARD]:  ?CPR0 ?CR12H ?CS10 ?CLN8 ?CSBDS ↵

Do you want to add another group of lines? [N]  ↵

Enter a command:  A ↵

    Name of device to be added:  LPB ↵
    Device code [17]:  ↵

Enter a command:  P ↵

    Swap [2147483647]:  ↵
    Page [2147483647]:  ↵
    Cache [128]:  ↵
    Minimum number system pageable pages [10]:  ↵
    Default file element size [4]:  ↵
    Frequency [10]:  ↵
    Access [YES]:  ↵
    Initial program for PID 2 [CLI.PR]:  ↵
    Initial IPC message for PID 2 []:  ↵
    Max program load pages -noncontention [0]:  ↵
    Max program load pages -contention [0]:  ↵
    Fault time prepaging maximum [0]:  ↵
    Do you wish to use variable swapfiles [N]:  ↵
    Do you wish to truncate swap files after use [N]:  ↵
    Do you wish to truncate page files after use [Y]:  ↵
    Size above which page files will be truncated [2048]:  ↵
    Lowest priority for group 1 processes [255]:  ↵
    Lowest priority for group 2 processes [258]:  ↵
    Suppress soft tape error reporting [N]:  ↵
    Default system dump device [MTB]:  ↵
    Maximum number of processes [255]:  400  ↵
    Do you wish to use the System Management Interface [N]:  ↵

Enter a command:  N ↵

    Enter new system name [none]:  SYS_7.00 ↵

Enter a command:  B ↵

    Creating specification file
    Do you want to save TMP files? [Y]  ↵

    System build in progress

    System build completed

Enter a command:  Q ↵
*)
```

DG-27027T

Figure 4-7. A VSGEN Session for an MV/20000 with Disks on the Second IOC (concluded)

Installing Patches

Before you create or update your tailored system, you should make sure that your system programs — including VSGEN — are as up-to-date as possible. Do this by running the update tool. (If you've installed AOS/VS updates before, you probably used the autopatch macros, which installed patches (corrections) to VSGEN and other system files. The update tool replaces the autopatch macros and introduces a new procedure.) This tool installs system patches, including VSGEN patches, and you should run it now before running VSGEN. You will also run the update tool to patch your tailored system, after creating it.

For information about using the update tool, type

```
) HELP/V *UPDATE ↵
```

The update tool uses the PATCH.PR program, so you can continue to patch specific programs as explained on pages 4-55 and 4-56.

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(All text previously on page 4-53 deleted.)

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Patching Specific Programs

The PATCH program — used by the autopatch installation macros — installs patches in individual program files. Generally, we recommend that you use the autopatch macros. Under some circumstances, however, you (and/or a DG system engineer) may want to install an individual patch using the PATCH program.

As with autopatch, the system won't let you patch an open file. And, if you patch a program that's already running, the patch won't take effect until the program is restarted from disk.

Before using the PATCH utility, make :PATCH the working directory. The PATCH command line has the form

XEQ PATCH/Y/P=patch-pathname/T=program-pathname *[/L=pathname]*

where

/Y specifies Yes (tells PATCH to install the patch).

/P=patch-pathname gives the pathname to the patch file. This patch file must be written according to PATCH rules, as in the PATCH help file (HELP *PATCH ↵). Generally, we suggest that you keep all patches in the :PATCH directory.

/T=program-pathname specifies the target program to patch. You must include the .PR suffix, if the program has one.

/L=pathname selects a disk file to store console messages from PATCH. These messages will be sent to your console screen in any case.

It's a good idea to copy a program to a backup file before patching it. An example of a manual patch sequence is

... (Copy program to a backup file) ...

*) DIR :PATCH ↵

... (Load the patch file into :PATCH) ...

*) X PATCH/Y/P=DG_UTILITY.PATCHFILE/T=:UTIL:DG_UTILITY↵

... (PATCH applies patches) ..

*)

If the patch you want to apply uses symbolic addresses, then the program symbol table file (program-name.ST) must be in the same directory as the program file. The two files are placed in the same directory by default when you create a program with Link or load an AOS/VS revision.

For every program that it patches, PATCH creates a patch history file, named program-name.PH, in directory :PATCH.

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If the PATCH program reports an error, make sure that your command line syntax is correct, and that the symbol table file (.ST) exists in the program's directory. If a patched program does not work properly, you can retry with a new copy of the backup version. (Don't patch the backup version itself.)

Testing the New System

First, shut down the current system. (If the multiuser environment is up, make sure all users are logged off first). Type

```
*) BYE ↓
Do you really want to shut the system down?      Y ↓
Starting system shutdown date

System shutdown
```

Boot the new system:

```
SCP-CLI>     RESET ↓
SCP-CLI>     BOOT  27 ↓        (Or BOOT  24 for models 6236, 6239, 6301)

        Operating System Load Menu

1 Continue immediately with operating system load
2 Enter the Technical Maintenance Menu
. . .

Enter choice [1]: 2 ↓     (Choose option 2)

        Technical Maintenance Menu

. . .

6 Run a specified program
. . .

Enter choice [1]: 6 ↓     (Choose option 6)

Pathname? :SYSGEN:sys.PR ↓     (e.g., :SYSGEN:SYS_7.00.PR )
```

sys is your system name. As shown, you must type the full pathname from the root directory; shown as :SYSGEN:SYS_7.00.PR ↓.

```
Date (MM/DD/YY) ?          (Enter date; e.g., 5  23  86 ↓)
Time (HH:MM:SS) ?          (Enter time; e.g., 16  30 ↓)

Override default specs [N]?
```

The system in asking about specs you gave to VSGEN for the new system. You don't want to override, so press ↓

A pause occurs here, then

```
AOS/VS CLI REV n date time
)
```

The new, tailored system is running. Skip the next section.

If the New System Doesn't Come Up or Work Properly

If the new system doesn't come up, there will usually be an error message that describes the problem. The solution may simply be a matter of editing a device in the spec file. If the message is *FATAL AOS/VS ERROR*, note the figures displayed and run ESD (Emergency Shutdown). Then boot the starter system.

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To bring up the starter system, choose option 1 from the Operating System Load Menu or wait for the time-out delay. (The starter system is the installed system.) Then, if you think the problem is in the VSGEN spec, execute VSGEN with the /DEFAULT=sys switch; fix the offending device spec(s); give the original name in the NAME command; use the SPEC command to overwrite the old spec file; then use the BUILD command again and repeat "Testing", above.

If the new system fails again, or if the problem isn't the VSGEN spec, perhaps you haven't installed patches. Install patches (described earlier); then try again. If the new system fails again, type the panics file via COPY @LPB :UTIL:AOSVS.PANICS.SR ⤸; then interpret the panic values as explained in Chapter 6.

A Fast Checkout for the Tailored System

If you know that your VSGEN spec file is okay (perhaps because it has been used before to build a system that works), you can skip this section.

If your VSGEN spec file is new, you may want to check a few basic things. (You won't really know that the system works until you've brought up the multiuser environment, as described in the next chapter.) As a basic test, try a few CLI commands:

```
) SEARCH      :UTIL ⤸
FILES/AS/S    :PAGE:+ ⤸
ERROR: FILE ACCESS DENIED, ...
) SUPERUSER   ON ⤸
*) FILES/AS/S    :PAGE:+ ⤸
     ... (Sorted list of files in directory :PAGE) ...
```

This sequence of commands sets the search list to :UTIL, then checks file access controls and shows you the FILESTATUS /S (SORT) and /AS (Assortment) switches.

Now, if you have any other LDUs (formatted with the Disk Formatter), try to initialize and release them. For example, assume you have an LDU with disk unit name DPJ1 that you named UDD1. With unit DPJ1 ready, type

```
*) INITIALIZE   DPJ1 ⤸        (Initialize using unit name)
UDD1                          (System displays LDU name)
*) RELEASE   UDD1 ⤸           (Release using LDU name)
```

Try this with all your LDUs. If the commands work, your disk controllers were correctly identified to VSGEN. If a command doesn't work, you forgot or entered an incorrect controller specification; the VSGEN spec file may need editing.

Turn your line printer on; make sure paper in it is aligned; put it on line; and type

```
*) COPY @LPB :UTIL:AOSVS.PANICS.SR ⤸      (Or @LPD, or @LPE instead of @LPB)
*)
```

This shows that the line printer works and also gives you a copy of the Panics file — useful for describing fatal AOS/VS errors.

Type

```
*) CHAR/DEFAULT ⤸
... (characteristics) ...
*)
```

This shows you the default console characteristics VSGEN set up for the system console.

Type

```
*) PROCESS/DEF/IOC=@CON2 :CLI ⤸
PID:  3
*)
```

This creates a CLI process to run on console CON2. The @ is shorthand for the peripherals directory. Go over to the console connected as CON2 (line 0 of IAC, MCP1, or ATI) and verify the baud rate and parity settings on the back (if it's a CRT). Make sure it is on line.

Wait a few moments, then press ↵ a few times. If the CLI prompt appears, this means that you have at least one user console line connected and identified to VSGEN correctly. It's very good news. But if nothing happens on CON2, the hardware may be wrong, or you may have made a mistake in VSGEN.

To terminate the process on CON2, type BYE ↵ on the CON2 keyboard.

Next, try some magnetic tape I/O with the tailored system (if it has tape). Get a blank tape, ring in, and mount it on unit 0. Put the tape unit on line. Type

```
*) DIR  : ↵
*) DUMP/V  @MTx0 ↵          (x is B, C, or D, depending on tape unit model)
```

... (System verifies files dumped) ...

```
CTRL-C CTRL-A               (Press CTRL-C, then CTRL-A)
```

ERROR: CONSOLE INTERRUPT

```
*) REWIND  @MTx0 ↵          (x is B, C, or D, as above)
```

This shows that the tape driver for unit 0 is okay; it also shows how to interrupt CLI commands with CTRL-C CTRL-A. You can dismount the tape.

You've done nearly all the testing it's practical to do without bringing up the multiuser environment.

Making a Tailored System Tape

After testing the system, you should make a system tape or diskette of your tailored system. This can save many steps if you need to rebuild your system LDU. To make a tailored system tape, follow these steps.

- Get a blank tape, with the write ring in. Mount and thread it on tape unit 0, the one you used for the initial AOS/VS load. Make sure power is ON, then press BOT and ON LINE.
- Type

  ```
  ) SUPERUSER  ON ↵
  *) DIR  :SYSGEN ↵
  *) SYSTAPE[/16K] @MTx0 sys.PR ↵   (x is B, C, D, or J, depending on the unit
                                     type. sys is your tailored system name.
                                     Use /16K for type MTJ cartridge tapes.)
  ```

  Commands in the SYSTAPE.CLI macro make you a tailored system tape. SYSTAPE.CLI uses a default buffer size of 8192 for SYSBOOT, :SYSGEN:sys.PR (your tailored system), and the dump files (tape files 6 and 7). The /16K switch, however, uses a buffer size of 16384; use it for 21-Mbyte and 130-Mbyte cartridge tapes.
- When the CLI SUPERUSER prompt returns, rewind the tape:

  ```
  *) REW  @MTx0 ↵
  *)
  ```

  Remove the tape from the unit, remove the write ring from the tape, and clip the cover on the tape.

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Any system tape you make using the SYSTAPE macro has the same format as the AOS/VS system tape supplied by DG. However, it has your tailored, patched system in file 5 instead of the starter system. And, it has all files and programs currently in your root (:), :UTIL, :HELP, and :SYSGEN directories — including the ones your site created, and a copy of the microcode/SCP-OS file (MVnnnn.MCF).

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If you ever need to rebuild a blank LDU using this tape, you can abbreviate the procedures given in Chapter 2 or 3. You won't need to load microcode from a separate tape, or run VSGEN again; in fact, after you load tape file 7, you'll come up in AOS/VS with the root, :UTIL, :HELP, and :SYSGEN directories restored as of the time the system tape was made. Because SYSTAPE uses a default buffer size of 8192 (or 16384 if you specified the /16K switch), you will have to specify LOAD/BUFFERSIZE=8192 or 16384 when loading tape file 7. LOAD_II and the INSTALLER automatically match buffersize.

Making a Tailored System Diskette

To make a tailored system diskette, follow these steps.

- Get a new, blank diskette and insert it in unit 0.
- Type

```
) SUPERUSER  ON ↵
*) DIR   :SYSGEN ↵
*) COPY   @DPJ10  sys.PR ↵        (sys is your tailored system name; e.g.,
                                   SYS_7.00.PR. If the disk and diskette share a
                                   controller, the diskettename is DPJ1.)
... (Delay while it copies to diskette) ...
*)
```

- Remove the diskette from the unit, and return it to an outer envelope.

This copy diskette has the same format as the starter system diskette supplied by DG. If you ever need to rebuild a blank LDU (Chapter 2), you can load your tailored system from this diskette and skip VSGEN.

Making the Tailored System the Default System

By default, SYSBOOT brings up the default system. The first time you bring up a new revision of AOS/VS, this is the installed starter system. If you've named another system as the default system, SYSBOOT will bring up that system instead of the starter system. Now that you have tested your tailored system, you can tell SYSBOOT the name of your tailored system so that in the future SYSBOOT will bring it up. To make the tailored system the default system, follow these steps.

1. Shut down the current system, if one is running, with the command BYE ↵; then type Y ↵. If the multiuser environment is running, make sure all users are logged off first.
2. Boot the starter system:

```
SCP-CLI>      RESET ↵
SCP-CLI>      BOOT 24 ↵       (Or 27)
```

3. From the Operating System Load Menu, type 2 ↵.

```
        Operating System Load Menu

1  Continue immediately with operating system load
2  Enter the Technical Maintenance Menu

. . .

The default system pathname is xxx

Enter choice [1]:  2 ↵
```


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4. Choose option 8 from the Technical Maintenance Menu:

   Technical Maintenance Menu

   . . .

   8 View or change the default operating system filename

   . . .

   Enter choice [1]: 8 ↵

5. SYSBOOT prompts you for the pathname of the tailored system:

   Default operating system [xxx]:

   If the system named in *pathname* is the one you want, press ↵. If not, type the pathname of your tailored system, starting from the root. For example, type

   :SYSGEN:SYS_7.00.PR ↵

6. Now bring up the tailored system by choosing option 1, "Load and start the default operating system."

   Enter choice [1]: ↵

   ... (pause) ...

7. The date and time questions are skipped on computers with a working boot clock.

7a. *Date (MM/DD/YY)?* 5 23 86 ↵ (Type current date)

7b. *Time (HH/MM/SS)?* 17 24 ↵ (Type current time)

8. *Override default specs [N]?* ↵

   ... (pause) ...

9. *AOS/VS CLI REV n date time*

Congratulations. Your tailored system is running and SYSBOOT knows it is the default system. The next time you start your system, SYSBOOT will start your tailored system as the default system.

Generating Other AOS/VS Systems

After you generate an AOS/VS system that you like, you can use the sys.CSF spec file as a base for all future systems.

There are two main reasons for generating a new AOS/VS system. The first is to change a specification (as when you acquire a new device) or change parameters for performance tuning. The second is to install a new AOS/VS revision.

You can generate a new system for either case using the /DEFAULT switch; for example

*) X VSGEN/DEFAULT=SYS_7.00 ↵

VSGEN will warn you if any interrevision changes may cause problems.

When you name a new AOS/VS system, you determine whether the old system will be deleted. If you give the new system the same name as an old one, the old system will be deleted (after VSGEN gets confirmation). If you give the new system a different name, the old system will continue to exist in directory :SYSGEN.

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If you answer Yes, PREDITOR asks

User locality - non-batch [ ] change? (Y or NL)

The operator will be able to change locality of non-batch processes to any locality you specify here. Respond with the numbers of *all* localities you want the user to have, or press ↵ to prevent the operator from changing locality. Separate numbers with spaces. For example, 1 3 5 6 ↵.

Default user locality - batch [0] change? (Y or NL)

This question applies to batch processes only, letting you distinguish between user's interactive processes and batch jobs.

For the operator profile, we recommend the default, 0. For the default, press ↵.

Use other localities - batch [No]? (Y, N, or NL)

The locality issue is meaningful only after you've built an application and created classes. For initial profiles, we recommend the default; press ↵ and skip the next question.

If you answer Yes, PREDITOR asks

User locality - batch [ ] change? (Y or NL)

The operator will be able to change locality of batch processes to any locality you specify here. Respond with the numbers of *all* localities you want the user to have, or press ↵ to prevent the operator from changing locality. Separate numbers with spaces. For example, 1 3 5 6 ↵.

User comment [] change? (Y or NL)

User comments are simply text strings placed in the profile file; they are purely informational. They are handy for users' full names and/or dates. To enter one for the OP profile, type Y ↵ and enter a useful comment; for example,

```
                    Y ↵
New (0-79 chars):   OP  PROFILE,  30  MAY 86 ↵
```

Command:

You've finished the Operator profile. As with any existing profile, you can list its specs by typing L ↵, then the username ↵. You can edit its specs one by one by typing E ↵, then username ↵.

The first time you run it on an LDU, PREDITOR creates the user directory directory, :UDD. For every profile you create, PREDITOR creates a user directory (with the disk space limit specified) in :UDD, and the system creates a profile in :UPD (the User Profile Directory). Each user directory and profile is named username; e.g., :UDD:OP for username OP.

Standard User Profiles

Users' needs vary. Some may need large working set sizes and large amounts of disk space. After all, you bought your computer system to run programs — perhaps very large programs — and the process that will run these programs will need a user profile (unless you plan to run all large programs interactively from the master CLI, which has the Superuser privilege and can do anything it wants).

Given these variables, we suggest general-purpose default values for all users. You can then tailor these for individual users. To set up the default profile, edit PREDITOR's internal default profile (!DEFAULT!) as in the following dialog. But, for CEO user profiles, see *Managing the CEO® System* or Chapter 7.

```
Command:      E ↵
Username:     !DEFAULT! ↵
Password change? (Y or NL)     Y ↵
New (6-15 chars):    GENERAL    ↵
Encrypt password [No]?     Y ↵
Initial IPC file [] change? (Y or NL)     Y ↵
New (0-63 chars):    :UTIL:LOGON_CENTRAL.CLI ↵        (Type central macro name)
Program [:CLI.PR] change? (Y or NL)     ↵
Create without block [No]? (Y, N, or NL)     ↵
Use IPC [No]? (Y, N, or NL)     ↵
Use console [Yes]? (Y, N, or NL)     ↵

Use batch [Yes]? (Y, N, or NL)     ↵
Use virtual console [Yes]? (Y, N, or NL)     ↵
Access local resources from remote machines [Yes]? (Y, N, or NL)     ↵
Change password [Yes]? (Y, N, or NL)     ↵
Unlimited sons [No]? (Y, N, or NL)     ↵
Sons [1] change?  (Y or NL)     Y ↵
New (0-1023):    3 ↵
Change priority [No]? (Y, N, or NL)     ↵
Change type [No]? (Y, N, or NL)     ↵
Change username [No]? (Y, N, or NL)     ↵
Access devices [No]? (Y, N, or NL)     ↵
Superuser [No]? (Y, N, or NL)     ↵
Superprocess [No]? (Y, N, or NL)     ↵
System manager privilege [No]?     ↵
Modem [No]? (Y, N, or NL)     ↵
Change address space type [No]? (Y, N, or NL)     Y ↵
Change working set limit [No]? (Y, N, or NL)     ↵
Priority [2] change? (Y or NL)     ↵
Max qpriority [0] change? (Y or NL)     ↵
Disk quota [500] change? (Y or NL)     Y ↵
New (0-2147483647):     15000 ↵
Logical address space - batch [-1 ... default] change? (Y or NL)     ↵
Logical address space - non-batch [-1 ... default] change? (Y or NL)     ↵
Minimum working set size - batch [-1 ... default] change? (Y or NL)     ↵
Maximum working set size - batch [-1 ... default] change? (Y or NL)     ↵
Minimum working set size - non-batch [-1 ... default] change? (Y or NL)     ↵
Maximum working set size - non-batch [-1 ... default] change? (Y or NL)     ↵
Default user locality - non-batch [0] change? (Y or NL)     ↵
Use other localities - non-batch [No]? (Y, N, or NL)     ↵
Default user locality - batch [0] change? (Y or NL)     ↵
Use other localities - batch [No]? (Y, N, or NL)     ↵
User comment [] change? (Y or NL)?     Y ↵
New (0-79 chars):     GENERAL USER ↵
Command:
```


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This tailors PREDITOR's !DEFAULT! profile for general use. Now, when you create each profile, the new defaults you gave will appear; this allows you to default more questions and saves time. The original [default] values will return when PREDITOR terminates — so you should do all the profiles you need during this session.

High Security Systems

If yours is a C2 or other tight-security system, your standard user profiles will certainly not include Superuser, Superprocess, System manager, or *Access devices* privileges, since these privileges permit a user wide-ranging access to files and control over processes and system control functions. To limit such access, and to make it easy to determine who has done what on the system, these privileges should be assigned only to those few individuals who need them to manage the system or perform special operations.

Similarly the *Change username* privilege enables a user to assume other identities, such as OP, thus gaining access to others' files or even the entire system, and making tracing of his or her actions difficult. Do not assign this privilege unless it is clearly needed.

Direct access to a system from the outside, such as through a network or by modem, also endangers security by opening up the system to people who are not part of the immediate organization, who may be less well known, and who are thus less subject to control. Once logged on your system, a sophisticated person can find ways to circumvent file access controls and other security measures in order to acquire, change, or even destroy data or programs. For this reason a C2-type AOS/VS system may not include modems or networking in its configuration.

Users on a system without modems or networking obviously have no need for the *Use virtual console*, *Access local resources from remote machines*, and *Modem* privileges, and should not be assigned them. Otherwise, these privileges should only be assigned on an "as needed" basis.

For more information about security and C2 systems, see Chapter 16.

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To accept the default, press

↵

Logical address space - batch [-1 system default] change? (Y or NL)

This series of questions gets more detail in Chapter 7. For now, default them.

↵

Logical address space - non-batch [-1 system default] change? (Y or NL) ↵
Minimum working set size - batch [-1 system default] change? (Y or NL) ↵
Maximum working set size - batch [-1 system default] change? (Y or NL) ↵
Minimum working set size - non-batch [-1 system default] change? (Y or NL) ↵
Maximum working set size - non-batch [-1 system default] change? (Y or NL) ↵
Default user locality - non-batch [0] change? (Y or NL)

This has meaning only if you plan to use class scheduling on your system, as mentioned earlier.

For initial user profiles, we recommend the default, 0. For the default, press ↵. (There's more information on this question and the next in Chapter 7.)

Use other localities - non-batch [No]? (Y, N, or NL)

The locality issue is meaningful only after you've built your application and created classes. For initial profiles, we recommend the default; press ↵ and skip the next question.

If you answer Yes, PREDITOR asks

User locality - non-batch [ ] change? (Y or NL)

The user will be able to change the locality of interactive processes to any locality you specify here. Respond with the numbers of *all* localities you want the user to have, or press ↵ to prevent the user from changing locality. Separate numbers with spaces.

Default user locality - batch [0] change? (Y or NL)

This question applies to batch processes only, letting you distinguish between user's interactive processes and batch jobs. We recommend the default, 0. For the default, press ↵.

Use other localities - batch [No]? (Y, N, or NL)

The locality issue is meaningful only after you've built an application and created classes. For initial profiles, we recommend the default; press ↵ and skip the next question.

If you answer Yes, PREDITOR asks

User localities - batch [ ] change? (Y or NL)

The user will be able to change locality of batch processes to any locality you specify here. Respond with the numbers of *all* localities you want the user to have, or press ↵ to prevent changing locality. Separate numbers with spaces. For example, 1 3 5 6 ↵.

User comment [GENERAL USER] change? (Y or NL)?

As described earlier, you can use this for text comment about the user: full name, date, etc. Type Y ↵, then the desired command. For example,

```
                    Y↵
New (0-79 chars):   JACK  ARMSTRONG  30  MAY  86 ↵

Command:
```

You have finished this profile. PREDITOR has written it into its profile directory :UPD, as a file with the filename of the username; e.g., JACK for a username of Jack. The profile is ready for use.

To do another profile, type C ↵ and run through this section again. (Remember that a user must have a profile to log on to the system. Many people can have a common profile — usable through a common username and password — but, aside from using the system console, a person who doesn't know a valid username and password cannot use the system.)

When you have finished all the profiles you want, PREDITOR will be asking for a command. Leave PREDITOR and return to the CLI by typing

```
BYE ↵
)
```

Continue to the next section.

Initializing EXEC and Its Queues

With the user profiles done, you can initialize the EXEC process. This involves executing EXEC and creating and opening EXEC queues; generally, you need to do it only once.

Via your primary tool, the master CLI, set your search list and turn on SUPERUSER:

```
) SEARCH    :UTIL ↵
) SUPERUSER    ON ↵
*)
```

Now start up EXEC:

```
*) PROCESS/DIR=@/DEF/NAME=EXEC    EXEC ↵
PID 3
From Pid 3 : (EXEC) Revision n Ready
↵
*)
```

The PROCESS command creates a new process — just as XEQ does — but it is more versatile. The /DIR switch makes the EXEC process home directory :PER (@ means :PER); the /DEF switch gives it default privileges; and the /NAME=EXEC switch makes its process name EXEC. This is required. EXEC's process name must be EXEC; other processes, such as SVTA, will not come up if EXEC has a different name.

The Pid messages indicate that EXEC is running as a process with Process ID 3 (PID 3); and give its revision and the time.

Now create the batch and spool queues and open the MOUNTQ via the following commands to EXEC.

```
*) CONTROL @EXEC  CREATE  PRINT  LPT ↵
From EXEC ...
*) CONTROL @EXEC  OPEN  BATCH_INPUT ↵
From EXEC ...
*) CONTROL @EXEC  OPEN  BATCH_OUTPUT ↵
From EXEC ...
*) CONTROL @EXEC  OPEN  BATCH_LIST ↵
From EXEC ...
*) CONTROL @EXEC  OPEN  LPT ↵
From EXEC ...
*) CONTROL @EXEC  OPEN  MOUNTQ ↵
From EXEC ...
*)
```


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The CONTROL @EXEC directs the command through the CLI to EXEC. The commands created EXEC's permanent spool queues in a file named :QUEUE:QUEUE_DESCRIPTORS. As long as this file exists, you'll never need to repeat these commands.

Now, go to the line printer and make sure power is on, paper is aligned, and that it is on line. The printer must be on line for EXEC to start it.

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Editing Macro UP.CLI

After writing some macros with SED, you're ready to tackle UP.CLI. To start, type

```
*) SED  UP.CLI ⤵
SED Rev n - Input file :UTIL:UP.CLI
*
```

Type LIST ALL ⤵ to see the entire prototype macro. As you can see, there are instructions at the end on how to make it executable.

As time passes, and your system grows and changes, you'll be editing this macro to reflect the changes. In this session, we'll simply give some general-purpose answers that will make UP.CLI executable — without explaining the other lines in the macro. An example of a real UP.CLI macro appears in Chapter 15.

The first line to edit is line 1. Line 1 makes the macro nonexecutable — it says "if 1 equals 2, execute all lines up to the next !ELSE or !END." So, using cursor controls, position on the line and make the two numbers equal. For example,

```
[!EQUAL,1,1] ⤵
```

Now find the PROCESS command that starts EXEC:

```
* FIND  "PROCESS/" ⤵
n       PROCESS/DEFAULT/DIRECTORY=...
```

Insert the following lines to run the queue cleanup program, QCMP:

```
WRITE  Running QCMP now...
XEQ  QCMP/YES
WRITE  QCMP is done.
```

The QCMP program helps keep directory QUEUE neat by deleting unused files in it. QCMP must run before EXEC does. You have just made sure it will do so.

Initializing a Second Processor in a Multiprocessor System

If you have an MV/20000 Model 2, it's a good idea to initialize the second processor in your system's UP.CLI macro. Add the following line to the UP.CLI macro before any process or execute commands:

```
) JPINITIALIZE n
```

(n is 0 if 1 is the mother processor or 1 if 0 is the mother processor)

See Table 9-1 for switches to the CLI command JPINITIALIZE.

If You Have Graphics Consoles

AOS/VS Revision 7.00 supports windowing on graphics (pixel-mapped) consoles on systems like the DS/7700 computer. On such systems, a user can create windows on a graphics console, but in order to do so, must first assign (get ownership of) the PMAP, an entry in :PER, for the device. Unauthorized access to PMAP entries represents a potential security risk. (Graphics terminals are not permitted in a C2-type system; see the section in Chapter 16 "Preventing Unauthorized Access to Windows" for an explanation of the security risk involved.)

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To prevent unauthorized creation of windows — a security breach — add the following line to your system's UP macro *before* the line that enables consoles:

```
ASSIGN ([!FILENAMES @PMAP+])
```

This assigns (gives ownership of) the PMAP device entries (specified by @PMAP+) to PID 2.

Likewise, if you have a program that creates additional windows, deletes default windows, or repositions or resizes windows, you can run that program from your UP macro — but run it *before* assigning the PMAPs.

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Enabling User Consoles

The UP.CLI macro contains an EXEC ENABLE/ALL command, so you do not need to insert ENABLE commands.

But, after EXEC enables a console, it "owns" that console. Some other DG programs need to "own" consoles to run on them. Among these are data entry programs (Idea, TPMS) and IBM emulator programs (RCX70, DG/SNA). If you plan to run one or more of these other programs, decide which consoles you want them to use. Then, in the UP macro, execute the other programs and have them take charge of the consoles they need *before* the CONTROL @EXEC ENABLE/ALL command. The other program(s) will get use of the consoles, and there will simply be a *DEVICE ALREADY IN USE* error message when EXEC tries to enable them. Also, if you want to change any console characteristics (CHARACTERISTICS/DEFAULT command), this must be done before the console is enabled.

To enable consoles selectively, you can replace the ENABLE/ALL command with specific enable lines of the form

```
CONTROL @EXEC ENABLE @CON(n,n,n ... )
```

For example,

```
CONTROL @EXEC ENABLE @CON(2,3,4,5,6,7,8,9,10,11,12)
```

This would allow you to specifically enable consoles and avoid the EXEC *DEVICE ALREADY...* error messages. You can deal with this issue later, when you know more about your applications software. But it's important to know how to handle the console enabling issue. (The parentheses iterate the CONTROL @EXEC ENABLE @CON command on each number within them. Parentheses work the same way with other commands to the CLI.)

(If you're wondering why we didn't simply say "CX" instead of CONTROL @EXEC, you should know that it's good practice to use full commands within a macro. This helps keeps macros simple, versatile, and independent of one another.)

After making sure that the consoles you want will be enabled, proceed.

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You don't have to edit either of the log-on screen files, but it's a nice way to personalize your system. If neither of these screen files exists, EXEC will display the default one-line banner.

If you are very security-conscious, you may decide not to reveal your system name or other information in a log-on banner, but rather to stay with the default. This is particularly true if people can dial into your system via modem lines.

User Log-On Files

When you specified the "Initial IPC file" to PREDITOR, you gave a central macro filename (example, :UTIL:LOGON_CENTRAL.CLI) that would be executed for users when they logged on. You planned for this macro to execute a logon macro in each user's directory. There will be no error message if these files don't exist, but they serve as a useful information and control tool for users — so you might as well create them to see how they work.

Use a text editor (SED or SPEED) to create the files. First, create the central macro — shown by example as file :UTIL:LOGON_CENTRAL. The text might look something like this:

```
Comment This is a central macro that executes user log-on macros.
SEARCHLIST :UTIL
DEFACL [!USERNAME],OWARE
:UDD:[!USERNAME]:LOGON.CLI
```

Now, create the LOGON.CLI macro to be moved into user directories. Sample text for the initial IPC file follows.

```
WRITE Welcome to the AOS/VS Operating System. The file you are reading
WRITE is a CLI macro in your own directory. You can edit it as desired:
WRITE to set console characteristics and/or searchlist and/or default
WRITE access control list -- DEFACL -- for your files.
SEARCHLIST [!SEARCHLIST]
WRITE Your searchlist is [!SEARCHLIST]
WRITE Type HELP NEWLINE for Help.
```

After writing both macros, test them by typing

```
*) MOVE/V/R :UDD:[!USERNAME]:LOGON.CLI ↵   (Put user macro in your directory)
LOGON.CLI
*) LOGON_CENTRAL ↵                         (Try central macro)
```

You should see the text you typed after each WRITE command, and the current searchlist set by the SEARCHLIST command. If there are error messages, they probably result from syntax errors. The system displays only the first 512 characters in the central macro file, so you shouldn't make it more than 512 characters long.

When the log-on macro runs without error messages, give everyone all access to the macro and move a copy of it to everyone's directory by typing the following commands.

```
*) MOVE/V/R  :UDD  LOGON.CLI ↵
LOGON.CLI
*) DIR  :UDD ↵
*) ACL  LOGON_CENTRAL.CLI  +,RE ↵          (Use your central macro name)
*) ACL  LOGON.CLI  +,OWARE ↵
*) SPACE  +  50 ↵
*) MOVE/V  ([!FILENAMES  +])  LOGON.CLI ↵
```


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... (CLI verifies each file moved) ...

This sequence initializes each user directory and moves a copy of LOGON.CLI into each one.

Note that the macro text applies only to CLI users (users whose *program*, specified to PREDITOR, is CLI.PR). If a user's *program* is BASIC.PR, LOGON.CLI must be rewritten in BASIC to PRINT the log-on message you want. A BASIC program cannot use CLI commands directly. CEO, however, ignores the IPC file, so you need not rewrite it for a CEO user.

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LOGON.MESSAGE File

If you create a file called LOGON.MESSAGE in :UTIL, EXEC will display the contents of this file to every user who logs on — in whatever program.

LOGON.MESSAGE is quite useful for general system information, like planned shutdowns, new features, and so on. The system manager or operator can add information to this file as needed — any day or any hour. If you wish, you can give the file an access control list that allows any CLI user to edit it — adding messages that he or she feels would be of general interest. As with the user log-on file, only the first 512 characters of LOGON.MESSAGE are read (but people can TYPE LOGON.MESSAGE⤸ to see the whole thing, if it exceeds 512 characters).

Create and/or edit file LOGON.MESSAGE as you would any file. It must be in directory :UTIL. Sample text is

```
This is the wonderful world of AOS/VS.
If you have questions, please see system operator.
```

After creating both the user log-on and LOGON.MESSAGE files, bring everything UP ⤸, then log on as OP on a user console. You will see the messages just as any user will see them.

Giving and Getting Help

AOS/VS has a Help mechanism that can help inexperienced people to use the system. You may have used part of this with VSGEN, PREDITOR, and SED; you can also use it with the CLI, EXEC, and other DG products. For example, type the following commands.

```
*) HELP ⤸
```

... (CLI displays list of HELP topics) ...

```
*) HELP   *COMMANDS ⤸
```

... (CLI displays list of its commands) ...

```
*) HELPV   ACL ⤸
```

... (CLI describes ACL command) ...

```
*) XHELP ⤸
```

... (EXEC displays all its commands) ...

```
*) XHELP   ENABLE ⤸
```

... (EXEC describes its ENABLE command) ...

You can see that HELP provides quick, pertinent information, when people need it. All Help messages, for all programs, are in directory HELP. This directory was created, and its files loaded, when you first brought up the starter system.

Each Help file begins with a character string that identifies it to the system. For example,

The contents of a Help file named	Will be displayed by the CLI command
CLI.TPC.TOPICS	HELP ⤸
CLI.TPC.string	HELP *string ⤸
CLI.CMD.string	HELP string ⤸
CLI.PSM.string	HELP !string ⤸
EXEC.string	XHELP string ⤸

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Additional Help files in :HELP, accessible from non-CLI programs, are

Filename	Accessible from
DEBUG4.string	Assembly language debugger.
FED.string	Assembly language disk file editor.
SED.string	SED text editor.
SPEED.string	SPEED text editor.
VSGEN.string	VSGEN program.

By default, every user can read these files (via appropriate HELP or TYPE pathname commands), and the system will automatically find and display them.

Generally, if you want to create one or more Help files and have the system type its contents, use the filename form

CLI.TPC.string

The system will then display the string in proper alphabetical order when a user types HELP ⤸. It will display the file's contents when a user types HELP *string ⤸.

If a Help message can tell the whole story by itself, you can simply leave it as a Help topic. But if the explanation is quite long, you can use the topic file to tell the user what files to TYPE for more help.

All Help files you create should have an Access Control List (ACL) of at least +,R so the users will be able to read them. You can set ACLs as shown in the example below.

Even if you decide not to create your own Help messages now, all files from nonAOS/VS products that begin with "CLI.TPC." should be in directory :HELP. This will allow users to see the topic when they type HELP ⤸.

You can find all CLI.TPC.- filenames via a filename *template* (character that matches all or parts of filenames). The character + (plus sign) matches all characters. So, in directory "dir", you can see which filenames begin with CLI.TPC. — and sort the filenames — by typing

```
*) DIR   dir ⤸
*) F/S   CLI.TPC.+ ⤸
... (System lists all filenames that begin with CLI.TPC. alphabetically) ...
*)
```

Help File Example

In directory HELP, use a text editor to create a file named

CLI.TPC.ABOUTSYSTEM

The contents of this Help file can be any message you want. For example:

```
ABOUTSYSTEM — This is a DG MV/Family CPU running the AOS/VS operating
system. TYPE any of the following files for more information: ↵

:HELP:COMPILERS          Describes compilers and how to use them.
:HELP:BATCH              Describes using Batch.
:HELP:DAY_RUN            Describes schedule of application programs.
:HELP:DAY_DUMP           Describes daily schedule of Dump/Backup runs.
```

After leaving the text editor, give everyone Read access to the Help file:

```
*) ACL/V   CLI.TPC.ABOUTSYSTEM      +,R ↵
CLI.TPC.ABOUTSYSTEM
*)
```

This shows the simplest approach to Help messages. When any user types HELP ↵ from the CLI, *ABOUTSYSTEM* will appear as a topic. When the user types HELP *ABOUTSYSTEM ↵, the file text will be displayed; the user can then type any of the pathnames described for more information. You'll be able to think up more sophisticated ways to use Help messages later on. But the main point is to know about it: it can be a great boost to productivity.

Overview of Your System File Structure

Your multiuser environment is ready for users. During the whole process, there were a number of directories and files created — some via the system tape, some by the tailored system, some by PREDITOR and EXEC, and some by you.

Figure 5-1 shows the directory structure, with some pertinent files, and describes how and when the files were created. An oval indicates one or more directory files; a box indicates one or more individual files.

CAUTION: AOS/VS and many system programs expect to find the system files described in Figure 5-1 in the directories shown. Do not move these directories or create links to them. If you do, the system may not work as expected, or may not work at all.

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What Next?

This chapter has given you the essentials on creating the multiuser environment.

It has shown you how to create good general-purpose user profiles with the PREDITOR profile editor and how to initialize EXEC, the multiuser environment "manager"; given you some pointers on other DG software and the ERMES error file; shown you how to make life easier for users with initial user IPC files and the log-on message file; and offered a picture of your finished system's directory structure.

This chapter ends the "cookbook", blank-disk to finished-system portion of the book. This portion has introduced you to the DG hardware and software in Chapter 1; told you how to format LDUs, install, and bring up the starter system in Chapter 2 or 3; explained how to generate, test, patch, and optionally install a tailored system in Chapter 4; and showed how to create the multiuser environment in this chapter.

Whoever you are — DG engineer, system manager, DP manager, MIS manager, or nonadministrative person — you have done a tremendous job. Not only have you had to execute many steps, but you've had to learn a lot. Your tailored, multiuser system is up and running. You may have to execute parts of preceding chapters again — but you will rarely, if ever, need to do it all again for your installation.

The rest of this book gives the details — in a form designed for reference — of programs to help generate and run an AOS/VS system. The next chapter details startup and shutdown, both normal and abnormal. Read it if you want to learn about startup and/or handling abnormal shutdown. Chapters 7 and 8 give the *details* on PREDITOR and EXEC — batch, spooling, and tape mounting — read them for the inside story on these important programs. Chapter 9, "Other Runtime Tools", describes general-purpose operator tools, like the PED environment display program, and the system log and report utilities. Chapter 10 describes system backup.

Chapter 11 tells you how to handle unusual system conditions; Chapter 12 details the Disk Formatter; and Chapter 13 details the Installer. Chapter 14 gives some summary pointers and cautions.

Chapter 15 examines system management issues — excluding security; and Chapter 16 deals with security. Both chapters try to show how to make the best decisions for your installation.

Depending on your interest — go to the appropriate chapter, or check the index for a specific topic or product.

Directory name (pathname)	Description
: (Root)	This is the root directory. It contains all other directories. It was created by the starter system during the initial load. Its nondirectory files include the system Agent, peripheral manager, stand-alone FIXUP disk fixer, and DFMTR Disk Formatter, the CLI files, the edited UP.CLI and DOWN.CLI (which you moved there), and the error message file, ERMES.
FORMS (:UTIL:FORMS)	This is the FORMS directory that you created to hold special printing form directive files; it will be empty until someone places files in it.
HELP (:HELP)	This is the HELP directory, created by the starter system from tape during the initial load procedure. It contains topic Help files, command and pseudomacro Help files, and VSGEN and EXEC Help files. You can also place your own help files here.
NET (:NET)	This is the network directory, created by a tailored operating system the first time the system comes up. XODIAC network host names are put here automatically by XODIAC software. Generally, don't put user files here.
PAGE (:PAGE)	Like SWAP, PAGE is part of the AOS/VS memory structure; AOS/VS creates it at startup and deletes it at shutdown. You can override the size specified at VSGEN when you bootstrap. Don't place user files here.
PATCH (:PATCH)	This is the patch directory, created by AOS/VS updates but only used by updates through Revision 7.56. (The update tool introduced in Revision 7.57 replaces :PATCH with :UPDATE.) You can delete this directory.
PER or @ (:PER or @)	This is the Peripherals directory, created by a tailored AOS/VS system each time it comes up. PER contains a device entry file for each device (not controller) generated to be part of the operating system (e.g., MTB0, DPF0, CONn, LPB). The @ is convenient shorthand for PER; for example @MTB0 is easier to type than :PER:MTB0. PER is also the home directory of EXEC (although the EXEC program and overlay files are in :UTIL). When AOS/VS starts up, it creates device entries in PER. When EXEC starts up, it creates batch and device queues in PER. Other software products, like networking or communications products, also create entries in PER when they are started up. When a system is shut down normally, it deletes PER, so don't place user files there.

Figure 5-1. Directory Structure in the Finished AOS/VS System (continues)

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Directory name (pathname)	Description
PROC (:PROC)	AOS/VS uses the PROC directory to keep track of running processes. It is created at startup and deleted at shutdown. Don't place user files here.
QUEUE (:QUEUE)	This is directory QUEUE, created by EXEC the first time EXEC starts up. QUEUE contains two files, QUEUE_ENTRIES and QUEUE_DESCRIPTORS, which have queue information for EXEC. The QCMP utility program may delete all user files in QUEUE, so don't place user files here.
SYSGEN (:SYSGEN)	This is the system-generation directory. It was created by the starter system from the system tape during the initial load procedure. It contains needed VSGEN and library files for system generation.
SYSTEM_CALL_SAMPLES (:UTIL:SYSTEM_CALL_SAMPLES)	This subdirectory contains sample assembly language source programs that you can assemble, link, and execute. For more information, see the manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
SWAP (:SWAP)	The SWAP directory is part of the AOS/VS memory management mechanism. AOS/VS creates it at startup and deletes it at shutdown. Its size is specified at VSGEN but you can override this if you override default specs when you bootstrap. Do not place user files here.
UDD (:UDD)	This is the user directory directory, created by PREDITOR the first time PREDITOR is run on this LDU. In this directory, PREDITOR creates a user directory for each user given a profile. This directory has the name given as a username to PREDITOR; for example, ROBIN, F77, or INFOS. The user directory becomes the user's working directory when the user logs on; within it, the user can create files and subordinate directories.
UPD (:UPD)	This is the user profile directory, created by the system if it doesn't exist. The user profile for each user lives here. EXEC checks the directory for a matching profile file before allowing a user to log on. And, after each user has logged on, the system itself enforces the limits set within the profile file.
UPDATE (:UPDATE)	This is the update directory, created by AOS/VS updates starting with Revision 7.57. It holds the update tool, a copy of the PATCH program, and script files that install updates to AOS/VS. Subdirectories for those updates contain the update notice (085_000147_14), patch files, and usually new program files and text files.
UTIL (:UTIL)	This is the utilities directory. It contains most AOS/VS utility program files: the SED text editor, macroassembler, Link, debugger, etc. UTIL also has operator tools like PREDITOR, EXEC, and PED. It was created by the starter system during the initial load.

Figure 5-1. Directory Structure in the Finished AOS/VS System (concluded)

End of Chapter

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Chapter 6
Startup and Shutdown

Read this chapter

- when you want to start up your computer system;
- when you want to start a program like an AOS/VS system or the FIXUP Disk Fixer;
- when you want to shut an AOS/VS system down;
- if AOS/VS hangs or stops with a fatal error or hard error message;
- when power returns after a power failure.

This chapter gives the details on system startup, normal shutdown, and abnormal shutdown. The major sections are

- The SCP and SCP CLI Commands
- CPU Front Panel
- Startup
- Normal Shutdown
- Abnormal Shutdown
- The FIXUP Disk Fixer
- Power Failures

The SCP and SCP CLI Commands

In addition to running AOS/VS, MV/Family computers also run a second operating system, called the System Control Program (SCP or SCP-OS). On the ECLIPSE MV/20000, MV/15000, MV/10000, MV/8000, MV/7800, MV/6000, and MV/4000, AOS/VS and the SCP run concurrently because each runs in a separate processor. When you bring up AOS/VS, it gets and keeps control of the system console until it is shut down. Then, the SCP CLI gets control of the system console.

On the MV/2000 DC, the 4000-series, and the DS/7000-series computers, AOS/VS and the SCP run alternately, sharing the same processor. When you bring up AOS/VS, a subset of the SCP-OS remains in microcode. AOS/VS gets and keeps control of the system console while it runs. When the CPU is halted (as when AOS/VS is shut down), the subset SCP CLI gets control of the system console.

So, on all computers but the MV/2000 DC, the 4000-series, and the DS/7000-series, you can use the SCP CLI while AOS/VS is running. On the other systems, you can use the SCP CLI only when AOS/VS is not running (when it is shut down or frozen).

When the SCP CLI has control, it displays the prompt

SCP-CLI> (or *SCP-CLI/Jpn>* on MV/20000s; *n* is 0 or 1)

on the system console. Next to the prompt, you can type SCP commands to boot an AOS/VS system or other stand-alone program; the SCP will then load a program that loads your specified program into the main processor's memory. The new program takes control of the processor and system console and starts its own dialog. But the SCP CLI will regain control when the new program terminates.

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SCP CLI commands (also called the *soft console)* extend the functions of hardware switches on the computer front panel. Generally, you should use SCP CLI commands only when AOS/VS is shut down. Most SCP CLI commands change main processor state — so if you use them when AOS/VS is trying to run the processor, AOS/VS may fail when it regains control of the processor.

The most common SCP CLI commands appear in Table 6-1.

SCP features are further described in Chapter 11 and in the *System Control Processor* manual (014-series) supplied with your computer.

Table 6-1. Commonly-Used SCP CLI Commands

Command	What it Does	Example
ATTACH *[n]*	Multiple-processor computers only. Tells the SCP to apply future commands to processor *n* (*n* can be 1 or 0; by default the SCP applies all commands to processor 0). Simultaneously, the SCP detaches itself from other processors. If you omit *n*, the command displays the number of the processor currently attached to the SCP.	*SCP-CLI/Jp0>* ATTACH 1 ↵ *SCP-CLI/Jp1>* BOOT 24 ↵
BOOT n	Program loads from the first device on device code n. The program on this device takes control of the system console. Be sure the main processor is RESET ↵ before using BOOT.	*SCP-CLI>* B 24 ↵
CONTINUE *[arg]*	Tells the main processor to continue running a halted program. With an argument, continues running a program only on the named processor. Useful on MV/2000 DC, 4000-series and DS/7000-series systems to continue running AOS/VS. Also useful when you want to rerun a stand-alone program like the Disk Formatter.	*SCP-CLI>* CON ↵ *SCP-CLI>* CONTINUE ↵
FLAGS arg {No / Yes}	Sets or clears an SCP flag. The most common flags are DATE, SCOPE, and LOCK. DATE sets the system date. SCOPE tells the SCP to erase characters when you press the DEL key; it's useful if the system console is a CRT (SCOPE is not available on 4000-series systems). LOCK disables the break sequence. This can be useful on MV/8000s — but on other machines, it's better to lock the computer.	*SCP-CLI>* FLA SCOPE Y ↵

(continues)

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MV/8000 Panel Switches

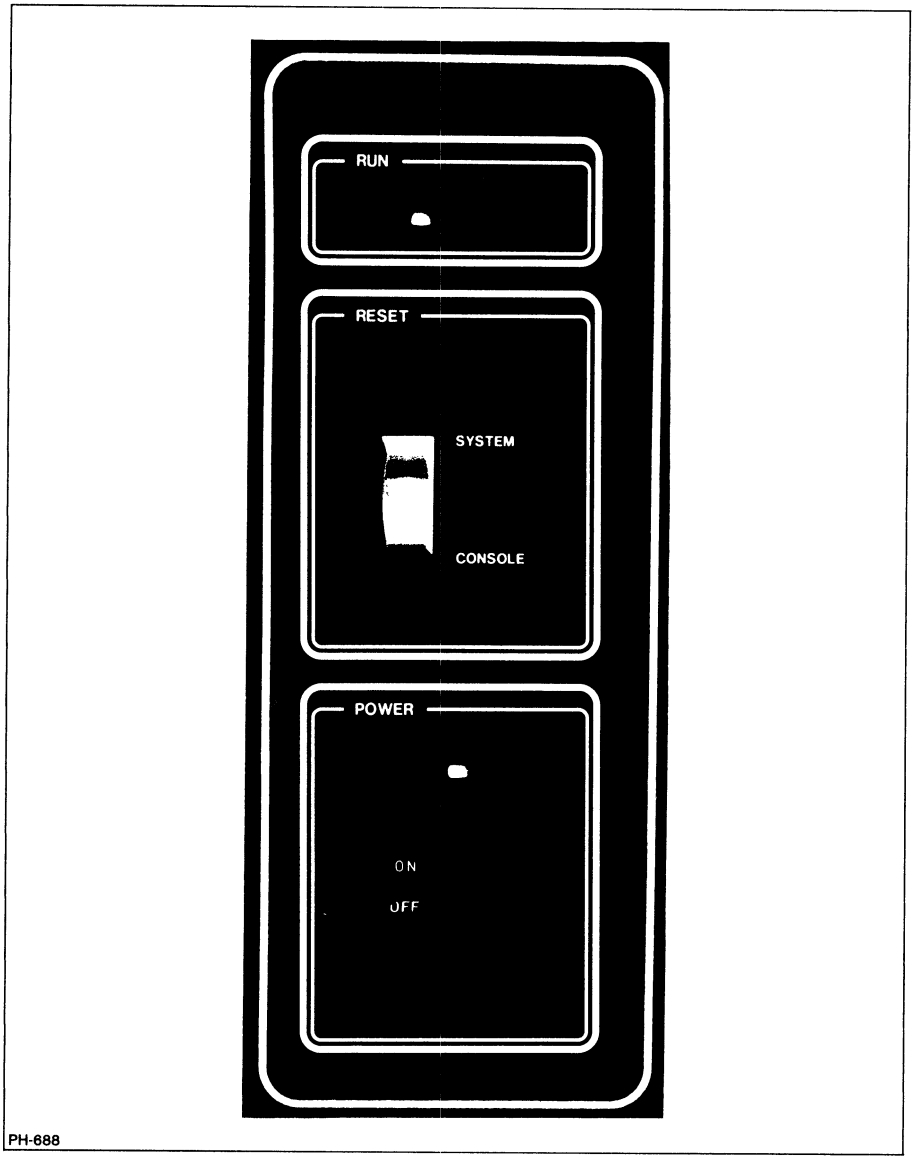


Figure 6-4. MV/8000 Computer Front Panel Switches

As you can see from Figure 6-4, MV/8000 computers have one light (on when power is on) and two front panel switches: RESET and POWER. The switches work as follows:

- RESET switch. Pressing this to SYSTEM resets the CPU; *don't do it if AOS/VS is running.* Pressing this to CONSOLE has the same effect as a break sequence.
- POWER switch. This switch should be ON, unless you want to cut CPU power.

Typing the break sequence (CMD and BREAK keys, or BRK key, or BREAK key, depending on console type) gives the SCP control. Avoid typing the break sequence unless you must (as for an AOS/VS deadlock). You can disable break with the SCP CLI FLAGS command. It will stay disabled while power stays up or until you re-enable it. If you really need the SCP CLI, you can get to it by pressing the RESET switch to CONSOLE.

If you find the *SCP-CLI>* prompt on the system console when AOS/VS is running, you can return control to AOS/VS by typing TTY ⤵. For example,

```
SCP-CLI>     TTY ⤵
⤵
)
```

In the normal course of system operations, you don't need any panel switches. To cut CPU power, press POWER OFF. To power up, press POWER ON. Otherwise, avoid touching the switches unless you must force shutdown.

MV/7800, MV/7800 C, MV/7800 XP, and MV/7800 U Front Panels

Figure 6-4a shows the MV/7800, MV/7800 C, MV/7800 XP, and MV/7800 U front panels.

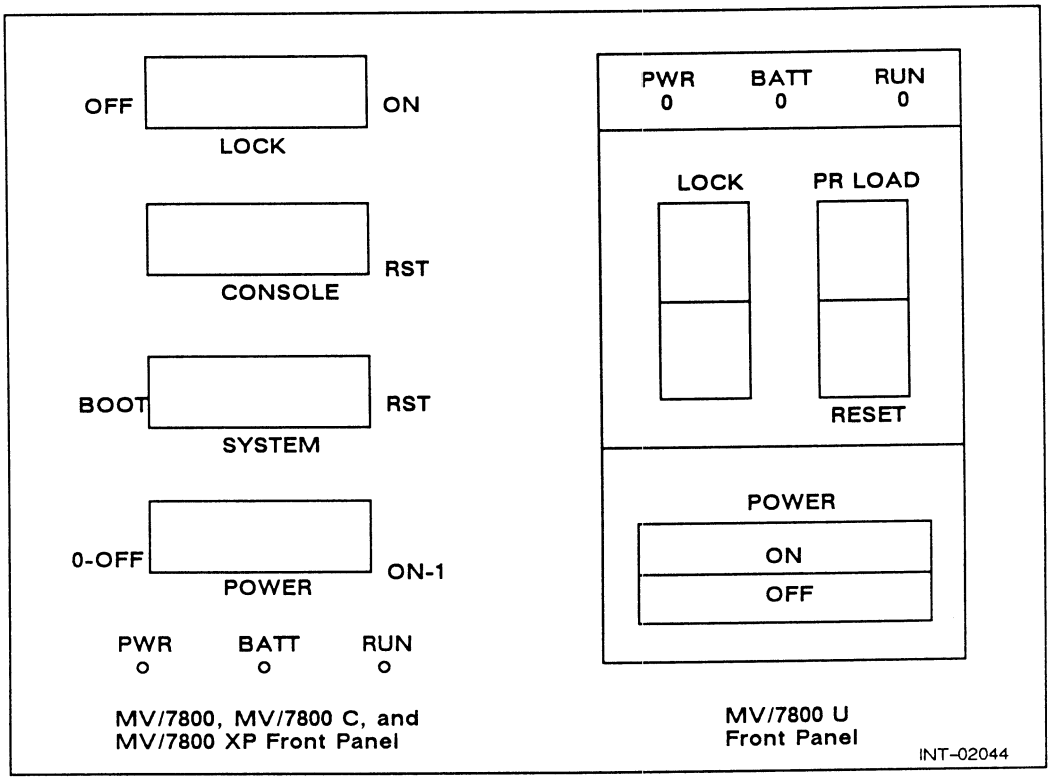


Figure 6-4a. ECLIPSE MV/7800, MV/7800 C, MV/7800 XP and MV/7800 U Front Panels

MV/7800 computer front panels differ, depending on the model. All have three front panel lights: PWR, BATT, and RUN, and three or four rocker switches. The lights work as follows:

PWR light	lit when dc power is normal; off when power is off or the computer is under battery backup.
BATT light	lit when computer has transferred from normal power to backup battery.
RUN light	lit when the computer is executing instructions (AOS/VS, diagnostics, etc.); off when the computer is halted.

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When the computer is running AOS/VS on normal power, the PWR and RUN lights are lit. When the PWR switch is off, all lights are off. Blinking lights indicate a fault. See *Starting ECLIPSE MV/7800™ Series Computers* for what to do if they are blinking.

ECLIPSE MV/7800, MV/7800 C, and MV/7800 XP computers (on the left) have four front panel rocker switches: LOCK, CONSOLE, SYSTEM, and POWER. The *cabinet* power switch above these (not shown), must be set to the ON position to provide cabinet power; we suggest that you leave this switch on and use device switches to control power.

ECLIPSE MV/7800 U computers (on the right) are upgrades of S/120 and S/140 computers. They have three front panel rocker switches: LOCK, PR LOAD/RESET, and POWER.

On all machines, the *panel* switches work as follows.

- LOCK switch. In the ON or LOCK position, the LOCK switch disables the CONSOLE switch, the SYSTEM switch, the PR LOAD/RESET switch, and the break sequence.

  LOCK in the ON position enables transfer to the backup battery (if any) if outside power goes down. The LOCK switch also tells the hardware to program load from the preselected device code (usually 24 or 27) when power is turned on. You must turn the LOCK switch off to turn power off with the rocker switch, enable the break sequence, or bootstrap from a device other than the one selected with jumpers. *Keep LOCK in the ON position unless you want to do one of these things.* (The LOCK switch does not disable the *cabinet* POWER OFF switch.)

- CONSOLE switch. Pressing this switch to the RST position on an unlocked computer halts the CPU and gives control to the SCP. AOS/VS, if running, is frozen. To have AOS/VS continue, type CONTINUE ⤵. Avoid using this switch unless you really need the SCP CLI.

- SYSTEM switch. Pressing the SYSTEM switch to the BOOT position tells the SCP to display the Automatic Program Load Menu on the system console. SYSTEM BOOT has no effect if the CPU is running (as when AOS/VS is running). Pressing the SYSTEM switch to the RST position resets the computer, if unlocked. *Don't do this if AOS/VS is running.*

- PR LOAD/RESET switch. Pressing this switch to the PR LOAD position loads from the preselected device code. Pressing this switch to RESET resets the computer if it is unlocked. *Don't do this if AOS/VS is running.*

- POWER switch. This switch should be in the ON position, unless you want to cut CPU power.

If you find the *SCP-CLI>* prompt on the system console when you thought AOS/VS had control of the system, you can return control to AOS/VS by typing CONTINUE ⤵.

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Data General DS/7000-Series and MV/2000 DC Front Panels

Figure 6-5 shows the Data General DS/7000-series and MV/2000 DC front panels.

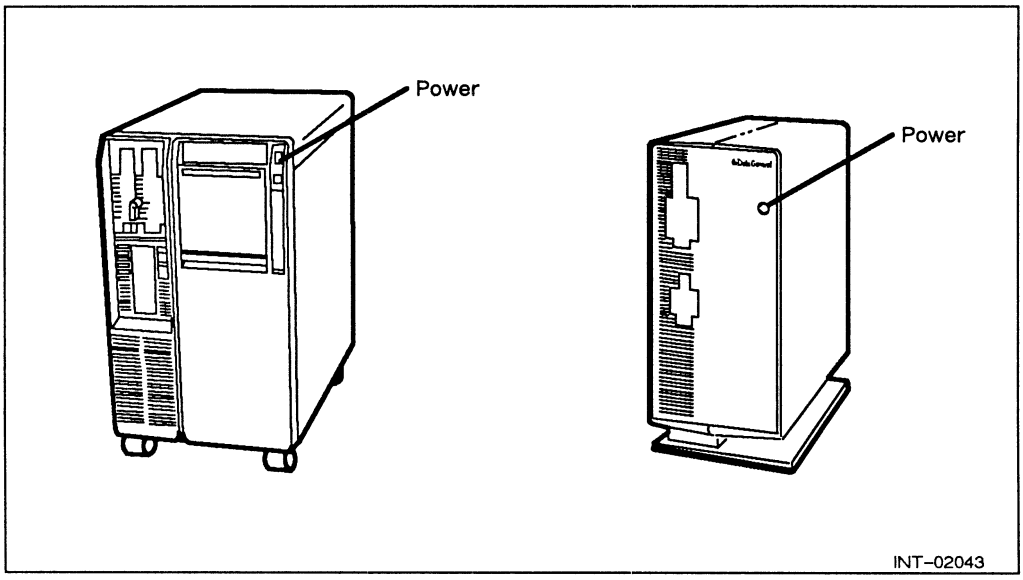


Figure 6-5. Data General DS/7000-Series and MV/2000 DC Front Panels

The Data General DS/7700 computer front panel has an on/off rocker switch for power and a digital display for fault codes. A light near the power switch glows when power is on.

The Data General DS/7500 and MV/2000 DC front panels have an on/off button switch for power. A light within the button glows when power is on.

On both machines

- The power switch controls power to the computer and all devices in the cabinet, including disk, diskette, and/or tape units. (Disk, diskette, tape, and other I/O devices are controlled by an integral 80186 processor.) When you turn power on, the computer displays an automatic program load menu, which allows you to specify the startup device (code), run diagnostics, and other things. If you do nothing, or select the default choice, the main processor tries to program load from the preset device code. Usually, when you've reached this point, the device code will already be preset to the device code of the hard disk, 24 — and the AOS/VS bootstrap program will be loaded from the hard disk.
- Powerup diagnostics test every PC board in the system; the test messages, followed by *PASSED* messages, appear on the system console. If a fault occurs on power up, the digital display (DS/7000 only) or system console will indicate an error condition (fault code or partial powerup *TEST* message). To interpret the error indicator, consult the System Control Processor (SCP) manual supplied with the computer.

In the normal course of system operations, you don't need the power switch. To cut CPU power *after shutdown*, press the power switch to the 0 (off) position. To power up, press the switch to the 1 (on) position. Otherwise, avoid touching the power switch.

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Cold Start, Computer Power Off, MV/7800-Series Computers

1. Make sure the system console is on and on line. Make sure that the disk(s) you want to use are on, started (for removable disks), and write-enabled. Each unit's READY light must be lit.

2. Press the computer LOCK switch to LOCK unless you want to cold start from magnetic tape. LOCK is a two-position rocker switch; you can see whether it's in LOCK or unlock.

3. Turn the computer POWER switch on. The POWER switch light should glow.

4. Now, the computer does some powerup tests. When these succeed, the system console displays

   ** *POWERUP TESTING COMPLETED* **

   (If this entire message doesn't appear, try again: set LOCK switch to unlock, power OFF, LOCK switch to LOCK, power ON. If you still get only a partial message or if you get the message ** *POWERUP TESTING FAILED*, consult the manual *Starting ECLIPSE MV/7800™ Series Computers* for what to do.)

   After successful powerup, the system displays the Automatic Program Load Menu:

   date *time*

   Automatic Program Load Menu

   1 Continue immediately with preset values.
   2 Change preset values.

   Loading with preset values will continue automatically unless you respond within 45 seconds.

   The default device is dd.

   Enter choice [1]:

5. The default choice (1) has the hardware continue with AOS/VS startup, using preset values for startup device, date, time, and time-out delay. You can change a preset value by typing 2 ↵; then working from another menu (described later in this chapter, in the section "Changing Automatic Program Load Preset Values." You must type 2 ↵ and select 3 "Load from different device" if you want to load from a device other than the one specified by code dd; for example if you want to start from tape (device code 22).

   Generally, you'll want to start from the default dd. To do so, press ↵ or wait out the time-out delay (original default 45 seconds). The hardware reads the default startup device and loads the disk bootstrap, which in turn loads the SYSBOOT program. SYSBOOT displays the Operating System Load Menu:

   Operating System Load Menu

   1 Continue immediately with operating system load
   2 Enter the Technical Maintenance Menu
   ...
   The default operating system pathname is xxx
   ...
   Enter choice [default]:

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6. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you through the Technical Maintenance Menu to FIXUP.)

   To take the default, press ↵ or wait out the time-out delay (original default is 45 seconds). To avoid the default, perhaps to change the default system or shorten SYSBOOT's time-out delay, skip ahead to the next numbered step in this section.

   SYSBOOT now loads microcode from the default microcode file, MV7800.MCF. This may take up to a minute. Then SYSBOOT loads AOS/VS. There's a pause, and the system console displays *AOS/VS REV n* and a question. Skip ahead to the section, "Initializing AOS/VS — All Computers."

   (If FIXUP is needed, SYSBOOT displays the Technical Maintenance Menu. Press ↵ for the default choice or wait out the time-out delay. SYSBOOT loads microcode from the default microcode file, which takes a minute or so; then loads FIXUP. The system console displays the FIXUP banner. If a default script filename has been identified to SYSBOOT, FIXUP runs automatically. Otherwise, FIXUP will ask questions. The FIXUP section later in this chapter can help you answer these questions or create a script file to run FIXUP automatically.)

   If an error occurs during any of these operations, control goes to the SCP. Press the SYSTEM switch to RST (or press the PR LOAD/RESET switch to RESET), and return to step 4.

7. To avoid the default choice, type 2 ↵. SYSBOOT then displays the Technical Maintenance Menu. On the Technical Maintenance Menu, make the choice you want (like a new default system or shorter time-out delay).

   After changing defaults on the Technical Maintenance Menu, you can continue loading the default operating system by selecting choice 1. SYSBOOT will then load microcode and the default system as above. Details on changing defaults using SYSBOOT's Technical Maintenance Menu appear later in the section, "Changing Operating System Load (SYSBOOT) Defaults."

   If an error occurs during any of these operations, control goes to the SCP. Turn power off and on again and return to step 1.

Cold Start, Computer Power Off, DS/7000-Series Computers

See the cold start section on MV/2000 DC computers.

Cold Start, Computer Power Off, MV/6000 Computers

1. Make sure the system console is on and on line. Make sure that the disk(s) you want to use are on, started (for removable disks), and write-enabled. Each unit's READY light must be lit.

2. Press the CPU LOCK switch to LOCK unless you want to cold start from magnetic tape. LOCK is a two-position rocker switch; you can see whether it's in LOCK or unlock.

3. Turn the CPU POWER switch on. The POWER lamp should light.

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4. Now, EPROM code in the SCP does some powerup tests. When these succeed, the system console displays

   POWER UP TESTING COMPLETED

   (If this entire message doesn't appear, try again: set LOCK switch to unlock, power OFF, LOCK switch to LOCK, power ON. If this doesn't help, consult Table 17-5, "MV/6000 Powerup Faults (Partial Powerup Message)."

   The SCP reads the startup device and loads the disk bootstrap, which in turn loads the SYSBOOT program.

4a. If your system disk was formatted as part of a multiple-disk LDU by a Revision 6.00 Disk Formatter, then the first time you start AOS/VS, SYSBOOT will prompt you to *Specify each additional disk in the LDU.*

   Specify each disk unit name (for example, DPF1 ↵) and default or specify the device code until you've described all disks; then press ↵. SYSBOOT then loads microcode and the system (or FIXUP) as described next. In future, SYSBOOT will skip these questions unless all disks in the LDU aren't on line at startup.

   Then, SYSBOOT displays

   Operating System Load Menu

   1 Continue immediately with operating system load
   2 Enter the Technical Maintenance Menu
   ...
   The default operating system pathname is xxx
   ...
   Enter choice [default]:

   (If you turn power on when the LOCK switch is unlocked, no menu is displayed. Instead, it asks *BOOT DEVICE* and you must enter the two-digit device code of the device you want to boot from; for example, 22 ↵ for tape or 27 ↵ for a DPF-type disk. The first blocks on the device must contain the appropriate bootstrap (tape or disk). The device must contain the SCP-OS and needed microcode; and it must include a program to load SCP-OS and microcode. All these conditions are true for the MV/n system tape you received from DG and for your master LDU.)

   (If the LOCK switch is in the ON position and nothing happens, consult Chapter 17.)

5. Generally, you'll want the default choice 1 "Continue ..." with the load of operating system xxx. (If the default choice is 2, this means AOS/VS wasn't shut down normally. You must run FIXUP. SYSBOOT defaults will lead you to FIXUP through the Technical Maintenance Menu.)

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Initializing AOS/VS — All Computers

The system console shows

AOS/VS Rev n

Master LDU: name (*name* as given to the Disk Formatter)

Date (MM/DD/YY) ?

If your computer has a battery-powered clock (boot clock), AOS/VS can get the time and date from this clock. If so, AOS/VS will skip the *Date* and *Time* questions and ask *Override default specs?* (see item 3 below). (But if the boot clock isn't running or its battery is exhausted, AOS/VS *will* ask the date and time questions.) Having the date and time supplied automatically is a convenience, but check to make sure they're correct when the AOS/VS CLI displays its banner on the system console. Computers with boot clocks include MV/20000, MV/15000, MV/7800, DS/7000-series, MV/1400 DC, and MV/2000 DC systems.

(If you see a message starting with *WARNING:SYSTEM PATCH AREA CONTAINS NO PATCHES*, continue bringing up AOS/VS — but, immediately, install patches as described in Chapter 4. Patches are extremely important. Unless you apply them, your system may crash repeatedly.)

1. It's *very* important that the date and time be correct. (You can fix them if needed, via the DATE or TIME command, after the CLI comes up.) Type the date as numbers for month, day, and year. Spaces or slashes can separate numbers. For example, for May 30, 1986, type

   5 30 86 ↵

   Time (HH:MM:SS) ?

2. Type the time, based on a 24-hour clock, in hours, minutes, and seconds. (Minutes and seconds are optional. If you omit them, the system sets each to 0.) Use spaces or colons to separate each number pair. For example, for 2:35 p.m., type

   14 35 ↵

   Override default specs [N] ?

3. *Specs* means the parameters in the system specification file created during VSGEN. These parameters include the following.

   - *Number of buffers in cache* (number of system buffers).
   - *Swap directory definition* (swap file size or device).
   - *Page directory definition* (page file size or device).
   - *Initial load* (used when you are installing a new revision of AOS/VS on this LDU).

   For more information, see the section in Chapter 4, "Parameters for the System."

   If you wish to override any default spec, answer Y ↵; the system will then ask about each one and you can take the default or specify a new value. In most cases, though, you will not want to override the default specs, so you will press

   ↵

   A pause occurs here, then

   AOS/VS CLI REV n date time
)

   The master CLI, process ID (PID) 2, is running.

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NOTE: If the date or time is wrong, fix it now, with the DATE or TIME command, before bringing up the multiuser environment. (On computers with boot clocks, the CLI commands DATE and TIME also set the boot clock's date and time.) Changing date or time while EXEC is running can confuse EXEC as it tries to keep track of user log-on time. Also, if you run the system log (SYSLOG), changing the time after you start logging may produce wrong account information. For these reasons, you should never change the date or time while the multiuser environment is running. Bring the environment down first.

It is possible, via VSGEN, to have the master CLI execute a command file automatically when it starts up. A likely candidate for auto execution is your UP.CLI macro. If the UP macro is executed automatically, then

- you must ensure that all printers are on and on line before bringing up AOS/VS;
- you must take extra care to type the correct date and time when you initialize AOS/VS; and
- you can skip the next two steps.

4. Make sure that all your line printers are on and on line, with paper aligned.
5. Bring the multiuser environment up by running your tailored UP macro:

```
) UP ↵
Pid n
... (EXEC messages) ...

... (Messages you may have put in UP.CLI) ...
)
```

6. Make sure the CPU LOCK switch (if any) is in the locked position. Or, on an MV/20000, press the DISPLAY switch if the other switches are lit.

EXEC and the multiuser environment are up; users can log on; and you can bring up other processes and/or issue EXEC and CLI commands (described in Chapter 8, "EXEC and User Processes" and Chapter 9, "Other Runtime Tools") as needed.

If you have a multiple-processor system like an MV/20000 Model 2, your UP macro should have initialized the second processor via the CLI command JPINITIALIZE. JPINITIALIZE is described in Chapter 9.

Figure 6-9 shows the steps taken by all parties to bring the whole system up. Later in the chapter, Figure 6-10 summarizes cold startup and normal shutdown for computers other than MV/8000s; Figure 6-11 does the same for MV/8000 computers. And, there is handy startup/shutdown reference card you can consult.

Changing Automatic Program Load Preset Values on MV/20000, MV/15000, MV/7800, DS/7000-Series, MV/2000 DC, and MV/1400 DC Computers

MV/20000, MV/15000, MV/7800, DS/7000-series, MV/2000 DC, and MV/1400 DC computers have automatic program load menus built into hardware (EPROM code). Via a menu, you can change any or all of the following preset values:

- date and time (maintained in the boot clock and passed to AOS/VS)
- startup device
- default startup device
- time-out delay

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To change any of these values except date and time, you must first power down the computer. (Make sure AOS/VS is shut down first.) Then turn power on again. (The boot clock date and time can also be changed by CLI commands DATE and TIME.)

The hardware will display the Automatic Program Load Menu. Type 2 ↵ before the default time-out delay expires. (Startup continues automatically after the delay expires, giving SYSBOOT control. Changing SYSBOOT defaults is explained later on). The hardware will then display the Change Preset Values Menu. Depending on your machine and options, there may be up to nine choices. You may not see nine choices. All possible choices follow.

1 Continue the powerup
2 Change the system date or time
3 Start from a different device
4 Change the default device
5 Change the time-out delay for the Automatic Program Load Menu
6 Enter the SCP CLI
7 Change the system console (DS/7700 or DS/7500)
8 Select diagnostics sequence (DS/7700 or DS/7500)
9 Configure parallel printer port

The following sections explain how to change the system date or time (choice 2), start from a different device (choice 3), change the default device (choice 4), change the time-out delay (choice 5), access the SCP CLI (choice 6), change the system console to a graphics console (choice 7), run abbreviated diagnostics (choice 8), and configure a parallel printer port (choice 9).

Changing the System (Boot Clock) Date or Time

The battery-powered boot clock maintains date and time even while power to the computer is off. At startup, AOS/VS asks this boot clock for the date and time; if the boot clock responds, AOS/VS uses its date/time for its own real-time clock. Also, SCP log settings (not vital) depend on this clock. Thus, the boot clock's settings can be very important. (However, setting the AOS/VS clock with the CLI commands DATE and TIME also sets the boot clock, so setting it from this menu isn't essential.)

In any case, you can set the boot clock via choice 2 on this menu. Then, the system displays

Date [DD-MMM-YY]:

Type the correct date — numbers for day and year, three letters for the month. Or, if you don't want to change the date, press ↵. For example, to specify July 23, 1986:

Date [22-JUL-86]: 23-JUL-86 ↵

On MV/7800 computers, the date format is MM-DD-YY rather than DD-MM-YY. So, for these computers, to specify July 23, 1986, you'd type 07-23-86 ↵.

Then it displays

Time [HH:MM:SS]:

Type the correct time, using a 24-hour clock. Or, if the time is correct, press ↵. For example, to specify 2:15 p.m.:

Time [14:10:00]: 14:15:00 ↵

Next, it displays

Offset to GMT [+0:00]:

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"Offset to GMT" (Greenwich Mean Time) has meaning only if your system will communicate with another computer system in a different time zone. To specify no offset — skip the issue — press ↵. Otherwise, find out the number of hours (and fractions of an hour, if this applies) from Greenwich Mean Time. Then type the number of hours and minutes to add (+ or -) to local time to equal Greenwich Mean Time. For example, if you're in New York City during Eastern Daylight Time, type

Offset to GMT [+0:00]: -5:00 ↵

After answering this question, you will return to the Change Preset Values Menu.

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Starting From a Different Device

If you want to load from a device other than the default device — for example, to start from tape — you must select choice 3 from the Change Preset Values Menu.

The tape (file 0) or disk(ette) (blocks 0 and 1) must have a loader bootstrap; a disk(ette) also must have a bootstrap program (SYSBOOT). The tape or disk(ette) must be on unit 0 of the pertinent controller. And, the tape or disk(ette) unit must be on, on line, and ready.

When the tape or disk(ette) is ready, choose option 3 from the Change Preset Values Menu. On DS/7000-series and MV/2000 DC systems, it displays

Start from a Different Device

1. Hard disk
2. Diskette
3. Tape
...
Start from which device? [1]

Choose the device you want. After you type a valid number and ↵, the hardware tries to program load from the device. If you made a mistake and the device isn't on line, turn power off and on again and retry.

On an MV/20000, it asks

Boot from what device? [dd]

On an MV/20000, *dd* is the two- or three-digit device code (if three, the first digit is the IOC channel number: 0, 1, or 2). Most devices you boot from are on the first IOC; if so, specify channel 0. On an MV/20000, the default device code of the tape unit is 22 (for an MTB tape unit) or 62 (for an MTD unit). For other computers that have automatic program load menus, the tape device code is usually 23. For example, to start from an MTB tape unit:

Boot from what device? [24] 22 ↵
Channel number? [0] ↵ (Asked only for MV/20000s with multiple IOCs)

If the device you want is on the second IOC, specify channel number 1; on the third IOC, specify channel 2. For example, to start from MV/20000 device code 124 (a DPJ disk on the second IOC), the sequence might go

Boot from what device [24] ↵
Channel number? [0] 1 ↵

When you've finished specifying the device with the "channel" question, the hardware tries to start from the device. If you made a mistake, turn power off and try again.

Changing the Default Device

When your first system was built, we recommended setting the default device. If you ever want to change the default device, select choice 4 from the Change Preset Values Menu. The system will run through the same dialog as in the previous section; then the Change Preset Values Menu will return.

Generally, the default device should be your system disk ("Disk" for DS/7000-series and MV/2000 DC systems, device code 24 — or possibly 27 — for MV/20000 systems). Don't make the default device anything but the system disk unless you *must*.

Changing the Time-out Delay

After you've cold started your computer a few times, you may want to shorten the time-out delay before the hardware loads from the default device (loading SYSBOOT, which displays the Operating System Load Menu). To change the delay, select choice 5 from the Change Preset Values Menu. The system prompts

Time-out delay (in seconds) for the Automatic Program Load Menu [45]:

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Microcode Filenames

Microcode is the heart of your MV/Family computer. It's essential that the correct microcode for your system be loaded. SYSBOOT does this load on a cold start — you specify the default name using a SYSBOOT Technical Maintenance Menu.

Correct microcode for your system was supplied on the MV/n tape or diskette shipped with the system. You'll receive periodic updates if you belong to the Microcode Subscription Service. Table 6-3 shows the correct filenames for all MV/Family machines.

Table 6-3. ECLIPSE MV/Family Default Microcode Filenames

CPU Name	Hardware Floating Point Option	Other Options	No Options
MV/20000	MV20000.MCF	Doesn't apply	MV200000.MCF
MV/15000 Model 8	Not available	Doesn't apply	MV15000_8.MCF
MV/15000 Model 10	Not available	Doesn't apply	MV15000_10.MCF
MV/15000 Model 20	Not available	Doesn't apply	MV15000_20.MCF
MV/10000 SX	MV10000SX.MCF	Doesn't apply	Doesn't apply
MV/10000	MV10000.MCF	Doesn't apply	Doesn't apply
MV/8000 II	MV8000_IIFP.MCF	Doesn't apply	MV8000_II.MCF
MV/8000 C	MV8000_CFP.MCF	Doesn't apply	MV8000_C.MCF
MV/7800	Not available	Doesn't apply	MV7800.MCF
MV/7800 XP	Not available	Doesn't apply	MV7800XP.MCF
DS/7700	Doesn't apply	Graphics Instruction DS7700GIS.MCF	DS7700.MCF
DS/7500	Doesn't apply	Graphics Instruction DS7500GIS.MCF	DS7500.MCF
MV/8000 (file on diskette)	MV8000FP.MCF	Doesn't apply	MV8000.MCF
MV/6000	Not available	Doesn't apply	MV6000.MCF
MV/4000	MV4000FP.MCF	Doesn't apply	MV4000.MCF
MV/4000 DC	MV4000FP.MCF	Doesn't apply	MV4000.MCF
MV/4000 SC	MV4000FP.MCF	Doesn't apply	MV4000.MCF
DG DS/4000-series	MV4000FP.MCF	MV4000G.MCF * MV/4000GFP.MCF	MV4000.MCF
MV/2000 DC	Doesn't apply	Doesn't apply	MV2000.MCF

*With Graphics Instruction Set (GIS) alone, the filename is MV4000G.MCF; with GIS and hardware floating point, the filename is MV4000GFP.MCF

If microcode is loaded when you change the default, SYSBOOT *may not* load the new microcode, but may just bring up AOS/VS. You can make sure the new microcode is loaded by selecting choice 2, "Load and verify microcode," on the Technical Maintenance Menu.

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Normal Shutdown

Normal shutdown means orderly shutdown from an active multiuser system to the SCP CLI, and, optionally, to turning off power to devices.

These shutdown steps assume that EXEC is running and that multiple users are logged onto the system.

1. Send a message to all users indicating that the multiuser environment will be coming down. You could use the BROADCAST macro (Chapter 5) for this.

```
) SEND/2=1  @CON-  System coming down in 5 min. Please log off. ↓
or
) BROADCAST  System coming down in 5 min. Please log off. ↓
```

2. Use the EXEC PAUSE command to pause batch streams and spool queues; for example:

```
) CX  PAUSE ↓

) CX  PAUSE  @LPB ↓

)
```

3. Use the ? macro (Chapter 5) to verify that users are logged off. Use SEND (or BROADCAST) and ? until all users who stand to lose work are logged off. CLI users might not lose anything when you bring EXEC down (although they might be annoyed if they are not notified). People using text editors — and perhaps user processes running application programs — *will* lose work if you terminate EXEC, so you should try to get them out of their editors or programs before you do it. For example, type

```
) ? ↓

PID:        1 PMGR        PMGR       :PMGR.PR
PID:        2 OP          OP         :CLI.PR
PID:        3 OP          EXEC       :UTIL:EXEC.PR
PID:        4 JACK        CON4       :CLI.PR
PID:        5 SALLY       CON5       :CLI.PR
PID:        6 SALLY       006        :UTIL:SED.PR
  ...
PID:          20 OP       CON20      :CLI.PR

) SEND  @CON-  System coming down in 2 min. Please log off now. ↓
 or
) BROADCAST  System coming down in 2 min. Please log off now. ↓
) ? ↓

PID:        1 PMGR        PMGR       :PMGR.PR
PID:        2 OP          OP         :CLI.PR
PID:        3 OP          EXEC       :UTIL:EXEC.PR
PID:          20 OP       00020      :CLI.PR
)
```


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Chapter 7
About the PREDITOR Profile Editor

Read this chapter

- when you want to be more specific than in Chapter 5 about privileges for users on your system;
- when you want to understand the privileges that you can give or withhold from a user.

PREDITOR profiles, along with EXEC, provide the base for the multiuser environment. Profiles allow only authorized persons to use the system, without trespassing on other persons' or system files.

If you created your system's multiuser environment (described in Chapter 5), you already have some experience with PREDITOR. Chapter 5 described how to create a privileged operator profile and many general-purpose user profiles. As a base for the user profiles, the reader edited PREDITOR's default profile, then used the new default values as a basis for each user profile.

This chapter describes all PREDITOR commands — alphabetically. These commands allow you to create, edit, delete, and rename profiles, among other things. For ease of use, this chapter duplicates some of the material in Chapter 5. The major sections are

- About PREDITOR
- BYE Command
- CREATE and EDIT Commands, with Comments on Disk Space Control
- DELETE Command
- HELP Command
- LIST Command
- QUESTION Command
- RENAME Command
- USE Command
- PREDITOR Error Messages

If you want to create a system for C2-level security, you must severely restrict certain user privileges. For more information about privileges in a C2-level system, see Chapter 16.

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About PREDITOR

The PREDITOR program file, PREDITOR.PR, is in directory :UTIL. It is a privileged program: only users with Superuser privilege can run it, but they do not need to turn Superuser on in order to execute PREDITOR.

When it starts up, PREDITOR checks to see if the user directory directory (:UDD) exists. If :UDD does not exist, PREDITOR creates it. Then, for every user profile you create, PREDITOR creates a user directory in :UDD, and the system creates a profile in the user profile directory, :UPD. The user directory and profile have the username you gave to PREDITOR. When you delete, edit, or rename a profile, PREDITOR makes the appropriate changes in file :UDD or has the system change the profile in :UPD.

When a person tries to log on to a console, or submits a batch job, EXEC checks the profile before it creates a user process to serve that person. If there is no valid profile, EXEC rejects the user or job. If there is a valid profile, EXEC creates a user process with the privileges defined in the profile. While the user process runs, it can exercise only these privileges. Thus, profiles are central to multiuser system operation.

User Access Control List

When you create a new profile or rename an old one, PREDITOR sets the Access Control List (ACL) of the user directory to username,OWARE. This ACL gives the user *all* access privileges to the directory. No one else, except a superuser, can access it at all. This gives the user privacy, security, and unique access to all files and directories that he or she may create.

Executing PREDITOR

PREDITOR is in directory :UTIL, so, unless the working directory is :UTIL, your search list must include :UTIL. (The UP macro does this for the master CLI and its sons, so you need not do it if the multiuser environment is up.)

To execute PREDITOR, type

```
) XEQ    PREDITOR ⤸
```

AOS/VS User Profile Editor Rev n date time

Command:

PREDITOR is ready for a command.

If you want to change an answer that you previously gave to PREDITOR, press the uparrow cursor control key ↑ or type ^ (press SHIFT and the 6 key) until you reach the bad entry. Then type the desired answer and proceed. For example,

Use IPC [No] (Y, N, or NL)	Y ⤸	Type answer.
Use console: ↑		Press uparrow to correct previous entry.
Use IPC [Yes] (Y, N, or NL)	N ⤸	PREDITOR backs up and you change it.

If — at any point — you want to return to the *first* PREDITOR question, press CTRL-C CTRL-A.

Usernames, Passwords, and Network Access

This section is similar to the section of the same name in Chapter 5. It's repeated here for your convenience.

The username you specify for each user is important. The username is the only trace to the person who's responsible for the account. Usernames persist over long periods of time; they are not often changed (although PREDITOR does have a command to rename a profile).

Generally, your system should have a unique username for every person; more than one user should not use a single account. If, for any reason, you want to place a set of users in a group, think up a special identifier (like a suffix) for the usernames and make the identifier part of each username. Username groups are further explained in Chapter 16.

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Chapter 8
EXEC and User Processes

Read this chapter

- when you want to learn about the EXEC program or any of its commands;
- when you want to learn how user logon, batch, or device queues work;
- when you want to learn how to handle user tape mount and dismount requests.

The EXEC program, located in :UTIL, supervises the AOS/VS multiuser environment. EXEC manages user logon and logoff, batch processing, printer queues, and user mount requests. You can perform many of these functions with System Management Interface (SMI) menus. If you do use the SMI, see *Using the AOS/VS System Management Interface (SMI).*

This chapter describes the EXEC commands that you can issue from the CLI. To ensure that you can issue every EXEC command from the CLI, you must be logged on with the same username as EXEC's father process, usually OP.

Selected users can issue particular EXEC commands for a queue or device if you give them ownership of the queue or device. In this way, users can help with some of the tasks of system management, such as controlling printers. (And sharing system tasks or responsibilities in this way won't compromise system security.) The ACCESS command, described in the "EXEC Commands" section of this chapter, describes how to give users ownership of queues and devices.

This chapter tells all about EXEC — its functions, commands, and operator and user messages. The major sections are

- What EXEC Does
- Creating and Terminating the EXEC Process
- Pertinent CLI Commands
- EXEC Command Overview
- General Commands to EXEC
- About User Log On
- About Batch
- About Spooling
- About User Tape Mount Requests
- EXEC Commands — Listed Alphabetically
- EXEC Messages

Appendix B, near the end of this book, is a concise, alphabetical summary of all EXEC commands. There's also a reference card of EXEC commands.

What EXEC Does

When it is running, EXEC can do the following things.

1. Log users on and off. When a user tries to log on, EXEC checks for a valid profile. Then, if the username and password that the user types match those in a profile, EXEC creates a user process, with parameters defined in the profile, for that user. When the user process terminates, EXEC logs the user off.
2. Manage batch and spool queues. EXEC maintains a batch input, list, and output file for each batch request; it has a minimum of four batch streams to handle batch requests. (You can create additional batch input queues and batch streams.) EXEC also spools output to devices like line printers. Users queue batch and printing requests with CLI Q-series commands — and EXEC manages them with little or no operator intervention.
3. Gather and display queue status information.
4. Help manage user requests to mount and dismount tapes on tape units.

EXEC has commands that control all these functions. But usually — after the UP.CLI macro brings it up — EXEC runs practically by itself. All the EXEC files are in directory :UTIL. These include

- program file, EXEC.PR;
- line printer manager program, XLPT.PR;
- forms control utility, FCU.PR;
- queue conversion and cleanup program, QCMP.PR;
- card reader program, STACKER.PR.

The system expects to find EXEC files in directory UTIL, so don't move them.

Creating and Terminating the EXEC Process

The UP.CLI macro includes the CLI PROCESS command that creates EXEC and EXEC commands to enable consoles and start queues. You can type or print file :UP.CLI to see them. But, for completeness, we will show the PROCESS command here. It is

PROCESS/DEFAULT/DIRECTORY=@/NAME=EXEC EXEC *[/SUPPRESS]*

where

PROCESS	is a CLI command that creates a new process (just as XEQ does, but PROCESS is more versatile).
/DEFAULT	Gives the new process all the privileges of the father process. The father is nearly always the master CLI, PID 2, which has the PREDITOR privileges that EXEC needs.
/DIRECTORY=@	Makes the peripheral directory (:PER, shorthand @) the home directory of the EXEC process. This is necessary because all the device entries EXEC needs are in :PER.
/NAME=EXEC	Gives the EXEC process the simple process name EXEC so that the system can access it by this process name. If you don't give EXEC this process name, other system processes, such as SVTA, will not come up.
EXEC	is the program name to execute; here, EXEC.
/SUPPRESS	tells EXEC to suppress status messages. (EXEC continues to send serious messages and operator messages to the current operator's console.) /SUPPRESS is like EXEC's SILENCE command, but is even more inclusive. For example, /SUPPRESS inhibits even EXEC's *Ready* message.

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Table 8-3. EXEC Commands by Function

Function Category	EXEC Command	Brief Description
Batch/ Spool	ACCESS	Specifies user access to queues and devices.
	ALIGN	Stops or continues the line printer (used to align it).
	BATCH_LIST	Sends default list files to specified list queue.
	BATCH_OUTPUT	Sends default output files to specified output queue.
	BINARY	Puts a letter-quality printer or line printer in binary mode.
	BRIEF	Tells EXEC to make batch or spool messages brief.
	CANCEL	Cancels a request that is waiting in a queue.
	CLOSE	Closes a device queue to user requests.
	CONTINUE	Continues a paused batch stream or device queue.
	CPL	Changes the maximum number of printed characters per line.
	CREATE	Creates a device queue.
	DEFAULTFORMS	Sets new printer CPL and LPP parameters.
	DELETE	Deletes a device queue.
	ELONGATE	Turns LP2/TP2 elongated printing on or off.
	EVEN	Turns even pagination on or off for a printer.
	FLUSH	Flushes (kills) an active batch or device request.
	FORMS	Specifies a file to be used for printer format control.
	HEADERS	Changes the number of printed header pages.
	HOLD	Holds (suspends) a batch or spool request.
	LIMIT	Enforces user- or operator-defined limits on CPU time (batch) or printed pages (spool).
	LPP	Changes the maximum number of printed lines per page.
	MODIFY	Modifies inactive queue entries.
	OPEN	Opens a device queue to user requests.
	PAUSE	Pauses one or more batch streams or devices.
	PURGE	Deletes entries in a stopped device queue.
	PRIORITY	Sets a new priority and/or type for batch streams and cooperative processes (XLPT).
	QPRIORITY	Sets a new range of batch/print priorities that will be accepted by a batch stream or device.
	RESTART	Restarts device queues after abnormal EXEC termination (batch restarts automatically).
	SILENCE	Suppresses all EXEC messages except user mount requests.
	SPOOLSTATUS	Displays queue-device association and status.
	STACK	Tells EXEC to accept batch jobs in stacked format.
	START	Associates a queue and device with a cooperative process.
	STATUS	Displays batch stream or device status.
	STOP	Dissociates a device from a queue (opposite of START).
	TRAILERS	Changes number of printed trailer pages.
	UNHOLD	Negates HOLD command.
	UNLIMIT	Negates LIMIT command.
	UNSILENCE	Negates SILENCE command.
	VERBOSE	Tells EXEC to make batch/spool messages verbose.
Mount	ALLOCATE	Restores a tape unit to the list of mountable units.
	DISMOUNTED	Tells EXEC that a person has physically dismounted a tape.
	MOUNTED	Tells EXEC that a person has physically mounted a tape on a unit.
	MOUNTSTATUS	Displays MOUNT and mount request status.
	OPERATOR	Tells EXEC that an operator is on or off duty.
	PREMOUNT	Tells EXEC that a person has physically mounted a tape before a MOUNT request occurred.
	REFUSED	Tells EXEC and a user that you refused the user's MOUNT request
	RELEASE	Removes a tape unit from the list of mountable units.
	UNITSTATUS	Describes the mount status of tape units.

(concluded)

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About User Log On

A console that's turned on and enabled by EXEC displays the log-on banner, which looks like this:

***** AOS/VS Rev n / Press NEW-LINE to begin logging on *****

Or it displays a tailored log-on screen. ("Tailoring the Log-on Screen" in Chapter 5 explains how to create one.)

To log on, a person presses NEW LINE on an enabled console; EXEC then prompts for a username and password. Users cannot log on under EXEC unless they have valid user profiles, created with PREDITOR. EXEC compares the username-password pair the user types in with the pair in the user's profile.

When — and only when — the person types a valid username and password, EXEC tells AOS/VS to create a user process for that person and logs the user on. The operating system uses the parameters in the profile when it creates the user process, and it enforces these thereafter.

Parameters in the profile include initial IPC file, program to be executed for the user, number of sons, Superuser, Superprocess, and System Manager specifications, and the amount of disk space allowed, among other things. All these issues are covered in the previous chapter.

The initial IPC file is often in the user's initial directory, where the user can edit it as desired. Another file — LOGON.MESSAGE — is in :UTIL; as each user logs on, EXEC automatically displays the first 512 characters of this file on each user's screen. Examples of creating initial IPC files and LOGON.MESSAGE are given in Chapter 5.

While the user process runs, EXEC records console use, pages printed, device time used for MOUNT requests, and privileged-user logons. It places this information in the system SYSLOG file if system logging is on. SYSLOG is different from EXEC's own log file.

When a user terminates his/her initial program (as by typing BYE ↵ to the CLI), EXEC terminates the user process; the console is then free for other users. Naturally, a privileged process like the master CLI or EXEC can terminate the user process whenever it wants, but this is unpleasant for the user and should be done only if necessary.

The user's screen displays

Process n terminated
Connect time H:MM:SS
User 'Username' logged off @CONn DD-MMM-YY HH:MM:SS

Log-On Errors

EXEC expects the user profile and user directory created by PREDITOR to be intact. If the user directory was somehow deleted, or its ACL changed, or if the profile was tampered with, the user may receive an error message and be advised to call the system manager.

Should this problem occur, run PREDITOR on the profile of this username. PREDITOR will then automatically rectify file problems. (But if the directory was inadvertently deleted, the user's files will need to be reloaded from backup media.)

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Log-On Commands

EXEC log-on commands are CONSOLESTATUS, DISABLE, ENABLE, and TERMINATE. These are summarized in Table 8-3 (earlier) and detailed in the alphabetical section, later in this chapter.

About Batch

The following subsections give some background on batch jobs and queues.

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At this point, you have two logical files, USERS and SYSTEM, on a three-volume fileset. If — later — you want to read a dumped disk file from file USERS, you'll need to start at the first volume. But if you want to read a dumped disk file from file SYSTEM, use the /SPECIFIC switch to avoid reading the first volume. For example, to retrieve file :UTIL:LINK_ERMES.CLI, you could type

```
*) DIR  : ↵
*) LOAD/V/SPECIFIC   @LMT:VOL2:SYSTEM    UTIL:LINK_ERMES.CLI ↵
... (EXEC prompts for VOL2 on the system console) ...
```

Then you mount and the system starts reading the specific volume VOL2. Doing it the other way would have required VOL1 to be mounted and read. The other way might look like this:

```
*) MOUNT/EXTEND/VOLID=VOL1/VOL=VOL2/VOL=VOL3   ZTAPE   Buster ↵
... (EXEC prompts for VOL1; tape is mounted and EXEC notified) ...

*) DIR  : ↵
*) LOAD/V  [!USERNAME]:ZTAPE:SYSTEM   UTIL:LINK_ERMES.CLI ↵
```

Here, the system would need to read through VOL1 before reading VOL2, which is where logical file SYSTEM begins.

This technique, with the /SPECIFIC switch, is useful only if your site does multiple writes (like multiple dumps) to the same tape fileset.

If you use DUMP/SPECIFIC to start a dump to a second logical file, use LOAD/SPECIFIC to load from that logical file.

Using the /SEQUENTIAL Switch

Usually, loading to or dumping from the next fileset on labeled tapes means waiting for the tape to rewind itself, and then advance to the "next" position.

You can save a lot of time by using the /SEQUENTIAL switch with DUMP/LOAD and DUMP_II/LOAD_II and labeled tapes. Using the /SEQUENTIAL switch lets you dump to or load from the next fileset on the tape without having to wait for the tape to rewind and advance.

To use this functionality, use the following format:

```
X LABEL unit volid
MOUNT/VOLID=volid linkname message
DUMP/SEQUENTIAL linkname:file# files or
LOAD/SEQUENTIAL linkname:file# files
```

The /SEQUENTIAL switch works only if you are dumping to or loading from the files in order. Using /SEQUENTIAL when trying to address a previous fileset on the tape will return an error message. In this case, you can dismount the tape, mount it again, and use /SEQUENTIAL. Or, you may simply prefer to omit the switch and let the drive rewind and advance the tape.

User Programs and Labeled Tapes

Users are not restricted to DUMP and LOAD with labeled tapes; user programs can also access labeled tapes. Such a program must open linkname:tape-file (if the user issued a MOUNT command before running the program). Or a program can open @LMT:volid:file, for an implicit mount. In either case, the program must open the tape file for either input or output, not both (this is true for all tape I/O). The program must write/read sequential fixed- or variable-length records; it cannot write/read data-sensitive or dynamic records.

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If users want to create their own labels, they should use the standard formats described in the *System Call Dictionary (AOS/VS and AOS/DVS)*.

Generally, the mount/dismount procedure will be smoother if users request explicit mounts via the MOUNT command before they run programs that need the volume(s). Implicit mounts can be tricky in such situations.

Using MOUNT and Label Tapes in Batch

Batch is ideal for large labeled tape dumps and loads. Users can queue such batch requests for a time when workload is light. However, labeled tape I/O *does* require that an operator be on duty — which anyone can ensure by applying the /OPERATOR switch to the QBATCH or QSUBMIT command. Such jobs will not start if the operator is off duty (EXEC OPERATOR OFF command).

If you, as the system operator, want to DUMP or LOAD via labeled tapes, you should log on to a user console and do it in batch. EXEC will prompt for tape volumes and help with tape I/O.

Figures 10-1 and 10-2, in Chapter 10, show backup macros shipped with AOS/VS that use batch.

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Mount/Dismount Summary and Pointers

- The CLI command MOUNT requests you, the system operator, to mount a tape. *A user process* must issue the MOUNT command, and you or a privileged user must be available to mount tapes (using the OPERATOR ON command). The user can regain the CLI prompt after issuing the MOUNT command by using the /NOPEND switch to the MOUNT command.
- Whenever you, as operator, see a ***Unit Mount*** or an ** *Explicit (or Implicit) Labelled Mount* ** message, you can get the (specified) tape, mount it on an idle tape unit, and type CX MOUNTED @unitname ⤶. Or you can refuse the request via CX REFUSED ⤶.
- If EXEC's response to a MOUNT request includes a volid, the request is for a labeled tape. You must find a tape with the specified volid, and mount it, or refuse the request. *Make sure that the volid is correct*; if you are uncertain, use TYPE @unitname ⤶ to verify the volid. If the request needs multiple volumes, you can eliminate some prompts by mounting all volumes needed (or as many as possible), then typing MOUNTED for the first volume and PREMOUNT for the others. Then EXEC will manage the tape volumes without operator intervention.
- You can use the LABEL utility to create tape labels, at any time — even when EXEC is prompting you.
- You can use EXEC's MOUNTSTATUS command or the CLI QDISPLAY command to keep track of mount requests. And you can use the UNITSTATUS command to see which tape units are mounted and premounted. (Suggestion: use EXEC's RELEASE command to remove tape units you don't have from the list of mountable units. See the RELEASE command later in this chapter.)
- If you get confused, or if EXEC seems unwilling to let go of a tape unit, you can always solve the problem by having the user who issued the request dismount it, cancel it with the CLI QCANCEL command, or log off. This prompts EXEC to sever all connections with the unit and all you need type is CX DISMOUNTED ⤶.
- Within any labeled tape fileset, writes must occur sequentially, from one volume to the next. If you set up multiple filesets with different linknames (e.g., TAPE1, TAPE2, TAPE3), then you can dump to each fileset simultaneously — saving time if you have multiple tape units. If you have only one fileset, you can dump to only one volume at a time.
- Any user (including yourself) can specify *more* volumes than needed for a tape write — e.g., a dump. When all specified material has been written to tape, the user DISMOUNT command will write an EOF trailer on the current tape volume. The fileset write will be complete and you can ignore "extra" volids specified.

  Or, any user can apply the /EXTEND switch to the MOUNT command. If so, if the user's tape I/O needs more tape volumes than the user specified, EXEC will prompt the operator to label another tape and mount it.

  But if a user specifies *too few* volumes, and omits /EXTEND, tape file space will be exhausted. No EOF trailer can be written; EXEC will display a *No More VOLIDS...* error message on the user's console; and the fileset will be incomplete. And — generally — the write must be redone from the beginning. This can be frustrating at the end of a 10-volume dump. So, generally, users should be generous in the volid lists, or they should use MOUNT/EXTEND, or both.
- A user can start a labeled tape read or write on a specific volume with the LOAD or DUMP command and /SPECIFIC switch. The mount can be explicit or implicit. If explicit (MOUNT/VOLID=...), the LOAD command must use the form @LMT:desired-volid:fileset-name (not tape linkname) to access the tape.

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ACCESS command (continued)

If you want to run a C2-level secure system, make sure the UP.CLI macro eliminates user access to the MOUNTQ before UP enables consoles. UP can do this via the command ACL @MOUNTQ OP,WR. Only user OP or a superuser will be able to post mount requests via the MOUNT command.

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OPEN

Opens a queue to users (opposite of CLOSE).

CX OPEN queuename

where

queuename is an existing spool queue you want to open.

The OPEN command opens queuename so that users may submit requests to it. You must create and open a queue before users can submit jobs to it. Use the CREATE and OPEN commands, respectively, to do this. Generally, an output queue must be started on a device, and the device must be continued, before users can use the queue successfully.

Users access a queue via CLI commands like QSUBMIT, QBATCH, QPRINT, QPLOT, QPUNCH, or QFTA. User programs can also access the queue by name via program OPEN, WRITE, and READ statements.

The first time EXEC is brought up, someone must open EXEC's BATCH_INPUT, BATCH_OUTPUT, and BATCH_LIST queue; and someone must create and open the print and possibly plotter and networking queues. This was covered in Chapter 5 and at the beginning of this chapter.

The CLI command QDISPLAY describes queues and their open and closed status.

Why Use It?

Each queue must be opened before it can be accessed; this is usually done the first time EXEC is brought up. Each time you create a new queue you must open it.

Also, if you close a queue for any reason, you must open it to make it accessible to users.

Example

```
) CX  OPEN  LQP ↵
) CX  START  LQP  @CON25 ↵
) CX  CONTINUE  @CON25 ↵
```

This sequence opens, starts, and continues the letter-quality printer queue, LQP, on the printer attached to line @CON25.

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OPERATOR

Tells EXEC that an operator is or is not available to handle MOUNT requests.

CX OPERATOR { ON / OFF } *[@CONn]*

@CONn is the name of the console to which EXEC sends messages, where *n* is the number of the console. If you omit @CONn, but specify CX OPERATOR ON, EXEC turns the OPERATOR command on at the system console.

An operator must be available (ON) for EXEC to process user mount requests or batch requests submitted with the /OPERATOR switch. If an operator is not on duty (OFF), EXEC holds the /OPERATOR batch requests in the queue until an operator is available (i.e., he or she types CX OPERATOR ON ↵).

When EXEC is brought up, the operator status is OFF.

You (and any user) can tell whether the OPERATOR status is on or off with the !OPERATOR pseudomacro. For example

```
) WRITE An operator is [!OPERATOR] duty. ↵
An operator is OFF duty.
)
```

If a privileged user issues the OPERATOR ON command while you are still an active operator, that person becomes the current operator. You will receive a message from EXEC stating that someone else has taken over operator responsibilities.

EXEC's OPERATOR command has no relation to the CLI command OPERATOR. The latter command enables the CLI to write and read labeled diskettes, described in Chapter 10.

Why Use It?

Some EXEC-controlled functions require a person in the role of system operator. For example, if a user requests a tape mount, someone must be available to mount the tape. The OPERATOR command tells EXEC that such a person is available.

If your system is to process user tape mount requests, or batch requests submitted with the /OPERATOR switch, you must issue the CX OPERATOR ON ↵ command. Later, if you leave your console and no one is available to handle such requests, issue the CX OPERATOR OFF ↵ command so that user requests will not wait in vain for operator service.

Example

```
) WRITE  [!OPERATOR ] ↵
OFF
) CX  OPERATOR  ON  @CON25 ↵
From Pid 3 : (EXEC) System Operator On Duty at @CON25
)
```

This command makes @CON25 the current operator console until the EXEC OPERATOR command is issued with a different console name, OPERATOR is turned off, or the system comes down.

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Process Environment Display (PED)

PED, the Process Environment Display program, displays information about the active processes running on your system. It is designed for DASHER CRT display consoles, but will also run on hardcopy consoles.

There are many different ways to invoke PED. The easiest way is simply to type

```
) PED ↵
```

which invokes the supplied macro PED.CLI, and gives you a display that looks like Figure 9-1.

```
PID USERNAME PROCESS  PROGRAM    ELAPS   CPU BS   SH7   US7   I/O   FTA   WSS
  1 PMGR     PMGR     PMGR       22/51  9:55       0     1   204   267   273
  2 OP       OP       CLI        22/51 34.14 B     17    12  2795  1641   127
  3 OP       EXEC     EXEC       18/06 26.05 B      1    28  3339  2213   284
  4 OP       LPB      XLPT       18/06 28.07 B      4     4  5331    93    61
  6 OP       00011    PED         2.00  0.09        20    86     0    76    83
  9 OP       CONO     LOCK_CLI   13/10  0.65 B     17     3   114   252   112
 12 SALLY    00012    SED         0:24  0.34        42    19    20    42    48
 14 JACK     00014    F77        20.00  0.37        14   364     9   122   118
 45 BEN      BATCH_IN CLI        12.01  0.81 B     18     2    38    85    55

PED Rev 07.00.00.00 Friday 23-May-86  4:15:52 PM DOC5 AOS/VS REV 7.00
```

Figure 9-1. Sample PED Display

By default, PED displays only active processes. In the example, the master CLI process (PID 2) is running EXEC, EXEC's cooperative XLPT process, PED, and LOCK_CLI. User Sally is running the SED text editor, Jack is compiling a FORTRAN 77 program, and Ben is using batch.

PED column heads have the following meanings.

PID	is the process ID;
USERNAME	is the username, first eight characters only;
PROCESS	is the system name for the program process; you can assign this by including /NAME= in the PROCESS command. Only the first eight characters are displayed.
PROGRAM	is the program filename (first 10 characters);
ELAPS	is the amount of time the process has existed. Abbreviations are defined next.
CPU	is the amount of CPU time used.
BS	means blocked, swapped to disk, neither (2 spaces), or both;
SH7	is the number of shared pages in ring 7 (the default ring for user processes);
US7	is the number of unshared pages in ring 7;
I/O	is the number of 512-byte disk blocks transferred via the data channel;
FTA	is the number of pages that had to be read from disk because they weren't in virtual memory (page faults). Page faults are an important indicator of program efficiency;
WSS	is the number of pages in the process' *working set* of pages in main memory.

By default, PED displays only those processes that have changed since the last screen update. The default screen cycle period is 10 seconds, but you can change this with runtime commands or the /CYCLE= switch; the minimum is 1 second. Or, you can update the display by striking any key other than a PED command key. The /ALL switch tells PED to display all processes, but in many systems all the PIDs won't fit on a screen.

The default PED display is useful in many situations. You can get a different display by using switches when you execute PED. While in a PED session, you can dynamically change the PED screen's display by pressing M (menu) and selecting different statistics for display. You can also issue runtime commands to PED.

PED is a HELP topic; any user can get help by typing HELP *PED ↵.

PED Switches

There are two types of PED switches: those that select process statistics for display, and those that set PED parameters. If you select statistics (e.g., /FTP), PED will display only those you select. The parameter group includes /ALL, /CYCLE=, /LISTFILE= and /MINPID=. If you use parameter switch(es), and no statistics switches, PED will display all statistics shown above.

You can abbreviate all switches to the shortest unique form. PED ignores ambiguous abbreviations and nonexistent switches.

The switch order is unimportant: PED always displays columns in a specific order, regardless of your switch sequence.

Switch	What It Displays or Does
/ALL	All PIDs; the default is active PIDs. On a CRT, active PIDs are bright, others are dim.
/BATCH	Runs PED in batch mode, freeing up your console. PED ignores runtime commands when you use this switch. Use /BATCH with /LISTFILE. For example,) PROC/DEF PED/BATCH/CYCLE=1/SNAP=10/LIST ↵
/BS	Blocked and swapped status.
/CLASSID	Class ID for each process. The column header is CID.
/CLASSNAME	Classname for each process. Classnames are created via the optional Class Assignment and Scheduling Package (CLASP).
/CPU	CPU time used (total).
/CPUS	Milliseconds of CPU used per second. Each unit is 0.1% of the total CPU time. For example, 500 means 50% of the total CPU time. The column header is CPS.
/CYCLE=n	Sets a cycle time of n seconds between updates.
/ELAPSED	Process' elapsed time.
/FATHER	Father process ID, under head FP.
/FLAGn	Flag word n, where n is 1 through 5 (the flag words contain process parameters, described under ?PSTAT in the *AOS/VS Programmer's Manual*).
/FTA	Page faults, sum of logical and physical.
/FTAS	Page faults, sum of logical and physical, per second.
/FTL	Page faults, logical.
/FTLS	Page faults, logical, per second.
/FTP	Page faults, physical.
/FTPS	Page faults, physical, per second.

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Switch	What It Displays or Does
/IO	I/O blocks (number of 512-byte blocks transferred to disk or tape).
/IOS	I/O blocks per second.
/IREC	Number of process' tasks that are waiting for an IPC message (are waiting on an ?IREC system call). The column header is IR.

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DISPLAY and File Comparison Utilities

The DISPLAY program can read any binary, ASCII or EBCDIC file — on tape or disk — and display it or write it to a listing file. DISPLAY is useful when you want to read a tape file without loading it; or when you want to see what an EBCDIC file looks like in ASCII; or when you want to see everything (including nonprinting characters) that a program wrote to a disk file. For example:

```
) XEQ DISPLAY @MTB0:0 ↵
) X DISPLAY MYPROG.PR ↵
*) X DISPLAY :SYSLOG ↵
) X DISPLAY/L=REAL_OUTPUT_FILE OUTPUT_FILE ↵
```

DISPLAY is a help topic. Anyone can get help on it by typing HELP *DISPLAY ↵.

FILCOM and SCOM are file-comparison utilities. FILCOM compares binary files; SCOM compares ASCII text files. These programs can be helpful when you want to see if two files differ, or how they differ. For example, if you have two revisions of a program and want to see if they differ, you'd use SCOM for the source file or FILCOM for the program file. For example

```
) DIR NEW_PROGS ↵
) XEQ FILCOM  MPROG_1.PR MPROG_2.PR ↵
... (Listing to console) ...
) XEQ SCOM/L=@LPT MPROG_1.SR MPROG_2.SR ↵
... (Listing to line printer) ...
)
```

The CLI manual gives a little more information on FILCOM and SCOM.

Event Logging with SYSLOG, the Error Log, and REPORT

SYSLOG, the system log function, records user information in file SYSLOG. It also records hardware errors in the system *error* log, ERROR_LOG. The REPORT program can produce reports from either log — even while the log file is open and logging is occurring.

While on, the system log records

- user account-related information, as gathered by AOS/VS and EXEC;
- XODIAC network information, as gathered by networking software and AOS/VS.

If you select full-detail logging, the log also records file access information, as gathered by AOS/VS and EXEC, to help you monitor the level of system security.

People and programs can write additional information to the system log file several ways:

- with the CLI command LOGEVENT. Any superuser can write messages into the log file with the LOGEVENT command;
- with the assembly language system call ?LOGEV (Superuser mode required), described in the *System Call Dictionary (AOS/VS and AOS/DVS)*.

Device error information, like entries for hard disk errors or ERCC memory errors, is *not* recorded in the system log file. Device errors are recorded in the error log file (pathname :ERROR_LOG). Error logging is always on (you cannot turn it off) to make sure error records will be available if needed. The error log includes information on hardware errors and AOS/VS errors like hangs or panics. You can rename the error file (which starts a fresh error log file), using a SYSLOG switch.

Other Log Functions

There are a number of other logging functions in MV/Family software. They include

- The SCP log. On computers that have an SCP CPU, the SCP-OS always logs certain kinds of hardware errors (all MV/Family computers except the 4000-series have an SCP CPU). The SCP log file is on diskette for MV/8000 systems; it is retained in SCP memory for other systems. Some — but not all — material from the SCP log is written into file ERROR_LOG. Generally, the AOS/VS error log will tell you what you need to know; you don't need the SCP log unless you're having problems. Reading the SCP log is described in Chapter 11.
- EXEC's log. EXEC has its own logging feature, described in Chapter 8. EXEC always writes user-relevant information to SYSLOG; so, in terms of user logging, you don't need EXEC's log if you use SYSLOG.
- The Common Logger. This is relevant if your system runs DG's INFOS II file management system. The Common Logger records database-backup information on tape. It has no relation to SYSLOG.
- XODIAC network logging. This is relevant if your system runs DG's XODIAC network system. Via CONTROL commands, you can direct networking processes like X.25 and LMGR (Link manager) to log network events. Each XODIAC log file is separate from SYSLOG; it is usually in directory :NET. SYSLOG records some — but not all — of the network events recorded in the XODIAC log file(s).
- Communications product logging. This is relevant if your system runs an IBM emulator like DG/SNA. These products have logging features similar to those of XODIAC; and SYSLOG records *some* of their events.

The system log is useful because it records user and user account information. The error log can be very useful to DG diagnostic personnel, since it continuously records hardware errors.

Starting and Stopping Logging

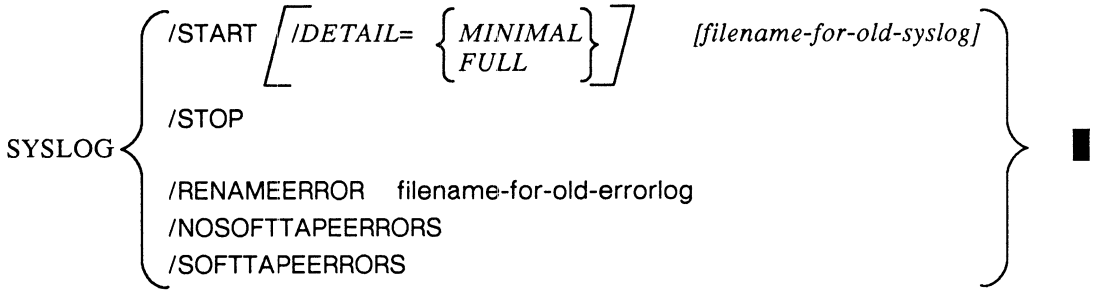
The current system log file is always called SYSLOG and is located in the root directory. (You can put the current system log file in a different directory via a link file named SYSLOG in the root directory, that gives the actual log file's pathname. See "Using a Specific Log Directory" later in this chapter.) You start and stop logging with the CLI command SYSLOG.

The current error log file is named ERROR_LOG, also in the root directory. Error logging occurs automatically — and you can use the SYSLOG command to rename the old error log file and start a new error log.

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SYSLOG is the CLI command to control logging. If you type SYSLOG alone, without arguments or switches, it tells you the status of system logging: *OFF* if system logging is off and *ON* if system logging is on. (Error logging is always on.)

SYSLOG is a privileged command; only the master CLI, PID 2, can issue it. The SYSLOG command has the following variations.



where

/START

starts recording in the system log (:SYSLOG). If file :SYSLOG doesn't exist, the system creates it. If it does exist, and you omit the *filename-for-old-syslog*, the system appends to it. If you include the *filename-for-old-syslog*, the system renames the old system log file to the new name, then starts logging in a fresh file named :SYSLOG.

/DETAIL=MINIMAL
/DETAIL=FULL

tells the system how much detail to write to the log file. The default, MINIMAL, includes most user account information except for file access. Minimal logging includes console connect time, CPU time, I/O blocks, pages printed, and other things. With detail set to minimal, if the LDU that holds the log file fills up, logging will stop.

A detail setting of FULL includes all account information above, plus user access (audit trail) information. This setting records events that may relate to system security, as follows:

- all file access attempts (successful or unsuccessful);
- all file ACL changes;
- all file renames or deletes;
- all process creations (with process privileges), process terminations, and ring loads (?RINGLD system calls);
- all attempts to turn Superuser and Superprocess on or off.
- an error code, if an error occurred on the event. If no error occurred, the user's call succeeded.

Be aware that all this information will make file :SYSLOG grow quite rapidly. And, with detail set to FULL, the system tries to continue logging at all costs: if the LDU that holds the log file fills up, the system won't disable logging; it will panic. See "Disk Space Cautions" later in this chapter.

To change detail from full to minimal, use SYSLOG with the */DETAIL=MINIMAL* switch.

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/STOP — stops recording in the system log file. (Error logging continues.) Shutting down AOS/VS automatically stops recording in the system log file, so you don't need to use this switch before shutting down.

filename-for-old-syslog — is the new name you want for the existing system log file. The system renames file :SYSLOG to this name, then creates, and starts logging in, a new log file named :SYSLOG.

/RENAMEERROR — renames the error log file, ERROR_LOG, to filename-for-old-errorlog. The system starts recording hardware errors in a new, fresh ERROR_LOG. This is useful when you want to dump and/or delete an error log file.

filename-for-old-errorlog — tells the system to rename the old error log file to this name, and start recording errors in a new, fresh ERROR_LOG file. Renaming the error log is useful when you want to dump and/or delete old error information.

/NOSOFTTAPEERRORS — tells the system *not* to record soft tape errors in the error log file or display them on the system console. More than 3 soft tape errors, however, *will* be logged. A soft tape error is an I/O inconsistency that disappeared in fewer than 13 retries. (If it persisted for more than 13 retries, it would be a hard error.) By default, soft tape errors are logged in the error log file. However, certain brands of magnetic tapes can produce many soft error messages — growing the log file rapidly and slowing response.

To disable soft tape error logging in the error log file, include this switch. You can use this switch, or the next one, at will from PID 2.

/SOFTTAPEERRORS — tells the system *to* record soft tape errors in the error log file. This switch is useful if you want to record soft errors and the current VSGEN system was generated with soft tape error reporting suppressed. (See /NOSOFTTAPEERRORS above for more information.)

NOTE: AOS/VS buffers both SYSLOG and ERROR_LOG events. Stopping logging explicitly or through renaming a log file flushes those events from the buffer and ensures that the log file is up to date.

Log File Pointers and Suggestions

Generally, logging is useful for the following reasons.

- It can track the amount of system resources used by each user. This is useful for billing — or other user monitoring situations — in a timesharing system.
- It can record file accesses and use of special privileges and processes — events that may affect system security. This can be critically important on a system used to maintain sensitive or classified databases and programs.
- It records hardware errors. This happens automatically.

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With detailed logging, you may lose information if you stop or start logging while the system is active. If you are concerned with security, do not stop or start the system log while the multiuser environment is active. (Be careful: using the SYSLOG command with the /DETAIL= switch implicitly stops, then starts logging — even without the /START or /STOP switch.) If you do start logging while the multiuser environment is up, SYSLOG cannot *get* information you need. For example, any processes that are running when logging starts will have only PID number (not username) data available for reports. Also, any files that are open when logging starts will have only PID and channel number (not pathname) data available.

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For detailed logging, we suggest that you start the system log immediately after the master CLI comes up, before EXEC or any other process. (The UP macro is a good place from which to start logging.)

If you do need to stop logging or rename the log file via SYSLOG/START pathname (perhaps because disk space is low), we recommend shutting down every process except the master CLI (PID 2) before doing so. This will limit the processes recorded without a username to PID 1 and 2 (PMGR and master CLI), and these processes' usernames (PMGR and OP) are easy to identify in reports.

If you must stop logging while the multiuser environment is active, use PED (PED/ALL/L=path; then wait 10 seconds and press CTRL-C CTRL-B) to record the PIDs and usernames on the system. The list PED produces will help you match usernames to PIDs on reports you may generate later on from the new log file.

To be most useful, logging should be consistent. And, log records for at least the last 12 months should be available. Because system logs — especially those with detail set to full — grow so rapidly, you need a procedure for naming, archiving, and deleting them.

The current log pathnames are always :SYSLOG and :ERROR_LOG. One way to identify old logs is, each time you start logging in a new log file, to rename the old one to a name that indicates the date it was started. You might do this every week or oftener for the SYSLOG file, which grows rapidly, and every month or so for the error log file, which grows slowly. This way, the filename will show the beginning of the logging period covered by the file. For the date, you could use the form

ddmmmyy

where ddmmmyy is the date on which the preceding logfile was started; for example, 30MAY88. This identifies each log clearly and uniquely. For more clarity, you can add the suffix .LOG or LOG.ERROR to the filename.

You can rename an old log file (starting a new log file) at any time. Commands to rename have the form

SYSLOG/START *[other-switches]* name-for-old-logfile

SYSLOG/RENAMEERROR name-for-old-errorfile

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For example, a sequence might go

AOS/VS CLI REV date time	(Bring up AOS/VS system.)
) DATE ↵ *30-NOV-...*	(Check date.) (It's 30 November.)
) SYSLOG/START 29NOV.LOG ↵	(Rename old system log file to previous date and start new system log file (SYSLOG).)
) SYSLOG/RENAMEERROR 29NOV.LOG.ERROR ↵	(Rename old error log file to previous date and start new error log file (ERROR_LOG).)
) SUPERUSER ON ↵	(Turn on Superuser.)
*) LOGEVENT Running new rev ↵	(Log an event in system log.)
*) UP ↵	(Bring up multiuser environment.)
... (System runs through the day) ...	
) DOWN ↵	(Bring it down.)
*) BYE ↵ *SYSTEM SHUTDOWN*	
SCP-CLI> BOOT 24 ↵ ... *AOS/VS CLI REV ....*	(Bring it up.)
) DATE ↵ *02-DEC-...*	(Check date.)
) SYSLOG/START 30NOV.LOG ↵	(Rename system log and start new one.)
) SYSLOG/RENAMEERROR 30NOV.LOG.ERROR ↵	(Rename error log and start new one.)
) UP ↵ ...	(Once more with feeling...!)

There are several different approaches to this. An easy way is to start fresh logs each time a system is brought up — by commands like those shown above. But you can't *always* start fresh logs at startup, since bringing up the system twice on the same day would mean renaming logs to existing names. Ideally, you'd rename the logs only if they weren't started today. A macro to do this is shown in Figure 9-3. This macro starts the system log, and renames both logs to filenames that show the date they were started *if* logs weren't renamed today. If disk space is an issue — and with full-detail logging it usually is — you might also use the CHECK_SPACE macro, which is designed to warn you when disk space is low. See "Disk Space Cautions," later in this chapter.

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Text of SYSLOG_UP.CLI Macro

```
[!equal,%0/%,/H]
     write  This macro starts the system log with a SYSLOG command that
     write  renames the old system and error log files to the date they
     write  were started. Then it moves the old system log and error
     write  files into directory :LOGS. If the old :SYSLOG was started
     write  today the macro starts :SYSLOG and doesn't rename the system
     write  log -- appending new information to the existing :SYSLOG and
     write  :ERRORLOG instead of renaming and moving them. You could
     write  name this macro SYSLOG_UP.CLI and call it from the UP macro.
     write  Before the macro will work, someone must:
     write  ,, 1. Create it in the root directory.
     write  ,, 2. Create macro MAKE_DATE.CLI in the root directory.
     write  ,, 3. Create directory :LOGS  -- e.g., via CREATE/DIR :LOGS
     write  After these steps have been done, the macro will do log
     write  housekeeping simply via the command ,, SYSLOG_UP. It takes
     write  no arguments but the /H switch produces this help message.
[!else]
     push
     superuser on
     dir  :
     string [MAKE_DATE [!explode [!date]]].LOG
     [!nequal,([!filenames LAST_LOG_DATE]),()]
     comment  For security, use /DETAIL=FULL. Add this switch to the
     comment  two syslog command lines.
          push
          string [LAST_LOG_DATE]
          comment  If today's date differs from the date stored in file
          comment  LAST_LOG_DATE, rename the log files and move them.
          [!nequal,[!string/p],[!string]]
              syslog/start/1=warning/2=warning  [!string]
              syslog/renameerror  [!string].ERROR
              acl  [!string]  OP,OWARE +,RE
              write Moving log files [!string] and [!string].ERROR to :LOGS
              move   LOGS  [!string]  [!string].ERROR
              delete  [!string]  [!string].ERROR
          [!else]
              comment SYSLOG was started today -- just start logging.
              syslog/start
          [!end]
     pop
    [!else]
      write File ,, LAST_LOG_DATE ,, doesn't exist. I will create it.
      write Please rerun this macro by typing %0% after it stops.
    [!end]

comment Update -- or create -- the LAST_LOG_DATE file.
delete/2=ignore   LAST_LOG_DATE
string/l=LAST_LOG_DATE
acl  LAST_LOG_DATE   +,R
pop
[!end]
```

Text of MAKE_DATE.CLI

```
%1%%2%%4%%5%%6%%8%%9%&
```

Figure 9-3. Example SYSLOG_UP and Companion Macros

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Assume you run the SYSLOG_UP macro shown in Figure 9-3 on 27 November 1986 (after following setup instructions in the macro).

Then, on 28 November, you run the macro again. Since today's date (28 November) differs from the last date :SYSLOG was started (November 27), the macro renames the logs and moves them to directory :LOGS. The current log filenames remain (as always) SYSLOG and ERROR_LOG. The logs with records from yesterday to today have the pathnames

```
:LOGS:27NOV86.LOG          (system log)
:LOGS:27NOV86.LOG.ERROR    (error log)
```

Later on, at reasonable intervals, you can dump and delete log files in directory :LOGS. If desired, before deleting them, you can create reports (using the REPORT program), then print and delete the report files. The REPORT step depends on whether standard reports (which can be done as a matter of routine) will satisfy your needs.

In any case, if you need a report on a given period, you can always reload the dump file that holds the desired logs, and then run REPORT on these files.

Disk Space Cautions

As mentioned earlier, log files can grow to consume a large amount of disk space. This is most critical with full-detail logging. If you start logging with detail set to full, AOS/VS will panic if the log file grows to the point where it runs out of disk space.

The next two sections suggest a way to avoid running out of disk space. The first section shows how to put the system log file in its own directory, ideally on its own LDU. The second section shows how to use the CHECK_SPACE macro, which monitors disk space, and warns you when space becomes crucial.

Whatever the degree of logging (minimal or full), and even if you devote a whole LDU to the log file, you need to monitor disk space carefully. Periods of intense activity (like heavy interactive use and backup) make the log file grow rapidly.

The space-warning threshold should leave space for report generation. Then, if disk space reaches the warning point, space will remain for a report. After the warning, the operator can rename the log (starting a new one), generate a report from the old log, then print the report, and dump and delete the log. (The SYSLOG_UP macro shows a way to rename the old log and start a new one automatically. The CHECK_SPACE macro can warn of low disk space.)

Using a Specific Log Directory

With system logging — especially with detailed logging — you should put the log file in its own directory, ideally a separate LDU. This will minimize file creations and deletions in the root directory — minimizing file fragmentation and I/O to the system disk.

Logging occurs to file :SYSLOG on the master LDU — but :SYSLOG can be a link file to a log file in another directory, in the master LDU or another LDU. For example, suppose you have an LDU called LOGS (formatted with that name by the Disk Formatter). In the root of the master LDU, you create a link to SYSLOG on the log LDU:

```
*) CREATE/LINK  :SYSLOG   :LOGS:SYSLOG )
```

Your UP macro can initialize the LDU. After initializing, the UP macro must conditionally create a file of type LOG on the LDU; then it should assign a null ACL to file SYSLOG. (If the SYSLOG file is not type LOG, the system will conclude it's not a real log file; it will then delete the link and create a SYSLOG file in the root. Creating a file of type LOG is easy via the CREATE command and /TYPE= switch.)

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```
[!else]
   [!ult [!var2] [!var0]]
      send 2 [!ascii 212] [!ascii 207]
      send 2  [!ascii 214]
      send 2 [!ascii 216] *** Warning -- Low Disk Space *** [!ascii 217]
      send 2 [!ascii 212]
      send 2 Space left in log directory PARENT directory is [!var1].
      send 2 The threshold is [!var0].
      pause 5
      send 2 [!ascii 212]
      send 2 [!ascii 216] *** Warning -- Low Disk Space *** [!ascii 217]
   [!end]
[!end]
[!equal,comment,]  Pause 30 minutes -- 1800 seconds, and call this macro again.
[!end]
pause  1800
%0%
[!ELSE]
write This macro is nonexecutable. To make it executable you must use a
write text editor to change the 2 in line 1 to 1 -- both numbers must be 1.
[!END]
```

Figure 9-4. CHECK_SPACE Macro to Check Disk Space Periodically (concluded)

Detail-Log Panics

If a growing log file does force an AOS/VS panic, follow these steps.

1. Run ESD and restart AOS/VS (but don't type UP ↵ yet). Before resuming normal processing, you must dump and delete the log file.
2. Check the log file size with the FILES/AS command. If the log file will fit on one tape, you can dump it and delete it without bringing EXEC up. (A 2,400-foot tape, at 1600 bpi, can hold a 39,000,000-byte file.) Dump the log to unlabeled tape (MTxn:0), delete it, and bring everything up.
3. If the log file won't fit on one tape, you must start EXEC and use labeled tape. Use a manual PROCESS command, instead of the UP macro, to start EXEC (the syntax is shown in your UP.CLI macro). Then, via a labeled tape mount request, labeling tapes as necessary, dump the log file to labeled tape, and delete it. Bring everything up.

After this kind of panic, you might want to review your log file procedures — and perhaps generate reports, and dump and delete log files, more often.

User Writes and Reads with the System Log File

Any Superuser can post messages into the active SYSLOG file, under the general-purpose code, with the CLI command LOGEVENT. Or, a user program with Superuser turned on can do the same thing with the ?LOGEV system call, if it uses event code 1065 (2051 octal). Either of these writes an event record into the log file (but neither returns an error if logging is not on).

SYSLOG files are not directly readable. But user programs can read these files if they use the proper record formats. Also, users can read log files (including the active one) via the DISPLAY program. Most important, they can get reports on log files using the REPORT program. Qualified users can run REPORT on file SYSLOG even while logging is on.

As with all files, a user cannot read or write a log file without read or write access to it — unless he or she has Superuser on. The access control list for file SYSLOG is null (only superusers can read it). The access control list for ERROR_LOG is OP,R.

The REPORT Program

The REPORT program interprets, sorts, and displays the records in system and error log files. REPORT is in :UTIL, filename REPORT.PR. It is available to any user process. It is a CLI Help topic, so anyone can get help on it by typing HELP *REPORT ↵.

REPORT can write the logged information to any device or file you name. It can report specific types of information and can report on multiple log files.

If you run REPORT on a system log file, the report includes user information. If you run it on an error log file, the report includes device error information. The default report from a system log file is a summary of user information. The default report from an error log file includes hardware errors. You can specify both system and error log filenames to REPORT; if so, the report includes both user and device information. From any file, you can select specific information via switches.

If you omit switches, REPORT creates a default report. A default user report includes the following information for each user.

- username (* means that this user has a Super or access devices privilege);
- user tape or disk mount requests (if any);
- console connect time. The format is hours and minutes (HH:MM), but if the system log file was started or stopped while this user was logged on, it is shown as 0:00;
- time unit. Unit time is the total time charged for labeled tape use, that is, the total amount of time (in hours and minutes) a process had tapes mounted. This figure does not include unlabeled tape use.
- number of pages printed;
- CPU time in hours, minutes, seconds and milliseconds;
- I/O blocks: the number of 512-byte disk blocks read or written;
- page-seconds. This relates memory usage and CPU time; it is memory pages used multiplied by the number of CPU seconds; and
- number of processes created for this user during his or her connect time.

For example, take the commands

```
*) SEARCHLIST [!SEARCH],:LOGS ↵
*) X REPORT/L=@LPT 15SEP86.LOG 15SEP86.LOG.ERROR ↵
```

The REPORT program might produce reports that look like Figures 9-5 and 9-6.

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```
USER SUMMARY FROM FILE(S): :15SEP86.LOG

 USERNAME          CONNECT   TIME   PAGES      CPU TIME        I/O      PAGE NUMBR
                   CONSOLE   UNIT PRINTED                     BLOCKS      SECS PROCS
  BILL               1:14   0:00       5   0:00:05.847          517       437    10
  BRIDGET            4:30   0:00     119   0:10:04.370        34409     79391   170
 *GAMMA              3:00   0:00       0   0:04:27.916        29761     31903    61
  JEFF               1:34   0:00       0   0:00:38.435          714      2662    19
  JOE                2:47   0:00       6   0:02:22.956        11084     15046    80
  LUCY               4:27   0:00       0   0:04:28.486        30421     18306    45
  MARC               2:22   0:00       7   0:03:53.311        13029     26748    44
  MASM               2:29   0:00       0   0:02:29.910         6819      8080    43
  NETOP              0:00   0:00       0   0:00:02.451          103       150     2
 *OP                 2:46   0:34      20   0:15:28.560        82321     66996    59
  PAUL               0:01   0:00       0   0:00:00.418           61        23     2
  PETE               1:03   0:00      14   0:12:33.800       148183     53282    50
  STEVE              0:02   0:00       0   0:00:01.045           46        64     2
  SWAT               4:03   0:00      50   0:24:09.367        56109    172285   409

        NO DEVICE ERRORS REPORTED
NO DEVICE SUMMARY WILL BE PRINTED
```

Figure 9-5. Default Report from System Log (User Summary)

```
NO USER ERRORS RECORDED
NO USER SUMMARY WILL BE PRINTED

DEVICE SUMMARY FROM FILE(S): :15SEP86.LOG.ERROR,

 DEVICE  UNIT        ERRORS
 CODE          HARD  SOFT  TIMEOUT
  22      0      0    31        1
```

Figure 9-6. A Default Report from an Error Log File

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Running REPORT

To run REPORT, use the command form

[QBATCH] XEQ REPORT *[switches] [logfile-pathname] [...]*

where

QBATCH — Runs REPORT in batch. Depending on the size of the log file(s), REPORT may take some time (say 15 minutes for a 2-megabyte log file) to create the report on line. Thus, you might want to run REPORT in batch to keep your console free.

switches — Select options as described next. If you omit switches, the report goes to the generic output file @OUTPUT. By default, @OUTPUT is your console.

logfile-pathname — Specifies the system or error log file from which you want the report. If you omit a *logfile-pathname*, REPORT will use all the log files in the working directory. (Log files are a special type of file, LOG. REPORT reports on all files of this type.)

For a report on the current log file (system or error), you will need to turn Superuser on, since the ACL for this log file is null. (If the ACL of SYSLOG isn't null, make it null when you start logging, since the log file often contains sensitive information.)

AOS/VS buffers both SYSLOG and ERROR_LOG events, and REPORT cannot report on events that the system has not flushed from those buffers. To flush the buffers and ensure that the system log file is up to date, from PID 2 type

```
) SYSLOG filename-for-old-syslog ↵
```

For the error log file, type

```
) SYSLOG/RENAMEERROR filename-for-old-errorlog ↵
```

When it generates a report from multiple log files, REPORT processes the files in chronological order of creation time — regardless of the order in which you specify them.

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REPORT Switches

REPORT *always* produces the default report on users or errors. You can request additional reports via one or more REPORT switches, described below.

REPORT can report only on events whose codes are recorded in a system or error file. These codes are recorded only when AOS/VS (or ESD) is running with logging on. There are some events that AOS/VS can't record, for the following reasons.

- The event forces AOS/VS to panic. Some events indicate an error condition so serious that the safest course is for AOS/VS to panic. If AOS/VS panics, ESD will write the panic information to the error log, but it will be written under the panic event code, not the specific error event code.
- The event occurs so often that logging overhead would degrade performance. If an event would occur very frequently, in the course of normal operations, AOS/VS will not log it. This applies only to error conditions like a persistent memory parity error or disk error, not to security-related events. (But AOS/VS logs everything if you specified a detail setting of FULL when you started logging.)
- AOS/VS is not running when the event occurs. For example, a BOOT command to the SCP cannot be logged, since AOS/VS isn't running when it occurs.
- If detailed logging was started *after* the multiuser environment was brought up, important information (like usernames) may not be available for reports. For example, REPORT can provide only the PID (not the username) of processes started before logging was started. Also, REPORT can give only the channel number and user PID (not the pathname) of files opened before logging was started.

  If you care enough about security to use detailed logging, you should start logging immediately after AOS/VS startup (in the UP macro); don't stop until shutdown.
- The SCP is responsible for telling AOS/VS about the event, but doesn't do so (perhaps because the SCP, or its interface to AOS/VS, is having problems). Certain events can be detected only by the SCP. On one of these SCP-detected events, the SCP notifies AOS/VS on device code 45; then, if AOS/VS is logging, AOS/VS notes the event code in the error log file. If AOS/VS isn't notified, it cannot log the event.
- Implementation is planned for the future. One revision of AOS/VS may not log an event, but future revisions *will* log the event.

Under any of these circumstances, the pertinent event code will not be written to SYSLOG. And REPORT will not be able to report the event.

Several REPORT switches include the functionality of other switches. For example, the /C switch includes reports on all 30-odd CPU-related switches. So — if you use the /C switch — you will see a report (usually with *NO EVENTS RECORDED*) for each CPU-related switch.

All REPORT switches and descriptions follow. The log event code, in form decimal (followed by octal in parentheses), is part of the description. For events detected by the SCP, you may be able to find more information in Chapter 11, Table 11-1 (using the octal error code).

NOTE: REPORT requires that you type the *entire name* of each switch. If you abbreviate a switch name, REPORT will ignore the switch specification (displaying no error message!). Be sure to type the full name of each switch. The maximum number of characters for all switches is 256. ■

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Switch	What It Does

/AFTER=dd-mmm-yy *[:hh:mm:ss]*	Reports only the events that occurred on or after the specified date or time. This is relevant for both system and error log files. You can combine the /AFTER= and /BEFORE= switches to display any time period. For example, to view only those events occurring on December 4, 1986:
	`*) X REPORT/AFTER=4-DEC-86/BEFORE=4-DEC-86 & ↵`
	`*&) pathname ↵`
	To see the action between 8 p.m. and 2 a.m. on this night:
	`*) X REPORT/AFT=4-DEC-86:20:00:0& ↵`
	`*&)/BEF=5-DEC-86:2:00:0 pathname ↵`

/AIR	Reports air flow faults, as detected by the SCP (on MV/8000s with SCP diskette only). Relevant for error log files only. Event code is 102 (146).
/ATU	Reports events in which the CPU Address Translation Unit (ATU) accelerator was disabled or enabled by an operator command (detected by the SCP). Normally, the ATU accelerator is enabled. An ATU disable/enable cannot occur on an MV/4000. Relevant for error log files only. Event codes are 122 (172) and 123 (173).
/BB	Reports successful transfers to battery backup, as they were detected by SCP. Relevant for error log files only. Event code is 104 (150).
/BEFORE=dd-mmm-yy *[:hh:mm:ss]*	Reports entries that occurred on or before the specified date and time. Relevant for system and error log files.
/BNC	Reports the first word of buffer-not-clear events (the SCP did not clear the host-SCP buffer as expected). Relevant for error logs only. Event code is 80 (120).
/BT	Reports SCP time-outs (no response from SCP detected by AOS/VS within 20 seconds). Relevant for error logs only. Event code is 77 (115).
/C	Reports all CPU-related information. It includes all information gathered by the following switches: /AIR, /ATU, /BB, /BNC, /BT, /DT, /FATAL, /HANG, /HI, /HP, /HRCC, /IC, /IOC, /IPF, /IPR, /LD, /NF, /NRCC, /OS, /PAR, /PH, /PW, /PWR, /RB, /RC, /REC, /RES, /RQ, /SB,/SC, /SCP, /TE, /UN, /UPSC, and /XCM switches. Most of these reports will be "NO xx EVENTS RECORDED." This switch is relevant for error logs only.
/CT	Reports Connect Time (CT). For each console user, this report gives username, connect time, and console name (console name information is not in the default report). An example is shown in Figure 9-7. Relevant for system logs only. Event code is 1024 (2000).

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Switch	What It Does
/PT (cont)	The /PT switch can produce a very sizable report, since a process terminates after every text editing session, compilation, batch job, and so on. Relevant for system logs only. Event code is 3 (3).
/PW	Reports CPU power failure and power restore. These are logged as one event, at the time of power restore. Relevant for error logs only. Event codes are 7 (7) and 40 (50).
/PWR	Reports CPU power failure and power restore. These are logged as one event, at the time of power restore. Relevant for error logs only. Event codes are 100 (144) and 101 (145).
/RA	Reports a XODIAC RMA agent summary. By username, this gives total connect time and RMA requests. Also see the /X switch. Relevant for system logs only. Event code is 1030 (2006).
/RB	Reports host-SCP buffer full faults (indicates data overflow between processors). Relevant for error logs only. Event code is 76 (114).
/RC	The Bank controller normally detects, reports, and tries to correct ERCC errors. This report includes events in which the Bank detected so many ERCC errors that it disabled error reporting. (It continued to try to check/correct ERCC errors.) This event is reported via the SCP. Relevant for error logs only. Event code is 131 (203).
/REC	Reports SCP function request acknowledgements. This may occur so often that logging it would degrade performance; AOS/VS Revision 7.00 does not log it. REPORT looks for code 74 (112).
/RES	Reports SCP resets. AOS/VS Revision 7.00 does not log this code in SYSLOG. REPORT looks for event code 73 (111).
/RQ	Reports Host-SCP request errors. AOS/VS Revision 7.00 does not log this code. REPORT looks for event code 75 (113).
/SA	Reports a DG/SNA accounting summary. By username, it gives connect time, number of logical units, number of request units received and sent, and number of bytes received and sent. Relevant for system logs only. Event code is 1066 (2052).
/SB	Reports S-bus time-outs (detected by SCP). The SCP cannot use the CPU S-bus. Relevant for error logs only. Event code is 111 (157).
/SC	Reports events in which the CPU's system cache was disabled or enabled by operator command (detected by the SCP). This event cannot occur. Event codes are 119 (167) and 120 (170).
/SCP	Reports status of SCP logging, as detected by the SCP. By default, SCP logging is on. Events are recorded only if someone has turned it off or on with an SCP command. This has no meaning for MV/4000 logs. Relevant for error logs only. Event codes are 96 (140) and 97 (141).
/TA	Reports a XODIAC File Transfer Agent (FTA) summary. By username, it gives the connect time, number of FTA connections, number of FTA blocks, packets transmitted and received, and bytes transmitted and received. Relevant for system logs only. Event code is 1064 (2050).

Switch	What It Does
/TE	Reports overtemperature state, as detected by the SCP (on MV/8000s only). AOS/VS Revision 7.00 panics, thus does not log this code. Event code is 103 (147).
/TRACE=username	Reports on all security-related events (logons, file accesses, process creations, pages printed), that involved *username*, as well as multiprocessor and class events. This can produce a sizable report. The report is useful when you want to monitor a user's behavior, or check an application program (run by the user, like OP) for Trojan horses, or see class or multiprocessor events. Without =username, /TRACE reports on all users; with =username, reports only on the named user. For example *) X REPORT/TRACE=JKN ... :SYSLOG ↵ This switch is relevant for system logs only. Event codes include 910 through 947 (1616 through 1663), 966 and 967 (1706 and 1707), and 1211 through 1226 (2273 through 2312) for security-related events; 948 through 960 (1664 through 1700) and 964 (1704) for class and multiprocessor events; and 961 through 963 (1701 through 1703) for mirroring events. The security-related events represented by the codes are • Access devices privilege turned on (call ?DEBL) or off (call ?DDIS) (code 915) • Class or logical processor event, or user locality change (951 through 960) • Console assigned to a program or deassigned from a program (for example, assigned to EXEC when user logs on) (918 and 919) • File ACL change (939 and 943) • File close (922) • File create (929) • File delete (924 and 931) • File open (920) • File print (1214) • File rename (938 and 942) • File UDA create, read, or write (927 and 934, 925 and 932, 926 and 933) • Invalid log-on attempt (1215) • Job processor initialized or released, or status checked (948 through 950) • Labeled medium (tape) mount or dismount (1211 and 1212) • LDU (logical disk unit) initialize (937) or release (928) • Permit access to protected file (used to modify shared file) (947) • Process create (910) • Process chain to another process (917)

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Switch	What It Does
/TRACE=username (cont)	• Process ringload (?RINGLD) of a program (916) • Process terminated by superior process (912) • Shared file open (first and subsequent, 945 and 946) • Superprocess privilege turn on/off (914) • Superuser privilege turn on/off (913) • System Manager privilege turn on/off (964) • User password change (subset of 1225) • User logon (1213) • User profile created, deleted, or renamed (1220, 1221, 1222) • User profile opened, read, or closed (e.g., by EXEC when a user logs on) (codes 1223, 1224, 1226) • User profile written to (follows profile open) (1225). When anyone logs on, the time is written in the profile. Password changes are reported here and as specific events elsewhere. • Window create (966) and window delete. All of these events indicate *attempts* at the specified action. For example, "File open" means that a user tried to open a specified file. If the attempt failed, the record will include an error code which REPORT will interpret and display. If the attempt succeeded, there will be no error code.
/UN	Reports unknown DIB code from SCP events (the SCP requested AOS/VS to act, but AOS/VS could not understand or execute the request). Relevant for system logs only. Event code is 79 (117).
/USERS=name *[+name][...]*	Reports accounting information (like CPU and I/O usage) on only the user(s) specified with name(s). For example, for a report on users F77 and SWAT: `*) X REPORT/USERS=F77+SWAT pathname ↓` The /USERS switch is relevant for system logs only.
/UPSC	Reports UPSC (CPU power supply) faults detected by AOS/VS, on the following machines: MV/20000-series, MV/10000-series, MV/8000 II, MV/8000 C, and MV/4000. AOS/VS can record these only if it stays up through the error. Relevant for error logs only.
/X	Reports a XODIAC summary. This includes the reports from the /FA, /FE, /NA, /NE, /RA and /TA switches described above. Relevant for system logs only.
/XCM	Reports occurrences of the following SCP commands, as detected by the SCP (machines with SCP diskette only). Relevant for error logs only. • BOOT (AOS/VS cannot record this, since it is not running.) Event code is 99 (143); • CONTINUE, event code is 128 (200);

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Switch	What It Does
/TRACE=username (cont)	
	In addition to the events listed here, there are also a number of system calls used only by the operating system or its servers. If one of these so-called undocumented system calls is logged, the report will include the date, time, and username of the calling process, and the message *Attempted an undocumented system call.* If the user making such a call is the operating system (username=OP or a server like DBMS, for example), a security breach is not indicated. But if the report shows that a user has made such a system call, you should report this to your security administrator.
/UN	Reports unknown DIB code from SCP events (the SCP requested AOS/VS to act, but AOS/VS could not understand or execute the request). Relevant for system logs only. Event code is 79 (117).
/UPSC	Reports UPSC (CPU power supply) faults detected by AOS/VS, on the following machines: MV/20000-series, MV/10000-series, MV/8000 II, MV/8000 C, and MV/4000. AOS/VS can record these only if it stays up through the error. Relevant for error logs only.
/USERS=name *[+name][...]*	Reports accounting information (like CPU and I/O usage) on only the user(s) specified with name(s). For example, for a report on users F77 and SWAT: *) X REPORT/USERS=F77+SWAT pathname ⤵ The /USERS switch is relevant for system logs only.
/X	Reports a XODIAC summary. This includes the reports from the /FA, /FE, /NA, /NE, /RA and /TA switches described above. Relevant for system logs only.
/XCM	Reports occurrences of the following SCP commands, as detected by the SCP (machines with SCP diskette only). Relevant for error logs only. • BOOT (AOS/VS cannot record this, since it is not running.) Event code is 99 (143); • CONTINUE, event code is 128 (200);

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Switch	What It Does
/XCM (cont)	• HALT, event code is 127 (177); • INIT, event code is 130 (202); • START, event code is 129 (201); • XEQ DTOS, event code is 125 (175).

SYSLOG and REPORT Examples

```
) SYSLOG/START ↵
... (System runs) ...
*) XEQ  REPORT/USERS=F77+SACKVILLE  :SYSLOG ↵
```

... (Report on console) ...

```
*) X  REPORT/AFTER=[!DATE]/L=@LPT  :SYSLOG ↵
```

The preceding command reports on all entries that occurred today.

```
*) X REPORT/L=COBOL_BILL/BEF=17-DEC-86/AFT=12-DEC-86& ↵
*&)/USER=COBOL  :LOGS:17DEC86.LOG ↵
```

The preceding command reports on user COBOL, between 12 December, 1986 and 17 December 1986, and sends the report to file COBOL_BILL.

```
) SYSLOG/START/DETAIL=FULL ↵
... (System runs) ...
*) X  REPORT/TRACE=JOAN_S/L=LOGS:JOAN_S.REPORT  :SYSLOG ↵
```

... (Report on console) ...

This command sequence starts the log file — then, later, generates a report on all system use by user JOAN_S. The report is written to the file JOAN_S.REPORT in directory :LOGS. Superuser is needed to access the current log file.

```
) X REPORT/FAILED_LOGONS/EV  :LOGS:28SEP86.LOG ↵
```

This command produces a report on failed logons and events (written into the log file with the LOGEVENT command). The log file is 28SEP86.LOG in directory LOGS. Since no listing file was specified with /L, the report is displayed on the console.

```
*) X  REPORT/EV/PT  :LOGS:28MAY86.LOG ↵
```

This command would produce process termination reports (like those shown in Figure 9-7).

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Backup Sets of Tapes

The number of reels (or cartridges) you need for backup depends on the amount of disk space you have, change rate of your files, the tape length, the recording density, the buffer size used to dump, and how many tape sets you want to retain. (A tape set includes all volumes of the full backup and all following incrementals, up to the next full backup.) Approximate capacities of different tapes (and diskette) are shown in Table 10-1.

Table 10-1. Approximate Capacities of Tapes and Diskettes

Tape Length	Recording Density	Buffer Size	Approximate Capacity in Megabytes	Approximate Capacity in Disk Blocks
Cartridge	6,400 bpi	2,048 8,192	8 14	15,500 27,000
		16,384	20 (model 6351) 74 (model 6352)	39,000 144,000
1,000 feet (305 meters)	1,600 bpi	8,192	16	31,000
2,400 feet (732 meters)	1,600 bpi 6,250 bpi	8,192 32,768	38 130	74,000 250,000
Diskette	n/a	default	.74	1,400

To get the approximate number of tape volumes needed for a full backup of any LDU, type SPACE ldu-name ⟩ and divide the CUR figure by the pertinent capacity in blocks figure. For the master LDU, subtract 20,000 blocks — for system files — from the CUR figure before dividing. (System files usually aren't backed up, since you can restore them from an AOS/VS system tape.)

For incremental backup, take 20% of the number of full backup tapes. Multiply this number by the number of incremental backups you plan between full backups. Add the total incremental backup number to the full backup number. This gives the approximate number of tapes needed for one backup set.

You should have two or more backup sets of tapes. With two sets, you can keep the last backup set intact, and use the *previous* backup set for the new backup. Ideally, you'll have three or more backup sets of tapes.

Remember that dump density and label density must match; if they do not, you will get the message that there is a density mismatch. So, plan ahead: if you want to dump at 6250 bpi (MTD tape drives only), prepare labeled tapes by setting the density switch to 6250 or use the LABEL program's /DENSITY switch (X LABEL/DENSITY=6250).

Tapes and diskettes should have paper labels on them — on which you should write the date, volume ID, and other information you might need to restore the backed up material.

Whatever schedule and plan you come up with, be sure you have enough tapes on hand when you start a backup. If you run out of tapes and can't complete a backup normally, the backup will be incomplete. To make it complete, you'll need to start again from the beginning, with enough tapes.

On an MTB unit, a 2400-foot tape takes roughly 12 minutes to fill (DUMP_II program) or 20 minutes to fill (DUMP command).

On an MTC unit, model 6125, filling a 1000-foot tape may take about 12 minutes (DUMP_II) or 20 minutes (DUMP). A cartridge tape, used with a buffer size of 8192, can hold about 14.5 megabytes; but if you use DUMP or DUMP_II, a cartridge takes 40–50 minutes to fill.

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With a cartridge tape, you can shorten backup dramatically by using PCOPY instead of DUMP/DUMP_II. With a buffer size of 2 Kbytes, PCOPY can fill a cartridge in 6 minutes — but stores only 8 megabytes instead of 15. Thus, with cartridge tape, you may want to use PCOPY for full backups and DUMP for incrementals.

A Model 6352 cartridge tape drive (it uses squarish cartridges that are about four inches on each side) holds 74 Mbytes. Using the DUMP_II (and LOAD_II) /MAXCAPACITY switch and a buffersize of 16384 increases storage capacity to 120 Mbytes. The /MAXCAPACITY switch takes full advantage of the drive's ability to stream. Performance will degrade if you are dumping many small files that are widely scattered on your disk or if there is a lot of memory contention on your system. If either of these conditions is true, you'll hear the tape drive start and stop because the system can't stream effectively. In this case, postpone backup until the system is relatively idle or try using DUMP_II or LOAD_II without the /MAXCAPACITY switch.

If you want to use labeled tapes with a Model 6352 cartridge tape, use LABEL's /MAXCAP switch in addition to the DUMP_II/LOAD_II /MAXCAP switch.

Storing and Handling Tapes

If you handle and store your reel-to-reel tapes properly, they will last a long time — up to 10,000 reads. And, the data stored on them will remain intact indefinitely. Some handling cautions and hints follow.

- Cold, heat, and dryness can harm tapes. Store tapes between 50° and 90° F, between 10° and 40° C. Use tapes between 60° and 90° F. Relative humidity should be 20 - 90 percent. If you move a tape to a warmer or colder place, give it some time (ideally, 24 hours) to adapt before using it.
- Store tape reels in their outer plastic covers; remove the cover from the tape just before you use it.
- A magnetic field can erase part or all data on a tape. Keep tapes away from electric motors, magnets, and transformers.
- Always handle the tape reel by its hub (center). If you hold the outer flanges, you might squeeze them — compressing and damaging tape edges. Edge damage is a common cause of tape failure.
- If a tape has no paper label, apply one. Write on the label before applying it to the reel, to avoid bending reel flanges. If a label is already on a reel, use only a felt-tipped pen.
- Don't allow tape to rest or drag on the floor. Dust on the tape could prevent data transfer from the heads.
- Never touch tape in the data area. Touch only the tape that precedes the BOT marker (or follows the EOT marker). These reflective markers define the bounds of data. They are adhesive foil strips on the back (nonrecording surface), about 16 feet after the beginning and 25 feet before the end of the tape. If you touch the data area, the oil on your finger could make that part of the tape unreadable.
- Don't bend or twist tape when threading it (if your units have reels). Bending can dislodge the magnetic coatings, causing data loss.
- Tapes last a long time, but eventually they wear out. A growing number of *SOFT ERROR* messages are a warning. (A few *SOFT ERROR* messages are normal.)

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A *HARD ERROR* or *PHYSICAL UNIT FAILURE* message means that the rest of the tape is unreadable or unwritable. If this message appears during backup, use another tape. If it appears during a restoration, restart the restoration. If the hard error recurs, this probably means you cannot restore data from the rest of this tape and from subsequent tapes in this set. Try the tape on another unit, if you have one; or clean the unit heads with an alcohol-soaked swab. When all readable tapes have been read, you should bring down AOS/VS and run FIXUP on your LDU, since inconsistent information may have been copied to it.

- Before covering a tape reel, place a foam retainer or plastic strip on the leading edge of the tape. This prevents the tape from unwinding in storage.

Security is always a critical issue where backup media are concerned; any unauthorized person who has access to backup tapes can easily read, alter, or destroy any data they contain. Backup tapes should be stored in a locked area which only authorized people can enter. This is a requirement for C2-type closed-shop systems (see Chapter 16).

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This sequence repeats until the system has dumped all files (excluding those excluded in the dump template) to the tape file set.

Nearly always, 10 volumes will be enough for an incremental backup. (If not, EXEC will ask for another tape. Mount one and label it if needed using LABEL and the original volume ID sequence — INCR11, INCR12, and so on.) When you see the following message on the system console

*From Pid n : (EXEC) ** Waiting to be Dismounted ***
. . .
From Pid n : Request is 'Incremental dump of directory : done.'
From Pid n : Respond CONTROL @EXEC DISMOUNTED

You can dismount the tape(s) and type CX DISMOUNTED ↵. This completes the incremental dump. You can file the unused volumes. If you needed extra volumes, note their names on the dump listing and think about adding their volume IDs to the dump macro.

As with any user mount, you can refuse a request (CX REFUSED ↵) to restart; or you can cancel the batch job with QCANCEL sequence-number ↵ or CX FLUSH sequence-number ↵. Canceling the batch job will abort a dump in progress; you will need to type CX DISMOUNTED ↵ at the system console.

After the dump completes, make sure each reel has a paper label with its volume ID, the fileset name (ROOT), and the date. Store the reels safely, in order. You can use them again for another incremental dump.

You can reuse the backup tapes as often as desired — for example, every 6 weeks for full dumps, and every 10 working days for incremental dumps. This depends on how many backup sets (full and all incremental) you want to keep.

These dump macros, with the restore macro, can save a lot of time, effort, confusion — and data.

Verifying Dumped Material on Tape

Nearly always, dumped material will load perfectly, restoring your old file structure. But, if you really need to make sure there are no tape errors, you can do so quite quickly via the CLI command COPY. To verify a dumped tape, mount it on a tape unit and type the following commands

```
) COPY/IMTRSIZE=80   @NULL  @MTxn:0 ↵   (Tape unit name, file 0)
) COPY/IMTRSIZE=8192 @NULL  @MTxn:1 ↵   (Tape unit name, file 1)
) COPY/IMTRSIZE=80   @NULL  @MTxn:2 ↵   (Tape unit name, file 2)
```

These COPY commands do fast reads on the physical device. They use a buffer size (IMTRSIZE for COPY) of 80 for the labeled tape leader, 8192 (specified in the DUMP) for the data on tape, and 80 for the trailer. The output file is generic file @NULL, so the data read is not written; this speeds things up. You can expect some soft tape errors, particularly at the beginning and the end of each reel of tape. (But if you get too many retries, discard the tape and redo the backup.) On all but the last reel of multi-reel backups, you will see a message *File space exhausted* when the end of tape marker passes the read head of the tape drive. Except for the *File space exhausted* error, if all tape volumes read without errors, you can be virtually certain that it will load without errors.

You can verify each tape from the system console, if desired, after the entire dump or while EXEC is prompting for the next volume.

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Verifying Material Dumped on a Model 6351 Tape Drive

On most tape drives, dumped material will load correctly because the tape drives have a read head that verifies material when it is dumped (written by the write head). There is an exception to this general design. Model 6351 tape drives have only one head. For this reason, it is possible, especially with old tape, to dump to a tape that cannot be read. An easy way to verify a tape in this instance is to rewind the tape after the dump, and then use the LOAD command with the /N (name) switch. If the system can read the tape, it will display the names of files dumped on your screen. For example

```
REWIND @MTJ0 ⤸
LOAD/N @MTJ0 ⤸
... (names of dumped files) ...
)
```

Restoration Macro for Tape

Macro RESTORE_TAPE.CLI, Figure 10-3, restores material from either a full or incremental backup. By default, it uses the volume IDs used for incremental backups, but you can tell it to restore from a full backup. RESTORE_TAPE.CLI requires only the starter system disk structure — as created by an AOS/VS system tape — to restore incremental and full backups.

Resuming Normal Operations

On an MV/8000 system that has an SCP diskette, type **EXIT** ↵ to have microcode and the SCP-OS reloaded and return to the SCP-CLI. Then you can put your disks back on line, reboot AOS/VS (**RESET, BOOT 27** ↵, etc.), or do whatever is appropriate. You're done with the FRUs.

On any other machine put your system LDU on line. Press CPU power off. Then press the LOCK switch (if any) to the ON or LOCK position. Press power on; and SYSBOOT will lead you through the microcode load and back to AOS/VS. If this doesn't work, do a cold start as described in Chapter 6.

SCP-DTOS Commands

The operating system that runs FRUs (SCP-DTOS) has its own set of commands. Whenever you see the message *TESTOK* and the * prompt, this system is running, and you can type any of the following commands.

ACCEPT	Loads each of the FRU programs and runs it once. An example is above.
DIR	Lists the filenames of all the FRU and MV/Family system exerciser programs. You can LOAD any of these by filename.
EXIT	On MV/8000 systems that have an SCP diskette, this command reloads the SCP-OS and microcode from the diskette.
HELP	Gives help on SCP commands.
LOAD filename	Loads the file specified into SCP memory. If the file is a FRU test, the LOAD command runs it a predetermined number of times.

Other Diagnostics

The time may come when you want to run diagnostics on peripherals, like disks, tape units, or line printers. For example, you might want to run them on a disk if FIXUP or the Disk Formatter could not process the disk and aborted.

An MV system exerciser program comes on each MV/Family system tape; and you can run this if you wish, although it is meant primarily to test healthy hardware.

DG offers a diagnostic system, MV/ADES (Advanced Diagnostic Executive System), that includes test, exerciser, formatter, and alignment programs. MV/ADES is available as a separate product. It can be installed on your system LDU. Before you run MV/ADES on a peripheral, consult your DG support organization for more information.

If you do have ADES diagnostics installed and you want to run them, bring your system down. When you bring it up again, interrupt the Operating System Load Menu. Then, from the Technical Maintenance Menu, choose option 5.

Technical Maintenance Menu

. . .

5 Run diagnostics

. . .

Enter choice [1]: **5** ↵

SYSBOOT prompts

Are you sure you want to run diagnostics? [N]:

If you have co-resident ADES on your disk and you want to run it, type **Y** ↵. Otherwise, press ↵.

Software Problems — Submitting a Software Trouble Report (STR)

If you are having serious system problems, and your organization is *outside* the continental United States, you should generally consult your local DG systems engineer about them.

If your site is inside the continental U.S., and you have a contract with the Atlanta support center, call the support center for help. Before doing so, however, it's a good idea to try to define and isolate the problem — and to fill out the on-line STR form for AOS/VS-related problems (pathname :UTIL:STR_FORM_AOSVS) or for other products (pathname :UTIL:STR_FORM). You can use this form to report information to Atlanta or directly to Data General. The rest of this section guides you through some troubleshooting steps.

Wherever you are, it's important to discover whether the problem is software or hardware. The system error log (:ERROR_LOG), FRU tests, and the CONTEST program can help in this area. Be sure that you are running current versions of the AOS/VS and SCP operating systems, with current microcode, and that all patches and hardware fixes have been applied to your system. You may also be interested in the *AOS/VS Monthly Newsletter*; DG publishes STR responses in this newsletter.

The best way (often the *only* way) to identify a software bug is to reproduce the environment in which the bug appeared. To do this, DG requires a copy of the software *and* information on your environment. If you don't provide these, DG may not be able to help you. It's very frustrating to receive STRs that say simply "EXEC HANG" or "SYSTEM TRAPPED," and it may be impossible to provide useful answers to such STRs. So, it's in your interest to provide all the background information that you can.

Before you decide to submit an STR, be sure that all current patches have been installed. This includes peripheral manager, Agent, CLI, VSGEN, and other patches. If you patch VSGEN or any associated library, run VSGEN again to generate a new system; then apply AOS/VS patches to this system. In many cases, patching will clear up an error situation — allowing your applications to continue normally, and eliminating the need to submit an STR. Patches are easy to apply with the autopatch facility (Chapter 4).

Gathering STR Information

Ultimately, if you decide that you want to submit an STR, set up for the STR by running AOS/VS and other software that you normally use. Then, if the error condition occurs, execute the following steps.

1. If AOS/VS has panicked (displayed *FATAL AOS/VS ERROR*), record the panic code and values (or, with a hardcopy console, use the listing). Go to step 11.

2. Note all processes that are/were running, including both DG and user application. Describe types and priorities if you can.

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3. If a user process (son of EXEC) is malfunctioning or is deadlocked, note its process ID (pid). Then create a break file and dump it to tape or diskette via the following steps.

```
) SUPERPROCESS ON ↵
```

+) BREAKFILE/FILE=pathname pid ↵	(pathname gives the break file name. If the process is executing in a ring other than 7, you will also need to specify the ring. Type HELP/V BREAKFILE ↵ for more information.)
+) TERMINATE/B pid ↵	(Terminate process. If the process won't terminate, you will need to force a shutdown. Go to step 8.)

Mount tape or diskette on an available unit; e.g., MTB0.

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COPY @MTB0 pathname ↵ (For diskette, get to the pathname directory; then insert a diskette and type DUMP/V @DPJ10 filename ↵. If the file won't fit, use labeled diskettes (@LFD:volid:filename) as described in Chapter 10.)

Go to step 20.

4. If a process not under EXEC (a son of the master CLI) is malfunctioning or deadlocked, follow these steps. If the process is a CEO process, try to shut down CEO (type SUPERPROCESS ON ↵, CEO.SYSTEM STOP ↵). If the process is a XODIAC or INFOS II process, try to shut these processes down as you would for a normal shutdown. Now, follow the steps shown under step 3.

5. If the error condition is a process trap, follow these steps. When a process traps, it automatically creates a break file, with .BRK suffix, in its working directory. Note the trap type (e.g., VALIDITY), the program counter, accumulators (ACs), and carry (C). For tape, use the CLI COPY command to copy the .BRK break file to tape; e.g., COPY @MTB0 pathname ↵; and go to step 20. For diskette, use the dump command; for example, DUMP/V @DPJ10 filename ↵. If the file won't fit, use labeled diskettes as described in Chapter 10. Then go to step 20.

6. If more than one user process (but not every user process) is hung or malfunctioning, or if EXEC displayed an *INTERNAL INCONSISTENCY* message, then EXEC, the peripheral manager, or the system itself may be having problems. You will need to force a shutdown. Go to step 8.

7. If the entire system is hung, note whether the system console responds to commands or CTRL-C sequences. (This helps us determine whether the problem is in the peripheral manager or AOS/VS itself.) Also, note whether disk READY lights are blinking (the READY light blinks when the disk is busy). If tape I/O is in process, note whether the tape(s) are moving.

   Then break the deadlock, get information, and force a shutdown as follows.

   Unlock the computer (if locked). Type the break sequence (CMD and BREAK, BRK, or BREAK). The system console displays

   SCP-CLI>

   Get needed status information by typing the following sequence of commands *four times* (or eight times if the PC values are different).

   SCP-CLI> HALT ↵
   SCP-CLI> . ↵ (The . is the SCP status command. If HALT prints status information, omit the . command.)

   SCP-CLI> CONTINUE ↵
   AC0 AC1 AC2 ... PC MAP
   n n n ... n x (Note status information for both job processors on multiprocessor systems.)

   After doing HALT/CONTINUE four times (or eight times if the PC values differed), go to step 9.

8. If possible, warn users to log off if they can (use the SEND command or BROADCAST macro). If CEO, XODIAC, or INFOS II processes are running, try to shut them down normally (but *don't* use the DOWN macro, since it terminates EXEC).

   After you have as many processes as possible shut down, get to the SCP CLI: unlock the computer (if locked); then type the break sequence (CMD and BREAK keys, or BRK, or BREAK).

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9. Start ESD via reset and start:

   SCP-CLI> RESET ↵ (Use RESET, not HALT.)
   SCP-CLI> START 50 ↵

   Do you want a memory dump (to submit a Software Trouble Report) (Y or N)? [Y]

10. For reel-to-reel tape, get a scratch tape, 800 feet or more with write-enable ring in. Mount the tape on unit 0 on the first controller, if available. If the unit has a density switch, choose DENSITY HIGH.

    For diskette, get several scratch diskettes (3-4 needed with 2 Mbytes of memory). These must be hardware formatted but need not be formatted with the Disk Formatter. Insert a diskette in unit DPJ10 (or DPJ1 if the diskette and disk share a controller).

    The system console is displaying

    Do you want a memory dump (to submit a Software Trouble Report) (Y or N)? [Y]

11. Type Y ↵.

    The system console displays

    Dump to magnetic tape or diskette (T or D) ? [T]

12. For tape, press ↵ or type T ↵. For diskette, type D ↵. Depending on the device, it then displays

    Please mount tape. Then specify unitname. [default]
    insert diskette in unit.

13. If you mounted the tape or diskette in the unit shown as default (for example, MTB0 or DPJ10), press ↵. If the tape or diskette is on a different unit, type the unitname and press ↵; for example, MTB1 ↵.

    After you respond, the memory dump routine copies main memory and other things to tape or diskette. If it needs another tape it will display

    Please mount next tape.
    Press NEW LINE when ready.

13a. Mount another tape and press NEW LINE.

    For diskette, it displays *Dumping*, followed by periods to indicate the passage of time. If it needs another diskette, it will display

    Diskette is full.
    Please insert next diskette in unit.
    Press NEW LINE when ready.

13b. Insert another diskette and press ↵.

    When done, the routine rewinds the tape (if using tape), and starts Emergency Shutdown (ESD). If you are dumping to diskette, the routine prompts you to remove the last diskette and press ↵ before it runs ESD. If you had a diskette that was initialized as an LDU in the diskette unit, reinsert it *before* pressing ↵.

    ESD runs as shown in the next section. The messages are

    Memory dump completed. (Dumping to tape)

    Memory dump completed. Please remove diskette.
    Press NEW LINE when ready. (Dumping to diskette.)

    Running Emergency Shutdown (ESD)

    File system restart

    Now restarting device ...

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Formatting a Shared (Dual-Ported) LDU

Certain disk models can be connected to two MV/Family computers at once. (Each computer must, in addition, have a system disk of its own.) The main advantage of a shared LDU is fast recovery if one system fails — a big advantage for important database files.

On each computer, the system disk must be formatted and a system built — just as if the computers were not connected (doing this is described in Chapters 3, 4, and 5). You can format the shared LDU from either system, and, via the Disk Formatter, give it a unique ID and meaningful logical disk name. Give the LDU a restrictive ACL (for example, null). This will help prevent unauthorized people from initializing the LDU.

After the LDU has been formatted, you will need to protect its unit name entries in :PER. (If this isn't done, a user might read or write to the LDU as a physical device; for example, via DUMP/V @DPJ1 MYFILE ⤸.) The UP macro can protect a unit entry, with Superuser on, via a command like ACL @DPJn +, ⤸.

When one system wants to use the LDU, it can turn Superuser on, initialize the LDU, and change the Formatter-assigned ACL as needed. Then, users and programs can access it like any LDU, by directory name. After initialization, the LDU is part of the file system, and access controls remain in force.

An LDU cannot be initialized if it's already initialized — this prevents the second system from initializing the shared LDU while the first system is using it. After a system has released the shared LDU, it can be initialized by *either* system. Be careful, however, and prevent both systems from trying to access the LDU at the same time.

More information on using shared LDUs appears in Chapter 15.

Formatting a Mirrored LDU

Model 6236- and 6239-class disks permit logical disk mirroring. In logical disk mirroring, the operating system maintains two logically identical images of an LDU. Disk mirroring provides high data availability, but means giving up disk space. It may also have a performance cost. For more about logical disk mirroring, see Chapter 15.

You can mirror any LDU, including multi-disk LDUs, except an LDU named BOTH (used for SWAP and PAGE directories).

When you format a mirrored LDU, the Disk Formatter requires that the disks be the same size and on the same controller. You must also make the following the same for both images: LDU name, bad block table entries, remap area size and address, and diagnostic area. You must, however, make the LDU unique IDs different.

Tell the Disk Formatter that the disks you are formatting are to be mirror images by separating them with the ! associator. When the Disk Formatter prompts

Specify each disk in the LDU (press NEW LINE when done)
Disk unit name?

type the LDU names separated by a ! For example,

DPJ1!DPJ2 ⤸

Here, the two disks DPJ1 and DPJ2 constitute a single-disk mirrored LDU.

To format a multi-disk mirrored LDU, tell the Disk Formatter about each set of paired images. For example, you have four disks — DPJ0, DPJ1, DPJ2, and DPJ3. Let's assume that you want to create a mirrored LDU where each image is a two-disk LDU. In this example, DPJ0 and DPJ1 are one LDU image; and DPJ2 and DPJ3 are the other LDU image.

When the Disk Formatter asks

Specify each disk in the LDU (press NEW LINE when done)
Disk unit name?

Answer

DPJ0!DPJ2 ⤸

The Disk Formatter repeats

Specify each disk in the LDU (press NEW LINE when done)
Disk unit name?

Answer

DPJ1!DPJ3 ↵

The third time the Disk Formatter asks *Specify each disk..., Disk unit name?*, press ↵. Finish the DFMTR dialog, and you will have created a mirrored LDU that looks like the one shown in Figure 12-2.

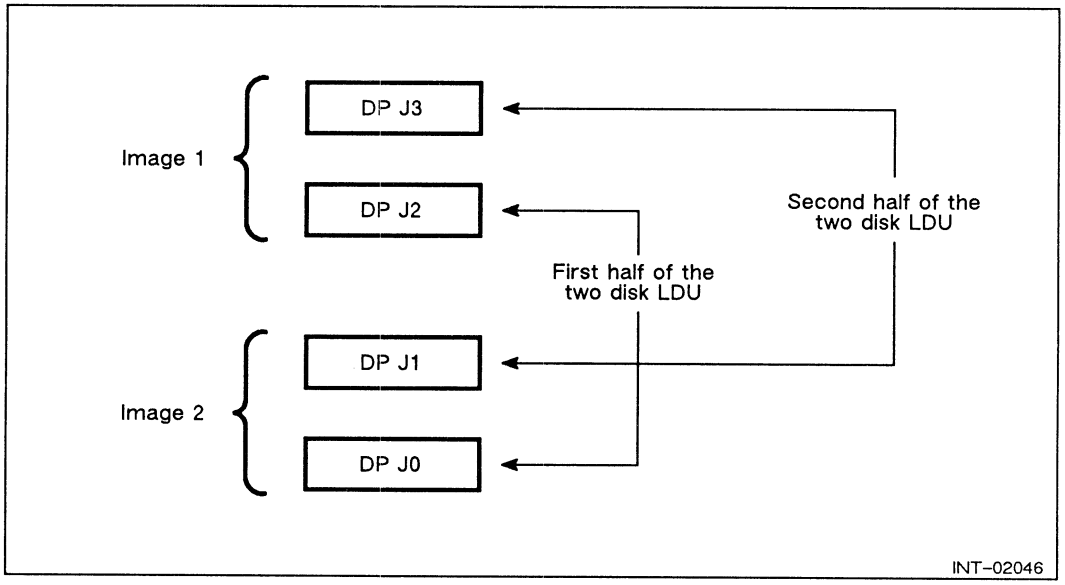


Figure 12-2. A Finished Two-disk Mirrored LDU

In Figure 12-2, DPJ0 and DPJ2 represent the first half of the two-disk LDU, and DPJ1 and DPJ3 represent the second half. DPJ0 and DPJ2 must the same size and on the same controller. Likewise, DPJ1 and DPJ3 must be the same size and on the same controller. But DPJ0 and DPJ2 *can* be a different size from DPJ1 and DPJ3.

Reformatting a Mirrored LDU Following a Disk Failure

If a hard disk error occurs while the system is writing to a mirrored pair of disks, the system will "break" the mirror. In such a case, a normal resynchronization cannot succeed. What you must do depends on whether the disk is a system disk or not. Determine what kind of disk has failed, and then follow the steps outlined below.

If the disk that failed is not the system disk

1. Run a Disk Formatter Full format on the broken mirror, performing a surface analysis (run patterns).
2. Run a Disk Formatter Partial format on both images, making sure you specify the good image first; then the newly formatted image.

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If the disk that failed is the system (or root) disk

1. Boot the Disk Formatter from tape and run a Disk Formatter Full format on the system disk only.
2. Install both a bootstrap and a system bootstrap, using the Installer program.
3. Run a Disk Formatter Partial format on both images, making sure you specify the good image first; then the newly formatted image.
4. Bring up the system and resynchronize the images.

The Bitmap/Overlay Areas and System Performance

The *bitmap* is an area on each LDU that describes which blocks are free and which are used for data storage. The overlay area contains the overlays of the currently running AOS/VS system. There is a bitmap on every LDU; there is an overlay area only on an LDU that includes a system disk.

AOS/VS must access the bitmap every time it creates or deletes a file. It must access the overlay area whenever it needs nonresident code to perform an operation. So the location of these two areas on the LDU can affect system performance.

The default bitmap and overlay area addresses are often chosen when an LDU is created. The default bitmap address is 3/8 the distance across the first disk in the LDU; and the default overlay area address follows the bitmap. These are good general-purpose addresses for a single-disk LDU: they are close to the center, which gives fast access if the LDU is nearly full of files. And they are closer to the beginning, which gives relatively fast access if the LDU has few files.

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Table 12-1. All AOS/VS Disk Unit Names and Device Codes

Disk Model Number, Description, and Capacity	Default Device Code of Controller	Disk Number on Controller	Disk Unit Name
6063, 6064, 6066. Each is a fixed-head disk. The 6063 holds 1 Mbyte, the 6064 holds 2 Mbytes, the 6066 is two 6064 units and one controller.	26	first (0) second (1) third (2) fourth (3)	DKB0 DKB1 DKB2 DKB3
	66	first (0) second (1) third (2) fourth (3)	DKB10 DKB11 DKB12 DKB13
6067. See 6060 description.			
6070.This is a moving-head unit with two disks: one removable, one nonremovable. Unit capacity is 20 Mbytes.	33	0 on dial 1 on dial 2 on dial 3 on dial	Removable: DPG0; nonremovable: DPG4 Removable: DPG1; nonremovable: DPG5 Removable: DPG2; nonremovable: DPG6 Removable: DPG3; nonremovable: DPG7
	73	0 on dial 1 on dial 2 on dial 3 on dial	Removable: DPG10; nonremovable: DPG14 Removable: DPG11; nonremovable: DPG15 Removable: DPG12; nonremovable: DPG16 Removable: DPG13; nonremovable: DPG17
6097. This is a diskette unit, single or dual slot. Diskette capacity is 1.26 Mbytes.	33	first second	Left: DPI0; right: DPI1 Left: DPI2; right: DPI3
	73	first second	Left: DPI10; right: DPI11 Left: DPI12; right: DPI13
6098. This is a moving-head sealed disk with diskette. A toggle switch makes the disk unit 0 and diskette unit 1, and vice-versa. Capacity: Disk 12.3 Mbytes, diskette 1.26 Mbytes.	33	only	Disk DPI0 and diskette DPI1; or vice-versa.
	73	only	Disk DPI10 and diskette DPI11; or vice-versa.
6099. This the same as model 6098, but without the diskette.	33	only	DPI0
	73	only	DPI10
6100. This is the same as 6098, with twice the disk capacity; disk 24.6 Mbytes, diskette 1.26 Mbytes.	33	only	Disk DPI0 and diskette DPI1; or vice-versa.
	73	only	Disk DPI10 and diskette DPI11; or vice-versa.
6103.This is the same as the 6100, without the diskette; capacity is 24.6 Mbytes.	33	only	DPI0
	73	only	DPI10
6122. See 6060 description.			
6160, 6161. See 6060 description.			
6214. See 6060 description.			

(continued)

Table 12-1. All AOS/VS Disk Unit Names and Device Codes

Disk Model Number, Description, and Capacity	Default Device Code of Controller	Disk Number on Controller	Disk Unit Name
6227. A sealed, moving-head disk, capacity 15 Mbyte. There can be a 1.26-Mbyte diskette on the same controller. If so, a toggle switch under the front panel makes the disk unit 0 and diskette unit 1, and vice-versa.	33	only	Disk DPI0 (with diskette, DPI0 or DPI1)
	73	only	Disk DPI10 (with diskette, DPI10 or DPI11)
6234. A sealed, moving-head disk, rack-mounted. It holds 50 Mbytes.	33	only	DPI0
	73	only	DPI10
6236, 6237, and 6357; 6239, 6240, and 6290; 6398, 6399, and 6400. A rack-mounted, sealed, moving-head unit with power switch on the right. It has an LED display that shows the number and can show the current cylinder or disk fault code. A controller can run four units. A model 6236 unit holds 354 Mbytes; a model 6237 is three 6236 units in one cabinet, on one controller. A model 6239 unit holds 592 Mbytes; a model 6240 is three 6239 units in one cabinet, on one controller; a model 6290 is two 6239 units in one cabinet, on one controller. A model 6357 holds 862 Mbytes; a model 6398 is two 6357 units in one cabinet, on one controller. A model 6399 is three 6357 units in one cabinet, on one controller. A model 6400 is six 6357 units in two cabinets, on two controllers.	24	first (0) second (1) third (2) fourth (3)	DPJ0 DPJ1 DPJ2 DPJ3
	64	first (0) second (1) third (2) fourth(3)	DPJ10 DPJ11 DPJ12 DPJ13
	*	first (0) second (1) third (2) fourth (3)	DPJ20 DPJ21 DPJ22 DPJ23
	*	first (0) second (1) third (2) fourth (3)	DPJ30 DPJ31 DPJ32 DPJ33
6309. This is a 737,000 byte, 5-1/4 inch, minidiskette unit. It is an add-on to the primary diskette on MV/4000SC and Data General DS/4000-series systems.	64	second (1)	DPJ11
6310, 6328, 6329, 6363. This is a 5-1/4 inch, sealed disk, an add-on to the primary disk on packaged systems like the MV/4000 DC and the MV/2000 DC and on engineering workstations like the DS/7500. Model 6310 holds 38 Mbytes. Model 6328 holds 70 Mbytes. Model 6329 holds 120 Mbytes. Model 6363 holds 160 Mbytes.	24	second (1)	DPJ1
6446-M, 6429, 6430, 6432, 6453, 6464, 6465, 6466, 6467. A 5-1/4 inch Winchester disk with a disk capacity of 234 Mbytes (Model 6446-M) but also available (as Combined Storage Subsystem or CSS) with two, three, or four disks and/or with cartridge tapes (21 Mbyte and/or 130 Mbyte) for a total of seven devices in two cabinets.	24	first (0) second (1) third (2) fourth (3)	DPJ0 DPJ1 DPJ2 DPJ3

(concluded)

* There is no default device code for the third, fourth, or subsequent disk controllers. These device codes are chosen at installation.

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Table 12-3. Surface Analysis Times for Disks

Disk Model	Capacity (megabytes)	Approximate Time Per Test Pattern
6060	96	13 minutes
6061	190	17 minutes
6122	277	26 minutes
6160	73	11 minutes
6161	147	22 minutes
6214	602	52 minutes
6227	15	10 minutes
6234	50	8 minutes
6236, 6237	354 per unit	35 minutes per unit
6239,6240,6290	592 per unit	50-60 minutes per unit
6309	0.7	2 minutes
6310	39	8 minutes
6328	71	14 minutes
6328	120	24 minutes
6063	1	3 minutes
6064,6066	2	6 minutes per disk unit
6097 (diskette)	1.26	2 minutes
6070	10 per disk	14 minutes per disk
6045	5 per disk	8 minutes per disk
6096, 6099	12.5 (disk) 1.26 (diskette)	14 minutes for hard disk 2 minutes per diskette
6100, 6103	25 (disk) 1.25 (diskette)	28 minutes for hard disk 2 minutes per diskette
6030 (diskette)	0.3	2 minutes

Analyzing Disk #n

The Disk Formatter now runs the pattern(s) on the current disk. As each pattern runs, the Formatter displays

— *Running pattern n*

where *n* is the octal value of the pattern that's running.

As the Formatter finishes the pattern(s) on each disk, it updates the disk's bad block table. Each disk that isn't analyzed retains its existing bad block table. If an existing table is invalid, the Formatter prints a message and zeros the bad block table. The Formatter issues an error message and terminates if it finds more than 126 bad blocks on one physical disk. (It allows up to 1022 bad blocks on a model 6214 disk.) All error messages are explained in Table 12-5.

When the Disk Formatter completes the surface analysis on this disk, it says

n bad disk blocks

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If there are bad blocks, it asks

Display bad block statistics? [N]

You may want to see the bad block statistics. If so, type Y ↵; and the Formatter displays the address of each bad block. You might want to note these for future reference (on any but a 6214 disk). To skip the statistics, press ↵ or type N ↵.

Next, the Disk Formatter asks for any additional bad block numbers.

Additional bad block number (press NEW LINE when done):

Generally, on a Full format, you will have no additional bad blocks to enter; if this is true, press ↵ and skip to the *Bitmap ...* questions. If you want to enter one or more bad blocks, type each block's address. You can do this by typing the logical block number (in octal). Or, for any disk except a DPJ-type disk, you can type the disk-number, cylinder, head, and sector numbers of each block in this format:

```
disk-number:cylinder-number,head-number,sector-number
```

(Omit the head number for a bad block in a fixed-head disk). Press ↵ to signal the end of your bad block entries. Now the Disk Formatter asks if it should display the updated bad block statistics.

Display bad block statistics? [N]

Press ↵ or answer Y ↵. If you answer Y ↵, the Formatter displays the updated bad block statistics. Then, if there is another disk in the LDU, the Formatter returns to run patterns (if specified) on it; then, it runs through the bad block statistics again.

If you are formatting a mirrored LDU, the Disk Formatter merges the bad block tables if they differ. When it does this, the Disk Formatter prompts *Bad block tables have been merged for disk # n* before the prompt *Display bad block statistics? [N]*.

When the Formatter has asked about bad block tables for all disks in the LDU, it displays the bitmap size and asks about the bitmap address:

Bitmap size: n

Bitmap address? [default]

The default address (displayed in brackets) is 3/8 of the distance across the first disk in the LDU. This is a good general-purpose choice; we recommend it. To select the default, press ↵.

There may be a reason to start the bitmap at the beginning of the LDU (described near the beginning of this chapter). If you know that you want the bitmap at the beginning of the LDU, type 0 ↵.

If the bitmap you specify or default contains bad blocks, the Disk Formatter issues a warning and asks you to confirm the address. Do *not* confirm it. Instead, type N ↵; then add 100 octal to the original bitmap address and try again. Keep doing this until the Formatter accepts your answer.

The Disk Formatter then writes the bitmap to the LDU. Then — unless you allocated a diagnostic area earlier — it asks

System LDU? [Y]

If you will ever want to bootstrap a program (like AOS/VS or PCOPY) from this LDU, answer ↵ or Y ↵. This tells the Formatter to reserve space for a system bootstrap on the LDU.

LDUs aside from your master LDU need not be system disks. But, since space for an AOS/VS system represents a small portion of total disk space (on most hard disks), you can generally default the answer to yes. Of course, if you're formatting a diskette or if you know that you will never want to bootstrap from this LDU, answer no (N ↵); the Formatter then skips the next two questions.

The Formatter now describes the bad blocks for this disk:

For disk #n
n bad disk blocks

If there are any bad blocks, it asks

Display bad block statistics? [N]

To see the details on old and new bad blocks, type Y ⏎. To skip the details, press ⏎; the Formatter then summarizes old and new bad blocks and skips to *Update bad block table*. A sample bad block display looks like this.

```
    Addr: 00000574537  Cyl: 000653  Head: 000010 Sect: 000017
    Addr: 00000747566  Cyl: 001043  Head: 000014 Sect: 000006
*   Addr: 00000747570  Cyl: 001043  Head: 000014 Sect: 000006
```

* *New bad block which was not allocated*
** *New bad block which was allocated (must run FIXUP!)*

n old bad blocks.
n new unallocated bad blocks.
n new allocated bad blocks.

For DPJ-type disks, only the block number (*Addr*) is displayed.

If *n new allocated bad blocks* is not 0, one or more new bad blocks have developed in AOS/VS file(s). (AOS/VS will prompt you to run FIXUP the next time you try to access this LDU.) If you have a recent full backup, you may be able to save a file, directory or database. See the CAUTION below.

But if the Formatter finds *many* new bad blocks (allocated or unallocated) during read-only analysis, this may mean disk hardware problems. In such cases, you might want to abort the Formatter with CTRL-C CTRL-B (stand-among) or the break sequence (stand-alone); then consider running diagnostics on the disk unit with a different pack (if possible). After all, you don't want bad blocks noted on the disk if the disk is fine and the unit *heads* are out of alignment.

Next, the Disk Formatter asks if you want to

Update bad block table? [N]

Press ⏎ if you don't have any new bad blocks to enter, or if you don't want the Disk Formatter to enter any bad blocks it found during the read-only analysis. If you press ⏎, the Formatter skips to the *Bitmap ...* questions.

Generally, if the Formatter found only a few new bad blocks, you should answer Y ⏎.

CAUTION: The Disk Formatter marks as "bad" any block it cannot read twice with the same results; it does not try to correct errors. The CLI DUMP command or the DUMP_II or PCOPY programs, on the other hand, may be able to correct errors and read a file. But if you answer Yes to the question *Update bad block table?*, none of the file backup programs will be able to read the bad block. If you don't have a recent full backup, abort the Partial format now (BREAK for stand-alone; CTRL-C, CTRL-B for stand-among) and take a full backup. Then run a Partial format again and answer Yes to this question. Finally, reload the full backup using the /R or /DEL switch.

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The Formatter then enters the new bad blocks it found; and it asks you to enter other bad blocks.

Additional bad block number (press New LINE when done):

Specify each bad block by typing its logical block number (in octal); or (except on DPJ-type disks) type the disk number, cylinder, head, and sector number in this format:

disk-number:cylinder-number,head-number,sector-number

(Omit a head number for a bad block on a fixed-head disk.) Press ↵ to signal the end of your bad block entries.

Now the Disk Formatter asks if it should display the updated bad block statistics:

Display bad block statistics? [N]

Press ↵ or type Y ↵. If you answer Y ↵, the Formatter displays the updated bad block statistics. Then, if there is another disk in the LDU, it does the read-only analysis (if specified) and runs through the bad block sequence again.

If you are formatting a mirrored LDU, the Disk Formatter merges the bad block tables if they differ. When it does this, the Disk Formatter prompts *Bad block tables have been merged for disk # n* before the prompt *Display bad block statistics? [N]*.

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When the Formatter has asked about bad block information for all disks in the LDU, it displays the LDU's bitmap size and asks about the bitmap address:

Bitmap size: n

New bitmap address? [default]

There is one bitmap for all physical disks in the LDU.

You can always take the default bitmap address, assigned when this LDU was fully formatted, by pressing ⤶.

By default — during the Full format that creates an LDU — the Formatter puts the bitmap 3/8 of the distance across the first disk in the LDU. This is a good general-purpose address.

There may be reason to move the bitmap to the beginning of the LDU — as described near the beginning of this chapter. However, if the LDU has been used with AOS/VS, the desired area probably has files in it; if so, the area won't be available for the bitmap. You can check by typing 0 ⤶; then, if the Formatter rejects your answer, you can retain the old address.

If you really want to have the bitmap at the beginning of the LDU, and this area is already allocated to files, the best course is to dump all files from the LDU, run a Full format and put the bitmap where you want, and reload the files. This will also reduce fragmentation on the LDU.

If the bitmap area you specify or default contains bad blocks, the Disk Formatter issues a warning and asks you to confirm the address. Do not confirm; type N ⤶. If the area has AOS/VS files in it, the Formatter will say *Specified area already allocated.* For either error, add 100 octal to the address typed and try again. Keep doing this until the Formatter accepts your answer.

Depending on your answer, the Formatter leaves the bitmap in its original spot, or moves it to a new one.

If the LDU was formatted as a system disk, the Formatter skips the next question. Otherwise, it asks

Allocate a system bootstrap area ? [N]

This question allows you to set up the LDU as a system disk, from which you can start and run an AOS/VS system.

If you answer Y ⤶, the Disk Formatter will reserve a 126-block area for SYSBOOT. It will also ask about overlay area size and address. To be able to boot and run AOS/VS from this LDU, you must answer Y ⤶ to this question, and specify the correct overlay area size to the next question. (The size is 620 octal.) Then you must use the Installer to install a disk bootstrap, system bootstrap, and system on the LDU. Next, from AOS/VS, you must copy the CLI, Agent, PMGR, and microcode (.MCF) files to the LDU (CLI MOVE command). Thereafter, if this LDU includes a disk on unit 0, you will be able to start and run AOS/VS on it as if it were your original LDU.

If you don't want to be able to start and run AOS/VS from this LDU, press ⤶ and skip to the *Remap area* questions.

New overlay area size [default]

Generally, you should take the default by pressing ⤶. But if the default is 0, and you want to set up the LDU as a system disk, type the appropriate value, described three paragraphs back, and ⤶.

New overlay area address [default]

To take the default, given when the LDU was fully formatted, press ⤶. (But if you moved the bitmap in the previous step, move the overlay area to start immediately after the bitmap. To do this, add the bitmap size given by the Formatter to the bitmap address you typed — octal arithmetic — and type this number.)

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Chapter 14
Cautions and Hints to the System Operator

Read this chapter

- when you want to learn some simple things to avoid;
- when you have a problem with the system and don't know what to do.

If you need to maintain a very secure AOS/VS system, such as one meeting U.S. Department of Defense Class C2 standards, read Chapter 16, "System Management Considerations — Security."

This chapter attempts to tell the operator, as quickly and tersely as possible, what not to do, and what to do in confusing or serious error situations. Each section ends with a series of blank lines — designed for the operator, system manager, or anyone in authority to add his or her own cautions and hints. Neither section is exhaustive; it simply attempts to cite common situations.

The major sections are

- Cautions
- Hints

Cautions

By observing the following list of cautions you will help preserve the integrity of your multiuser system.

- Don't leave the CPU, disk units, or system console unattended for long periods, unless you know that all people in the area are trustworthy and experienced users. Cutting power to the CPU or disks, or resetting the main processor, will usually bring AOS/VS down abnormally. Also, anyone with access to the system console can type the break sequence, run ESD, restart AOS/VS, and come up in the master CLI, with all its powers.
- Don't leave a standard CLI running on the system console. The master CLI and its son CLIs (except for LOCK_CLI) have all process control and "super" privileges. Do not endanger system integrity by allowing users access to these privileges.
- If your system is connected to another site — via modem or network — consider remote user privileges carefully. A privileged profile, with network or modem access, gives a network or modem user access to all your files from outside your installation.
- If you're running a secure system, with detailed logging (SYSLOG with /DETAIL=FULL), remain aware of the log file and its space requirements. If the system runs out of space for file :SYSLOG with /DETAIL=FULL, it will panic. Follow procedures for generating and examining reports, and for dumping and deleting old log files.
- Don't cut power to CPU or disk units without shutting the AOS/VS system down; if the CPU has a LOCK switch, keep it in the LOCK position.
- Don't type main processor control commands like HALT or RESET to the SCP-CLI when AOS/VS is running.
- Always shut down the system normally unless an emergency forces an abnormal shutdown.
- Don't panic if you accidentally hit the break sequence and see the SCP-CLI running on the system console. Type TTY ↵ (or on MV/4000, CONTINUE ↵)to return control to AOS/VS.

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- Don't allow hardware diagnostics (MV/ADES or DTOS) to run on a disk that has valuable data, unless you know the program will use only a reserved diagnostic track on the disk. Hardware diagnostics destroy the file structure and status information on some disk models. Generally, consult your DG support organization before running hardware disk diagnostics. When running tape diagnostics, always use a scratch tape.

Use the following blank lines for your own notes or comments.

Mirroring Messages and Errors

When using logical disk mirroring, you may get one of the messages reported in Table 15-6. (For convenience, the error messages also appear in Chapter 17.)

Table 15-6. Mirroring Messages and Errors

Message	Meaning and Action
CANNOT INIT AN LDU IMAGE THAT WAS PREVIOUSLY BEING SYNCHRONIZED	Someone aborted a command line that contained a MIRROR/WAIT command using this LDU image as an argument, or there was a system panic or hardware failure. Since you cannot initialize the image specified in the INITIALIZE command line, issue the INITIALIZE command, giving the other image as an argument.
CONTROLLER DOES NOT SUPPORT LDU MIRRORING	In AOS/VS Revision 7.00, logical disk mirroring requires 6236- or 6239-class disks. You tried to mirror an invalid type of disk, or your disk microcode is the wrong revision.
INCOMPLETE MIRRORED LDU SPECIFIED	You used the CLI INITIALIZE command to start mirroring, but specified only one LDU image. Type the command again, but specify two images using the format INITIALIZE unitname!unitname or use the command INITIALIZE/NOMIRROR if one image is not available.
LDU DOES NOT EXIST	The LDU specified with the MIRROR command does not exist. Check the command line.
LDU FORMAT MISMATCH - NOT A VALID MIRROR	The bad block table entries or the sizes or addresses of the remap areas on the two images differ. You must run a Disk Formatter Partial format on the disks and make the values match.
LDU IMAGE 'LDU unique ID' OF THE LDU NAMED 'name' HAS BEEN REMOVED BY THE SYSTEM	The system has removed one of the LDU images because of a hardware failure. Fix the problem. Then, start mirroring again with the CLI command MIRROR/SYNC.
LDU IMAGE 'LDU unique ID' OF THE LDU NAMED 'name' IS NOW SYNCHRONIZED	You started a mirror synchronization using the CLI command MIRROR. The synchronization is complete.
LDU IS NOT MIRRORED	You used the CLI INITIALIZE command to initialize a synchronized mirror, but the LDU is not part of a mirror.
LDU NAME MISMATCH - NOT A VALID MIRROR	You used the CLI INITIALIZE or MIRROR command to start mirroring, but the two LDUs have different LDU names. Check the command line or run a Disk Formatter Partial format on each LDU and make the names the same.
LDU SIZE MISMATCH - NOT A VALID MIRROR	You used the CLI INITIALIZE or MIRROR command to start mirroring, but the LDUs differ in size. Make sure the disks are the same size. If they are, check to see if the size of the diagnostic area on each disk is the same. If not, run the Disk Formatter Full format on the second disk and make these values (and the sizes) the same.

(continues)

Table 15-6. Mirroring Messages and Errors

Message	Meaning and Action
LDU UNIQUE IDS ARE NOT UNIQUE - NOT A VALID MIRROR	You used the CLI INITIALIZE or MIRROR command to start mirroring, but the LDU unique IDs are the same (they must be different). Run a Disk Formatter Partial format on either disk and make the LDU unique IDs different. Suggestion: make the LDU unique ID the same as the disk unit name (for example, DPJ1).
LDU WAS RELEASED DURING SYNCHRONIZATION - LDU IS NOT SYNCHRONIZED	Someone released an LDU image before a MIRROR/WAIT command that specified this image had completed. Issue the command INITIALIZE/NOMIRROR, giving as an argument the name of the preferred mirror. Then, issue the command MIRROR/SYNC, giving the other image as an argument.
MIRRORED LDU IS NOT SYNCHRONIZED	You used the CLI INITIALIZE command to start mirroring, but one of the images is less recent than the other. (If you don't know which is more recent, you can run FIXUP.) Then, use the CLI command INITIALIZE with the /NOMIRROR switch, giving the name of the more recent image as the argument. Finally, use the CLI command MIRROR/SYNC, giving the name of the other image as the argument.
MIRRORED LDU IS OUT OF PHASE	You used the CLI MIRROR command to start mirroring, but the LDU image is more recent than the initialized LDU image. If this is what you want to do, use the command MIRROR/FORCESYNC.
MIRRORED LDU SYNCHRONIZATION FAILED	An error condition occurred before a MIRROR/WAIT completed. Fix the problem and start over.
SYNCHRONIZATION OF LDU IMAGE 'LDU unique ID' OF THE LDU NAMED 'name' FAILED	Someone aborted a command line that contained a MIRROR/WAIT command, or they released the LDU, or there was a problem with the hardware. If there was a hardware problem fix it. In all cases, use the CLI command MIRROR/SYNC, giving the name of the other image as an argument.

(concluded)

Windowing with DG/VIEW

Windowing allows a user to run one or more processes in windows (rectangular areas on the console screen). Each process takes input and displays output in its window. A major advantage to windowing is the ability to see what's happening with several programs simultaneously.

NOTE: Windowing is not allowed on AOS/VS systems designed to meet U.S. Department of Defense Class C2 standards. See Chapter 16 for more information about security and C2 systems.

Windowing with DG/VIEW (DG's window management program) is supplied with DS/7000-series computers. DG/VIEW is an independent product, which you (or someone) must install from tape or diskette. It works on pixel-mapped (graphics) consoles only.

Users can execute DG/VIEW via the XEQ command, or you can make it a user's initial program via PREDITOR. Its pathname is :DGVIEW_UTIL:SYSTEM:DGVIEW.PR.

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In DG/VIEW, via menu entries, a user can choose his or her own list of applications from a predefined program list. The predefined program list can include often-used programs that are appropriate for windows, like the CLI, CEO or SED editor. And a user can add other applications, like CAD/CAM software that you've installed. After a user changes his or her applications list, DG/VIEW stores the modified list for that user (not for everyone) and displays it in menu form when he or she runs DG/VIEW.

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You can modify the predefined program list (displayed for users when they want to add a program to their menus) as follows.

Pathname and other information on programs in the predefined program list is maintained in a *program information file* (.PIF file) — in directory :DGVIEW_UTIL:PIFS. DG/VIEW looks for .PIF names in this directory and displays the name (without .PIF) on the predefined program list.

Manufacturers can create .PIF files and ship the files with their software, or you can create them with the DG/VIEW program information editor. When you run this editor (from the DG/VIEW Main Menu), it asks for program pathname and other information, then creates the .PIF file (by default in your user directory). The .PIF file has the program filename with the suffix .PIF instead of .PR. With Superuser on, you can then move the .PIF file to directory :DG_VIEW:PIFS and change the .PIF (and program) ACL to allow access. Thereafter, the program name will appear in users' predefined program lists and they can add it to their initial DG/VIEW menus very easily.

For example, say there's program :UTIL:ANYPROG.PR, which may be an application from a vendor other than DG, or a DG program (like CEO or the CLI), or a program written at your own site. ANYPROG can run in a window, and you want all users to have access to it from DG/VIEW. You *could* have them all add it by pathname to their program lists — or you could create a .PIF file and move it to directory :DG_VIEW:PIF.

To create a .PIF file, you'd

- Run DG/VIEW and use the program information editor to create a program information file (for example, in your user directory, so the pathname is :UDD:your-username:ANYPROG.PIFS).
- Move the PIF file and change ACLs as follows:

```
) DIR :UDD:[!username] ⤸
) SUPERUSER ON ⤸
*) MOVE/V :DG_VIEW:PIFS ANYPROG.PIF ⤸
ANYPROG.PIF
*) ACL :UTIL:ANYPROG.PR +,E ⤸
*) ACL :DG_VIEW:PIFS:ANYPROG.PIF +,RE ⤸
*) SUPERUSER OFF ⤸
)
```

Now, each user who wants to add a program to his or her initial DG/VIEW menu will see the name of ANYPROG and can add it easily. Any program supplied with AOS/VS Revision 7.00 (and any program that can run on a DASHER D460 console) can run in a window.

DG/VIEW users can make menu choices via terminal keys or, if the terminal has one, a mouse or stylus.

After users specify the applications they want (and assuming someone has provided .PIF files for needed applications or users know where the applications are), DG/VIEW needs little attention. It maintains all data and files automatically. However, DG/VIEW doesn't provide a way to delete its user directories (as you might want to do if you deleted a user account); to do this, turn Superuser on and type DELETE :DGVIEW_UTIL:USERS:username: ⤸.

By providing a base for a menu-driven system, DG/VIEW can help people become productive users quickly. *Using* the DG/VIEW product is further described in *Using DG/VIEW*. Windowing concepts are explained in *AOS/VS System Concepts*.

Using the System Management Interface (SMI)

Managing the AOS/VS system requires a working knowledge of the CLI and EXEC, as well as of programs and macros. The System Management Interface (SMI) is an easy-to-use, menu-driven manager interface that prompts the user rather than relying on the user's knowledge of the system. The SMI was designed primarily for novices, but even experienced system managers may welcome a tool that makes their tasks easier to perform. Because it is a menu-driven program, you cannot run the SMI on a hardcopy console. You may decide to use the SMI as your system interface, or make it available to certain privileged users on your system.

To enable and use SMI as your primary system interface, here are the things you must do:

- Create a PREDITOR profile that has the following privileges necessary to use all of the SMI functionality.
  - System manager privilege
  - Unlimited sons
  - Change priority
  - Change type
  - Change username
  - Access devices
  - Superuser
  - Superprocess
  - Change address space type

  Your system's OP profile may already have these privileges.
- To the VSGEN prompt *Initial IPC file for PID2*, specify the pathname of a macro that (1) creates the EXEC process and (2) enables @CON0. The SMI macro, :UTIL:UP_EXEC.CLI, does both of these things. If the macro doesn't do these things, you won't be able to log on.

  At startup, the macro will create the EXEC process, which will enable the system console as if it were a user terminal. The system console will display the message *Press NEW LINE to begin logging on*.
- Tell VSGEN that you want to run the SMI (by answering Yes to the question, *Do you wish to use the System Management Interface*).
- When the system starts, the UP_EXEC macro calls the system UP.CLI macro (:UP.CLI). You can move the macro SMI_UP.CLI shipped in :UTIL to the root directory (:), and rename it UP.CLI. (To do this, first rename :UP.CLI :UP1.CLI. Then type COPY :UP.CLI SMI_UP.CLI.) Or, if you already have an UP.CLI macro, edit it and delete the line that creates the EXEC process. (There can only be one EXEC process running on the system.) Also make sure that your UP.CLI macro is not interactive (look for the pseudomacro !READ). If it is, the system won't come up.

  If you think you may alternate between running with the SMI and running without it, you can have your UP.CLI macro do a conditional test for the file :2.INPIPE. (This file is a pipe the system uses to talk to the OP CLI (PID 2). Its existence indicates that you are running a system with the SMI option.) If the file exists, don't create the EXEC process.
- Move the macro SMI_DOWN.CLI from the directory :UTIL to the root directory, and rename it DOWN.CLI. (To do this, first rename :DOWN.CLI :DOWN1.CLI. Then type COPY :DOWN.CLI :SMI_DOWN.CLI.) Or, if you already have a DOWN.CLI macro in the root directory, you can test for the file :2.INPIPE and make conditional the line that halts or terminates EXEC. Likewise, make sure that the DOWN.CLI macro is not interactive.

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- To allow all users to edit the LOGON.MESSAGE file, create a directory :LOGON with an ACL of +WARE. Move the LOGON.MESSAGE file from :UTIL to :LOGON. Finally, create a link in :UTIL to the log-on message. Type

```
) CREATE/LINK LOGON.MESSAGE :LOGON:LOGON.MESSAGE ↵
```

For information about using the SMI, see *Using the AOS/VS System Management Interface (SMI).*

Routine Procedures

This section touches on some things you might want to consider doing regularly to keep things running well.

- Backup procedures. These are very important and ideally they will be done each day. You can use the DUMP command or DUMP_II utility, the PCOPY program, or MSCOPY program. Chapter 10 explains CLI macros for backup that are shipped with AOS/VS.
- Log files. The system log (SYSLOG) and the error log record user account and error information.

  If you want system logging, consider starting it in the UP macro. The system log file (SYSLOG) grows fast, so someone should dump and delete it regularly. This is critically important with full detail logging, since the system will panic if it runs out of log space. For logging to be worthwhile, reports should be generated and examined routinely (for errors and signs of security violations). This is further described in Chapter 16.

  The SCP log, ERRLOG (if any), is also a good soft/hard error indicator. If your computer has a diskette, someone should clear the log periodically (say every 2 weeks) using the ERRLOG INIT command.
- Diagnostics. Some organizations may want to run the supplied CPU FRU tests or the Advanced Diagnostic Executive System (MV/ADES) tests as a matter of course, say every two weeks. They take less than an hour, but require that AOS/VS be down.

  Periodically, you may want to run the CONTEST AOS/VS-hardware exerciser package to identify possible potential problems.
- Preventive maintenance. This can help safeguard your hardware, and keep your whole system running smoothly.

How to Handle Updates and New Revisions from DG

DG continually improves its software products and updates its technical manuals. It sends the improved products and manuals to all customers who are on the *Software Subscription Service.*

So, if you subscribe to this service, you will periodically get tapes or diskettes and new manuals. Generally, you should install the updated software. In nearly all cases, it will run your existing applications even better than your current revision.

Each AOS/VS revision number is greater than the last; the revisions go 6.00, 7.00, 7.50, 8.00, 9.00, and so on. DG may issue multiple AOS/VS *updates* for each revision. The updates are numbered on the right of the decimal point; for example, for Revision 7.50, the updates go 7.51, 7.52, 7.53, 7.54, and so on.

AOS/VS Updates

For information on using the update tool to install system patches, type

HELP/V UPDATE ⤶

The update tool replaces the previous PATCH utility.

Loading a New AOS/VS Revision

Each AOS/VS revision includes new versions of all AOS/VS program and support files, on an AOS/VS system tape or on diskettes. A revision also includes a printed Release Notice — also supplied as a disk file in :UTIL. The filename of the AOS/VS Release Notice is the same as its part number, with underscores instead of hyphens. For example, the AOS/VS Revision 7.60 Release Notice is :UTIL:085_000147_14. When an update ships with a revision, load the release first; then the update. AOS/VS Revision 7.60, however, has been pre-patched. (Copies of the patches are in the directory :UPDATE:7.60.)

If, as might happen, you receive a *microcode* update with an AOS/VS revision or update, load the microcode file into the computer and on the disk before loading the AOS/VS software. Microcode updates are described later in this chapter.

If, after receiving a new AOS/VS revision, you want to load *all* the new AOS/VS files, follow the steps described next. The steps advise you to install the new starter system — overwriting the current installed system, if any — but you can always install your new tailored system over this with little effort.

To start, read the Release Notice, "Notes and Warnings" section, to check for any interrevision incompatibilities. The Release Notice also names all directories and files on the new AOS/VS system tape. Generally, the only files shipped in an AOS/VS revision are those in the root and directories :UTIL, :SYSGEN, and :HELP. A file on the release (:UTIL:n.nn_AOSVS_FILES, where n.nn is the number of the release) lists the files shipped. Appendix C (with change pages in this documentation-changes file) briefly describes the purpose of each of these files.

By default, each file loaded will overwrite its older version on your LDU (if there is an older version). So you will want to protect certain files during the update. The files you will want to protect include UP.CLI, LINK_ERMES, and any other DG-supplied files that you have tailored for your system.

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So, from the CLI, rename any file you want to protect from being overwritten. For example:

```
*) DIR   :UTIL ↵
*) RENAME LINK_ERMES.CLI LINK_ERMES1.CLI ↵
```

Shut down AOS/VS.

Mount the new AOS/VS system tape or diskette number 1 on unit 0 on the first controller.

Proceed to the appropriate section: "Loading from Tape" or "Loading from Diskettes."

Loading a New Revision from Tape

Boot from tape and install the new bootstraps and starter system as follows.

```
SCP-CLI>   RESET ↵
SCP-CLI>   BOOT  22 ↵                    (Or 62 if tape is on an MTD unit.)
Tape file number?   3 ↵                  (Specify tape file 3.)
AOS/VS Installer Rev n
Specify each disk in the LDU
Disk unit name?   DPF0 ↵                 (Type master LDU unit name.)
Device code [default] ? ↵                (Enter all the units in the LDU.)
-- Disk bootstrap installed
Do you want to install a System Bootstrap [Y] ? ↵
Install from which unit [MTC0] ? ↵
Device code [22]  ↵                      (Or 62 for an MTD unit.)
File number [4] ? ↵
-- System Bootstrap installed
Do you want to install a System [Y] ? ↵
Install from which unit [MTC0] ? ↵
Device code [22]  ↵                      (Or 62 for an MTD unit.)
File number [5] ? ↵
-- System installed
Done!
```

Now, bring up the new starter system and specify an initial load.

```
SCP-CLI>   RESET ↵
SCP-CLI>   BOOT  27 ↵                    (Use device code of master LDU unit.)
        Operating System Load Menu
. . .
Enter choice [1]: ↵                      (Load and start operating system.)
AOS/VS Rev n
Date (MM/DD/YY) ?      12  19  86 ↵      (Type current date.)
Time (HH/MM/SS) ?      15  01 ↵          (Type current time.)
Override default specs [N] ?        Y ↵
Number of buffers ...  ↵
Swap directory ...  ↵
Page directory ...  ↵
Initial load [N]     Y ↵
Filename [@MTC0:6] ?       ↵
```


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The system will try to load the new files from tape file 6 into the root directory. For each file that already exists in the root, it will ask whether or not you want to replace the old copy. Since you are updating, answer Y ↵. For example:

Warning: File name already exists, File: AGENT.PR
Replace old copy [Y] ? ↵

Warning: File name already exists, File: ALPHARS.PR
Replace old copy [Y] ? ↵
...

When you've finished, the AOS/VS CLI prompt will come up on the system console. Since you are updating, use the LOAD command with the /DELETE switch, which automatically replaces each file with the revised version, where this applies. Type

```
) SUPERUSER ON ↵
*) LOAD_II/V/DEL      @MTC0:7 ↵        (Use @MTC0:7 with tape on MTB or
                                        MTC unit; use @MTD0:7 with tape on
                                        an MTD unit; or use @MTJ0:7 or
                                        @MTJ10:7 on MTJ units.)

DELETED...
DELETED...
DELETED...

*) REWIND   @MTC0 ↵                    (Or @MTD0, or MTJ0, or MTJ10.)
*)
```

If you have an ECLIPSE MV/4000 with hardware floating point, change the default microcode filename to MV4000FP.MCF as described in Chapter 6.

Dismount the tape and skip to the section "Generating a New System."

Loading a New Revision from Diskettes

Boot from diskette and install the new bootstraps and starter system as follows.

```
SCP-CLI> RESET ↵
SCP-CLI> BOOT 64 ↵

        Operating System Load Menu

. . .
Enter choice [1]: 2 ↵                  (Choose option 2)

        Technical Maintenance Menu

. . .
Enter choice [1]: 6 ↵                  (Choose option 6)

Pathname? INSTL ↵

AOS/VS Installer Rev n
Specify each disk in the LDU
Disk unit name?   DPJ0 ↵
Device code [default] ↵
— Disk bootstrap installed
Do you want to install a System Bootstrap [Y] ?
```


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Remove AOS/VS diskette number 1 from unit 0 and insert AOS/VS diskette number 2.

Press ↵

Install from which unit [MTB0] ? DPJ10 ↵
Device code? ↵

— System Bootstrap installed
Do you want to install a System [Y] ?

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After the new system comes up, compare your LINK_ERMES1.CLI macro and the new LINK_ERMES.CLI macros. Modify your macro, if it seems necessary. Then, delete the LINK_ERMES.CLI macro and rename LINK_ERMES1.CLI to LINK_ERMES.CLI. Finally, build a new error message file by executing LINK_ERMES.CLI. The new ERMES won't become effective until you shut down and restart AOS/VS.

Then bring up EXEC and the multiuser environment:

```
*) :UP ↵
...
```

Turn PERMANENCE off for the files you made permanent (if you leave permanence on, text editing the files will be more difficult).

```
*) DIR   :UTIL ↵
*) PERM   LINK_ERMES.CLI  OFF ↵
*) PERM   UP.CLI+    OFF ↵
*)
```

If there were no errors, patch the new system and make a system tape or diskette (as described in Chapter 4) and you're done. LDUs that you've built with the older Disk Formatter will work perfectly with the new AOS/VS software (such programs are designed to be revision-independent).

If, for any reason, you want to reload the *old revision*, get out the old AOS/VS system tape or diskette set and follow the appropriate procedure above.

As you can see, the update procedure isn't difficult. Restrictions and possible problems with it are as follows.

- It assumes that you haven't reconfigured the directory structure shipped by DG. For example, if the old revision of SED is not in directory :UTIL, the new revision will not overwrite it; there will be two revisions of the program on the LDU.
- Your master LDU cannot include disks other than those on the first controller, because the starter system supports only the primary controller.
- The new LOCK_CLI, with the original password, PASSWORD, will overwrite the old one; so, if you care about LOCK_CLI, you must edit its program file and insert the desired password (covered in Chapter 16).
- DG utility programs whose preambles you've edited (to take advantage of PID-size type, for example) will be overwritten by newer versions. You must use SPRED on them again. (Chapter 9 explains how.)

Note that you *can* load new files selectively; for example, LOAD/V/DEL/BUFF=8192 @MTC0:7 :UTIL:SED.PR ↵. But this is not recommended because the error message (ERMES) file may differ between the revisions. Better to do the whole thing.

Updating Your Manuals

DG ships the Release Notice both in printed form and as a disk file. Updates to your *manuals* are provided only as disk files. The pathnames are :UTIL:sss_pppppp_rr, where sss is the series, pppppp is the part number, and rr is the revision. For example, for manual 093-000122-06, the pathname is

:UTIL:093_000122_06

To keep your manuals up to date, we suggest that you read these files, print the ones you want, and correct the pertinent manuals. Then — if you need the disk space — delete the files. You can always reload any or all of them, if needed, from the AOS/VS system tape or diskette set.

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Computer Microcode, SCP, and Emulator Updates

Microcode is the foundation of your MV/Family CPU. It's important to run the current revision of both microcode and the SCP-OS.

DG maintains a microcode subscription service, similar to its software subscription service. New customers get membership automatically for a certain amount of time. If your membership has expired, we suggest that you renew it.

With the microcode subscription service, you will periodically receive new revisions of microcode, the SCP operating system, and FRU diagnostics. For original MV/8000s, these are shipped on diskette in a format the SCP can read. When you get the diskette, simply remove the old diskette from the CPU diskette unit, insert the new one, and turn CPU power off and on again to try it.

For MV/Family machines other than MV/8000s, the microcode, the SCP-OS, and the FRUs are shipped on tape or on a set of two diskettes. For tape, this is usually a 1600-bpi tape; file 0 is the SCP-DTOS system, bootable from tape. File 1 is the combined microcode/SCP-OS file, in AOS/VS DUMP format.

For diskettes, the second diskette (AOS FMT) has the microcode file in DUMP format.

To load the new microcode file:

- Mount the tape or diskette on unit 0.
- Type the following commands

```
) SUPERUSER  ON ⤸
*) DIR  : ⤸
*) RENAME  MVn.MCF  MVn.rev.MCF ⤸
```

(n is the name of your machine; rev is the revision of old microcode. For example, the new name might be MV6000.5.0.MCF. For MV/4000s with FPU, the old filename is MV4000FP.MCF; rename it MV4000FP.rev.MCF. The rename step saves the old microcode file, which you would otherwise need to delete to load the new one.) For tape, type

```
*) LOAD/V  @MTx0:1 ⤸          (x is B, C, or D, depending on the tape unit.)
```

For diskette, type

```
*) LOAD/V  @DPJ10 ⤸
MVn.MCF          (CLI verifies load of the the new file.)
```

For tape, type `REWIND @MTx0 ⤸`. Dismount the tape or diskette and store it safely.

To try the new microcode or SCP-OS, shut down AOS/VS. Then reboot it (`RESET ⤸`, `BOOT nn ⤸`, etc.). When SYSBOOT asks about microcode, say that you want to load and verify microcode. For example

```
        Operating System Load Menu
. . .
Enter choice [1]: 2 ⤸  (Choose option 2.)
        Technical Maintenance Menu
. . .
2 Load and verify microcode
. . .
Enter choice [1]: 2 ⤸  (Choose option 2.)
... (SYSBOOT loads and verifies new microcode.) ...
```


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If — for whatever reason — you ever want to load an older or different revision of microcode or SCP-OS, you can tell SYSBOOT that you want to view or change the microcode filename, then type the microcode filename. For example, on warm start:

Operating System Load Menu

. . .

Enter choice [1]: 2 ↵ (Choose option 2.)

Technical Maintenance Menu

. . .

9 View or change the microcode filename. . .
Enter choice [1]: 9 ↵ (Choose option 9.)

Default microcode filename [:MV4000FP.MCF]: MV4000FP.5.0.MCF ↵

Enter choice [1]: 2 ↵ (Choose option 2.)

... (SYSBOOT loads and verifies microcode.) ...

If you have a machine that uses emulator firmware (for example, an MV/4000 DC, which runs an emulator in its IOC), you may also receive new emulator revisions. If you receive an new emulator, install it via the dialog shown in Chapter 2, taking steps that include the "I/O CB EMULATOR" diskette.

Needless to say, keep all the system tapes and diskettes you receive from DG, and those you make yourself, in a safe place.

Disk Microcode Updates

Model 6236 and 6239 disk units have their own microcode, which is independent of CPU microcode. Disk microcode is stored on part of the disk that's invisible to AOS/VS. It's loaded into disk controller memory automatically the first time AOS/VS accesses a disk on the controller.

DG installs an initial version of microcode on each model 6236 and 6239 disk before shipment. However, the current revision of AOS/VS, or a program like MSCOPY, may require updated disk microcode. If updated microcode is needed, AOS/VS will display the message *CONTROLLER MICROCODE NEEDS TO BE UPDATED.*

A program to update disk microcode is shipped on tape, along with the disk controller. The updating program is called the *Peripheral Microcode Installer* — its model number is 30976. You can read about the disk microcode installer in the manual *Operator's Reference, Peripheral Microcode Installer*, part number 069-700013. You can run this program, when AOS/VS is not running, by mounting the tape on unit 0 of your primary tape controller and typing BOOT nn ↵ to the SCP CLI. For example,

SCP-CLI> BOOT 22 ↵

... (Peripheral microcode installer prompt) ...

The peripheral microcode installer program will then lead you through the steps needed to update your disk microcode. Afterward, it will return to the SCP CLI and you can bring up AOS/VS. You need not update disk microcode again unless you see the *CONTROLLER MICROCODE...* message.

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Getting Help from DG

Generally, when a customer buys a DG system, the price includes a certain period of engineer/support time, time on the Software Subscription Service, and perhaps training courses.

After the initial period has expired, customers must renew service contracts to assure continued support.

In the United States, support people work from the Atlanta Service Center; and, depending on your contract, you can call this center for help.

Outside the US, the support people are often DG system engineers; your system engineer can give you more information on support.

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Users and Productivity

A user is any person who can log onto the system, not only under EXEC, but under another DG product like TPMS or DG/SNA.

A user can be an applications or systems programmer, system operator, manager, or a nontechnical person like a data entry operator, word processing typist, executive seeking summary information, someone keeping files of personal information, or someone wanting to communicate over a network.

Usually, organizations acquire computer systems to increase productivity. For this to happen, users need to work effectively. This means keeping them happy.

Generally, anything you can do to make the system appear easier to use will please users. Users love easily accessible, pertinent help messages. They hate meaningless error messages. Interactive users hate slow response time.

Many DG products have help function keys; others (like the CLI) have help commands. Encourage users to try these. For your own applications, think about setting up easy to use, articulate help messages; this will probably pay dividends in productivity.

If response time seems long at user consoles, think about running fewer batch streams. Use PED to see how each process is behaving, and its working set and I/O usage parameters. MV/Family systems are fast — you can take advantage of this by basing process parameters on users' primary requirements at any given time.

For some perspective on a CLI user's point of view, sit down at a user console with *Learning to Use Your AOS/VS System.* It leads the reader through sessions with the CLI, text editors, FORTRAN 77, COBOL, Interactive COBOL, AOS/VS BASIC, Business BASIC, C, Pascal and AOS/VS assembly language programming.

A Real System's UP Macro

An UP macro can give you a perspective of an entire AOS/VS operating system: how it configures its devices, queues, and consoles for users; and what products it runs.

The UP macro shown in Figure 15-8 was adapted from a real AOS/VS system at DG. This macro defines its own switches, creates a system banner (Coldspot, followed by the system and system revision), sets tape unit ACLs, starts the system log, initializes LDUs and sets their ACLs, runs the QCMP queue cleanup program, starts up EXEC and continues batch streams, starts printer queues, sets specifications for printers, continues printers, starts an INFOS II process, enables local and virtual user consoles, brings up the network, sets type and priority for PID 2, and finally runs LOCK_CLI.

Three macros called by this UP.CLI are not shown. They are SYSLOG_UP.CLI (which resembles the one shown in Chapter 9); UP_NETWORK.CLI (supplied with the XODIAC networking system and tailored for this installation); and CEO.SYSTEM.CLI (supplied with DG's Comprehensive Electronic Office (CEO) system). The original macro is more complex than this, but we've simplified it for illustration.

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Chapter 16
System Management Considerations — Security

Read this chapter

- when you want to run a C2-level or other secure system; (C2 is a classification used by the U.S. Government; see the "C2-Level Systems" section below.)
- when you want to understand how user privileges and access control prevent system break-ins and abuse;
- when you want to run detailed system logging;
- when you want perspective on system security.

In this book, Chapters 1 through 14 give information without identifying the reader as manager. This chapter and the previous one touch on some management issues — not *how* to manage, but information and suggestions that can help the person who manages the system make good system-oriented decisions.

This chapter deals with security issues; management-oriented issues that don't relate to system security (for example, process concepts and information on installing updates) are described in the previous chapter.

Major sections within this chapter are

- AOS/VS Security Summary
- Open or Closed Shop?
- C2-Level Systems
- How to Create a C2-Level System — A Summary
- AOS/VS Security Features — A Summary
- User Privileges and Security
- Log-On Procedures and Security
- Controlling Access with ACLs
- Auditing with the System Log
- Protecting the System Site and Backup Media
- System Architecture — Hardware Protection Features
- Security Policies
- Detecting and Responding to Breaches of Security
- Deleting a User Profile (Revoking an Account)
- Security Check List

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AOS/VS Security Summary

AOS/VS has certain security features built in; others are optional — they should be used if a very secure system is desired.

In any standard AOS/VS system, the typical user

- must have a valid account to log on;
- cannot access another user's files (unless that user gives access explicitly by changing file ACLs or by changing his or her default ACL);
- cannot delete or modify system files;
- cannot add files to system directories;
- cannot examine data in deleted files or previously used memory pages;
- cannot edit his or her profile to become privileged.

Thus, the default privileges and access controls will protect the system from casual trespass or file violation. If more or less security is required, AOS/VS system flexibility permits adding or relaxing controls.

You can also have the system keep a detailed log with which you can — periodically — create reports and check user activities. For example, you can have every log-on and file access attempt recorded for specified users, or for every user.

The *physical* security of the system console, central processor, and disk units is another important aspect of system security. Anyone who can touch the computer or disk units can flip a switch, bring the system down, run ESD, then restart and come up in the master CLI. The only way to protect key peripherals is to lock them up and/or keep a reliable system operator on duty at all times. In any organization you must be able to trust the people who have physical access to the computer hardware.

Open or Closed Shop?

From the standpoint of security, computer sites range from casual, relaxed *open shops* to tightly controlled *closed shops*. In the center are *medium-security shops*. In reality, of course, there are more than three variations — the definitions used here are meant as general examples.

Table 16-1 offers perspective on security for your own site. In this table, "users" represent the average user, not every user.

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Table 16-1. User Action and Security Levels

In Your Ideal System	Open	Medium-Security	Closed
Can users access files without leaving tracks (records in a log file)?	Yes	Maybe	No
Can one account be used by the general public (is there a public account)?	Yes	Yes	No (may not be needed)
Can users learn the names of other users' files?	Yes	Maybe	No
Can remote users learn the names of other users' files?	Yes	No	No
Can users read and copy other users' files?	Yes	Maybe	No
Can users read other users' electronic mail?	Yes	No	No
Can users change or delete other users' files?	Yes	No	No
Can users gain access to tape or diskette units without operator intervention?	Yes	Maybe	No
Can users consume system resources by writing personal letters or playing games?	Yes	Maybe	No
Can users log on as other users?	Maybe	No	No
Can users give themselves additional privileges?	Maybe	No	No

The actions any user can perform are governed by his or her user profile, created by the system manager with a program named PREDITOR. Privileges that can be granted in user profiles are explained later in this chapter, in Table 16-2.

Table 16-1 is just a guideline. If most of the actions described are okay, then your security needs are low: an open shop will suit you. If you want to prevent users from doing most of the actions described, then your security needs are high: you need a closed shop.

The closed/medium-security/open shop issue is a management call; we can't tell you which way to go. Ultimately, you must balance the risk of losing critical information — causing delays and possibly jeopardizing deadlines, projects, corporations, or even people — against the cost and inconvenience of maintaining security. The files and information on your system may be even more important than the hardware. The general rules of risk analysis apply.

For more discussion of the issues and procedures involved in setting or changing security policy, see the sections, "Choosing Your Level of Security" and "Changing Security Levels" later in this chapter.

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The Open Shop

The category of open shop includes systems like single-user and graphics workstations — any system where system users don't need privacy or fear deletion of files or vandalism.

In an open shop, the hardware and system console may be open to programmers and even nonusers. Usually, LOCK_CLI is not run on the system console. Access control for the tailored AOS/VS system may not be enabled (enabling access control is a VSGEN option — you must enable it to have AOS/VS control access).

Generally, if you want to run an open shop (as defined here), you don't really need to read this chapter. Possibly, though, you might want to see how much work is involved in running a secure system, or learn about common break-in tactics. You might also want some information on full detail logging (see the"Auditing with the System Log" section).

The Medium-Security Shop

The medium-security shop wants some measure of security, without the inconvenience and performance penalties of a closed shop. At least some users require privacy and protection against file deletion and vandalism. Physical access to the computer and system console is more restricted than in an open shop.

A medium-security shop may or may not have a system operator. If not, LOCK_CLI will be run on the system console. Several people, but not all, may have Superuser privilege, and/or know the LOCK_CLI and privileged profile password.

In a medium-security shop no user's profile allows both special local privileges (like Superuser) and network or modem privileges. A user with powerful local and remote privileges in one profile can roam the system from outside the site, browsing, reading, deleting, and placing Trojan horses at will. (A Trojan horse is a program designed to do something useful for a site — and does this — but also does things it was not authorized to do, like gather confidential information, such as passwords, for its author.)

Backup media is well organized — it may or may not be kept physically locked up.

Software that may represent a threat to security, like application programs, may be checked for possible trespass (detailed under the "The Closed Shop" section below).

The Closed Shop

In a closed shop, few people have physical access to the computer, disk units, or system console. Users (including application programmers) work on consoles in a separate area. The CPU, disk and tape units, and even line printers are out of bounds to all but a few carefully screened and trained people. In closed shops, system operators are on duty most of the time. They mount and dismount tapes for users, handle printers, start application programs, do backups, bring the system up and down, and so on.

A closed shop should have someone check periodically, perhaps daily, for security violations and potential (and actual) break-ins. The site can run system logging with detail set to full, generate logging reports, and have the assigned person examine the reports for signs of unauthorized access.

Very few users in closed shops have Superuser or other special privileges. Any privilege that allows a user to bypass access controls means that he or she must be trusted; system security depends as much on privileged users as on AOS/VS enforcement of access controls.

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ACLs in closed shops are quite restrictive. When multiple users need access to a file, a closed shop may use explicit ACLs that spell out usernames, instead of using templates.

Software that's added to the core system, such as networking software, should be used very carefully in closed shops because it can compromise all security. For example, someone may check the files accessed by application programs for signs of Trojan horse incursions. When new versions of application programs are built, the new program file(s) or source file(s) may be compared to the old versions (using the FILCOM or SCOM program), and the differences examined. Media containing updates and revisions of DG software should be checked, before being installed on the system, to make sure they are genuine Data General products with DG labels, part numbers, etc.

Software acquired from an online bulletin board, via modem or otherwise, should not be added to the system unless the original source is known and reliable.

The *people* in a closed shop are essential to its security. Users can't touch disk and tape units, so at least one system operator stays on duty while the system runs. Administrators (system managers and operators) make decisions that can affect all access controls. They must plan and implement a secure system (using secure profiles, secure hardware, and ACLs) start logging, generate and check reports, plan user education, enforce password changes, and so on.

In some closed shops, system operators themselves have limited powers. A locked CLI runs on the system console, and very few people know the password. The operator must use EXEC and other CONTROL commands to run the system.

C2-Level Systems

One kind of closed shop is a *C2-level system*. The U.S. National Computer Security Center (NCSC) has defined several classes of computer systems from the standpoint of security; one of these is class C2. A system that meets C2-level security standards (if approved as such by the U.S. government) may be used, according to the rules for this class of systems, to handle sensitive and classified information.

What Is a C2-Level System?

A C2-level system must meet minimum security requirements in the following general categories:

- *controlled access* to information
- *accountability* — identification of each user and tracking of his or her security-related actions on the system
- *assurance* of continued correct and secure system operation

The core of a C2-level shop is the software and hardware that people rely on to operate securely. This system core is called the *Trusted Computing Base (TCB)*.

For details of C2 and other U.S. government security standards, see the Department of Defense directive, *Security Requirements for Automatic Data Processing (ADP) Systems*, number 5200.28.

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Components of the Trusted Computing Base (TCB)

For AOS/VS, software in the TCB includes the

- AOS/VS kernel and tailored system (which enforce access controls)
- Peripheral manager (PMGR and its companion IACRS or CPIRS programs). These programs manage character devices such as user consoles.
- PREDITOR profile editor, which creates and edits user profiles, and can provide password encryption
- EXEC and companion XLPT program, which oversee user log-on and tape mount requests, and manage batch and printer processes. EXEC has Superuser privilege and can bypass access controls
- Agent, which provides the user interface
- Other utility programs and files supplied with AOS/VS (there's a complete list in Appendix C)
- ADEX diagnostic system, to verify your hardware using the same microcode as AOS/VS

Note that AOS/VS access controls work *only* if, when the system was generated, the VSGEN parameter *Access* remained Y. The Access parameter is set to Y by default. If the Access parameter is changed to N, the resulting operating system will ignore access controls — it will be wide open. You can check all VSGEN settings, including the Access parameter, by typing TYPE SYSGEN:sys.CSF, where sys is the name of the AOS/VS system. Generally, unless your username is OP, you must turn Superuser on to read this file.

Before loading new AOS/VS software make sure the tape or diskette containing it was provided by Data General. It should be clearly labeled as a Data General product, with a DG part number and copyright symbol.

Hardware in the TCB includes

- the system console (because anyone with access to it can penetrate all safeguards)
- MV/Family CPU and microcode
- disk and tape units
- all removable media (like backup tapes) that contain security-related information
- printers, if they print sensitive material and are accessible to users

C2 Configuration Hardware

The following Data General hardware has been evaluated by the NCSC and certified — along with AOS/VS — as C2-compliant.

Processors:

MV/20000 Model II and Model 1
MV/10000 SX and MV/10000
MV/8000 II, MV/8000 C, and MV/8000
MV/7800, MV/7800 XP, MV/7800 U, MV/7800 DC, MV/7800 DCX
MV/4000, MV/4000 DC, and MV/4000 SC

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Processor hardware includes processor boards, memory boards and system console.

Asynchronous/Synchronous Controller Models	Description
4368-A	Intelligent asynchronous controller (IAC), 16 line
4367-A	Intelligent asynchronous controller (IAC), 8 line
4380	Intelligent synchronous controller (ISC)

Disk Models	Description
6122	277 Mbyte unit, removable pack
6061	190 Mbyte unit, removable pack
6060	96 Mbyte unit, removable pack
6236	354 Mbyte unit, nonremovable pack
6237	1062 Mbytes (three Model 6236 units in cabinet)
6249	1770 Mbytes (three Model 6239 592-Mbyte units, with nonremovable pack, in a cabinet)
6290	1180 Mbytes (two Model 6239 units in cabinet)

Tape Models	Description
6026	800 or 1600 bpi, reel-to-reel (MTB)
6125	1600 bpi, reel-to-reel, streaming (MTC)
6231	6400 bpi, cartridge, streaming (MTC)
6300	1600 or 6250 bpi, reel-to-reel (MTD)
6299	1600 or 6250 bpi, reel-to-reel (MTD)

Printers	Description
4374	1200 line-per-minute band printer
4373	890 line-per-minute band printer
4364	600 line-per-minute band printer
4363	460 line-per-minute band printer
4327	300 line-per-minute band printer
4328	240 line-per-minute band printer
4425	12 page-per-minute laser printer
4557	8 page-per-minute laser printer
4558	8 page-per-minute laser printer
4322	55 character-per-second letter-quality printer
6321	40 character-per-second letter-quality printer
4433	150 character-per-second matrix printer
6215/16	180 character-per-second matrix printer

You can add the following hardware and retain the C2 rating:

- DASHER terminals D2, D200, D210, D216, D300, D400, D410, D470
- disks, tapes, and asynchronous controllers as evaluated above

You will invalidate the C2 rating if you use any processor not named above or any of the items described in the next section.

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Items Not Permitted in a C2-Level System

Certain types of hardware and software, while useful or even necessary in certain installations, are difficult to control from a security point of view, and hence are not permitted in a C2-level system.

- *Networking, virtual terminals*, and *modems* all expose a system to individuals who are physically remote from the site and possibly not part of the organization. These factors make it difficult or impossible to impose the controls and accountability recommended for all closed shops and required for a C2-level system. A knowledgeable person working from a remote location via networking or a modem may be able to gain access to the system and read, copy, change, or delete files without being subject to the normal access controls and user guidelines.
- *Shareware* or unpublished software tools and programs available from online bulletin boards, etc., may contaminate the system either intentionally or unintentionally and should not be included in a C2-level system.
- *Graphics terminals* and *windowing* are also not permitted on a C2-level system: to use graphics terminal capabilities a user must get certain file access privileges that threaten security. For details, see the section "Preventing Unauthorized Access to Windows."
- *Guest accounts* or usernames which several people can use may not be used on a C2-level system, because they violate the principle of accountability: that each individual user can be uniquely identified.
- Any application that alters the TCB.
- A connection that allows diagnostics to be run remotely.

How to Create a C2-Level System — A Summary

This section summarizes the steps involved in building and maintaining a C2-level system.

1. Format a system disk and install AOS/VS on it as described in Chapter 2 or Chapter 3 (depending on your computer). Format other disks you may have as sketched in Chapter 2 or 3 and detailed in Chapter 12. These procedures are the same for C2- and non-C2-level systems.
2. Run VSGEN to create a tailored system as described in Chapter 4. Be sure to retain the default answer (Yes) to the Parameter question *Access?*. Patch and test the system as described in Chapter 4. These procedures are the same for C2- and non-C2-level systems.
3. Create user profiles and start EXEC as described in Chapter 5. Do not give any users the following privileges:

   Use virtual console (relates to networks, which aren't allowed with C2)

   Access local resources from remote machines (also relates to networks)

   Access devices

   Superuser

   Superprocess

   System manager

   Modem

   Change username

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Aside from C2 security issues, you can and should prevent users from denying service. You can prevent this by not granting the following privileges:

- Create without block
- Unlimited sons
- Change priority
- Change type
- Change working set limit

and by selecting the default answers for the *Priority* and *Max qpriority* questions.

4. Run LOCK_CLI on the system console, as described in Chapter 9. Before running it, change the password as described in this chapter. (The system console must be kept physically secure in a C2 system, but LOCK_CLI provides an additional layer of security.)
5. When people start using the multiuser environment, maintain a system log as described in Chapter 9. Periodically, or whenever you're very concerned with security, you might want to run a detailed system log; then generate and read reports on security-related issues.

   As described in this chapter in the "Auditing with the System Log" section, outline a plan to create reports regularly (using the REPORT program) from your system logs. Someone will need to read the reports and check for suspicious events (described later in this chapter in the "Detecting Security Breaches" section).
6. Maintain a sense of security consciousness in your user community.
7. Keep your backup media secure, as described in this chapter in the section "Protecting the System Site and Backup Media."
8. Keep the computer, system console, disk units, and tape units physically secure. If the line printer(s) prints classified or sensitive material, keep it physically secure. Doing these things is described later in this chapter in the section "Protecting the System Site and Backup Media."
9. Do not run network software, remote terminals (via modems), or graphics (pixel-mapped) terminals on your system.
10. Follow other guidelines suggested in this chapter.

The following sections describe the components of AOS/VS which, either automatically or through proper system management, provide system security at the desired level. When necessary, the steps necessary for C2-level security will be specified.

AOS/VS Security Features — A Summary

There are four security-related areas in data processing: discretionary access control, object reuse, identification and authentication, and auditing. AOS/VS security features in each area are as follows.

Discretionary Access Control

Discretionary access control means that access to both user files and system files is controlled by the person responsible for the file in each case. In an AOS/VS system, every file has an access control list (ACL), created automatically when the file is created. Only those users explicitly given file access by the ACL can read it or

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perform any other action with respect to it. (The exception is users with the Superuser privilege, who have full access to all user and system files.)

For a file created by a user, the initial ACL is the user's default ACL, which, if unchanged, prevents access by anyone other than this user (except for a superuser). *System* files are shipped with ACLs that protect them from all users except superusers and the system operator (username OP).

ACLs are described in detail in the section "Controlling Access with ACLs," and also in Chapter 9.

Object Reuse

The words "subject" and "object" provide a common ground in the context of computer security. A *subject* is an active entity that causes information to flow among objects or changes system state. Examples of subjects include users, processes, and system calls in running programs.

Objects are passive entities that contain or receive information. Objects include both physical devices such as printers, video displays and keyboards, and entities such as records, blocks, pages, files and directories. A *storage object* is one that supports both read and write access — for example, a disk block or memory page — and hence can be reused, when its data is no longer needed, to store new information. For a system to be secure, all information in a storage object must be removed before the object is reused — as in the zeroing of page frames, for example.

Deleting a file frees the data blocks allocated to the file. AOS/VS zeroes these blocks *before* it allocates them to any other file. This prevents users from creating new files, using positioning calls to allocate blocks that may contain data, and then reading the blocks.

AOS/VS manages main memory pages much the same way as it does files. Memory pages used by a program are not zeroed when the program terminates or when it's paged, but the page frames *are* zeroed before being assigned to another program. (Specifics on memory-page reuse appear in the manual *System Call Dictionary (AOS/VS and AOS/DVS)*, Chapter 2, under calls ?ALLOC, ?ISEND, ?IS.R, ?MEMI, ?SPAGE, ?READ, ?WRITE, ?RDB/?WRB, and ?PRDB/?PWRB.)

In these ways, AOS/VS prevents users from retrieving sensitive information through object reuse.

Identification and Authentication

With identification and authentication the system restricts access to only authorized users, protects the privacy of each user's files, and links each user with his or her actions on the system. This is made possible by the username-password combination.

Every AOS/VS system user is assigned a unique username and a password as part of his or her user *profile*. To log on, a person must have a valid user profile (valid account); and must type the username and password stored in the profile file. Passwords are 6 to 15 characters long and can — at the system manager's discretion — be encrypted.

All user profiles are stored in directory :UPD and have null access control lists (ACLs), which means that only privileged users (superusers) can read or change them. Profiles are created, changed, and deleted via PREDITOR, the user profile editor. PREDITOR requires Superuser privilege to run, which prevents any but a superuser from creating, examining, or changing *any* profile. The PREDITOR defaults are null (do not grant privilege) for questions about Superuser and other special privileges.

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While a user is logged on, his or her username remains constant. The ability to change a username requires a special privilege, which should never be given to a user under normal circumstances. The privilege to change password, on the other hand, is normally given to each user; changing password from time to time is one good way to protect the privacy of one's files.

The username/password arrangement enables AOS/VS to identify and authenticate users.

User privileges and security are explained later in this chapter. Details on PREDITOR appear in Chapter 7.

Auditing

Auditing refers to the ability of the system to keep a record (an "audit trail") of specified events, as the system manager considers necessary for system security. At the discretion of the system manager, AOS/VS can run a detailed system log, which records each file access and other security-related event. From a detailed log, the AOS/VS REPORT program can create reports based on username, filename, or failed logon. For each event, the report includes error information (if access failed); the absence of error information means that access succeeded.

The ability to audit users and events can help security-conscious sites determine whether someone has tried to, or actually *has*, broken into a system. The ACL of the system log file (:SYSLOG) is null; you must have Superuser privilege to read it, generate a report from it, delete it or modify it.

Detailed logging and REPORT program operations are explained in "Auditing with the System Log" and in Chapter 9.

The following sections describe the procedures to be followed by system managers, operators, and users to establish and maintain system security at the desired level.

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User Privileges and Security

The process created for each user at logon has only those privileges specified in the user's profile. Unless a user has special privileges, AOS/VS will reject commands that might threaten system security. For example, if a user tries to type a file he or she's not authorized to read, the system will respond with an *ACCESS DENIED* message; and if a user who lacks Superuser privilege tries to turn Superuser mode on, the system will respond *CALLER NOT PRIVILEGED FOR THIS ACTION*. Thus, the primary basis for a secure system is user profiles, created by the PREDITOR profile editor. Your system is only as secure as its users' profiles.

Table 16-2 names and describes privileges that can protect or threaten system security (it resembles a table in the previous chapter and is repeated here for your convenience). The privilege questions appear in the order asked by PREDITOR. Details on all privileges appear in Chapter 7.

Table 16-2. User Profile Privileges That Relate to Security

Privilege	What It Allows
Encrypt password	Without this privilege, a user's password is stored in the :UPD file in such a way that a superuser may be able to see it by reading the profile file. Encrypting the password makes it impossible to read. This is very desirable from a security viewpoint, but it may prevent certain kinds of network access. Encryption tradeoffs are described later, in the "Passwords" section.
Initial IPC file	This value determines which file (if any) will be executed for the user at logon. The IPC file can be a macro that sets default ACL (DEFACL), search list, and other things. For greatest control, we suggest you use a central log-on macro (perhaps in :UTIL) to execute individual user log-on macros. Give the central macro's name as the initial IPC file. Doing this is described in Chapter 5.
Use Console Use Batch	Either of these privileges allows a user to gain entry to the system. To deny the Use Console privilege is to restrict the user to using a card reader.
Use virtual console Access local resources from remote machines	These two values determine whether the user will be able to log on to your system, or to use resources on your system, from a remote system over a XODIAC network. A privileged user (one with the Superuser or Superprocess privilege) should *not* have either network privilege, since he/she could then explore your system at leisure from a remote site. If you want a user to have both network and either Superuser or Superprocess privileges, create two profiles for the user, one profile with network privileges, the other with Superuser or Superprocess privileges. Because of the security risks involved, *networking is not permitted, and these privileges would not be assigned, in a C2-level system.*

(continued)

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Table 16-2. User Profile Privileges That Relate to Security

Privilege	What It Allows
Use IPC	This privilege allows a user process to send Interprocess Communication (IPC) calls to any process in the system. CEO users need this privilege, and other programs may need it. Since AOS/VS logs IPC calls, granting this privilege is not a breach of security.
Create without block	A Yes value allows the user process to create sons (that in turn can create sons) without blocking. All its sons (and grandsons) can remain unblocked, increasing system overhead. This privilege relates to the next two. A CEO user needs this privilege.
Change Password	This privilege allows users to change their password while logged on. Because users should change their passwords often in a secure system, you should give this privilege to users (except multiuser "guest" accounts).
Unlimited sons Sons	These two values control the number of sons the user process can create. Generally, a user should not have the unlimited sons privilege. Each son requires some system overhead, especially if its father isn't blocked (above). Five sons is enough for practically anyone.
Change priority	The user process (and sons) can change its own priority if it has this privilege. It can gain favor over other processes; thus restricting access to others.
Change type	The user process (and sons) can change type (for example, to resident) if it has this privilege — gaining favor over other processes.
Change username	The user process can create a son process that has a different username. The ability to change username allows the user to *become* any other user, and thus gain access to the other user's files. By assuming the username OP, a user can gain unlimited access to many AOS/VS files — since, to help the system operator manage, these are shipped with ACLs that give OP unlimited access. Also, with the username OP, the user can issue EXEC commands (allowing the user to terminate user processes or change priority or type). Also, any user with this privilege can't be traced; he or she can try to break security under another person's username. For user files to remain secure, and logging to be useful, every user on your system should have his/her unique username — and be unable to change it. Do not give users this privilege if you want a C2-level or other secure system.
Access devices	The user process can define a new device (call ?IDEF), wire pages, access the device, and/or remove the definition. For this privilege to work, the process must be resident, which means the user must also have the *Change type* privilege. These privileges give the user *at least* the power to dominate or bring down the system. In a C2-level system, users are not given this privilege.
Superuser	Superusers can bypass all file access controls. And, they can run PREDITOR to give themselves any privilege — or possibly learn other users' passwords (if you don't choose encryption). Do not give users Superuser privilege if you want a C2-level or other secure system.

(continued)

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Table 16-2. User Profile Privileges That Relate to Security

Privilege	What It Allows
Superprocess	The user process (and sons) can change its own type and priority; and it can block or terminate any other process, including LOCK_CLI. Do not give users this privilege if you want a C2-level or other secure system.
System manager privilege	This privilege allows the user to initialize and release job processors (if your computer has more than one job processor), create and delete classes and logical processors (usually done via the optional CLASP utility), and change the locality of other users' processes. System Manager privilege also allows a user process to issue AOS/VS system calls that change the system date, time, ID (SYSID), and bias factor. Also, the user can start or stop the system log (SYSLOG). These privileges have significant impact on security. Use of classes and privileged system calls can affect the performance and security of your system. Generally, the master CLI issues all commands that require system manager privilege; do not give it to any other user unless he or she really needs it.
Modem	A Yes value allows the user to log on your system from a modem (over a phone line). You may want to allow selected people modem privilege, with certain precautions against break-ins on the line (described later). A privileged user (one with the Superuser or Superprocess privilege) should *not* have modem access, since he/she could then explore your system at leisure from a remote site. If you want a user to have both modem and either Superuser or Superprocess privileges, create two profiles — one with each privilege — for the user. Modems, like networking, are not allowed in C2-level secure systems.
Change address space type	This privilege allows a user to run 16-bit programs in addition to 32-bit programs. This is not a security issue.
Change working set limit	A Yes value allows the user process (and sons) to override the working set limit that AOS/VS dynamically assigns to each process. This privilege is needed for any of the Logical address space and Minimum/Maximum privileges below. Changing the working set size may allow the user process to monopolize memory and the system.
Priority	If given a higher-than-default priority, the user process (and sons) will get CPU preference over processes with lower priority. This privilege doesn't allow the user to *change* priority (see above).
Logical address space - batch Logical address space - non-batch	These parameters give the user process (and sons) a nondefault number of memory pages in batch or interactive processing. The default is a very high number. Giving a nondefault value might have some effect on system performance.

(continued)

Table 16-2. User Profile Privileges That Relate to Security

Privilege	What It Allows
Minimum working set size - batch Maximum working set size - batch Minimum working set size - non-batch Maximum working setsize - non-batch	These parameters give the user process (and sons) specific minimum and maximum working set limits in batch or interactive situations. Giving a nondefault value can have significant effect (usually bad) on performance, depending on your applications environment.
User comment	This question is *not strictly* security related. It allows you to write a line of text into the user's profile. The text can be the user's name followed by any short editorial comment you want to make. We recommend including the user's complete name. You can also include the user's console number and phone number or extension. Or, if the user has any special privilege, you can include a brief explanation of his or her need for the privilege.

(concluded)

Privileges in a C2-Level System

As explained in Table 16-2 above, C2-level system users would *not* be given the following privileges in their profiles:

- Use virtual console
- Access local resources from remote machines
- Change username
- Access devices
- Superuser
- Superprocess
- System manager
- Modem

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Process Privileges

Some *processes* automatically have special privileges, regardless of those specified in any user profile. These are listed in Table 16-3.

Table 16-3. Privileged Processes

Process	Privileges
PMGR (peripheral manager) PID 1, username PMGR	The peripheral manager has all possible privileges. It is run by the AOS/VS kernel and is not accessible to users.
Master CLI, PID 2, username OP	The initial CLI process runs on the system console. (You can select a different master process during VSGEN, if you want.) The master CLI is the progenitor of all other processes and has all privileges. (Also, as PID 2, it can set the system date and time, start or stop the log file, and set default characteristics for user consoles; no other process has these powers.) Processes created by the master CLI via the XEQ or EXECUTE command have all the master's privileges. Processes created by the master CLI via the PROCESS command have no special privileges unless the PROCESS command specifies privileges with switches. You can't remove the master CLI's privileges but can run a locked CLI under it — making some of its powers unavailable to users. LOCK_CLI is described later in this chapter.
EXEC, PID 3 (usually), username EXEC	EXEC is created by the master CLI with all privileges. It creates user processes with the privileges specified in the user profiles. EXEC commands relate to the batch, spooling, printers, tape units and tape mounts, and the multiuser environment in general. Any process with EXEC's father's username (usually OP) can issue commands to EXEC.
Any process, with any PID, username OP	Any process with username OP has owner access to many AOS/VS files. (These files are shipped with ACLs of OP,OWARE to help the system operator run the system without turning Superuser on.) Also, any process with EXEC's father's username (usually OP) can issue commands to EXEC — giving it immense powers (although it cannot issue privileged CLI commands, like SUPERUSER ON). By default, any CLI run by the master CLI has username OP. This means that LOCK_CLI, unless it was created with a username other than OP, can issue EXEC commands.

Protecting the system console is described later in this chapter.

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Log-On Procedures and Security

Before logon, the username-password pair is the first — and sometimes only — line of defense from break-in. After logon, there are sometimes signs of break-in that users can notice. This section tells you how to maintain the strength of the logon defense and how users can help protect themselves.

CAUTION: The security procedures described in this section will have no effect if users leave their consoles unattended while logged on.

Log-On Tries

To log on, a user must type his/her username and password correctly. By default, EXEC allows five log-on tries (which may be break-in attempts). After five unsuccessful log-on tries, EXEC locks the console for 10 seconds (local line) or breaks the connection (modem line). The console lock and broken connection are designed to discourage break-ins.

In the ENABLE command that activates each console line, you can specify a different number of log-on tries allowed — from 1 to 10. And, you can tell EXEC to disable the line (instead of locking it for 10 seconds or breaking the connection) after a given number of log-on tries. A disabled line can't be used again until someone at the system console re-enables it using the EXEC command ENABLE.

For greatest security, you might allow only one or two tries, and tell EXEC to stop (disable) the line thereafter. This is particularly relevant on modem lines (if you have them), since anyone who has a DG-compatible console and modem, and who knows your system's phone number can try to guess a username/password pair and — if she or he succeeds — break into the system. Many people who've used AOS/VS know that each system has an OP profile and that (often) the OP profile is privileged. All they need to do is guess the OP password (this is a good reason to keep modem, Superuser, and Superprocess privileges in separate profiles).

EXEC's ENABLE command, which allows you to change the number of tries allowed on a line, and specify what will happen then, is described in Chapter 8.

Log-On Banner

The system log-on banner (changeable via the SYSID command) identifies your system to users before they log on. You can edit it to identify your system uniquely. However, there is some measure of security in anonymity; therefore you may want to retain the anonymous default banner, which says only "AOS/VS n.nn" where n.nn is the revision number.

This is especially pertinent if you have a number of modem lines, since the default system ID gives little information to anyone seeking to break into your system over the telephone. (Modem lines themselves are not part of the C2 Trusted Computing Base, and shouldn't be part of a secure system; but you may have compelling reasons for using them.)

User Log-On and Log-Off Messages

Whenever a user logs on or submits a batch job, the following things happen:

1. A user types username and password, or the system accepts a batch job. Users can post batch jobs with the command QBATCH or QSUBMIT. Normally, a batch job is processed as soon as possible — but, if desired, a user can tell the system to run the job *after* a specific time, using the QBATCH or QSUBMIT switch /AFTER=.

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2. EXEC verifies the username and password, and tells the system to create the user process.
3. The system creates the user process for the user, running the initial program specified in the user profile.
4. The system writes the greeting message (LOGON.MESSAGE) to the user.
5. The system tells the initial program to execute the initial IPC file specified in the profile.
6. The system notes the date and time in the user's profile file (in :UPD) and in the system log (if logging is on).

The process then runs for the user until he or she logs off or the batch job terminates. Then, the following things happen:

1. The user logs off or the batch job terminates.
2. The system terminates the user process.
3. The system notes the date/time in the user's profile file (overwriting the logon time) and in the log file (if any).
4. The system writes a process termination message to the user. If the user was logged on over a modem line, EXEC automatically hangs up, breaking the connection.

During logon and logoff, messages are written to the console. For batch, messages are written to the batch output file (by default, the line printer).

Log-on and log-off messages can help you, and help users, identify possible system break-ins. Encourage users to *check* the displayed date/times each time they log on. If the displayed date/time doesn't match the last time the user logged on, this means someone else has been using this user's account. The user should change his/her password immediately and tell you (or tell the security person, if it isn't you) about the breach.

Sample system log-on and log-off sequences follow.

Log-on sequence:
⤵, username ⤵, password ⤵

```
————
Last message change              1-JUN-86          15:32:08
... (System displays contents of file LOGON.MESSAGE) ...
————
Last previous logon              2-JUN-86          8:22:59
... (System executes commands in user log-on macro, if any) ...
AOS/VS CLI   REV n               3-JUN-86          8:23:01
)
... (User works with system until lunch time) ...
) BYE ⤵
AOS/VS CLI   TERMINATING         3-JUN-86          12:04:44

Process n Terminated
Connect time  3:31:43
User 'xxx' Logged off @CONn      3-JUN-86          12:04:47
```


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If another user process with the same username is still running, the termination (obituary) message looks like this:

Process n Terminated
Connect time hh:mm:ss (the batch message is *Connect time hh:mm:ss)*

(Other jobs, same username:)
Number of console jobs, n
Number of batch jobs, n
User 'xxx' Logged off dd-mon-yy hh:mm:ss

Ask users, when they log off, to

- check for an *(Other jobs, same username)* message. This message means the system is running another process for the same username. By comparing the number of console and/or batch jobs given in the message, with his or her actual number (if any) of current batch jobs or logons at other consoles, the user can tell if someone else is using his or her username. If this seems to be the case, the user should tell you at once.

Ask users, when they log on, to

- check the *Last previous logon* date and time, as described above. If this doesn't match the time they remember, someone else may have been using the account. The user should tell you at once.

User Passwords

The person who creates a user profile also assigns the user's password. The password must be between 6 and 15 characters long. Case of letters is ignored. More than 15 characters won't work — if the password is 15 characters, and the user types these 15 and one more, the system will reject the password.

A user's password can include any printable character. Obviously, a password like !*%EO(- is hard to guess (and, perhaps, to remember).

With AOS/VS Revision 7.00, you can tell PREDITOR to encrypt a user's password before storing it. From a security standpoint, this is desirable because no one — not even a superuser — can figure out an encrypted password. But if the user relies on a network to other DG systems, encrypting the password may interfere with user access to other hosts. For any remote host running a revision of XODIAC that doesn't support encryption, encryption will prevent access via XODIAC's RMA and FTA agents. CEO doesn't need these agents for CEO Mail to work between hosts; however, CEO does rely on RMA for remote printer use). Read your XODIAC Release Notice to see if encryption is supported.

For a network user, you may decide against encryption, or encrypt on all systems (all must be running AOS/VS Revision 7.00 or later), or you might maintain two accounts for the user: one secure local account, with password encrypted, and one general-purpose account, with password unencrypted, to serve for network access. Remember, whatever your choice, that connection to a network is a security risk; do not participate in a network if security is critically important to you. Networks aren't allowed in C2-level systems.

Anyone who edits the profile can change the existing password without knowing the old one.

Users may be allowed to change their passwords. By default, PREDITOR grants this privilege (the default answer allows it).

Generally, users should be able to change their passwords, since if a user originates a password, he/she is likely to remember it. If someone else originates the password, the user is likely to forget it — and will probably write it down, producing a security risk.

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Unfortunately, given free choice, users are likely to choose obvious passwords. Passwords that users should avoid (because they are easy to guess) are

- initials or part of name (particularly the username, which is very easy for people to try);
- name of housemate, spouse, child, or pet;
- make or model of favorite auto;
- name, make, or model of boat;
- phone number;
- name associated with work, like company, group, or project; and
- anything people know this user cares about.

Good password choices include a mixture of letters, numbers, and punctuation; for example

WLS1.1

One way to build good, memorable passwords is to create them from phonetic syllables. For example, take the syllables

ang
fof
lal
dan
pok
soo

There are many combinations of these, memorable through their phonetic construction, and obscure enough not even to exist in the dictionary.

Another possibility is a foreign language, if you know it well. Avoid obvious words or phrases.

Yet another possibility for a password is a phrase, with words separated by periods or underscores. For example,

save.my.files

Passwords should be changed regularly — depending on the sensitivity of a user's data. They should be changed *immediately* if you suspect your system is under attack (signs are described later). Also, passwords should be changed whenever a privileged user plans to leave, or leaves, your organization. This is true because a person who leaves a group also leaves group rules and sanctions — in theory, he or she has nothing to lose by taking information.

The XODIAC RMA agent (also used by CEO) requires that a person have the same password on each system on which he/she will use remote printers. This means that a break-in on one system may indicate vulnerability in all systems on the network. All the more reason to make passwords very difficult to guess.

From time to time, users will forget their passwords. You can assign a new one via PREDITOR, if you edit the user profile. You need not know the original password to create a new password.

You can monitor user password changes with detailed logging.

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Guest Accounts and Shared Passwords

A guest account, which allows users without individual accounts to log on to your system, is a useful communications aid. Such profiles have public usernames and passwords which may be the same; for example $GUEST and $GUEST. Guest accounts are useful because they allow people without accounts to read general-distribution bulletins and mail.

Unfortunately, guest accounts represent holes in security, because — since many people know the password — it's difficult to identify an account abuser. You can trace suspicious activity only to the username, not to a person. This is a problem with *any* account that two or more people share.

If security is critically important to you (closed shop), avoid creating a guest account. Guest accounts are not permitted on a C2-level system.

If you really need a guest account, give it a username that has a unique character (for example, $ in $GUEST), so you can specifically *deny* access to this username in other users' default ACLs. For example, the central log-on macro could include the command line

```
DEFACL  [!USERNAME],OWARE   $+,,  +,RE
```

This would give the user ownership (as usual), anyone whose username began with $ (like $GUEST) *no* access, and other users read and execute access. Some files, like SED.PR in :UTIL, and mail files, must be accessible to users — access Read or Execute, or Read and Execute. Log on as a guest and try the operations you want guests to be able to do.

Avoid giving the guest account any of the privileges shown in Table 16-2 (except *Use console*). You might want to restrict the number of sons (to 0 or 1) to conserve system resources. And, you might restrict disk space to a reasonable minimum — say 500 or 1000 blocks.

Password-Stealing Programs

Any console left unattended (whether or not a user is logged on) is vulnerable to a password-stealing program or CLI macro (sometimes called a spoofer or password-grabber). Such a program usually involves a fake system log-on banner, which makes it appear as if a console is unused when actually it is running the password-stealing program.

In one scenario, the program author runs the stealing program on an unused console, using a public account to avoid identification. Eventually, a user tries to log on, typing username and password. The program stores them in a file that its author can access (in some public directory). Then, the program displays *Invalid username-password pair* and terminates. The system displays *Process terminated* and *User 'xxx' Logged off*, identifying the username. The giveaway here is the *terminated* and *Logged off* messages, which never appear in a real log-on sequence.

A stealing program run from a user process (a console in use left unattended) is more subtle. The original user returns to find the system banner on his/her console. He/she may not remember logging off, but blames the inconsistency on poor memory. He/she types username and password, and the program copies username and password as before; but then it chains to the CLI. It can produce a log-on message and AOS/VS CLI banner identical to the original. The only clue is the *Connect time* message displayed when the user logs off. This message will show a longer connect time than expected, since the user's initial process was running the whole time.

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There is no real defense against password-stealing programs — there's only detection. User awareness is needed to detect the first type of stealing program (*terminated* message). User consistency can prevent the second type of stealer: users who always log off when leaving their consoles won't be fooled.

When you, or a user, thinks a password might have been stolen, the user must change that password immediately.

The log file, with detail set to full, yields evidence of the second type of password stealing: a report of the original username's file accesses will show the steal file pathname.

Generally, you need the cooperation of users in many ways to run a secure system. For users, security features of AOS/VS are described in Chapter 2 of the manual *Learning to Use Your AOS/VS System*. You might encourage users to read that book.

System Calls and Tailored AOS/VS Applications

The following information on AOS/VS system calls is provided for those who are programming special AOS/VS-based applications. (For more information on system calls, see the *System Call Dictionary (AOS/VS and AOS/DVS)*.)

Console Access Control Rules

AOS/VS identifies and authenticates users during its log-on procedure, as follows. When a user at a terminal starts to log on, the EXEC program asks for username and password. If the user types a recognized username-password pair, EXEC tells the system to create a process for that user on that console. The system creates the process with the privileges specified in the user profile. The user process has control of the console until the user logs off.

If you want to write a program to identify and authenticate users (replace EXEC for these purposes), the program must assign the console and open it (using privilege settings given in the user profile, pathname :UPD:username) according to the following rules.

Console files in :PER have ACL PMGR,OWARE. This ACL is not meaningful to PMGR access rules.

When the system comes up, all consoles are unowned.

Usually EXEC will gain ownership of all consoles through the EXEC ENABLE command.

To have ownership of a console you must assign it by either:

- explicit assign (system call ?ASSIGN);
- open assignment (system call ?OPEN); or
- process assignment (system call ?PROC)

Once you own the console, you may perform I/O after you open the console (?OPEN call) for I/O access.

If you own the console via ?PROC, this is your "process console" and you are the interruptible owner. (Interruptible ownership means that CTRL-C sequences affect your process.)

Your I/O access to a console is lost when your program closes the console (?CLOSE system call) or terminates.

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Ownership and interruptible ownership are lost upon termination, deassignment, or passing the console to a son process (not shared). When a console is passed to a son process, the father process becomes suspended. The father regains the ownership when the son process terminates.

If an interruptible owner turns on the shared characteristic and passes the console to a son process, the father process remains the interruptible owner.

Request Types

Only a process with I/O access to a console may issue ?READ and ?WRITE.

Only the owner of a console may issue control requests (e.g., ?OPEN, ?GCHR, ?SCHR, ?STOM, etc.) with the following exceptions:

- PID 2 or the console owner may get the default characteristics
- PID 2 or the console owner may issue the ?CLRDV control request

Any process may issue a ?SEND call to any process console (no access checking). However, a process can turn off ?SEND message receipt via a characteristic. This characteristic cannot suppress messages from PID 2.

The only control requests allowed on an unowned console are ?ASSIGN, ?OPEN, or ?PROC and the following exception: only PID 2 can set default characteristics. It can set them on any console.

Discretionary Access Control

The system calls that affect discretionary access control are

- get or set ACL (?SACL);
- get or set default ACL (?DACL);
- get or set Superuser, Superprocess, or System Manager mode (?SYSPRIV).

A full list of system calls that relate to system security is given in Table 16-4 below. For specific information on the security requirements for these system calls, see Appendix C in the Document Changes file (Revision 08) for the *System Call Dictionary (AOS/VS and AOS/DVS)*, document number 093-000241-03.

Table 16-4. AOS/VS System Calls with Nonstandard Security Requirements

System Call Name	Function
?ALLOCATE	Allocates disk blocks.
?BLKIO	Performs (reads/writes) block I/O.
?BLKPR	Blocks a process.
?BRKFL	Terminates a process and creates a break file.
?CGNAM	Gets a complete pathname from a channel number.
?CHAIN	Passes control from a Ring 7 caller to a new program.
?CLASS	Gets or sets class IDs.
?CLRDV	Clears a device.
?CLSCHED	Enables, disables, or examines class scheduling.
?CMATRIX	Gets or sets the class matrix.
?CON	Becomes a customer of a specified server.

(continued)

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Table 16-4. AOS/VS System Calls with Nonstandard Security Requirements

System Call Name	Function
?CPMAX	Sets maximum size for a control point directory (CPD).
?CREATE	Creates a file or directory.
?CRUDA	Creates a user data area (UDA).
?CTERM	Terminates a customer process.
?CTYPE	Changes a process type.
?DDIS	Disables access to all devices.
?DEBL	Enables access to all devices.
?DELETE	Deletes a file entry.
?DIR	Changes the working directory.
?ENBRK	Enables a break file.
?ERMSG	Reads the error message file.
?EXEC	Requests a service from EXEC.
?FSTAT	Gets file status information.
?GACL	Gets a file entry's access control list (ACL).
?GCLOSE	Closes a file previously opened for block I/O.
?GLINK	Gets the contents of a link entry.
?GNAME	Gets a complete pathname.
?GNFN	Lists a particular directory's entries.
?GOPEN	Opens a file for block I/O.
?GPOS	Gets the current file-pointer position.
?GTACP	Gets access control privileges.
?IDEF	Defines a user device.
?IHIST	Starts a histogram for a 16-bit process.
?IMSG	Receives an interrupt service message.
?INIT	Initializes a logical disk.
?IRMV	Removes a user device.
?ISEND	Sends an IPC message.
?IXMT	Transmits a message from an interrupt service routine.
?JPINIT	Initializes a job processor.
?JPMOV	Moves a job processor to a new logical processor.
?JPREL	Releases a job processor.
?KINTR	Simulates keyboard interrupt sequences.
?LABEL	Creates a label for a magnetic tape or diskette.
?LMAP	Maps a lower ring.
?LOCALITY	Changes user locality.

(continued)

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Table 16-4. AOS/VS System Calls with Nonstandard Security Requirements

System Call Name	Function
?LOGEV	Enters an event in the system log file.
?LPCLASS	Gets/sets logical processor class assignments.
?LPCREA	Creates a logical processor.
?LPDELE	Deletes a logical processor.
?MAPDV	Maps a device into logical address space.
?MBFC	Moves bytes from a customer's buffer.
?MBTC	Moves bytes to a customer's buffer.
?MDUMP	Dumps the memory image from a user-specified ring to a file.
?MIRROR	Mirrors and synchronizes LDU images.
?MPHIST	Starts a histogram on a uni- or multiprocessor system.
?OPEN	Opens a file.
?OPEX	Communicates between the current process and an operator process.
?OVEX	Releases an overlay and returns.
?OVKIL	Exits from an overlay and kills the calling task.
?OVLOD	Loads and goes to an overlay.
?OVREL	Releases an overlay area.
?PCLASS	Gets a process's class and locality.
?PCNX	Passes a connection from one server to another in ring 7.
?PIDS	Gets information about PIDs.
?PMTPF	Permits access to a protected file.
?PRCNX	Passes a connection from one server to another.
?PRDB/?PWRB	Performs physical block I/O.
?PRIPR	Changes the priority of a process.
?PROC	Creates a process.
?PROFILE	Performs a profile request.
?RDB/?WRB	Performs (reads/writes) block I/O.
?RDUDA/?WRUDA	Reads/writes a user data area (UDA).
?READ/?WRITE	Performs (reads/writes) record I/O.
?RECREATE	Recreates a file.
?RELEASE	Releases an initialized logical disk.
?RENAME	Renames a file.
?RESIGN	Resigns as a server.
?RINGLD	Loads a program file into a specified ring.
?RPAGE	Releases a shared page.
?SACL	Sets a new access control list (ACL).

(continued)

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Table 16-4. AOS/VS System Calls with Nonstandard Security Requirements

System Call Name	Function
?SATR	Sets or removes the permanent attribute for a file or directory.
?SBIAS	Sets the bias factors.
?SCHR	Sets a character device's characteristics.
?SCLOSE	Closes a file previously opened for shared access.
?SDAY	Sets the system calendar.
?SECHR	Sets extended characteristics of a device.
?SLIST	Sets the search list for the calling process.
?SOPEN	Opens a file for shared access.
?SOPPF	Opens a protected shared file.
?SPAGE	Performs a shared-page read.
?SSID	Sets the system identifier.
?STMAP	Sets the data channel map.
?STOD	Sets the system clock.
?STOM	Sets the time-out value for a device.
?SUPROC	Enters, leaves, or examines Superprocess mode.
?SUSER	Enters, leaves, or examines Superuser mode.
?SYLOG	Manipulates the system log file.
?SYSPRV	Enters, leaves, or examines a privilege state.
?TERM	Terminates a process.
?TRUNCATE	Truncates a file at the current position.
?UBLPR	Unblocks a process.
?UPDATE	Flushes file descriptor information.
?VCUST	Verifies a customer in Ring 7.
?VRCUST	Verifies a customer in a specified ring.
?WHIST	Starts a histogram.
?WRB	Writes block I/O.
?WRITE	Writes record I/O.
?WRUDA	Writes a user data area (UDA).
?XINIT	Initializes a logical disk (extended).
?XPSTAT	Returns extended status information on a process.

(concluded)

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Controlling Access with ACLs

This section explains ACLs and how to use them to protect system security. It is based on the similar section in Chapter 9, and has some additional details.

In a multiuser system, users need access to, and privacy for, their own files. System and user files need protection from accidental or malicious deletion. AOS/VS file access control lists (ACLs) help ensure this.

NOTE: AOS/VS access controls work *only* if, when the system was generated, the VSGEN parameter *Access* remained Y. The Access parameter is set to Y by default. If the Access parameter is changed to N, the resulting operating system will ignore access controls — it will be wide open.

Each directory, including the root (:), and each nondirectory file, has an access control list (ACL). An ACL is a list of matched username-access pairs, with the form

username, access *[username, access]* ...

A username can be a real username, or it can include filename template characters to specify a group of usernames. Access types are O (Owner), W (Write), A (Append), R (Read), E (Execute), and null. They have the following meanings.

Access Type	Allows
O (Owner)	Owner access to a directory allows a user to change directory ACL, rename, or delete the directory, regardless of the ACLs of files in it. The user can also change the ACL of any file — directory or nondirectory — within the directory. In addition to Owner, Execute access is needed if the user wants to enter the directory or use its name in a pathname. Owner access to a logical disk unit (LDU, set by the Disk Formatter) is needed for a user to initialize the LDU. Owner access to a nondirectory file allows a user to change ACL, rename or delete the file, check file status, check or change permanence, or create, read, edit, or delete a user data area (UDA) for the file. For a directory or nondirectory file, Owner access differs from Write access as follows: with Owner access, a user can delete the file *without having Write access to its parent directory*; the user needs only Execute access to the parent directory. With Write (but not Owner access), a user can't delete the file unless he/she has Write or Owner access to the parent directory. This means that, if you want a user to be able to add to (but not rename or delete) a file in a directory to which the user has only Execute (or Read and Execute) access, give the file an ACL of username,WARE (not username,OWARE).
W (Write)	Write access to a directory allows a user to delete or rename any file (including directories) in the directory — regardless of the file's ACL. To delete or rename the directory itself, a user needs Owner access to it or Write access to its parent directory. Write access to a directory also allows a user to create files and change file ACLs there. Write access allows a user to initialize and release an LDU (the user also needs Owner access to the LDU and Execute access to the disk entry in :PER).

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Access Type	Allows
W (Write) cont.	Write access to a directory has little value by itself. To do anything in the directory, a user also needs Execute access to the directory. Write access to a nondirectory file allows a user to change file contents (for example, by editing with a disk file editor or adding text from another file), get a complete pathname, check file status, check or change permanence, and create or edit a user data area (UDA). Write access has little value without Read access, since without Read access, the user can't tell what's in the file. Generally, a user can't modify a file with a text editor unless he or she is able to delete it (he or she has Write access to the parent directory). This is true because at the end of the editing session the text editor tries to delete the original file and replace it with a new, updated file.
A (Append)	Append access to a directory allows a user to add files (directory or nondirectory) to it. Append access to a directory has little value by itself. To do anything in the directory, a user also needs Execute access to the directory. Append access to a nondirectory file allows a user to check the file status, get a complete pathname, and check or change permanence for the file.
R (Read)	Read access to a directory allows a user to read filenames in it (for example, in a FILESTATUS command, with or without templates). Read access also allows you to read ACLs of files *in* the directory. Read access to a directory has little value by itself. To do anything in the directory, a user also needs Execute access to the directory. Read access to a nondirectory file allows a user to read it — for example, with the TYPE command or a text editor. The user can also check the file status, get a complete pathname, and check or change permanence. The user also needs at least Execute access to the parent directory and all higher directories. Read access allows a user to copy a file or debug a program. This is *not* desirable for a program file, since a user can copy the file to his or her own directory and explore it at will (via a debugger or DISPLAY program). Or, he or she can use it to corrupt existing programs (for example, use a compiler to create a devious object file that will be linked into an application program).
E (Execute)	Execute access to a directory allows a user to enter the directory and use its name in a pathname. To list files or check file ACLs in the directory, a user must have both Execute and Read access. (Users *can* list a specific filename, if they know it, with Execute access only.) Execute access to a nondirectory file allows the user to execute the file as a program (XEQ or PROCESS command), to read file status, get a complete pathname, and to check or change permanence.

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Access Type	Allows
E (Execute) cont.	Execute access to a program file allows the user to run the program via the XEQ or PROCESS commands. To debug the program or run a disk file editor on it, the user needs Read *and* Execute access. Since Execute access alone doesn't allow the user to see the contents of the program, you can give Execute access safely to programs that (internally) contain sensitive information.
,, (null)	Null access excludes a user from access. For a directory, null access prevents the user from accessing files within the directory. The user can list the directory name. For a nondirectory file, null access prevents the user from accessing the file. By default, users who are not given access have null access anyway, which implies that you don't need to specify null access. But if you use a template to give a group of users access, null lets you *exclude* users in the group. You can assign null access specifically with ,, (two commas) after the username or template. NOTE: If you end an ACL command line with null, use one comma instead of two (e.g, ACL FILEA A+,WARE $+, ⤶). For example, assume you want to retain ownership of a file and give most users Read and Execute access to the file. You want to exclude users ANDY_B and any user whose username begins with $. You could type) ACL pathname [!USERNAME],OWARE ANDY_B,, $+,, +,RE ⤶ To deny everyone (including its creator) access to a file, use the ACL /K switch, as follows:) ACL/K pathname

When AOS/VS starts up, it assigns an ACL of +,E to the root directory, to allow users access to their own directories. This +,E ACL remains in force — regardless of any ACL assigned with the Disk Formatter or with the ACL command — while this AOS/VS system is running.

PREDITOR creates each user directory (in :UDD) with an ACL of username,OWARE. Each file the user creates within this directory gets the same ACL (username,OWARE) by default. The user profile files, in :UPD, have null ACLs, which means that only superusers, like EXEC, can read them.

Every user has Owner access to his/her files, and thus can change file ACLs with the ACL command, or change the default ACL with the DEFACL command.

A user can give another user (or all users) read access to a file by giving Execute access to his directories (up to :UDD:username) and by giving Read access to the file. For example, assume Sam wants to give Al read access to file :UDD:SAM:MARK_IV:MARKET_PLAN. Sam can type

```
) ACL   :UDD:SAM   SAM,OWARE   AL,E ⤶
) ACL   :UDD:SAM:MARK_IV   SAM,OWARE   AL,E ⤶
) ACL   :UDD:SAM:MARK_IV:MARKET_PLAN   SAM,OWARE   AL,R ⤶
```

(The SAM,OWARE is needed to retain Sam's access rights to his own file.)

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If a user will often need a tailored, nondefault ACL, you or the user can specify this ACL in the user's log-on macro with the DEFACL command. For example, assume that Sam will periodically want to give Al read access to selected files. Sam can put the command line

```
DEFACL SAM,OWARE  AL,E
```

in his log-on macro. This will allow Al to enter Sam's directories (but not browse for files in them). Sam can then let Al read a file by typing only *one* ACL command, regardless of the directory that holds the file; for example

```
) ACL  :UDD:SAM:MARK_XV:STRATEGY  SAM,OWARE AL,R )
```

In a more relaxed situation, you might want to specify Execute access for *everyone*. For this, the easiest method is to put the DEFACL command line in the *central* log-on macro (that executes user log-on macros). The command would be

```
DEFACL  [!USERNAME],OWARE  +,E
```

The DEFACL command can be inserted in a log-on macro with a text editor.

The ACL structure makes it very easy to restrict access. All you need do is remove general Execute access from any directory above the one you want to restrict. For example, changing ACL of user Jan's initial user directory to JAN,OWARE prevents anyone other than Jan without Superuser from accessing any of her files — regardless of the ACLs below directory :UDD:JAN.

Username Groups

If you want to group a set of users, create a username group. In AOS/VS, a username group is a set of users (usernames) that, combined with ACLs, allows (or restricts) access to a group of users.

To start, you need a unique specifier to use when creating the group members' user profiles with PREDITOR. Then, you can use this unique specifier in all pertinent users' default ACL settings (in log-on macros) to establish the needed access to files.

For example, assume a project called Mark II that involves Sally, Jack, Alexis, and Sam. Sam is the project leader. You want to create a username group that gives each person execute and read access to other group member directories. In addition, you want Sam to have append access to group member directories. As a group name, you can choose something like +.MK2 (the suffix .MK2 is the unique specifier). Using PREDITOR, you create the profiles

```
SALLY.MK2  JACK.MK2  ALEXIS.MK2  SAM.MK2
```

Then, you create a log-on macro for each user's directory. It contains the command

```
DEFACL  [!USERNAME,OWARE]  SAM.MK2,ARE  +.MK2,RE
```

The group's default ACL gives each user OWARE access to his or her files; it gives Sam Append, Read, and Execute access to all group member files; it gives group members other than Sam Read and Execute access to all group member files; and it gives no access to other users. Since each user has Write access, he or she can change ACLs (including the default ACL) at will. You rely on the people in the project to retain the ACLs needed for communication.

After deciding on a unique group identifier, you can check the users that belong to it with either the FILESTATUS command in :UDD or PREDITOR templates. To see which users belong to the Mark II group, you could type

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```
) SUPERUSER ON ↵
*) FILES/S    :UDD:+.MK2 ↵
```

... (it displays a sorted list of usernames)...

```
*)
```

Username groups can improve the flow of information, while retaining tight access control; they also make it easy to clean up (by deleting accounts) after a project is completed.

The use of username groups is not permitted in a C2-level system.

Order of Usernames in ACLs

When you (or anyone) give access privileges to different users, be sure to assign *specific* username groups before *general* username groups (templates). For example, the ACL

```
+,RE   SALLY,OWARE
```

gives all users (which includes Sally) Read and Execute access — and *only* Read and Execute access. The Owner, Write, and Append access for Sally are ignored. With this ACL, no one but a superuser can write to the file or change the ACL. But transposing the user groups:

```
SALLY,OWARE   +,RE
```

gives Sally all access, and gives all users Read and Execute access. When you use templates in an ACL, place specific username(s) first and the most general usernames (templates) last.

The specific-to-general rule also applies when you *exclude* users via null access. For an example, here's the example given above: You want to retain owner access, and give all users Read and Execute access — except ANDY_B and any user whose username begins with $. You can type

```
) ACL  pathname   [!USERNAME],OWARE   ANDY_B ,,  $+,,  +,RE ↵
```

By specifying null for the usernames you want to exclude, you tell the system to exclude them before it acts on the +,RE template.

Any username template is like a group name. If you like the concept of group names, you can use username templates to achieve the group name effect. For example, for all users associated with project MARK_II, you could create profiles with usernames that ended in .MK2. With these usernames, you'd carefully avoid overlap with irrelevant usernames. Then, you'd configure default ACLs within the +.MK2 user directories to specify the kind of access you wanted for each person.

The number of user-access pairs you can specify is limited only by the number of characters involved. The maximum number of characters allowed is 255. You can assign a multiple-line ACL easily by writing it into a macro file with a text editor, ending each line with the & continuation character; then using the macro to assign the ACL to the desired file(s). For example, assume you create the macro ACL_MARK_II.CLI with the following ACL specification:

```
ACL/V  (%-%)  al_r,RE allan,WRE barnes,RE carnaby_a,RE erm,RE fort-,RE &
jamison,RE s.a.a.,RE prodigy,AE &
```

You could then assign the long ACL to file(s) quite easily; for example

```
) ACL_MARK_II  PROG+  MESSAGES ↵
```


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This assigns the long ACL to all files whose names begin with PROG, and to file MESSAGES, in the working directory. To add OWARE access for the user who runs the macro, you'd insert the characters [!USERNAME],OWARE] in the macro before the first username-access pair.

If you (or a user) want to change the ACL of all files in a directory and its subordinates, get into the directory and type an ACL command of the form

ACL/V # username-access *[username-access ...]*

For example,

) ACL/V # SALLY,OWARE OP,OWARE ⟩

With Superuser on, you can bypass all ACLs. But so can any user who has Superuser privilege. The ideal arrangement allows people to work productively without Superuser.

After you've established the ACL standards that you want, the ACL mechanism works by itself. You don't need to change ACLs very often. But you do need to understand them.

Device and LDU ACLs

Devices — like disk and tape units, and consoles — are accessed through filenames in the peripherals directory (:PER). The default ACL of :PER is +, RE — but ACLs of files in it are more restrictive. For disk, diskette, and tape units the default ACL is OP, WARE, For consoles, it's PMGR,OWARE.

The default tape unit ACL (OP,WARE) allows users other than OP no access. To allow user access, many sites use the UP macro to change tape unit ACLs to +,WARE. Unfortunately, An ACL of +,WARE allows any user to read or write any tape that happens to be mounted on a unit — an obvious security risk.

One way to keep tape units secure (that is acceptable in a C2-level system) is to make users employ the MOUNT command, which asks the operator to mount a tape. After the operator mounts the tape and informs EXEC, EXEC changes the unit ACL to give the user exclusive access (username,WARE). The user retains exclusive access during the tape mount; then EXEC restores the old unit ACL.

You can restrict which users can use the MOUNT command by restricting access to the MOUNTQ. To do this, use the EXEC command ACCESS, with MOUNTQ and the username or template of the user(s) you want to give exclusive use of the MOUNTQ. For example, to give user Sally exclusive use of the mount queue, you would type CONTROL @EXEC ACCESS MOUNTQ SALLY OWARE ⟩. Sally, and no other user without Superuser privilege, could then submit mount requests. Any other user, except a superuser, would get a *Write access denied* error message after issuing the MOUNT command. You can restrict mount queue access to superusers by setting access to null (ACCESS with /K switch). Or to prevent any mount access, you can close the mount queue (EXEC CLOSE command).

Default disk and diskette unit ACLs — like tape unit ACLs — are OP,WARE. For diskette units — like tape units — many sites use the UP macro to change the unit ACL to +,WARE.

The ACL of a disk or diskette unit remains in force only while there is no initialized LDU in the unit. After a disk has been initialized into the file system, the ACL assigned to the LDU with the Disk Formatter takes effect. (But for the system LDU, the root ACL is always +,E.) An initialized LDU is treated like any directory; its ACL can be changed by an owner of the parent directory. To initialize an LDU, a user needs Owner access to the LDU (set by the Formatter), Write access to the directory, and Execute access to the unit name(s) in directory :PER. Setting ACLs with the Disk Formatter is described in Chapter 12.

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Before an LDU is initialized, it's vulnerable. Anyone at the system console or logged on with username OP can read from or write to it as a physical device (for example, by typing DUMP/V @DPJ10 MYFILE ↓). To prevent this, have all on-line disks initialized as soon as possible after starting AOS/VS, or leave disk power off, or change disk unit name ACLs in :PER to null.

AOS/VS does not have an object reuse policy in regard to scratch tapes or diskettes. To prevent someone from reading a scratch tape or diskette, use a bulk eraser on the tape or diskette.

Any standard CLI process with username OP has owner access to many AOS/VS files, allowing the process to do anything it wants with these files (ACLs of AOS/VS files are described in Table 16-5). Also, EXEC will obey the commands of any process with username OP. EXEC commands can change ACLs on tape units, queues, and printers, or otherwise exert control. For these reasons, avoid leaving a process with username OP running unattended. On the system console, run LOCK_CLI.

AOS/VS lets magnetic media (tapes and diskettes) be handled in a secure fashion by privileged users *only* in a C2 configuration through the use of ACL and EXEC ACCESS commands. The default device ACL (OP, WARE) allows access only to the OP username. The OP username is uniquely assigned in a C2 system to a privileged user (usually the operator). The privileged user changes the default ACL (to privileged_username, WARE) via EXEC and mounts the media. The privileged user retains exclusive access during the media mount; then, EXEC restores the default device ACL (OP, WARE).

Preventing Unauthorized Access to Windows

AOS/VS Revision 7.00 supports windowing on graphics (pixel-mapped) consoles on systems like the DS/7500 computer. On such systems, a user can create windows on a graphics console, but in order to do so, must first assign (get ownership of) the PMAP, an entry in :PER, for the device. Unauthorized access to PMAP entries represents a potential security risk because whoever has access to a PMAP entry can run programs (like a password-stealing program) in a related window. To prevent unauthorized access to windows, add to your system's UP macro a line that assigns PMAPs to PID 2 before the line enabling consoles. See the section, "If You Have Graphics Consoles" in Chapter 5.

Because of the security risk involved, windowing and graphics terminals are not permitted in a C2-level system.

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ACLs of AOS/VS Files

The ACLs of files shipped with AOS/VS (and created by AOS/VS utilities) are shown in Table 16-5. Do not change these ACLs (except user ACLs) unless you have specific reasons for doing so. Changing them can imperil the security or operation of your system.

Table 16-5. ACLs of AOS/VS and Selected Other Files

File	Default ACL	Reason for Default and Comments
: (root directory)	+,E	Users need access to the root to log on to their own directories. (Execute access is required for access to any directory, with or without other access.)
:CEO_FILES	+,AE	Users need to add files to the directory (through CEO).
:CEO_MAIL	OP,OWARE +,E	The operator needs access without turning Superuser on. Users need access (through CEO).
CEO_DIR (path :UTIL:CEO_DIR)	OP,OWARE +,RE	The operator needs access without turning Superuser on. Users need to read files in the directory and execute programs in it (through CEO).
devices		*See* :PER.
:CLI files	+,RE	Users need to be able to read and execute the CLI to log on.
:HELP	OP,OWARE +,RE	The operator needs access without turning Superuser on. Users need to read Help files in the directory. This ACL is also used for all files in the directory. Possibly, you might restrict operator access and/or user access to some files.
LINK.PR (:UTIL)	+,RE	Programmers need Execute access to write applications. For Link, other program (.PR) files in :UTIL, and compilers and other directories, we recommend removing Read access from the ACL (for example, make the ACL +,E). Don't change the ACLs of overlay (.OL) files.
:LOCK_CLI.OL :LOCK_CLI.PR	OP,R (null)	A null ACL for LOCK_CLI prevents any but a superuser from reading it (and learning the password). The overlay file's ACL of OP,R lets the CLI program read it.
magnetic tape units		*See* :PER.
:NET :NET:UTIL	OP,WARE +,RE OP,OWARE +,RE	The operator needs access without turning Superuser on. Users need to read network files and and execute network agent programs.
:PAGE	+,E	User processes must access this directory. Page files *in* the directory have null ACLs.

(continued)

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Table 16-5. ACLs of AOS/VS and Selected Other Files

File	Default ACL	Reason for Default and Comments
:UPDATE	+,RE	The operator and users must be able to read patch files in the directory and enter the directory. This ACL also applies to files in :UPDATE. You might consider giving :UPDATE a null ACL, since probably only a superuser will apply patches, and — possibly — a sophisticated user could learn points of weakness by reading patch files.
:PER	+,RE	User processes may need access to files in the peripherals directory (file ACLs follow).
:PER:CONn	PMGR,OWARE	These are user console ACLs. The peripheral manager must own consoles to manage them. The peripheral manager assigns them to EXEC as users log on.
:PER:DPxn	OP,WARE	These are disk unit ACLs. The operator needs WARE access to initialize disk units. User processes *may* need access to diskette units; if so, you can change diskette unit ACLs, perhaps in the UP macro. Generally, only superusers should access hard disks, so you shouldn't expand hard disk unit ACLs.
:PER:MTxn	OP,WARE	These are tape unit ACLs. The operator needs to read and write to tapes. If users need tape access, a secure system would keep a restrictive ACL and require users to ask for labeled tape mounts, which lets EXEC supervise ACLs.
:PROC	+,E	User processes need to access this directory.
:QUEUE	+,AE	User processes need to add files (to be printed or run in batch) to this directory. The ACL of file Q is +,R, to allow user processes to read QDISPLAY information. Users can read only the files that they have queued in :QUEUE.
:SWAP	+,E	User processes must access this directory. Swap files *in* the directory have null ACLs.
:SYSGEN	+,RE	Users may want to read system spec files. This directory is no great security risk, but you may want to change its ACL to null — on the grounds that only a superuser will be generating an AOS/VS system.
:UDD	+,E	Users must be able to access their own directories.
:UPD	null	Only superusers like EXEC and PREDITOR should read or change profile files.

(continued)

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Table 16-5. ACLs of AOS/VS and Selected Other Files

File	Default ACL	Reason for Default and Comments
user directories	username,OWARE	Users should be able to do what they want in their directories. A user's files should not be accessible to other users. This username,OWARE ACL is the default ACL for all files created by the user in *any* directory where he/she creates files. You, or the user can change the default ACL with the command DEFACL. Default ACLs are described earlier in this chapter.
:UTIL (utilities)	+,RE	Users must be able to execute utility programs; the programs need to read overlay and data files. All files in :UTIL are shipped with an ACL of +,RE. If you want users to be able to add files to :UTIL, give :UTIL an ACL of +,ARE (or, more specifically, use username,ARE before the +,RE).

(concluded)

Aside from the recommendations above, you generally don't need to change the ACLs of files supplied by DG and created by DG programs.

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Auditing with the System Log

Security doesn't maintain itself; it requires vigilance and review of system activity. The most important tool for review is the log file. This section outlines using the system log file and suggests procedures to follow. The section "Event Logging with SYSLOG, the Error Log, and REPORT" in Chapter 9, goes into the details.

You can select logging with detail set to full or to minimal (default). Full detail logging will provide information about nearly everything that happened on the system. From a detailed log, you can create reports based on

- username
- file pathname
- failed logons

Logging without full detail produces a log that can tell you how much system time each user consumed, and who the privileged users are, but cannot tell you about file access or failed log-on attempts.

If you care about security, you will probably want to check for unwarranted file access or break-in attempts — so you will need full-detail logging at least occasionally. You may not always to run the system log with detail set to full. Periodically, you should run it with detail set full to check for misuse of the system (like trespass on other users' or system directories). You should always run the log with detail full if you become suspicious about a user or file.

Logging Procedures

System logging (minimal or full detail) requires effort. Log files grow rapidly in a timesharing system, and — with full-detail logging — the system will panic if it runs out of log space. In any case, disk space is valuable. Here is an outline of the steps needed to use logging effectively.

1. Start logging. The SYSLOG command starts logging, and can rename the old log file. The system always writes user log information to file SYSLOG in the root directory. For full detail, add the /DETAIL=FULL switch to the SYSLOG command. SYSLOG is a privileged command; only the master CLI, PID 2, or a process with System Manager privilege can issue it. (Chapter 9 describes SYSLOG command syntax in detail.)

   Start logging as soon as possible in the UP macro and stop logging as late as possible in the DOWN macro. Do not start or stop SYSLOG while the multiuser environment is active.

   If you do start logging while the multiuser environment is up, SYSLOG cannot record information you need. If a process is running before SYSLOG starts, reports will identify the process by PID number only, not by username. And for a file open before logging starts, reports will include only the channel number and PID, not pathname. Thus for both processes and files, reports might not make clear the identities of users or of objects on your system.

2. Monitor disk space use periodically. With full-detail logging, if the log file grows to consume all available disk space, AOS/VS will panic. Chapter 9 suggests using a separate directory or LDU for logging and explains a macro (supplied with the system) for monitoring disk space.

3. Generate a report from the log file as described in the next section.

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4. At least weekly (better daily) dump the log file(s) and report(s) to backup media and delete them. Labeled media are best for this (described in Chapters 10 and 8). Log files are sensitive material, so store the log archives as securely as your other backup media.

   Old log files and reports can be very useful. Often, they can reveal when an intrusion started, and precisely what happened. Knowing these things gives you some picture of the damage — and, possibly some way to minimize this damage.

Creating and Interpreting Reports from Log Files

To get access to the information gathered by the system log files, use the REPORT program, specifying the log file(s), the output destination, and the type of information desired. (Do not run REPORT on the current SYSLOG file, because AOS/VS buffers SYSLOG events, and events in the buffer at the time REPORT runs will not be reported. Before running REPORT on the current SYSLOG file, close it and start a new one from PID 2 with the SYSLOG filename-for-old-syslog command line.)

To run REPORT, use the command form

[QBATCH] XEQ REPORT *[switches] [logfile-pathname] [...]*

where

QBATCH	Runs REPORT in batch. Depending on the size of the log file(s), REPORT may take some time (say 15 minutes for a 2-megabyte log file) to create the report on line. Thus, you might want to run REPORT in batch to keep your console free.
switches	Select options as described below.
logfile-pathname	Specifies the system (or error) log file from which the report will take its data. If you omit a *logfile-pathname*, REPORT will use all the log files in the working directory. (Log files are a special type of file, LOG.)

For a report on the current log file, you will need to turn Superuser on, since the ACL for this log file is null. (If the ACL of SYSLOG isn't null, make it null when you start logging, since the log file often contains sensitive information.)

When it generates a report from multiple log files, REPORT processes the files in chronological order of creation time — regardless of the order in which you specify them.

You can choose content for the report with switches. From the standpoint of security, the most useful reports include events by

- Username (Use switch /TRACE=username) The report lists all files the user accessed or tried to access, logons, processes created, pages printed, privileges turned on, file ACLs changed, and files deleted, with date and time. Since application programs run under specific usernames (like OP), a report by username can tell what files an application program accessed — a good way to check for Trojan horses.
- File pathname (Use switch /FILE=full-pathname) The report lists all users who accessed or tried to access the named file. The report gives username, date and time for each access, as well as printings, ACL changes, and deletion. This is useful as a check on sensitive files like :UPD, LOCK_CLI.PR,EXEC.PR, or your application program and data files.
- Failed logons (Use switch /FAILED_LOGONS) An increasing number of incomplete log-on tries may indicate that someone's trying to break into your system.

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The /AFTER and /BEFORE switches allow you to specify the time period to be reported on.

The switch /L alone sends the report to your generic @LIST file, while */L=pathname* sends the report to the file indicated by *pathname* (which could be a device, such as @LPT). If you do not use the /L switch the report goes to @OUTPUT, which, for interactive users, is your console screen.

A complete list of REPORT switches and the events they report appears in the section "Event Logging with SYSLOG, the Error Log, and REPORT" in Chapter 9.

If, in the report of an event, you see an error message, this indicates the user attempt failed. If there is no error message, the user attempt succeeded.

The choice of report content is very important. Generating a report can take a long time — 10 minutes, 20 minutes, even an hour. This practically eliminates spontaneous checking. But don't automatically include *everything* in your reports; aside from the resources and time required to generate large reports, too much material will overwhelm the person who reviews the reports.

If you care about security, you will probably want to check for unwarranted file access or break-in attempts -- so you will need full-detail logging at least occasionally. You should always run the log with detail full when you become suspicious about a user or file.

If you see signs of trespass or break-in, follow them up carefully. You should have the power to react: discipline the offender(s) and tighten security after trespass, or tighten security (require password changes) after a break-in.

Protecting the System Site and Backup Media

Software and hardware protection features are effective only if the system hardware, and your backup media, are physically secure from user access. This section describes ways to protect the user consoles, system console, CPU, power source, disk and tape units, and backup media from unauthorized and possibly harmful access.

Users and Unattended Consoles

Anyone who is logged on a console and leaves it unattended risks all his or her files. Any passer-by can read or delete them. In a medium-security or closed shop, users should log off when they leave the site. It's a good idea to urge them to log off for lunch, or whenever their consoles will be unattended.

If a user has sensitive data or special privileges, he or she should *never* leave a console while logged on. It takes only a moment to copy a sensitive file into a common directory, where it can be studied later, at leisure. Also, a trespasser may be able to use a privileged process to learn passwords. Even an unsophisticated trespasser, if angry, can delete all the original user's files — which can take a lot of time to restore. (Files not backed up *cannot* be restored).

System Console and LOCK_CLI

If the system console is accessible to the user community, and runs a standard CLI, it's a serious security risk. A standard CLI on the system console has all privileges, or it can be terminated to expose a CLI with all privileges.

LOCK_CLI is a lockable CLI that, while locked, ignores commands that may threaten system security. It cannot be signed off or aborted while locked.

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If you care about security, and your system console is accessible to users, you should run LOCK_CLI on it. Even if you have trusted operators, you may want to run LOCK_CLI as an additional security aid — or, if you want to limit the operator's powers.

The operation of LOCK_CLI is described in Chapter 9. But how to set the password is only described here.

Changing the Password of LOCK_CLI

LOCK_CLI, like the standard CLI, consists of two files, LOCK_CLI.PR and LOCK_CLI.OL. It is in directory :UTIL.

The password supplied with LOCK_CLI is PASSWORD, but you should change this before running LOCK_CLI. To change it, you must edit file LOCK_CLI.PR with the FED disk file editor, put the new password in location PASSW, and end the password with a null (ASCII 0). Up to 31 filename characters, including spaces and control characters (but not CTRL-L) are allowed. They must all be uppercase.

The following example shows you how to change the original password (PASSWORD) to MAGIC.

Choose a display console. If this is a user console, log on with a profile that has Superuser privilege.

If this is the system console and it is running a locked LOCK_CLI, unlock it by typing UNLOCK ⤵, then PASSWORD ⤵. If you are in a normal CLI, proceed.

After you execute FED, you can use its Help feature (type ESC H) if needed.

Press the ALPHA LOCK key on the console. Then type the following:

```
) SUPERUSER  ON ⤵
  *) DIR  : ⤵
  *) XEQ  FED  LOCK_CLI.PR ⤵

FED- Disk File Editor REV n
```

_ PASSW/ *050101* ⤵	Type PASSW/ to see start of current password. The _ is the FED prompt, don't type it.
BREAK/ESC T *00...01* _ 7 ⤵	Press the BREAK/ESC key and T to open the display mode register. Then type 7 ⤵ to make its value 7 for ASCII display. Press ⤵.
_ PASSW/ *PA* _ "MA CR	Open location PASSW again to see what the values are in ASCII. The first two characters are PA. Type a quotation mark ("); then the first two characters of the new password. Here, type MA; then press the Carriage Return (CR) key to open the next location.
PASSW+1/ SS _ "GI CR	Type a quotation mark, then the next two characters. Here, type GI, and then press CR to open the next location. (For a password with an even number of characters, type the last two characters, press CR; then type 0 (zero) to end the password, and press ⤵ to close the location.)

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*PASSW+2/ WO 'C*400*	C is the last letter in the example password. To specify one character, type an apostrophe rather than a quotation mark; then the character. Then, to put a null in the right byte, you must multiply the character by 400 as shown. The syntax is 'char*400 (As mentioned above, this isn't needed for a password with an even number of characters: you simply keep typing xx CR until you've entered the whole thing; then type 0 ↵ to produce the terminating null in the next word.)
_ PASSW/ *MA* _ CR	When done with the password, go back and verify it. The first two characters are okay.
PASSW+1/ GI _ CR	The second two characters are okay...
PASSW+2/ C<0> ↵	And the third two characters (last in the example) are C and null — okay.
_ ESC Z	Press ESC key and type Z to leave FED.
DONE!	
*) XEQ LOCK_CLI ↵	Back to the CLI. Try the new password...
AOS/VS CLI REV n	
) SUPERUSER ON ↵	Try Superuser...
)	LOCK_CLI ignores the command.
) UNLOCK ↵ MAGIC ↵	Type UNLOCK ... and the new password.
) SUPERUSER ON ↵ *) LOCK ↵)	See if it's unlocked... Yes; success. Lock it again.

If you cannot make the new password work, log on to a user console with a privileged profile, turn Superuser on, and use FED to check :UTIL:LOCK_CLI.PR, location PASSW, again; then try the UNLOCK again.

Note that file LOCK_CLI.PR should have a null ACL, but file LOCK_CLI.OL should have an ACL of OP,R so this CLI can read its own overlay file. The files are shipped with these ACLs, but you can assign them as follows:

*) ACL/K LOCK_CLI.PR ↵ *) ACL/V LOCK_CLI.PR ↵	
LOCK_CLI.PR	(The CLI displays nothing, which means that the ACL is null.)
*) ACL LOCK_CLI.OL OP,R ↵ *) ACL/V LOCK_CLI.OL ↵	
LOCK_CLI.OL OP,R	(The CLI displays an ACL of OP,R.)
*)	

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Now, with the new password and correct ACLs, LOCK_CLI can safeguard the system console, user processes, and the system itself. To run it automatically, edit the UP.CLI macro to include it as described under LOCK_CLI in Chapter 9.

The people who operate the system don't absolutely *need* to know LOCK_CLI's password. If they don't know it, they won't be able to shut the system down normally from the system console — which might be what you want. (Anyone who has Superuser can get Superprocess, and terminate LOCK_CLI from a *user* console; so if the operator has a privileged profile, he or she can do this.)

In any case, the fewer people who know the password the better, because anyone who knows it can unlock, turn on Super powers, and use them.

LOCK_CLI retains the username OP, so it can issue commands to EXEC while locked. Thus, the operator can issue EXEC commands even while restricted to a locked CLI.

Disabling the Break Sequence

Even with LOCK_CLI running, someone can type the break sequence, halt the CPU, and cause delays and lost data. Even worse, the person could run ESD, restart AOS/VS, and come up in the master CLI with all its powers.

You can prevent this by disabling the break sequence. This is useful only when the system console is separate from the CPU, because the effect of a break sequence can also be created by the use of CPU switches.

On ECLIPSE MV/10000 SX, MV/10000, MV/8000 II, MV/8000 C, and MV/4000 machines, use the CPU LOCK switch to disable the break sequence. On ECLIPSE MV/6000 machines, you should not disable the break sequence.

On an ECLIPSE MV/8000 machine, the only way to disable the break sequence is with the SCP command LOCK. You can do it at any time. If AOS/VS is running, enter the break sequence (CMD and BREAK, or BRK, or BREAK, depending on the system console); this gives control to the SCP-CLI. If AOS/VS is not running, simply type the SCP lock command. The SCP lock command is

```
SCP-CLI>   FLAGS  LOCK  Y ↵
SCP-CLI>
```

The break sequence is now disabled; you can return to or boot AOS/VS as desired. The lock cannot be cleared until the SCP-CLI is active again and someone types

```
SCP-CLI>   FLAGS  LOCK  N ↵
SCP-CLI>
```

A power outage to the CPU will also clear the lock. Pressing the CPU CONSOLE switch to RESET will give control to the SCP-CLI, regardless of the lock flag.

On ECLIPSE MV/4000 DC, MV/4000 SC, and Data General DS/4000-series systems, the only way to disable the break sequence is to type the SCP command FLAGS LOCK Y ↵.

Don't disable the break sequence on these systems, however, unless it's critically important to deny access to the SCP. If the system hangs while the break sequence is disabled, you won't be able use break to enter the SCP and run ESD. To shut down, you'll need to turn power off, which means FIXUP will be needed on all disks.

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Computer and Power Source

Anyone who can touch the computer can unlock it, halt and reset it, run ESD, restart AOS/VS, and come up in the master CLI with all its powers. The system is only as secure as the people who have access to the CPU. In a closed or C2-level system, the computer should be locked away from the user community or have a trusted operator nearby.

The computer, and disk and tape units, are vulnerable to vandalism.

Cutting ac power to the system doesn't represent a security violation per se, but it may bring everything down — reducing productivity, increasing downtime and expenditures, and perhaps jeopardizing deadlines and projects. If you can, make your computer system power source secure (keep all power lines covered and out of plain sight).

Disk and Tape Units

Cable lengths require disk and tape units to be fairly close to the computer. Thus, the same steps taken to protect the computer often serve to protect disk and tape units.

A user with access to disk units can bring down AOS/VS (by cutting power to the system disk or page/swap disk) or halt application-related work (by cutting power to other disks). If a disk unit has a removable pack, a user can remove the entire pack — perhaps to read it at leisure on a different system. Regardless of the disk type, a user with access to disks can harm the site and its productivity.

Tape units are always a risk — a user may be able to mount and read an accessible and sensitive tape.

Diagnostics and Maintenance Procedures

From time to time, you may run diagnostics (ADEX system tests) on your computer and peripherals. ADEX runs only on the system console, while user terminals are disabled. ADEX is designed to test computer hardware and detect errors without corrupting or changing user or system information. If ADEX is improperly used, however, it can erase information on disks and tapes. Therefore the person who runs it must be privileged, trustworthy, and knowledgeable.

Maintenance and preventive maintenance procedures (like changing printer paper, vacuuming, changing filters, and so on) require human access to the hardware. Anyone with this kind of access can start AOS/VS and steal or corrupt information. As with diagnostics, the people who perform maintenance must be trustworthy.

Backup and restoration procedures require the same kind of access as maintenance. The system is wide open to the person who does backups and restorations, because he/she requires (at least) Superuser privilege and, usually, access to the system console. As with maintenance, the people who perform backups and restorations must be privileged and trusted.

Precautions on *storing* backup media are explained in the next section, "Storing Backup Media."

Storing Backup Media

Anyone with physical access to backup media has an open ticket. He or she needs only a tape or diskette unit (or compatible disk unit, for disk backups) to read the entire contents of your system: passwords, private databases — anything. Sophisticated users can use the DISPLAY program to learn tape- or diskette-set volume IDs and filenames, and they can use the LOAD command and pathname templates at leisure to get the information they want. Or, for revenge, they can destroy data on backup

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tapes (simply a DUMP/V @MTxn:1 MYFILE typed to the first volume of a multivolume backup destroys the whole backup).

Access to backup media makes trespass and break-in relatively easy for experienced users who have access to devices (the devices can be on any DG system). For a closed or C2-level shop, you should observe the same precautions as for the computer: lock up the backup media or keep it under the observation of a trusted operator.

For maximum safety, store backups away from the computer site, using a company that understands magnetic media storage. Keep backups near the computer for only a short period, say a week. Don't let users carry backup media (like tapes) away from the site. Lock up write-enable rings.

System Architecture — Hardware Security Features

This section describes the protection features of MV/Family computers that AOS/VS relies on to ensure security of code and data in memory.

MV/Family computers have a hierarchical memory protection mechanism, which protects AOS/VS, its Agent and peripheral manager, some server programs (INFOS II and DG/DBMS), and sensitive user data. This arrangement allows common routines to be used by all programs.

In a computer with the hierarchical protection mechanism, each user's address space includes a copy of AOS/VS. This lets user programs see the entire operating system as a subroutine — accessible via subroutine calls instead of specific system calls.

MV/Family computer memory is divided into eight units of 512 megabytes each, which are called segments. Between the segments are protection systems called *rings*. The lower-numbered segments are the most privileged; the higher numbered, least privileged. Ring 0 protects segment 0 and allows only privileged instructions to execute in segment 0. Ring 1 protects segment 1, ring 2 segment 2, and so on. The AOS/VS kernel runs in ring 0 and its peripheral manager runs in ring 1. The AOS/VS Agent runs in ring 3, and INFOS II and DG/DBMS data management control programs run in ring 4.

User programs usually run in rings 6 and 7, where they have least chance to access AOS/VS code and address space.

Whenever an AOS/VS process refers to an address, the hardware checks the segment field of the address. The ring of the destination segment determines whether the source segment's reference is legal. This check occurs for any reference — a simple data reference or a transfer of control to the new segment.

A register called the segment base register (SBR) contains information about the validity of the referenced segment. If the reference is invalid, a protection fault occurs; the hardware blocks access to the segment, places the fault code 3 in AC3, and AOS/VS reports a protection fault to the process that attempted the access.

Accessing Other Segments for Data

A process can access data in another segment, depending on

- the process' location in memory;
- the protocol defined by the ring that protects the destination segment.

When the process makes the reference, the computer notes the source segment and destination segment, and determines if the source segment's reference is valid or not.

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If not valid, a protection fault occurs, similar to the fault described above; the hardware blocks access, places the value 4 in AC3, and AOS/VS reports a protection fault.

The segment hierarchy (low to high, okay; high to low, fault) applies to access for data as well as other access. Table 16-6 shows which accesses are valid and which cause a fault.

Table 16-6. Valid and Invalid Segment Access

Process in Source Segment	Destination Segment							
	0	1	2	3	4	5	6	7
7	fault	fault	fault	fault	fault	fault	fault	valid
6	fault	fault	fault	fault	fault	fault	valid	valid
5	fault	fault	fault	fault	fault	valid	valid	valid
4	fault	fault	fault	fault	valid	valid	valid	valid
3	fault	fault	fault	valid	valid	valid	valid	valid
2	fault	fault	valid	valid	valid	valid	valid	valid
1	fault	valid	valid	valid	valid	valid	valid	valid
0	valid	valid	valid	valid	valid	valid	valid	valid

Ring Crossing

A ring can't be crossed accidentally, since the computer increments only the part of the program counter that doesn't involve the segment. The program must issue an LCALL instruction to attempt a crossing.

The hardware will allow a process to transfer to another segment only if all the following are true.

- The process must issue a subroutine call or return. No other calls will be accepted across a ring.
- The subroutine call must be inward (toward ring 0), and a return must be outward (toward ring 7). An outward call or inward return will cause a protection fault.
- A program must be running in the destination ring, and this program must have specified one or more *gates*, via a gate array. (A gate array is a series of entry points into the inner segment.) Thus, the inner-ring process must have *invited* access by the outer-ring one.

In the gate array, the inner-ring process specifies

- the number of gates;
- the range of segments that can use this gate; for example, the value 3 allows access by a process in ring 0, 1, 2, or 3. Processes in other rings will take a protection trap and access will fail;
- the address of the gate array.

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When a process issues a ring-crossing call (LCALL), the computer checks its call against settings in the destination segment's gate array. If the crossing is allowed, it occurs. If the gate array doesn't allow it, a protection fault occurs in the *calling process*.

Protecting Against Hardware Trojan Horse Pointers

Suppose a process in segment 6 calls segment 2, and one of the arguments passed to segment 2 is a pointer to information in segment 2. When the process in segment 2 uses this pointer for reference, the computer will use segment 2's access privileges to determine the validity of the reference. These privileges may allow access to data *that would otherwise be restricted*. A pointer that attempts such access is called a Trojan horse pointer.

AOS/VS guards its kernel (in ring 0) and PMGR (in ring 3) against Trojan horse pointers, using hardware validate instructions. If you run application programs in inner rings, you might want to do the same (although processes are vulnerable to access only through gate arrays that they themselves define).

Indirection Protection

Whenever a process specifies an indirect address, the computer checks for a valid ring crossing. The first time each memory reference occurs, the computer treats the segment specified in the program counter as the source segment, and the segment specified in the intermediate address as the destination segment. The computer compares the fields; and if the access is invalid, the access is rejected and a protection fault occurs.

If the access is valid, the computer gets the new address specified by the intermediate address. Then, if another indirect address is specified, the computer treats the intermediate address as the source segment, and the segment specified in the new address as the destination segment (as described above).

Up to 15 levels of indirection are allowed. If a process tries more than 15 indirect address references, a protection fault occurs.

Page Protection

Page protection involves checks to see if an instruction in a process can legally access a page within the segment. There are two kinds of page protection: page-table entry validation and access validation.

Page-Table Entry (PTE) Validation

The validity bit (0) in the page table entry indicates whether the page is defined. If there's a reference to the page, and it isn't defined, this means it isn't in physical memory; a physical page fault occurs and the page is read from disk.

Access Validation

When a process tries to access a page that's in physical memory, the computer checks the page's access bits (2-4) for restrictions. For reads, it checks bit 2 (1 indicates a valid read, 0 an invalid read). For writes, it checks bit 3 (1 indicates a valid write, 0 an invalid write).

On transfer of control to the page, the computer checks bit 4 (execute). A 1 in bit 4 indicates a valid transfer, 0 an invalid transfer.

If the access bits forbid the type of access attempted, the access is blocked and a protection fault occurs.

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Protection Fault Summary

ECLIPSE MV/Family machines have a number of protection fault codes, placed in AC1 when a protection fault occurs. These codes are summarized in Table 16-7. AOS/VS interprets the codes and returns an appropriate error message if the errors occur.

Table 16-7. MV/Family Hardware Protection Fault Codes

Fault Code (Octal)	Meaning and Description
0	Page read violation. The page-table entry denies Read access.
1	Page write violation. The page-table entry denies Write access.
2	Page execute (transfer) violation. The page-table entry denies Execute access.
3	Validity violation, ring reference or page-table entry.
4	Inward address violation. The process tried to access an inner ring.
5	Defer (indirect) violation, more than 15 levels of indirection.
6	Illegal gate. The maximum number of gates defined by the gate array has been reached.
7	Outward call. The process attempted a subroutine call through an outer ring.
10	Inward return. The process in the current ring tried to return, but the return address specified an inner ring.
11	Privileged instruction violation. A process not in segment 0 attempted a privileged instruction.
12	I/O protection violation. The process attempted an I/O instruction, but the segment base register of the current segment is set to prevent I/O instructions from executing.
14	Invalid micro interrupt return block.

Security Policies

This section is included to help you design a framework — a set of security policies for your organization — within which to implement the procedures described in the "Security Procedures" section.

Human Factors in Security

It's impossible to maintain security, in any shop, without the commitment and support of your key employees. This book can't tell you how to maintain morale — but, unless you do it, your site will be vulnerable from within.

Anger and a desire for revenge are often factors in security breaches. So is opportunity — people who might otherwise respect the security of your system can be tempted by the sight of a Superuser prompt or tapes that obviously hold a backup image of the system disk.

Each site needs a security program that motivates people to protect information and limits exposure to sensitive information.

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Choosing Your Level of Security

At first, you may want to pursue maximum security — after all, why *not* provide the greatest amount of protection and privacy? Unfortunately, all security improvements cost something. The cost may be obvious (for example, hiring a system operator or buying an extra disk unit for logging) or hidden (for example, logging with full detail slows down general processing).

Users often find that very secure systems are the least friendly and hardest to learn. And, hiring full-time operators and providing physical security for your hardware is expensive.

Also, security controls alone won't give you a secure system. They can't prevent authorized users from stealing or destroying data. Your perceptions and judgments about the people you employ and create profiles for (your users) are at least as important as your implementation of security controls. This means a continuing commitment of time and energy to security.

On the other hand, the potential loss from lax security can be staggering. Users find it very unfriendly if your system is down for days while its file system is restored, or if your company suffers because competitors learn about its plans.

You must weigh user-friendliness and performance against data security, confidentiality, and integrity, and strike a good balance for your site. This will probably take some trial and error experience, and the arrangements you choose will need regular review.

Some major tradeoffs between closed and open systems follow:

Closed or Medium-Security System	Open System
High startup expense. The need to protect hardware forces you to hire system operators, build lockable areas and divert your attention from other things.	Low startup expense. Hardware doesn't need protection, and users can monitor themselves, avoiding the need for operators and your attention.
Inconvenience for users. Unprivileged profiles force users to seek help with file access from the operator or a privileged user.	Convenience for users. Privileged profiles allow users to handle file access problems by themselves (via Superuser or Change Username privilege).
Audit trail drawbacks. Logging consumes disk space. Checking log reports requires your time (or someone's time).	Easy logging or no logging. There's no need to check for security violations (although you might want to use log files for user accounting).
Lack of trust harms morale. Treating users and employees as if no one were trustworthy may cause resentment. Maintaining morale requires special effort, perhaps an entire program.	Implied trust of users is good for morale.
Sense of privacy and confidence can raise morale. User trust in the privacy of their files may increase productivity. For example, someone may do confidential work on the system instead of using a typewriter.	Wariness about open system harms morale. The possibility of trespass and lack of privacy may prevent users from using the system for confidential work. Or, data loss resulting from accidental or malicious trespass may disrupt work and schedules.

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Closed or Medium-Security System	Open System
A secure system may lead to financial rewards. A specific standard of security (such as the C2-level) is required by some government and private organizations — without it, you don't qualify for contracts.	An open system may reduce opportunity for company growth. Your competitors may win contracts that require security standards.
Security standards limit the risk in computer operations. They can help you minimize chances of disastrous loss. Security standards may simply be a matter of common sense.	Without security standards, there's no practical limit to the loss you can suffer. Loss of data in essential files, or theft of confidential material, can be disastrous — to people, companies, and even nations.

Changing Security Levels

The easiest course is to define the security level you want before your system is built, and then to build the system and live with that level. But people's needs change, and things may evolve to the point where you need to change security levels.

To *increase* security, you'll need to edit user profiles, and you'll probably need to change ACLs. You'll need to run LOCK_CLI on the system console (if you don't run it already). You may need to run system logging with detail set to full. Some of the procedures are

- Tell your user community why you're tightening security.
- In user profiles, with PREDITOR, remove special privileges: Change Username, Superuser, Superprocess, and Access Devices.
- For each user who deals with sensitive information, run PREDITOR and choose password encryption. (If any of these users relies on a network to other DG systems, encryption may interfere with network access. Password encryption won't prevent use of CEO Mail between systems, but encryption *will* prevent access by XODIAC's RMA and FTA agents to any system that doesn't run both AOS/VS Revision 7.00 or later and a revision of XODIAC that supports encryption. Read your XODIAC Release Notice to see if encryption is supported.

  If you determine that password encryption *will* interfere with network access, you may want to create a new, secure profile for the user and encrypt the password. Then, you can use the MOVE command to copy all files from the user's old directory to the new, secure one. From the new directory, change all ACLs to new-username,OWARE.

  Then, have the user delete all sensitive files from the old directory. In the future, have the user log on under the old username for network access, and under the *new* profile to work on sensitive files. (This may seem a lot of work, for both you and the user, but the increased security gained by password encryption and isolation from the network is worth the extra effort.)
- Perhaps, make ACLs more restrictive. For example, if your default ACLs have been [!USERNAME],OWARE +,RE, you might make them [!USERNAME],OWARE. You can change existing ACLs *en masse* with Superuser and the # template.

  Changing the default ACL is easy if you have a central log-on macro: just put or edit the DEFACL command in the central macro. Using a central log-on macro involves running a single macro for every user at logon (it's the initial IPC file for each user), and then having this macro execute a user-accessible macro in each user directory. Setting up a central log-on macro is explained in Chapter 5.

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If there is no central log-on macro, put the DEFACL command in each user's log-on macro.

If multiple users need access to a file, you may want to use tailored ACLs that spell out usernames, instead of using templates. Doing this effectively may mean eliminating automatic ACL assignment (via DEFACL) for some users. These ACL steps can tighten security quite a bit, at the cost of some extra work. CLI macros (run periodically during the day or after hours) can help ease such operations.

- Safeguard the system console. Either run LOCK_CLI on it, or keep it under continuous supervision, or both.
- To monitor user activity, you may want to use system logging, with detail set to full. The reports from this can tell you which users and processes are trying to touch (and actually touching) specific files.
- You may need to check your applications programs more carefully than before, restrict use of network software, and eliminate certain amenities like guest profiles.
- You may want to design some kind of orientation program to raise user consciousness about, and appreciation of, security.

If you need to introduce a C2 security level, incorporate all of the measures described above; in addition, eliminate or avoid all of the following on your system:

- networking
- modems
- graphics terminals (and windowing)
- guest accounts
- software from bulletin boards

Software from bulletin boards, while not specifically prohibited by the C2 standard, represents a security risk. Avoid it.

See the section "C2-Level Systems" earlier in this chapter for more details.

Loosening security is (generally) easier than tightening it. You can't simply let things degenerate into chaos, though. Some of the steps involved in loosening security are

- Tell your user community why you're loosening security.
- Widen the scope of ACLs. For example, include Read and Execute access for all users (via +,RE) in each user's default ACL.
- Use logging with minimal detail or don't log at all.
- Unlock your hardware (if physically locked away from users) and reduce the time an operator is on duty.
- Run a standard CLI on the system console.
- Give special privileges to more users. This is last in the "loosening" list, since it's potentially the most harmful.

Detecting and Responding to Breaches of Security

Recognizing that your system is under attack — or that a breach has occurred — is as important as the steps taken to ensure security.

It's essential to understand the *types* of violation that can occur, and the types of people who are motivated to do it. Generally, there are three types of threats to security. They are

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- probing
- irresponsibility
- break-in

Probing is often undertaken as a contest between a user and the system — an intellectual challenge. Many probers are motivated by curiosity and a desire to outwit system designers and security planners. They are often young and rarely malicious; they are not prototypical felons (although breaking into computer systems is a crime).

You can detect probing by checking reports from detailed system logs. Probing may involve log-on attempts or attempted access to files.

Probing — Failed Log-On Attempts

If the log shows many failed log-on attempts on local consoles, the prober may be a current user trying to log on to a privileged account (look for users trying to log on to privileged accounts, like OP). Since the log-on try was made locally, the person is probably (although not definitely) a user or a known person, since a stranger using a local console might be noticed and reported.

If the failed attempts occurred over a modem line or virtual console, the user may not be a current user but an unhappy ex-user or skilled break-in person who knows AOS/VS. The username recorded for the failed logon may offer some clues.

Probing — Attempted Access to Files

A large number of failed file accesses (to :UPD, :LOCK_CLI, or applications programs, for example) may indicate probing. The username is a matter of record, and you should talk with the user who has this username. To be tactful, say that you assume the account is being used by someone else, and have the user change passwords at once.

Then, if the failed accesses continue with the same username, this person is almost certainly the culprit; further disciplinary action is needed. If the failed accesses stop, either someone else was using the account and was foiled by the password change, or the user was doing the probing and has stopped. In any case, you win: you've stopped the probing.

Password stealing, described earlier in this chapter, is another kind of probing. It's usually discovered by users. The best defense against it is user awareness.

Irresponsibility

On most systems, there are users whose access rights allow them to take confidential or privileged information, or to corrupt data or files. If such users abuse their privileges (steal passwords or copy sensitive data files), they lack a sense of responsibility. The system's security controls aren't to blame.

If a user is irresponsible with his own account — by telling people his password or allowing them to see him type it — you can suggest that he be more careful.

You can minimize damage done by irresponsible users by restricting access as far as possible. Review user privileges and sensitive file ACLs periodically. As important as system control, though, is a user's behavior. Is he or she acting responsibly? Working competently? Looking for another job? If a user's status within your organization is about to decline (or end), you should think about reducing his/her privileges, or even deleting his/her account.

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Break-In

A person who breaks into your system (penetrates the secure perimeter) is often highly skilled and motivated. There are several forms of break-in: by a successful prober; by a programmer who, through a Trojan horse, learns privileged passwords and confidential information; by an agent or covert operative who has planned the assault for a long time.

Whoever does it, a break-in is serious. Typically, the person doesn't leave obvious tracks — detection may be a matter of luck or occur from events that have nothing to do with your security arrangements. However, if you maintain security awareness, study the log file regularly, and watch for signs of break-in, you will improve your chances of detecting a break-in.

The person who probes or breaks in may be a student, middle manager, or agent of a rival organization or country. Some sample sites, people, roles, and goals follow.

College or high school	A student may break in, moved by curiosity, intellectual challenge, or the appeal of free computer time. His or her resources include time and ingenuity.
Retail chain or any industrial firm	A clerk may break in, moved by resentment. His or her resources include familiarity with the site and access to the system.
	A manager may break in, moved by desire for capital gain or by resentment. His or her resources include access to the system, its records, and — perhaps — privileges like Superuser to bypass all controls.
	An industrial spy may break in, moved by desire for capital gain or for trade secrets. His or her resources include computer expertise and money.
	An applications programmer may break in, moved by desire for capital gain or for trade secrets. His or her resources include computer expertise, intimate knowledge of the computer system, and access to applications code.
	An outsider may break in, moved by desire for trade secrets or by resentment. His or her resources include time and money.
Bank or Stock Exchange	A manager or officer may break in, moved by desire for capital gain, for inside information, or by resentment. His or her resources include familiarity with the system and money.
	An applications programmer may break in, moved by desire for capital gain, for inside information, or by resentment. His or her resources include computer expertise, knowledge of the system, and access to applications code.
Phone network, power grid, or military site	A terrorist and/or religious fanatic may break in, moved by desire to destroy order. His or her resources include dedication and money.
	An agent of an unfriendly nation may break in, moved by desire for strategic advantage and/or political gain. His or her resources include computer expertise, new technology, and money.

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Students (hackers) are most likely to probe — and possibly break in. But they don't often do serious damage. Managers and bank officials often represent cases of irresponsibility — and possible probing. An outsider who attempts access to a phone network or military site represents the most serious threat — and will often have the resources to break through security safeguards.

Detecting Security Breaches

If your system is vulnerable to attack — perhaps under attack — warning signals usually come from several sources:

- users
- your own observations
- study of log reports.

User Observations

Users have the power of numbers. Often, there are many users. They can be very helpful (and occasionally frustrating, by reporting anomalies that have an obvious explanation). Users may report the following kinds of events:

- Files are missing or inaccessible.
- A log-on message indicates that the user logged on when he or she did not. Or, at logoff, a user sees a *Other jobs, same username* message when he or she has not logged on to another terminal or submitted a batch job.
- A list of processes (displayed by the ? macro) shows a user logged on to a second console when he/she is not.
- Users find software and/or data files that they didn't write in their directories.
- Printed files with a user's username on the header are found, but the user didn't print them.
- Users of modem lines encounter busy signals more often.
- Off-hour users find the system unusually slow.

Any of these observations could indicate trouble, and you should explore it promptly, checking the complaint against reality. If the unusual situation really exists and doesn't result from user error, treat the situation as a real break-in attempt and take action to identify the perpetrator and his/her access method (compromised password, insider access, etc., perhaps using the log file).

If the user's report is a false alarm — perhaps a result of ignorance — don't castigate the user. User training is the province of system administrators and managers; the responsibility rests with you, not users. It's in both your interest and the user's to increase his level of competence.

In any case, don't insult the user. By doing so, you would lose his/her observation powers, reduce site morale, and perhaps create resentment that could lead to future break-ins.

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Your Powers of Observation

As a person who cares about security, you should stay alert to conditions that may indicate future incursions. Here are some of these conditions:

- After you type ?), it displays a process with a username belonging to a user who could not be logged on (he or she is on vacation, or is logged on to a modem line and doesn't have a modem).
- The ?) command displays process names or batch streams unknown to you.
- System response changes dramatically and inexplicably from time to time.
- Media (tapes or diskettes) and/or listings are missing.
- You find strange software in directory :UTIL or your main applications directories.
- There's physical evidence of tampering — your papers have been rearranged, or material is missing from a locked closet.
- The system seems to be doing an unusual volume of processing in off hours; for example, it seems to be busy at 6:00 a.m. or 11 p.m.
- There are ACL changes on critical files, like LOCK_CLI.PR and directory :UPD.
- Your organization has obvious morale problems: lower earnings, layoffs, employee turnover, and/or reorganizations have produced a subdued or hostile atmosphere.

As with user-reported anomalies, each of these observations warrants exploration. You may find that there is a problem and take preventive or other action; or there may be a harmless cause.

Study of Log Reports

With log detail set to full, you can track every pertinent file access, every process creation, and every failed log-on attempt. (Logging without detail set to full can yield a report of privileged users, and how much system time users consumed, but it cannot provide other security and access-related information.)

How to decide on the information to have reported is discussed earlier (details are in Chapter 9). System files like LOCK_CLI and :UPD, and Trojan horse candidates like text editors and applications programs, are good candidates. And you can get reports on ACL change attempts. (A list of AOS/VS files and their default ACLs appears earlier in the chapter, in Table 16-5.)

When a Breach Occurs

When a breach occurs, or is attempted and fails, there is standard sequence to follow:

- Detecting the breach — you learn that someone is probing or has penetrated your security perimeter.
- Identification — you learn the identity of the offender(s).
- Defense — you adapt security arrangements to prevent further violation.
- Repair — you fix the damage as far as possible.

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Detecting Failed Break-Ins

Acts that suggest failed break-ins include file browsing (going shopping in other users' directories), password guessing, use of password-stealing programs, and unusual activity on console lines.

Browsing is easy to identify from reports from a detailed log file. Browsing often results from natural curiosity, and users may browse without malicious intent. You should treat an innocent browser differently from a malicious one, although it may not be easy to distinguish the two. An easy rule of thumb is to treat first offenses as innocent, other offenses as a sign of — charitably — noncooperation. Browsing *is* theft, theft of information. The value of the information stolen, or vulnerable to theft, should determine the strength of your response.

Password guessing and the use of password-stealing programs are often detected by users. Password guessing produces many failed log-on attempts, but not under the user's actual username.

Password-stealing programs may give clues to their authors — if you get a log file report on file access of the target user's username (described in "Password-Stealing Programs," earlier in this chapter).

When someone is trying to break in, via password guessing or stealing, detailed log reports can tell you at least the *username* tried. Sometimes this is an anonymous name, like OP. But it may suggest a real user on your system. If the attempt is occurring from local consoles, you might actually be able to catch the offender in action. If it's occurring over a modem line, identification is harder. You *can* get users to change passwords or phone numbers, or direct EXEC in the ENABLE command to stop (disable the line) after a given number of retries. The latter solution may interfere with legitimate users, however.

Sometimes, the only way to identify an outsider is simply to wait — taking no new steps to bar intrusion and lay a few traps — in hopes that somehow the perpetrator will yield his/her identity.

Detecting a Break-In

When you learn of a break-in, it feels like an assault — a violation or theft of something close to you. Coping with trauma and the threat will require user efforts, and your best efforts as a manager.

Detecting a break-in may be easy or not easy — some signs of break-ins are described in previous sections. When you suspect or confirm a break-in, consider the possibility that the perpetrator has been using your system for days or even weeks. Consider what discretionary information you've lost. Then, if you ran detailed logging, dig out the old reports and, maybe, load one or two old log files to generate reports that may tell you when the break-in first occurred.

Identifying the Offender

After a break-in has occurred, you must decide whether the offender is an insider or outsider. This distinction is important, since it determines your prevention measures. The first step is to accumulate and analyze the information you have:

- user observations,
- your observations,
- your knowledge of the attempt (How well does the intruder seem to know the system? How were break-in attempts made?),
- and your old log files and reports, which may give some history on the break-in attempts.

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One way of preventing this inadvertent granting of access to new users is *never* to reuse a username. Another way is to check ACLs of all directories at the :UDD:username level after creating a new profile. Without at least Execute access to directory :UDD:username, a user can't access any file in :UDD:username.

Security Check List

Figure 16-1 summarizes the security points in this chapter. It's a list of one line questions, followed by check boxes, multiple-choice boxes, or fill-in blanks. The list is designed to serve both as a checklist and summary.

If you want to run a secure system, we suggest you fill each space (use pencil). Then, for perspective, or if you want to increase or decrease security at your site, you'll have a point of reference.

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AOS/VS Security Check List

1. My site is an

   Open shop___ Medium-Security Shop___ Closed Shop___ C2-Level Shop ___

2. My user community includes

   ___ User Profiles ____ CEO Users

   ___ Total Users (include guests and multiple users of one profile)

3. Users in the community fall into the following categories:
   (include users in more than one category as appropriate)

   CEO Users ____ Data Entry Clerks ____ Managers ____ Programmers ____

   Secretaries ____ Word Processing Typists ____

4. Hardware and software

4a. CPU model (e.g., MV/20000) _____

   It has ____ type _____ asynchronous controllers and ____ user consoles.

   (For example, "It has 4 type IAC-16 asynchronous ... and 50 user consoles."

   It has ____ model _____ disks on ____ controllers.

   (For example, "It has 6 model 6239 disks on 2 controllers.")

   It has ____ model _____ disks on ____ controllers.

   It has ____ model _____ disks on ____ controllers.

   It has ____ model _____ tapes. It has ____ model _____ tapes.

4b. Aside from AOS/VS, I run the following software:

   Ada___ BASIC___ C___ CEO___ COBOL___ DG/DBMS___ DG/SQL___

   FORTRAN 77___ INFOS II___ INTERNET___ PASCAL___ PL/I___ PRESENT___

   Sort/Merge___ SWAT___ TRENDVIEW___ XODIAC products X.25___ FTA___

   RMA___ VTA___ Others_____ _____ _____ _____ _____ _____ _____ _____

4c. My site's application programs are written in the following language(s):

   _____ _____ _____ _____ _____ _____ _____

5. Physical security. Are any of the following under supervision of a system operator (Y or N)?___

   First shift: CPU__ System console__ Disk units__ Diskette units__ Tape units__

   Second shift: CPU__ System console__ Disk units__ Diskette units__ Tape units__

   Third shift: CPU__ System console__ Disk units__ Diskette units__ Tape units__

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Figure 16-1. AOS/VS Security Check List (continued)

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6. Physical security. Are any of the following locked away from the user community (Y or N)?

   CPU__ System console__ Disk units__ Diskette units__ Tape units__

6a. How do users access tapes?

   Via physical access to units___ Labeled tape mount requests through EXEC___

   Either physical access or labeled tape mount, depending on user ___

6b. How do users get their printed text from the printer(s).

   Via physical access to printer(s) ___ Distributed by operator(s) ___

7. Do you encrypt passwords in users' PREDITOR profiles?

8. How many system users have the following privileges?

   Change username__ Superuser__ Superprocess__ Access devices__ System Mgr__

8a. Write the username of each privileged person and check privilege(s).

   Username_____
   Change username__ Superuser__ Superprocess__ Access devices__ System Mgr__

   Username_____
   Change username__ Superuser__ Superprocess__ Access devices__ System Mgr__

   Username_____
   Change username__ Superuser__ Superprocess__ Access devices__ System Mgr__

   Username_____
   Change username__ Superuser__ Superprocess__ Access devices__ System Mgr__

   Username_____
   Change username__ Superuser__ Superprocess__ Access devices__ System Mgr__

8b. Do any of these privileged users have network or modem privileges?
   If so, write the username and check the privileges.

   Username_____ Network___ Modem___

   Username_____ Network___ Modem___

   Username_____ Network___ Modem___

   Username_____ Network___ Modem___

   Username_____ Network___ Modem___

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Figure 16-1. AOS/VS Security Check List (continued)

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9. Have you changed any of the default ACLs supplied with or created by AOS/VS files? If so, specify the parent directory name and filename.

Parent directory information Name _____ ACL _____

Filename _____ Old ACL _____ New ACL _____

Reason for change _____

Parent directory information Name _____ ACL _____

Filename _____ Old ACL _____ New ACL _____

Reason for change _____

Filename _____ Old ACL _____ New ACL _____

Parent directory information Name _____ ACL _____

Reason for change _____

Parent directory information Name _____ ACL _____

Filename _____ Old ACL _____ New ACL _____

Reason for change _____

10. At your site, what would be the two most destructive security-related events and their (estimated) dollar values?

Event _____ $_____

Event _____ $_____

11. Does your site have a clearly defined security program (Y or N)? _____

11a. If there is a security program, do users know why there is one? ___

11b. If there is a security program, how do users feel about it (check one)?

Like it____ Accept it____ Dislike it___ Hate it____

11c. If there is a security program, name major reasons for it (past break-in, general prudence, sensitive data, contract requirements). Write as many as apply.

_____

_____

_____

12. Does your site run the system log?

Yes, with detail full___ Yes, without detail full___ No___

If no, skip to question 18.

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Figure 16-1. AOS/VS Security Check List (continued)

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13. How often do you generate reports?

    Daily____ Two to five times weekly___ Weekly___ Biweekly___

    Monthly___ When it seems appropriate___ Never____

14. If your site generates reports, what kind do you generate?

    By username ____ By filename ____ Failed logons ___

    Other (specify switches) _____

14a. Why do you do it this way? _____

15. How often are the reports read?

    Daily____ Two to five times weekly___ Weekly___ Biweekly___

    Monthly___ When it seems appropriate___ Never____

16. How often are the log files dumped and deleted?

    Daily____ Two to five times weekly___ Weekly___ Biweekly___

    Monthly___ When it seems appropriate___

17. Where is the log directory (check one)?

    Root (:)____ Other CPD directory on master LDU ____

    Directory on a nonmaster LDU ___

17a. Approximate size by which the log file grows each day, blocks _____

18. Are you satisfied (generally) with the level of security maintained at your site (Y or N)? ____

Notes:

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Figure 16-1. AOS/VS Security Check List (concluded)

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What Next?

Chapters 1 through 5 of this book describe *bringing up* an AOS/VS system from scratch. Chapters 6 through 14 explain *running* the system; and Chapters 15 and 16 (this one) deal with system management issues.

Thinking about, and achieving, a secure system is complex, because it involves strong — and unpredictable — human feelings and behaviors. This chapter is more of a beginning than an end. It explained degrees of security (open, medium-security, closed, and C2-level shop), privileges, ACLs, the LOCK_CLI password, hardware security, user cautions, logging, danger signals, and the protection safeguards in ECLIPSE MV/Family architecture. Finally, it summarized these issues in a security checklist.

At this point, you might want to check out the error chapter or appendixes — or review earlier material.

End of Chapter

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
AN UNLABELED DISKETTE HAS BEEN INSERTED. DO YOU WANT TO LABEL THIS DISKETTE? [N]	From CLI, on a labeled diskette write. The diskette you inserted is not labeled.	If you want to label the diskette, type Y ↵. The CLI will then ask for the volume ID you want, and will display a default based on the label you specified for the first diskette. If you thought the diskette *was* labeled, or think you may have made a mistake and inserted a diskette with valuable data, press ↵. Then remove the diskette and try to find and insert the diskette with the label you expected.
AOS/VS cannot run with this instruction set	From SYSBOOT. SYSBOOT has detected that the microcode that's loaded does not match the CPUID.	Perhaps you loaded the wrong microcode (for example, C/350 microcode on an MV/8000). Reload the microcode and try again.
ATTEMPT TO ACCESS PROCESS NOT IN HIERARCHY	From AOS/VS. Either the process doesn't exist, or is terminating or your commmand can't be executed because your process is not the father of the target process.	See if the process exists by typing ? ↵. If it does exist, and you still want to execute the command, turn Superprocess on and try again.
ATTEMPT TO CONNECT A- AND C-TYPE PROCESSES	From remote host system. You're logged on to another system via VTA, and tried to run an anyPID program (VTA would need to connect to a C-type process, which is illegal). This error occurs anytime an A-type process tries to connect to a C-type process (using a ?CON system call).	You cannot run this program remotely. You can either go to the remote system, log on as a local user, and retry; or you can try to execute a hybrid or smallPID version of the program. If your own process caused the error, you must either configure the program for any PID or have the program try to connect to a B-type or A-type process.
ATTEMPT TO WIRE TOO MANY PAGES	From the system. A 16-bit process tried to wire pages.	Build a system with variable swap files. In the system parameters section, when VSGEN prompts, *Do you wish to use variable swapfiles [N]:*, answer Yes, and set the maximum swapfile size and the default swapfile size to 300.
Bitmap not aligned, should be at n	From PCOPY or MSCOPY, on restore. The bitmap address on the destination LDU is not the same as the address on the LDU that was backed up.	The bitmap, and certain other disk tables, must have the same size and address as those recorded in the backup. For PCOPY, check this message in Table 10-2; for MSCOPY, check this message in Table 10-3.
BOOT TIMEOUT	From SCP EPROM. It couldn't program load from the device specified (or from code in jumpers with CPU locked on power up).	If disk or tape is not on line and ready, put it on line. If message recurs, get the MV/n system tape and reload microcode as described at the beginning of Chapter 3. Also see message under None (message about bootstrap jumpers) in this table.
Both LDU images have inconsistent data — must run a Full format	From the Disk Formatter or the Installer. Either program has found that the information on the images is inconsisent.	If you specified incorrect images, specify correct ones. Otherwise, you must run a Full format. (A Full format will destroy all data on the disks, so you will have to reload from a backup.)

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
C...	During MV/8000 power up, partial *CONSOLE READY* message. Problems with one or more SCP or main processor components.	Make sure diskette is properly inserted; or perhaps insert another copy of diskette. Turn CPU power off and on again. For interpretation, see Table 17-4.
CALLER NOT PRIVILEGED FOR THIS ACTION	From system. Your command requires a privilege or PID that your process lacks. For example, you need to turn on Superuser to read a file, or be PID 2 to set the system date or time. Or, you need the *Create without block* privilege to use the PROCESS command without the BLOCK switch.	If you really want to have the command obeyed, either log on with a privileged profile and turn Superuser on, or go to the system console and become PID 2, which has all privileges.
Cannot create file pathname	From Update tool. It can't create a needed file (like the log directory). Perhaps you lack Write access to the working directory.	Turn Superuser on and retry; or change the ACL of the working directory to give yourself Write access.
CANNOT DELETE UNEXPIRED FILE ON LABELED MEDIUM	From system, on a write to labeled tape or diskette. The retention date for the fileset (default 90 days, can be selected with DUMP's /RETAIN= switch) has not yet expired. For tape, the system will not let you write to the tape set unless you relabel each tape. For diskette, the CLI asks if you want it to relabel the diskette.	You can either select another tape or diskette set for the write, or use this set. To use this set, you'll need to relabel each tape or diskette. To relabel tapes, use the LABEL utility. Then retry the write. For diskettes, if you need only a few, have the CLI relabel them. If you need many diskettes, the easiest course is to use auto-labeling. Abort the command (CTRL-C CTRL-A). Type) OPERATOR OFF ↵) OPERATOR/LABEL ON ↵ The CLI will now relabel diskettes without asking for confirmation. Restart the dump. For a dump to either tape or diskette, think about shortening the retention period via the /RETAIN= switch, so this doesn't happen again.
Cannot find file pathname	From Update tool. It can't find a required file or directory. If this message is followed by a usage summary, it means the tool can't find the revision directory you specified with /REV=revision.	The tool requires a specific directory structure, created when you load the update. The default structure is :UPDATE:rev-directory. Check with FILES :UPDATE:*.** ↵ If the update hasn't been loaded, load it (see the Update Notice). Otherwise, you may have mistyped the system pathname, which must include the .PR suffix, and which is usually in :SYSGEN. Check and retry. You may want to delete the log directory (filename update-rev_date_time.LOG) before retrying.

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
CANNOT INIT AN LDU IMAGE THAT WAS PREVIOUSLY BEING SYNCHRONIZED	From SYSBOOT. Someone aborted a command line that contained a MIRROR/WAIT command using this LDU image as an argument, or there was a panic or hardware failure.	Since you cannot initialize the image specified in the INITIALIZE command line, release the LDU containing the other image and reverse the order. Issue the INITIALIZE command, giving the other image as an argument.
CANNOT READ IN THE DIB FOR THE LDU	From FIXUP. The DIB (Disk Information Block) is unreadable.	There may be surface or hardware format damage. Rerun FIXUP from the beginning.

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
Cannot write { *data* / *label* } *record due to write error.* *Use a different tape.* *Mount reel n of tape file x.nnn.yymmdd... and enter tape unit name [MTB0]*	From MSCOPY, on a backup. MSCOPY tried to write to the tape 14 times without success. The tape is defective.	Dismount the tape, discard it, and mount another tape. Then type the unit name and press NEWLINE (or, for unit MTB0, simply press NEWLINE). The backup continues.
CAN'T INITIALIZE LDU; RUN FIXUP ON IT	From system. You can't initialize the LDU because it wasn't closed normally (via the RELEASE command or shutdown).	Start up stand-among FIXUP via XEQ FIXUP and run it on the LDU. Then retry the initialize command.
CAUTION -- USTORE OR SPAD NOT LOADED CORRECTLY	From SCP on power up; microcode or scratchpad memory hasn't been loaded correctly.	First, turn CPU power off, lock the CPU (if possible), and turn power on again. Step through the microcode load. If there are no errors, proceed with normal operations. If the error recurs on an MV/8000 with an SCP diskette,try another SCP diskette. If the error recurs on any other machine, }load the SCP-OS from the MV/n system tape (Chapter 3; steps 3, 4, 5, and 6, 7, or 8). If the tape-based SCP-OS and microcode work without errors, use the CLI to load the tape-based .MCF file onto the LDU (Chapter 3, step 53). Keep the MV/n tape handy in case you need it again. If this message recurs after you try the steps above, contact your DG support organization.
CHECKSUM BAD	From SCP on power up. The SCP operating system may have failed a checksum test.	Follow the steps described in the *CAUTION-USTORE...* message in this table.
CHECKSUM ERROR	From AOS/VS or support program. The tape unit hardware couldn't read your tape.	Retry; if error recurs, try another tape or a different unit (if possible). Sometimes cleaning the tape or tape unit read/write heads with an alcohol-soaked cotton swab will help.
CLI command error during xxxxxx	From Update tool. An error occurred during CLI command xxxxx.	The error message that you received previous to this message gives more detail. Find that message in Table 17-1 and read the description for it.
CLI OPERATOR ALREADY EXISTS	From system. You tried to turn CLI Operator mode on when it was already on.	Proceed with the desired labeled diskette operation.

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
CONTROL POINT DIRECTORY MAX SIZE EXCEEDED, FILE file	From the system. Your command cannot be completed because the directory *file* (or a control point directory above *file*) has used all disk blocks allowed for it.	To recover, you must expand the space available to this directory via the SPACE command (e.g., SPACE XDIR 5000 ↵); or delete some files. If you expand a user directory (:UDD:username) this way, the expansion lasts only until the person logs on again. If the full directory is the system root (:) or any directory of type LDU, you must delete some files, since expanding an LDU requires a full disk format. If system logging caused the error by filling up the directory (via file or link :SYSLOG), rename the current log file according to your log naming convention (if any); then dump and delete the log file before starting logging.
CONTROLLER DOES NOT SUPPORT LDU MIRRORING	From SYSBOOT. In AOS/VS Revision 7.00, logical disk mirroring requires 6236- or 6239-class disks. You tried to mirror an invalid type of disk, or the disk microcode is the wrong revision.	Consider purchasing disks of the right class or install the right revision of microcode.
CONTROLLER MICROCODE NEEDS TO BE UPDATED	From system. Someone tried to initialize a peripheral that has an intelligent controller, but the revision of microcode running in the controller isn't compatible with this revision of AOS/VS.	A new revision of microcode must be installed on all disks connected to this controller. You (or a DG field engineer) can do this using a program named the Peripheral Microcode Installer (model number 30976). This program described in Chapter 15. You can read more about the disk microcode installer in the manual *Operator's Reference, Peripheral Microcode Installer*, part number 069-700013.
Couldn't access code for message	From EXEC. The :ERMES message file, from which most programs get the text for messages, has a bad ACL, is missing, or is invalid.	Make sure the ACL of file :ERMES includes +,RE. If this error recurs, rebuild ERMES as described in Chapter 5.
Couldn't access message for code	From EXEC. The :ERMES message file, from which most programs get the text for messages, has a bad ACL, is missing, or is invalid.	Make sure the ACL of file :ERMES includes +,RE. If this error recurs, rebuild ERMES as described in Chapter 5.
CPUID indicates less than n KB of memory	From AOS/VS during system initialization. The main processor CPUID indicates too little memory for AOS/VS.	Fix the CPUID as described in Chapter 11; then retry.

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
DATA OVERRUN ERROR	From system. During transit over a console line, characters are being dropped. Causes may be	Recover as follows.
	- Flow control isn't working properly.	- Make sure that output flow control (characteristics IFC and OFC, or VSGEN mnemonic ?MIFC and ?MOFC) are enabled on the console line.
	- There's too much system load for all characters to be transmitted.	- Reduce the processing load or have users type slower.
	- A program is receiving characters without posting a read for them (a user is typing characters but the application program is not ready for them).	- Have the program rewritten so that it issues read calls more often — say 5-10 seconds or more often; or have the user wait for the program prompt.

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
File is open, can't exclusively open	From PCOPY. PCOPY must open an LDU exclusively, and the LDU is already open.	You may have already started to run a copy of PCOPY on this LDU. Check by typing ? ⤵.
FILE IS OPEN, CAN'T EXCLUSIVELY OPEN, filename	From system. The program you're running tried to exclusively open a file, but a program already has the file open. This can happen if you try to edit a file that's being printed, since text editors try to exclusively open files.	Type QDISPLAY ⤵ to see if this file is being printed. If so, wait for printing to end. If it's not being printed, perhaps it's being dumped or moved. Wait a few moments and try again.
FILE RENAMED ...	From FIXUP. FIXUP had to rename the file.	See this message in the FIXUP error table (end of Chapter 6) for action.
File set ID does not match ... ID	From PCOPY, on a load. The tape/diskette volume is wrong, or the LDU you're restoring is wrong.	Find the PCOPY error message in the Backup chapter, Table 10-2, for details.
FIXUP CHECKSUM ERROR ...	The FIXUP program or a script file hasn't been read into memory correctly, or the disk file has been corrupted.	Reload microcode by turning CPU power off, locking the CPU (if possible), then turning power on. Restart. Skip the script file (if any) and run an interactive session. If the error recurs, load FIXUP from an AOS/VS system tape, file 1, or AOS/VS diskette number 1.
FIXUP does not exist	From SYSBOOT at startup (if FIXUP had to be run) or whenever you tried to run FIXUP from SYSBOOT's Technical Maintenance Menu. FIXUP is not in the root (:).	Reload FIXUP from file 1 of the AOS/VS system tape or from the first AOS/VS system diskette, and try again.
FIXUP recommended on this LDU to reclaim space	From SYSBOOT at startup or from AOS/VS when you delete a file, initialize or release an LDU, or shut down the system (in which case the message applies to the master LDU only). A file was deleted but the system was unable to reclaim disk space. It's a good idea, then, to run FIXUP. When FIXUP asks, "May I fix it?", answer Yes. This will restore disk space.	At startup, choose option 7, "Run FIXUP," from SYSBOOT's Technical Maintenance Menu or think about running FIXUP when there is time.
FRAMING ERROR	From system, may be displayed by EXEC or other console-managing program. An incomplete character was sent. Causes may be an open line (with no console at its end), a faulty connection, or hardware problems in the console	Check the console and connection. If the console has been disconnected/removed, run without it until someone reconnects it. If the connection is faulty, try to reseat the cable. If reseating doesn't help, contact your DG support organization.
From Disk bootstrap: message	The message may give the cause; e.g., SYSBOOT not installed.	Install a system bootstrap via the Installer if this is the problem, and retry. Else note the error code in the Peripherals book.

(continued)

Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
From Pid n : (process)	Console message from another process; e.g., EXEC.	If process name is EXEC, see message in this table or in Table 8-5. If the name belongs to another process, see book(s) that describe the other process.
From system: message	AOS/VS detected a serious error.	Find the message in this table.
Generate a new AOS/VS system after update tool finishes	From Update tool. The update requires that you generate AOS/VS via VSGEN. The update program updates everything except the tailored AOS/VS system. This is a warning message only; updating continues.	After the update finishes, run VSGEN. Then, if the update tool told you to *... please update the system later*, run Update again, using the /SYSTEM switch to patch the system file only; for example, UPDATE/REV=7.57/SYSTEM :SYSGEN:MYSYSTEM.PR ↵
Hard disk error while writing to the LDU	From SYSBOOT. SYSBOOT tries to write to the disk but cannot because the disk is not write enabled.	Write-enable the disk and start over again.
Hard error: device d, unit u, retries=r *statuses:field,field* *fields are* *[DIA=mmmmmm,]* *[DIB=nnnnnn,]* *[DIC=oooooo,]* *[CB ERROR=x,]* *[address=addr unit=u]*	From system. During I/O with a device, the system found invalid or inconsistent data. The system retried the I/O 16 (octal) times without success; the error condition remained. All hard errors are noted in the error log. You can get a report by typing) X REPORT :ERROR_LOG ↵	The cause may be obvious: a disk has gone off line, been turned off, or been write-disabled (if possible). If the cause is obvious, fix it: put the unit back on line, turn it on, or write-enable it. Run ESD or FIXUP if needed. For more detail, read on.
	If the unit is a model 6236 or 6239 (DPJ) disk, the status display has DIC and CB ERROR fields. It ends with an ADDRESS field or a UNIT field.	With a model 6236 or 6239 disk, if the status display ends with the field ADDRESS, this probably means the disk has developed a new bad block. Run a Disk Formatter Partial format, with read-only analysis on the LDU. If the Formatter finds a reasonable number of new bad blocks (say 10 or fewer), tell the Formatter to update the bad block table. Run FIXUP if the Formatter tells you *MUST RUN FIXUP*. If, with a model 6236 or 6239 disk, the last field is UNIT, call your DG support organization.
	If the unit is a DPF-type disk (model 606n, 616n, 6122, 6214), the status display ends with DIA and DIB fields.	With a DPF-type disk, check the DIB value. If the DIB value ends with 00 (nnnn00), then check the DIA value. If the DIA value is an odd number (and the DIB value ends with 00), this probably means the disk has developed a new bad block. Run a Disk Formatter Partial format, with read-only analysis, on the LDU. If the Formatter finds a reasonable number of new bad blocks (say 10 or fewer), tell the Formatter to update the bad block table. Run FIXUP if the Formatter tells you *MUST RUN FIXUP*.

(continued)

Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
Hard error: device... (continued)	DPF-type disk (continued) For a tape unit, the status display includes field DIA and, on MTB and MTD units, field DIC.	If, with a DPF-type disk, the DIB value does *not* end in 00, call your DG support organization. For a tape unit, check the DIA value, fourth digit (DIA=mmmXmm). If the fourth digit X is 4 or 6, this means a bad tape. A bad tape error may be caused by dirty or worn tape or read/write heads. If it occurred on read, the unit might be incompatible with the unit that wrote the tape. Try another tape or unit; or try cleaning unit heads with an alcohol-soaked cotton swab. If the first digit of the DIA value is 1 (DIA=1mmmmm), call your DG support organization.
	For a diskette unit, the diskette may be badly seated; or it may write-protected; or it may not have been hardware formatted for DG drives.	For diskette, remove the diskette from the unit and remove the write-enable tape (if any). Reinsert the diskette (shown in Chapter 2, Figure 2-1). If the error recurs, the diskette may not be hardware formatted (can be done via DG Customer Diagnostics). Or, the diskette may be unusable.
	A hard error occurs on a device that isn't a disk, diskette, or tape unit.	For a hard error on a nonmagnetic device, call your DG support organization, and try to run without the device until it is fixed.
HARD ERROR WHILE WRITING TO SYSTEM OVERLAY AREA	The system cannot write to the first disk in the master LDU.	Perhaps the disk is not write-enabled. If so, write-enable it and restart AOS/VS.
HARD INTERRUPT FROM board	From SCP. A CPU hardware problem has halted the main CPU. AOS/VS, if it was up, is frozen.	Record the whole message and contact your DG support organization.
IAC REQUEST FAILURE -- IRRECOVERABLE ERROR followed by panic 12300, subcode 310	You generated a system that specified more IAC input and output buffer space than the IAC contains.	Bring up another system — such as the Starter system — and generate a new system with permissible sizes for input and output buffers. See the latest AOS/VS Release Notice, which gives the total and average ring buffer sizes for various IACs.
ILLEGAL OPTION REQUESTED	From AOS/VS. This reports an error returned by a JP-series hardware instruction. The error, which can occur after the CLI command JPINITIALIZE or JPRELEASE, indicates a wrong use of an instruction; and should not occur.	See the MV/20000 *Principles of Operations* manual for more on "options."
INCOMPLETE MIRRORED LDU SPECIFIED	From SYSBOOT. You used the CLI INITIALIZE command to start mirroring, but specified only one LDU image.	Type the command again, but specify two images using the format INITIALIZE unitname!unitname or use the command INITIALIZE/NOMIRROR if one image is not available.

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
Inconsistent LDU	From SYSBOOT (1) when you try to initialize an LDU; or (2) during startup. In (1), the disk is not recognizable as part of an LDU, possibly because the disk was never Full formatted (made into an LDU) with the Disk Formatter or because the disk's Disk Information Block (DIB) was destroyed. (This can happen if you write to the disk as a device (for example, via DUMP/V @DPJ1 MYFILE; or because of a hardware failure. In (2), the last disk unit you specified holds a disk that isn't part of the LDU.	For (1), you *can* use the disk for storage *or* as an LDU, but not both. Decide which you want to choose. To use the disk as an LDU, you must run a Disk Formatter Full format on it. For (2), mount the correct disk and specify the correct disk.
Inconsistent LDU revision, must run a Full format	From the Disk Formatter. Disks in the specified LDU have different revision numbers.	You must run a Full format. If the error occurs during a Partial format, you need only run a Full format on the image being introduced.
Inconsistent mirrored LDU	From the Disk Formatter or the Installer. The LDU you specified has inconsistent information in the Disk Information Block (DIB).	Respecify the LDU.
Incorrect disk format revision number...	From FIXUP. The disk you tried to run FIXUP on is not recognizable as an LDU. Perhaps it's a disk(ette) that was never Full formatted, or a disk(ette) whose directory structure was overwritten. In any case, it cannot be used as an LDU.	Continue with normal processing. You cannot (and need not) fix this disk. If you were using the disk as a physical device (e.g., via DUMP or LOAD), reissue the original command. To use the disk as a directory, you must run a Disk Formatter Full format on it.
INCORRECT FILE SECTION NUMBER	From system, on load from labeled tape. The file section number of this volume is wrong. It is probably the wrong volume. From PCOPY. This volume doesn't belong to the fileset.	Dismount the tape; find the correct volume, mount it, and continue. Dismount the tape or diskette; find the correct volume and respecify unit and volume ID if asked.
INCORRECT LABELED TAPE FILE message	From system, usually on load, but can appear on dump. File ID data on the HDR2 label (near the beginning of the volume) is inconsistent or invalid.	See *INCORRECT LABELED TAPE VOLUME MOUNTED*, below.

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
Mirror should be specified	From FIXUP. In a multi-disk LDU configuration, you specified a mirrored pair for the *Disk unit name* prompt but not for a subsequent prompt.	Specify both images of the mirror.
Mirror should not be specified	From FIXUP. In a multi-disk LDU configuration, you specified a single image for the *Disk unit name* prompt but the specified two images for a subsequent prompt.	Specify only one image.
Mirror synchronization was in progress - FIXUP cannot run on LDU-id	From FIXUP. You attempted to run FIXUP, but one image was in the process of being synchronized at the time of the failure.	Specify the other image of the mirror.
Mirror synchronization was in progress - FIXUP cannot run on these disks	From FIXUP. You attempted to run FIXUP, and both images have the synchronization-in-progress bit set.	Run a Disk Formatter Full format to reclaim the disks. (This error is highly unlikely.)
Mirrored LDU is not synchronized	From FIXUP. FIXUP will fix the files on the preferred image.	None necessary.
MIRRORED LDU IS NOT SYNCHRONIZED	From SYSBOOT. You used the CLI INITIALIZE command to start mirroring, but one of the images is less recent than the other.	If you don't know which is more recent, you can run FIXUP. Then, use the CLI command INITIALIZE/NOMIRROR, giving the name of the more recent image as the argument. Finally, use the CLI command MIRROR/SYNC, giving the name of the other image as the argument.
MIRRORED LDU IS OUT OF PHASE	From SYSBOOT. You used the CLI MIRROR command to start mirroring, but the LDU image is more recent than the initialized LDU image.	If this is what you want to do, use the command MIRROR/FORCESYNC.
MIRRORED LDU SYNCHRONIZATION FAILED	From SYSBOOT. An error condition occurred before a MIRROR/WAIT completed.	Fix the problem and start over.
MORE THAN 255 PROCESSES	From AOS/VS. A process tried to create another process when the maximum number of processes was running. The default maximum is 255 processes.	If you need to run more processes, set up for big PIDs as described in Chapter 15.

(continued)

Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
Need { *Execute* / *Read* / *Write* } *to* { *directory* / *file* }	From Update tool. To update your system, you need — and do not have — the kind of access specified.	Turn Superuser on and retry the update. You may want to delete the update directory (filename update-rev.date.time.LOG) before retrying.
NETWORK NOT AVAILABLE	From AOS/VS. Either the network isn't up or the command may require the File Transfer Agent (/FTA switch on the MOVE command).	If you used the MOVE command, retry with the /FTA switch; otherwise, check for network processes (X.25, etc.) and bring up the network (macro UP.NETWORK.CLI).
NO JP STATE BLOCK DEFINED	From AOS/VS. A JP-series hardware instruction returns this error. The error which can occur after the CLI commands JPINITIALIZE or JPRELEASE, indicates wrong definition of a job processor, and should not occur.	For more on job processor state blocks, see the MV/20000 *Principles of Operations* manual.
NO OPERATOR AVAILABLE	From the CLI. Your command requires an operator, but there is no operator (human or CLI) available.	Type OPERATOR ON ↵ and retry the command that caused the error. If typing OPERATOR ON ↵ eliminates the error, this means you tried to use labeled diskettes (pathname @LFD:volid:filename), without turning CLI operator mode on. Now that you've turned operator mode on, you can proceed with the labeled diskette access. If you want to have the CLI label many diskettes, turn operator off and turn it on again with the /LABEL switch. Using the CLI command OPERATOR is described in the Backup chapter. If turning CLI OPERATOR on doesn't eliminate the error, this means that some operation requires a person to be on duty at the system console. To tell the system that a person *is* available, use the EXEC command OPERATOR. Type) CX OPERATOR ON ↵ on the system console. Then — from a user console — reissue the command that provoked the error. Someone must be present at the system console to mount tapes, etc., for this command to work.
NO SUCH ARGUMENT	From system. The program requires an argument (like the filename) that you omitted.	Check the required format (using the CLI manual or this one) if needed. Rerun the program, specifying additional argument(s).
NON-EXISTENT JP	From AOS/VS. A JP-series hardware instruction returned this error. The error, which can occur after the CLI commands JPINITIALIZE or JPRELEASE, means that the hardware doesn't recognize the job processor you specified.	If you made a typing error, retry. For more detail, see the MV/20000 *Principles of Operations* manual. (The error returns a hardware status code of 2 in AC1.)

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
SWITCH VALUE FORMAT ERROR	From system. You mistyped a switch value. Perhaps you accidentally inserted a space — for example,) MOUNT/VOL=□VOL1 XTAPE ↵	Retype the command, using a valid switch value.
SYNCHRONIZATION OF LDU IMAGE 'LDU unique ID' OF THE LDU NAMED 'name' FAILED	From SYSBOOT. Someone aborted a command line that contained a MIRROR/WAIT command, or there was a problem with the hardware.	If there was a hardware problem, fix it. In all cases, use the CLI command MIRROR/SYNC, giving the name of the other image as an argument.
System Bootstrap not installed	From the disk bootstrap on startup. The system bootstrap is necessary for booting (loading and running) other stand-alone programs, like FIXUP or the operating system.	Install the system bootstrap. See Chapter 2 or 3.
SYSTEM BOOTSTRAP TOO LARGE	From the Installer. The tape file whose number you specified is too big for its reserved area on the LDU. This probably means you specified the wrong tape file or used the wrong diskette.	If you get a *MUST RUN FIXUP* message, run FIXUP on the LDU. Rerun the Installer and type the correct file number (4 for system bootstrap, 5 for the AOS/VS system) or use diskette 2 for the the system bootstrap and diskette 3 for the AOS/VS system. Make sure the tape/diskette is an AOS/VS system tape/diskette (created as shown near the end of Chapter 4).
System file is too large to load	From SYSBOOT. There is not enough room in SYSBOOT's address space to load the system.	Your computer's main memory appears not to meet the Minimum Equipment Configuration (MEC) for a DG license. Call your Data General representative.
SYSTEM PATCH AREA CONTAINS NO PATCHES	From AOS/VS. Patches were not applied to this AOS/VS system; thus it may not work perfectly. This message will appear at startup until the system is patched.	Get the latest AOS/VS update tape or diskette and apply patches to the system (and other system programs) as described in Chapter 4.
/SYSTEM requires AOS/VS system pathname	From Update tool. You used the /SYSTEM switch to update the AOS/VS system only, but you omitted the system pathname.	If you want to update the system only (the rest of the update has been done), retype the command and specify the pathname of your tailored AOS/VS system. For example, type UPDATE/REV=7.57/SYSTEM :SYSGEN:MYSYSTEM.PR ↵
Tape has not exceeded retention period . . . *Select action ...*	From MSCOPY, on backup. The retention period set when MSCOPY wrote to the tape (default 90 days from backup) hasn't expired. MSCOPY can't write to the tape unless MSCOPY relabels it.	If you decide you want to write to this tape set, type RELABEL ↵. You'll need to type this for each volume in the set. To retain data on the tape set, dismount the tape, and find and mount a tape that's not unexpired. Press ↵.

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
Tape has not reached its expiration date. *Do you want to override it (Y or N)?*	From PCOPY, on backup. The problem is the same as with MSCOPY. See *Tape has not exceeded its retention period*, above.	Read the message above and decide what you want to do. To relabel the tape, type Y ↵. To retain it, type N ↵.
Tape reel is out of sequence	From MSCOPY, on restore. This tape is from the right backup, but mounted in the wrong order.	Find the correct tape from the tape set, mount it, and press ↵.
TARGET PROGRAM CANNOT BE CHAINED TO BY B- OR C-TYPE PROCESS	From system. A C-type process tried to chain to a smallPID or hybrid program. This is illegal.	Perhaps you can use a different chaining process. For example, if you tried to chain from a CLI, run a C-type CLI. Creating such a CLI is described in Chapter 15, under "Running an AnyPID CLI."

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
TARGET PROGRAM CANNOT BE RINGLOADED BY *B- OR C-TYPE PROCESS*	From system. A C-type process tried to ring load a smallPID or hybrid program; or a B-type process tried to ring load a small PID program.	Either the ring-loading process must be more restricted (e.g., an A-type process), or the program to be ring loaded must be more versatile (e.g., a hybrid program). The latter is preferable; you might want to configure the target program for any PIDsize, described in Chapter 15.
THE LABEL ON THIS DISKETTE IS NOT THE LABEL REQUESTED. *INSERTED: xxx* *REQUESTED: yyy* sometimes followed by *DO YOU WANT TO RELABEL THIS DISKETTE? [N]*	From the CLI, on labeled diskette access. The diskette you inserted does not have the label expected. On a dump, it asks if you want to relabel the diskette.	On a dump, if you think you may have made a mistake and inserted a diskette that holds valuable data, press ↵; then find and insert the correct diskette. Relabeling a diskette destroys all information on this and subsequent diskettes, if it is part of a sequence. If you want to have the CLI relabel the the diskette, with the volume ID shown in xxx, type Y ↵. On a load, it asks you to insert the next diskette. Find the correct diskette, insert this in place of the current one; then press ↵.
The LDU is not mirrored as stated in script file	From FIXUP. You ran FIXUP using a script file for input, but the disk is not mirrored.	Either build a new script file, or run FIXUP interactively.
The LDU selected for fixing differs from preferred image	From FIXUP. You ran FIXUP using a script file for input. FIXUP aborted because the LDU selected in the script file is less recent that the LDU FIXUP has determined needs fixing.	Rerun FIXUP interactively, specifying the other image.
There are AOS/VS patches — Please update AOS/VS system later	From Update tool. There are patches for your AOS/VS system, but you omitted the system pathname from the command line. This is an advisory message; updating continues.	After the update finishes, you must run the Update tool again to patch your tailored AOS/VS system. (If this message follows a *Generate a new AOS/VS system* message, run VSGEN first.) To patch AOS/VS, run the Update tool again, using the /SYSTEM switch; for example, UPDATE/REV=7.57/SYSTEM :SYSGEN:MYSYSTEM.PR ↵
THERE HAS BEEN A POWER FAILURE. ... NOW RESTARTING DEVICE n UNIT n	From AOS/VS auto-restart routine. AC power failed, but the backup battery maintained power to the CPU. The restart routine tries to restart all disks, and restores AOS/VS status as of the power failure.	If AOS/VS cannot restart a device, it tells you so. If the device is a disk or diskette, run FIXUP on it; for a different device, you may need to shut down and AOS/VS. Regardless, any tape write to an MTB or MTD unit must be restarted, and printers must be put on line.
This LDU is not in use, fixing is not necessary. *Do you want to cancel this request [n]*	From FIXUP. The LDU was closed normally by AOS/VS, thus running FIXUP is not mandatory.	You can skip FIXUP by typing Y ↵. But you must run FIXUP anyway if any of the following is true. 1) You ran a Disk Formatter Partial format on this LDU and the Formatter found new, allocated bad blocks (it said *MUST RUN FIXUP*); or 2) The system displayed *FIXUP RECOMMENDED* when you brought up AOS/VS or initialized the LDU. Also, you should run FIXUP if you suspect errors on the LDU.

(continued)

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Table 17-1. Important Errors and What To Do About Them

Message	Source and Meaning	Action
Too many bad blocks for a mirrored disk	From the Disk Formatter. The bad block tables on a mirrored disk must be equivalent. The Disk Formatter has found more than 126. bad blocks, too many to permit mirroring.	You should have a DG representative hardware format DPJ (6236-class) disks to *remove* bad blocks.
Turn off permanence for file pathname	From Update tool. The update requires this file to be deleted and replaced with a newer file; but the tool can't delete the file because permanence is on.	Turn permanence off for this file; then retry the update. You may want to delete the log directory (filename update-rev_date_time.LOG) before retrying.
UNKNOWN ERROR CODE n	From any AOS/VS program.	If you think *n* is a valid error code, the system ERMES file may need rebuilding.
Unrecognized CPU model ID	From SYSBOOT at startup. SYSBOOT can't read the CPU ID.	Call your Data General representative.
Update directory is not :UPDATE	From Update tool. The standard directory for update files is :UPDATE. This message means that the update files are running from a different (nonstandard) directory; the update was loaded into a directory other than root (:). This is a warning only; updating continues.	If you expect the update files to be in a nonstandard directory (perhaps because you loaded them there), ignore this message. If you want updates to run from the standard directory, interrupt with CTRL-C CTRL-A, delete +.LOG files, make the root directory your working directory, and reload the update (see the Update Notice).
USER SPECIFIED FORM DOES NOT MATCH FORM IN PRINTER	From XLPT process, appears on printed file. A user tried to print a file with UDA specs (created by FCU) that exceed a limit (like LPP or CPL) specified for the printer.	For the file to be printed, one of the following things must happen. 1) The offending spec in the UDA must be reduced (perhaps by the user) to match the default form limit; or 2) You can pause the printer and specify a form that allows the user's spec (use EXEC's FORMS or DEFAULTFORMS command).
VOLID TOO LONG OR NULL	From LABEL program. The volume ID must be from 1 through 6 characters long.	Run LABEL again, specifying a valid volid.
WARNING: message	From the CLI or EXEC. The program was not able to execute part of the command. The program continues running.	If the message enables you to solve the problem, do so. Otherwise, find the message text in this table.
Warning — disk is normally mirrored	From FIXUP. You specified only one image of a mirrored LDU. In order to determine which image is *preferred*, FIXUP needs to know about both images.	Continue if you know the image you have specified is more recent. Or rerun FIXUP and specify both images.
WRITE ACCESS DENIED	From the CLI. You lack the needed Write access privilege.	See *DIRECTORY ACCESS DENIED* message.
ZERO LENGTH FILENAME SPECIFIED, FILE pathname	Your command line specified a filename of zero length. This can occur if you insert a space in a pathname; for example, TYPE MYDIR:□MYFILE ↵ would cause this error. On a read from a labeled tape, this error can be caused if you omit the tape filename; for example) MOUNT/VOLID=V1 XTAPE Pls ↵ ...(Operator mounts tape)...) LOAD/V XTAPE + ↵	Retype the command to eliminate the space. For a read from labeled tape, specify the filename that's on the tape; for example,) LOAD/V XTAPE:TFILE + ↵

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AOS/VS Numeric Error Codes

While you are bringing up AOS/VS, or running the stand-among Disk Formatter, error messages may appear as numeric codes, without text explanation. This happens because the active program doesn't have access to the ERMES message file.

Should it happen, you can find the number, and its meaning, in Table 17-2. For a complete list of AOS/VS numeric codes, print file :UTIL:PARU.32.SR.

Table 17-2. AOS/VS Numeric Error Codes

Numeric Error Code	Text
5	INSUFFICIENT MEMORY IS AVAILABLE
15	DATA CHANNEL MAP IS FULL
21	FILE SPACE EXHAUSTED
23	DIRECTORY DOES NOT EXIST
24	ILLEGAL FILENAME CHARACTER
25	FILE DOES NOT EXIST
26	FILE NAME ALREADY EXISTS
30	END OF FILE
32	WRITE ACCESS DENIED
33	READ ACCESS DENIED
43	SWAP FILE SPACE EXHAUSTED
44	DEVICE ALREADY IN SYSTEM
45	ILLEGAL DEVICE CODE
51	NO PID AVAILABLE FOR THIS PROCESS
63	DEVICE ALREADY IN USE
70	PARITY ERROR
71	RESIDENT PROCESS TRIED TO CREATE SON AND BLOCK
72	NOT A DIRECTORY
74	TOO MANY SUBORDINATE (son) PROCESSES
75	FILE READ ERROR
76	DEVICE TIMEOUT
102	CALLER NOT PRIVILEGED FOR THIS ACTION
107	ATTEMPT TO ACCESS PROCESS NOT IN HIERARCHY
110	ATTEMPT TO BLOCK UNBLOCKABLE PROCESS
112	ATTEMPT TO START MULTIPLE AGENTS
113	CHANNEL IN USE
114	NOT ENOUGH CONTIGUOUS DISK BLOCKS
115	STACK OVERFLOW
116	INCONSISTENT BIT MAP DATA

(continues)

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Table 17-2. AOS/VS Numeric Error Codes

Numeric Error Code	Text
121	PHYSICAL UNIT FAILURE (hard error)
122	PHYSICAL WRITE LOCK
123	PHYSICAL UNIT OFF-LINE
126	DISK AND FILE SYSTEM REVISION NUMBERS DON'T MATCH
127	INCONSISTENT DEVICE INFORMATION BLOCK (DIB) DATA
130	INCONSISTENT LOGICAL DISK
131	INCOMPLETE LOGICAL DISK
134	LDU IN USE, CANNOT RELEASE
141	TOO MANY OR TOO FEW ARGUMENTS TO PMGR
147	ILLEGAL CHANNEL
167	ILLEGAL ACL
172	FPU HARDWARE NOT INSTALLED
175	DISCONNECT ERROR ON MODEM
177	SYSTEM NOT INSTALLED
200	MAXIMUM DIRECTORY TREE DEPTH EXCEEDED
202	RESOURCE DEADLOCK
203	FILE IS OPEN, CAN'T EXCLUSIVELY OPEN
204	FILE IS EXCLUSIVELY OPENED, CAN'T OPEN
205	INITIALIZATION PRIVILEGE DENIED
237	CONTROL POINT DIRECTORY MAX SIZE EXCEEDED
240	SYSTEM OR BOOTSTRAP DISK NOT PART OF MASTER LOGICAL DISK
241	UNIVERSAL SYSTEM, YOU CAN'T DO THAT
242	EXECUTE ACCESS DENIED
243	CAN'T INITIALIZE LDU; RUN FIXUP ON IT
244	FILE ACCESS DENIED
245	DIRECTORY ACCESS DENIED
253	RESOURCE LOAD OR RELEASE FAILURE
254	ZERO LENGTH FILENAME SPECIFIED

(concluded)

Powerup and Power Supply Fault Codes

Powerup and power supply fault codes reflect problems with hardware. In this section, we differentiate between them, suggest what you can do if you get one of them, and refer you to tables here and in other documentation in case you want to know more.

Powerup fault codes indicate faulty CPU components, as detected by EPROM code when you turn power on. After you see a powerup fault code, you may want to run DTOS FRU tests or MV/ADES tests to confirm the faulty component.

A powerup fault code is a partial powerup message (with one or more characters missing) or a message that indicates that powerup testing failed. The powerup messages are

POWER UP TESTING COMPLETED	On MV/20000 Model 2, MV/20000 Model 1, MV/15000-series, MV/10000 SX, MV/10000, MV/8000 II, MV/8000 C, MV/7800-series and MV/6000 systems;
or	
***POWER UP TESTING - FAILED*	On MV/20000-series, MV/15000-series, and MV/7800-series systems;
or	
CONSOLE READY	On MV/8000 systems;
or	
MV4000 READY	On MV/4000, MV/4000 DC, MV/4000 SC, and Data General DS/4000-series systems

Power supply fault codes indicate serious error conditions like brownouts or short circuits in the supply. These errors are detected (usually after powerup) by the MV/20000, MV/10000 or MV/4000 power supply. The codes appear in the LED diagnostic window (MV/20000 Family computers) or CPU front panel lights, not on the system console.

On any system, aside from running FRU tests or MV/ADES tests, there is little you can do. Generally, write down the messages or record the lights that lit, and then shut down. When you call your DG support organization, give this information, which may be useful for them when they decide what material to bring to your site.

Table 17-3 refers you to hardware manuals or tables in this manual for powerup and power-supply fault codes for all MV/Family computers.

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Table 17-3. Powerup and Power-Supply Error Codes Documentation

Computer	Manual or Table
MV/20000	*Starting ECLIPSE MV/20000™ Series Systems*
MV/15000	*Starting ECLIPSE MV/15000™ Series Systems*
MV/10000	*ECLIPSE MV/10000™ System Control Processor User's Manual*
MV/8000	Table 17-4 (MV/8000 powerup faults)
MV/8000 II	Tables 17-6 (powerup faults) and 17-7 (power supply faults)
MV/8000 C	Tables 17-6 (powerup faults) and 17-8 (power supply faults)
MV/7800, MV/7800 C, and MV/7800 XP	*Starting ECLIPSE MV/7800™ Series Computers* or call 1-800-DGHELPS
MV/6000	Table 17-5 (MV/6000 powerup faults)
MV/4000	*Data General 4000-Class System Control Programs Operator's Reference*
DS/7700	*Setting Up and Starting Your System: DS/7700 Series Systems or Starting and Running AOS/VS on ECLIPSE MV/2000™ DC and DS/7000 Series Systems*

Table 17-4 shows the MV/8000 powerup faults.

Table 17-4. MV/8000 Powerup Faults (Partial Console Ready Message)

Message	Faulty Component(s)
(none)	SCP (MBC CPU and/or TTO circuit boards).
** _ **	SCP (MBC CPU circuit board).
C_	SCP (MBC TTO circuit board).
CO_	CC circuit board.
CON_	Microsequencer or CC circuit board -- in order of probability.
CONS_	CC circuit board.
CONSO_	Power supply.
CONSOL_	Power supply (the temperature is too high and the SCP won't allow it to operate).
CONSOLE_	Power supply (air flow is restricted, and the SCP won't allow it to operate).
CONSOLE R_	SCP (MBC RAM circuit board).
CONSOLE RE_	CC circuit board, ATU circuit board, or Microsequencer circuit board — in order of probability.
CONSOLE REA_	Microsequencer circuit board.
CONSOLE READ_	SCP (diskette controller board).

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Table 17-5 shows the MV/6000 powerup faults.

Table 17-5. MV/6000 Powerup Faults (Partial Powerup Message)

Message	Missing Letters	Faulty Component(s), in Order of Probability
(none)	All	SCP.
** _ **	P	SCP.
** *P_* **	O	SCP.
** *PO _***	W	SCP.
** *POW _***	E	SCP, Microsequencer, or Bank Controller.
** *POWE_* **	R	SCP.
** *POWER _* **	U	SCP.
** *POWER U_* ** ** *POWER UP_* **	P T	Microsequencer, SCP, or ATU.
** *POWER UP T_* **	E	Microsequencer or SCP.
** *POWER UP TE_* **	S	ALU, Microsequencer or SCP.
** *POWER UP TES_* **	T	System Cache, Instruction Processor, or ATU.
** *POWER UP TEST_* **	I	System Cache, SCP, or I/O Controller (IOC).
** *POWER UP TESTI_* **	N	ATU or ALU-1.
** *POWER UP TESTIN_* ** ** *POWER UP TESTING_* **	G C	System Cache, ALU-1, or ATU.
** *POWER UP TESTING C_* **	O	System Cache, Bank Controller, or Memory Module 0.
** *POWER UP TESTING CO_* **	M	System Cache, SCP, or I/O Controller (IOC).
** *POWER UP TESTING COM_* **	P	Instruction Processor (IP) or ALU-1.
** *POWER UP TESTING COMP_* **	L	Host board. To identify the board, run DTOS FRUs as in Chapter 11.
** *POWER UP TESTING COMPL_* **	E	Reserved.
** *POWER UP TESTING COMPLE_* **	T	Reserved.
** *POWER UP TESTING COMPLET_* **	E	Reserved.
** *POWER UP TESTING COMPLETE_* **	D	Reserved.

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Table A-2. AOS/VS Disk Unit Names and Device Codes

Disk Unit Description, Model and Capacity in Megabytes (Mbytes)	Default Device Code of Controller	Disk Number on Controller	Disk Unit Name (under AOS/VS, Use Leading @)
Model 6239=592 Mbytes Model 6240 = three 6239 units in one cabinet on one controller. Model 6290 = two 6239 units in one cabinet on one controller. Model 6350 = three 6240 units bolted together. Model 6357 = 862 Mbytes; Model 6398 = two 6357 units in one cabinet on one controller. Model 6399 = three 6357 units in one cabinet on one controller. Model 6400 = six 6357 units in two cabinets on two controllers.		first (0) second (1) third (2) fourth (3)	DPJ30 DPJ31 DPJ32 DPJ33
Sealed, moving-head disk, rack mounted. Model 6234 = 50 Mbytes	33 73	only only	DPI0 DPI10
5-1/4 inch disk unit and controller, included in cabinet of packaged systems like the MV/4000 DC and the MV/2000 DC and engineering workstations like the DS/7500. It has no separate model number.	24	first (1)	DPJ0
Add-on 5-1/4 inch disk unit, available for above machines. Model 6310 = 38 Mbytes. Model 6328 = 70 Mbytes. Model 6329 = 120 Mbytes. Model 6363 = 160 Mbytes.	24	second (1)	DPJ11
5-1/4 inch diskette unit and controller, included in cabinet of an MV/4000 SC or Data General DS/4000-series system. It has no separate model number. Capacity = 0.737 Mbyte (737,000 bytes).	64	first (1)	DPJ10
Add-on 5-1/4 inch diskette unit, available for above machines. Model 6309 = 0.737 Mbyte (737,000 bytes)	64	second (1)	DPJ1

(continued)

Table A-2. AOS/VS Disk Unit Names and Device Codes

Disk Unit Description, Model and Capacity in Megabytes (Mbytes)	Default Device Code of Controller	Disk Number on Controller	Disk Unit Name (under AOS/VS, Use Leading @)
5-1/4 inch Winchester disk unit and controller (Model 6446-m) in a rack-mounted cabinet with other disks and/or 21-Mbyte and/or 130-Mbyte cartridge tape. This Combined Storage Subsystem (CSS) can be part of initial purchase or as add-ons. CSS model numbers include: Model 6429 = 234 Mbytes. Model 6430 = 468 Mbytes. Model 6452 = 702 Mbytes. Model 6432 = 936 Mbytes. Other model numbers include disk(s) and cartridge tapes.	24	first (1)	DPJ0 DPJ1 DPJ2 DPJ3

(continued)

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Table A-2. AOS/VS Disk Unit Names and Device Codes

Disk Unit Description, Model and Capacity in Megabytes (Mbytes)	Default Device Code of Controller	Disk Number on Controller	Disk Unit Name (Under AOS/VS, Use Leading @)
Sealed, moving-head disk. There can also be a 1.26-Mbyte diskette on this controller. If so, a toggle switch under the front panel makes the disk unit 0 and diskette unit 1, and vice-versa. 6227 = 15 Mbytes 6225 = 5 Mbytes 6098 = 12.3 Mbytes+diskette 6099 = 12.3 Mbytes 6100 = 25 Mbytes +diskette 6103 = 25 Mbytes	33	only	Disk DPI0 (with diskette, DPI0 or DPI1)
	73	only	Disk DPI10 (with diskette, DPI10 or DPI11)
Sealed disk unit, nonremovable disk, rack mounted. When power is on, unit number shows in neon through small plastic window. This is a fixed-head disk. Model 6063 = 1 Mbyte Model 6064/5 = 2 Mbytes Model 6066 = 2 6064/5s.	26	0 1 2 3	DKB0 DKB1 DKB2 DKB3
	66	0 1 2 3	DKB10 DKB11 DKB12 DKB13
A minidiskette (5-1/4 inch) unit with one or two slots, used in DESKTOP GENERATION and other systems. Model 4514=0.368 Mbyte (368,000 bytes).	20	first	DPM0, DPM1
	60	second	DPM10, DPM11
A diskette unit with one or two slots. The only switch is the power switch. Model 6097 = 1.26 Mbytes	33	first	Left: DPI0; right: DPI1
	73	second	Left: DPI10; right: DPI11
A disk unit with two switches and a wheel to select unit number. It has two disks; the top is removable, the bottom is nonremovable. Model 6070 = 10 Mbytes/disk	33	0 on dial 1 on dial 2 on dial 3 on dial	Removable: DPG0; nonremovable: DPG4 Removable: DPG1; nonremovable: DPG5 Removable: DPG2; nonremovable: DPG6 Removable: DPG3; nonremovable: DPG7
	73	0 on dial 1 on dial 2 on dial 3 on dial	Removable: DPG10; nonremovable: DPG14 Removable: DPG11; nonremovable: DPG15 Removable: DPG12; nonremovable: DPG16 Removable: DPG13; nonremovable: DPG17

(continued)

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DISMOUNTED [*mount-ID* | *@devicename*]

Tells EXEC you have physically dismounted a tape.
Example: ***UNIT DISMOUNT***

```
. . .
) CONTROL @EXEC  DISMOUNTED ↵
```

ELONGATE @devicename { ON | OFF }

Turns elongated printing on or off for LP2 or TP2 printers.
Example:

```
) CONTROL @EXEC  PAUSE @CON25 ↵
) CONTROL @EXEC  ELONGATE @CON25 ↵
) CONTROL @EXEC  CONTINUE @CON25 ↵
```

ENABLE { @consolename | /ALL }

Enables one or all (/ALL) consoles for user logon.
Example:

```
) CONTROL @EXEC  ENABLE/ALL ↵
```

EVEN @devicename { ON | OFF }

Turns even pagination off or on for a device.
Examples:

```
) CONTROL @EXEC  ENABLE  @CON45 ↵
) CONTROL @EXEC  ENABLE/TRIES=3/STOP  @CON8 ↵
```

FLUSH { queuename n | n | @devicename | @cooperative n }

Flushes (terminates) the job that a batch stream or device is processing.
Example:

```
) CONTROL @EXEC FLUSH @LPB ↵
```

FORMS @devicename *[form-name]*

Identifies a file that specifies a form to be used for special form printing; e.g., mailing labels.
Example:

```
) CONTROL @EXEC PAUSE @LPB ↵
) CONTROL @EXEC FORMS  BILLS @LPB ↵
) CONTROL @EXEC CONTINUE @LPB ↵
```

HALT

Terminates EXEC.
Example:

```
) CONTROL @EXEC  HALT ↵
```

HEADERS @devicename n

Specifies n (0, 1, or 2) header sheets to be printed.
Example:

```
) CONTROL @EXEC  HEADERS  @LPB  2 ↵
```

HOLD { sequence-number | /USERNAME= }

Suspends a batch or spool request, or all requests made by the user you specify.
Example:

```
) CONTROL @EXEC  HOLD/USERNAME=OP ↵
```


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LIMIT [*queuename [n] [CPU-minutes]* | *n [CPU-minutes* | *@devicename [n-pages]*]

Enforces user- or operator-defined limits on CPU time on a batch queue or stream or printed pages (devicename).

Examples:
```
) CONTROL @EXEC LIMIT 2 1:30 ⤸
) CONTROL @EXEC LIMIT @LPB 25 ⤸
```

LOGGING [*[/START [/MAX=n] [pathname]* | */STOP* | */CONSOLE=@CONn* | */NOCONSOLE*]

Directs EXEC status and critical messages to a console or file you specify; n is maximum log size in blocks.

Example:
```
) CONTROL @EXEC LOGGING/START XLOG ⤸
```

LPP @devicename n

Changes maximum lines per page on devicename to n.

Example:
```
) CONTROL @EXEC PAUSE @LPB ⤸
) CONTROL @EXEC LPP @LPB 60 ⤸
) CONTROL @EXEC CONTINUE @LPB ⤸
```

MESSAGE message

Writes message text to EXEC's log file.

Example:
```
) CONTROL @EXEC MESSAGE 4 STREAMS ⤸
```

MODIFY/switchname(s) sequence-number

Modifies existing inactive queue entries.

Example:
```
) CONTROL @EXEC MODIFY/CPU=1:00 11243 ⤸
```

MOUNTED *[@devicename]*

In response to user mount request, tells EXEC that a tape is physically mounted on a tape unit.

Example:
```
**UNIT MOUNT**
. . .
) CONTROL @EXEC MOUNTED @MTB 1 ⤸
```

MOUNTSTATUS *[mount-ID]*

Displays status of user tape mount requests.

Example:
```
) CONTROL @EXEC MOUNTSTATUS ⤸
```

OPEN queuename

Opens the specified queue to user requests. After opening the queue, you must start and continue it.

Example:
```
) CONTROL @EXEC OPEN MYQUEUE ⤸
```

OPERATOR { ON *[@CONn]* | OFF }

Indicates that a person is or is not available to handle user mount requests. Also see CLI OPERATOR command.

Example:
```
) CONTROL @EXEC OPERATOR ON @CON14 ⤸
```


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Appendix C
Files Shipped with AOS/VS

Table C-1 lists and describes files that are part of AOS/VS Revision 7.60. Nearly all these files are shipped on AOS/VS release media — tape or diskettes. Patch files, which have filenames in the form 7.60_programname_PAT, usually shipped only on AOS/VS update media, are shipped with AOS/VS Rev. 7.60. All but the system patches (to your tailored system) have been pre-applied in AOS/VS Rev. 7.60.

The current microcode file for your machine, whose filename has the form MVn*[FP]*.MCF, is shipped with the computer on the MV/Family system medium (not with AOS/VS).

Table C-1 lists files alphabetically by filename, followed by the home directory name and a brief description. Unless noted otherwise, files are included on the AOS/VS release tape. For brevity, some filenames are templates to indicate more than one file. The normal template rules apply (* means one character, + means any number of characters, and so on).

General filename suffix rules also apply: a .CLI suffix indicates a CLI macro; an .OL suffix, an overlay file; a .PR suffix, a program file; and an .ST suffix, a symbol table (needed for patching the program, if needed, automatically).

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
069_000031_**	:UTIL	Documentation changes for *Learning to Use Your AOS/VS System.*
069-000129-**	:UTIL	Documentation changes for *Starting and Running AOS/VS on ECLIPSE MV/2000™ DC and DS/7000-Series Systems.*
069_000203_**	:UTIL	Documentation changes for *Using the AOS/VS System Management Interface (SMI).*
085_000147_**	:UTIL	Disk file copy of the AOS/VS Release Notice.
093_000122_**	:UTIL	Documentation changes for *Command Line Interpreter (CLI) User's Manual (AOS and AOS/VS).*
093_000129_**	:UTIL	Documentation changes for *Starting and Running AOS/VS on ECLIPSE MV/2000 DC and DS/7000-Series Systems.*
093_000203_**	:UTIL	Documentation changes for *Using the AOS/VS System Management Interface (SMI).*
093_000241_**	:UTIL	Documentation changes for *System Call Dictionary (AOS/VS and AOS/DVS).*
093_000242_**	:UTIL	Documentation changes for *AOS/VS Macroassembler (MASM) Reference Manual.*
093_000243_**	:UTIL	Documentation changes for *How to Generate and Run AOS/VS.*
093_000245_**	:UTIL	Documentation changes for *AOS/VS Link and Library File Editor (LFE) User's Manual.*
093_000246_**	:UTIL	Documentation changes for *AOS/VS Debugger and File Editor User's Manual.*
093_000335_**	:UTIL	Documentation changes for *AOS/VS System Concepts.*
n.nn_UPDATE_SCRIPT.CLI	:UPDATE	A macro that installs update n.nn. This calls other macros.
n.nn_+_PAT	:UPDATE:n.nn	Effective with AOS/VS Revision 7.57, patches are shipped in this directory and not in :PATCH.
n.nn_AOSVS_FILES	:UTIL	A list of files shipped with an AOS/VS release. (This list used to be part of the Release Notice.)

(continued)

Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
AGENT.PR and AGENT.ST	: (root)	Agent program, provides user interface to AOS/VS system calls.
ALPHARS.PR and ALPHARS.ST	: (root)	Operating system to run in MIOC controller, used on MV/4000 DC, MV/4000 SC, and Data General DS/4000 systems. Loaded by AOS/VS.
AOSVS.PANICS.SR	:UTIL	Explanation of AOS/VS panic codes (displayed with *FATAL AOS/VS ERROR* message).
AOSVS_MODEL	:UTIL	A file containing the textstring "3900." The UP_EXEC.CLI macro reads this file to determine how to tailor the SMI interface.
AOSVS_UPDATE_NOTICE	:UPDATE:n.nn	A printed copy of the update notice ships with the update media. Loading the update also loads this file, a copy of the update notice.
BELL.CLI	:UTIL	A macro the System Management Interface (SMI) uses. This macro rings the console's bell, and is necessary for 8-bit consoles.

(continued)

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
BOOMER.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B in the manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
BRAN.PR and BRAN.ST	:UTIL	Break file analyzer, useful for problem diagnosis by system programmers.
BROADCAST.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro allows any user to send messages to all users on the system.
BROADCAST_SELF.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro simulates a broadcast when the SMI is in tutorial mode.
BSCGEN.PR and BSCGEN.ST	:SYSGEN	Bisynchronous line system generation program, used in addition to VSGEN if you need support for bisync lines.
CHECK_CON0.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro checks to see if CON0 is a link in the BROADCAST.CLI macro.
CHECK_SPACE.CLI	:UTIL	CLI macro to monitor disk space remaining in the system log directory.
CLEAR	: (root)	File to clear a laser document printer.
CLEAR_SCREEN.CLI	:UTIL	Macro that displays a form feed, used by other macros.
CLI.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro chains to the CLI.
CLI.CMD.+	:HELP	CLI command Help files (approximately 100); they provide the text for HELP/V command displays.
CLI.OL, CLI.PR, and CLI.ST	: (root)	The CLI — user interface to AOS/VS.

(continued)

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
CLI.PSM.+	:HELP	CLI pseudomacro Help files (approximately 55). They provide the text for HELP !pseudomacro-name displays.
CLI.TPC.+	:HELP	CLI topic Help files (46 with AOS/VS; other software has additional topic Help files). They provide the text for HELP and HELP *topic displays.

(continued)

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
CLIBT.LB	:SYSGEN	System-generation library VSGEN uses to build the special CLI used for initial loading.
CLREERMES.OB	:UTIL	Error message text for programming languages in the Common Language Runtime Environment (CLRE).
CONTEST.+.PR and CONTEST.+.ST	:UTIL	CONTEST program to test system hardware and software (9 program and symbol table files).
CONTEST.CLEAN.CLI	:UTIL	Macro to delete temporary files created by CONTEST.
CONTEST.CLI	:UTIL	Macro to execute CONTEST program test suite.
CONTEST.ERRORS.CLI	:UTIL	Macro to display errors detected by CONTEST.
CONVERT.PR and CONVERT.ST	:UTIL	Program to convert an RDOS object file to an AOS/VS or AOS object file.
CPIRS.PR and CPIRS.ST	: (root)	Operating system to run in a CPI/24 (Computer-PBX Interface) asynchronous line controller. Loaded by AOS/VS PMGR.
CREATE_WINDOW.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B in the manual *System Call Dictionary (AOS/VS and (AOS/DVS)*.
CX.CLI	:UTIL	CLI macro that contains CONTROL @EXEC %-%. It lets you issue EXEC commands.
DCTLIB.LB	:SYSGEN	System-generation library of routines to create device driver control tables.
DEBUG4.+	:HELP	Help files for assembly-language debugger (28 files).
DEFAULT.SPEC	:SYSGEN	File with default specs for BSCGEN.PR.
DEVLIB.LB	:SYSGEN	System generation library of routines to create device drivers.
DFMTR and DFMTR.ST	: (root)	Stand-alone Disk Formatter, to create or modify a logical disk unit (LDU).
DFMTR.PR and DFMTR.ST	:UTIL	Stand-among Disk Formatter, to create or modify an LDU. Runs under AOS/VS.

(continued)

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
DGLERMES.OB	:UTIL	Message text for DG/L language runtime errors.
DISCO.PR and DISCO.ST	:UTIL	DISCO disk-load monitor program.
DISKETTE_BACKUP.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro lets a user back up files to diskettes.
DISKETTE_RESTORE.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro lets a user restore files from diskettes.
DISPLAY.PR and DISPLAY.ST	:UTIL	DISPLAY program, to display contents of any file (program file, magnetic tape file, and so on).
DLIST.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of the manual *System Call Dictionary (AOS/VS and (AOS/DVS)*.
DOWN.CLI	:UTIL	Macro to bring down multiuser environment.
DPJ1_FIXUP_SCRIPT.FXP	:UTIL	A FIXUP scriptfile for systems that use the System Management Interface (SMI).
DUMP_II.CLI, DUMP_II.PR, and DUMP_II.ST	:UTIL	DUMP_II macro and program for fast file backup.
DUMP_II_LOAD_II_ERMES.OB	:UTIL	Error message text for DUMP_II and LOAD_II programs.
DUMPLIB.LB	:SYSGEN	System-generation library of routines to create a memory dump driver.
EBID.SR	:UTIL	ECLIPSE basic instruction definitions, used to create macroassembler permanent symbol file.
ECID.SR	:UTIL	ECLIPSE commercial instruction definitions, used to create macroassembler permanent symbol file.
EDIT.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro lets an SMI user edit UP.CLI, DOWN.CLI, SETUP.CLI, and LOGON.MESSAGE.
EMASM.CLI	:UTIL	Macro to assemble an error message object file (-ERMES.OB); for AOS/VS programs, these files are shipped ready-made.

(continued)

Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
ERMES	: (root)	Error message file. As shipped, it includes error text for all AOS/VS programs, DG/L, FORTRAN 77, PL/I, and assembly language runtime errors.
ERMES.SR	:UTIL	Source file that explains format of ERMES error messages in AOS/VS.
EXEC.+	:HELP	Help files for EXEC; they provide the text for XHELP commands (about 50 files supplied).
EXEC.PR and EXEC.ST	:UTIL	EXEC program, that manages user logon and logoff, batch, spooling, and labeled tape mounts for users.
F77ERMES.OB	:UTIL	Message text for FORTRAN 77 runtime errors.
FCU.PR and FCU.ST	:UTIL	Forms control utility, creates special form printing settings.
FED.+	:HELP	Help files for assembly language disk file editor (16 files).
FED.PR and FED.ST	:UTIL	Disk file editor, used for changing disk location contents (needed for patching).
FF.CLI	:UTIL	Macro that prints a form feed (blank sheet).
FILCOM.PR and FILCOM.ST	:UTIL	Program to compare binary files and display differences (a better comparison program for program source and text files is SCOM.PR).
FILCREATE.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
FIXUP and FIXUP.ST	: (root)	Stand-alone disk fixer, corrects LDU inconsistencies after an abnormal shutdown.
FIXUP.PR and FIXUP.ST	:UTIL	Stand-among disk fixer, corrects LDU inconsistencies after abnormal shutdown; runs under AOS/VS.
FULL_BACKUP.CLI	:UTIL	Macro to execute full backup of user files and non-AOS/VS files — to diskettes.
FULL_DUMP.CLI	:UTIL	Macro to execute full backup of user files and non-AOS/VS files to labeled magnetic tape.

(continued)

Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
GATE.ARRAY.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary AOS/VS and AOS/DVS*).
GRAPHICS_SAMPLE.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. Included in AOS/VS Model 31133 only.
GSMGR.PR and GSMGR.ST	: (root)	Global sync-line manager program; run it if your system will use sync lines.
HEAR.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
HELPV.CLI	:UTIL	Macro to display Help message a screenful at a time.
HELPV1.CLI	:UTIL	Macro needed by HELPV.CLI.
HISTO.DOC, HISTO.PR, and HISTO.ST	:UTIL	Histogram generator documentation and program.
HISTOREPORT.PR and HISTOREPORT.ST	:UTIL	Histogram report generator (works on files created by HISTO.PR).
IACRS.PR and IACRS.ST	: (root)	Operating system to run in an IAC asynchronous line controller. Loaded by AOS/VS PMGR.
INC_BACKUP.CLI	:UTIL	Macro to execute incremental backup of user files to diskettes. Used between full backups done with FULL_BACKUP.CLI.
INC_DUMP.CLI	:UTIL	Macro to execute incremental backup of user files to labeled mag tape. Used between full backups done with FULL_DUMP.CLI.
INRING.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
INSTALL.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro lets a user load files from release media.
INSTL and INSTL.ST	: (root)	Stand-alone Installer program, to install a disk and system bootstrap and, optionally, a system on an LDU.
INSTL.PR and INSTL.ST	:UTIL	Stand-among Installer program, to install a disk and system bootstrap and, optionally, a system on an LDU; runs under AOS/VS.

(continued)

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
IOPRS.PR and IOPRS.ST	: (root)	Operating system to run in a ATI's IOP (this device controls asynchronous lines on an original MV/8000). Loaded by AOS/VS PMGR.
LABEL.PR and LABEL.ST	:UTIL	Tape labeling program; creates a labeled tape.
LACRS.PR and LACRS.ST	: (root)	Operating system to run in a Local-Bus Asynchronous Controller (IAC-12). Loaded by AOS/VS PMGR. Model 31133 only.
LANG_RTERMES.OB	:UTIL	Message text for DG runtime language errors.
LFCOPY.PR and LFCOPY.ST	:UTIL	Labeled floppy copy program, copies a memory dump that was done to diskettes. Intended for DG personnel.
LFE.PR and LFE.ST	:UTIL	Library file editor program, builds libraries from program routines.
LIB1.LB, LIB2.LB, LIB3.LB, and LIB4.LB	:SYSGEN	System-generation libraries, used to build operating systems.
LINK.PR and LINK.ST	:UTIL	Linker program, creates executable program files from object files.
LINKERMES.OB	:UTIL	Error message text for Link program errors.
LINK_ERMES.CLI	:UTIL	Macro to create new error message file (ERMES).
LOAD_II.CLI, LOAD_II.PR, and LOAD_II.ST	:UTIL	LOAD_II macro and program for fast loads from dump files.
LOAD_II.CLI and LOAD_II.PR	: (root)	LOAD_II macro and program are in the root directory for faster initial loads. When you load tape file 7, we replace LOAD_II.PR with a link to :UTIL:LOAD_II.PR.
LOCK_CLI.OL, LOCK_CLI.PR, LOCK_CLI.ST	:(root)	A CLI that can be locked in a harmless state, designed to safeguard system console.
LOGCALLS.DOC, LOGCALLS.PR, and LOGCALLS.ST	:UTIL	System call logger documentation and program.
LPMGR.PR and LPMGR.ST	: (root)	Peripheral manager (PMGR) program that runs consoles for users; the system loads it at startup into ring 3.
MAPPER.1.SR	:UTIL	Example template for creating a mapper file.
MAPPER.2.SR	:UTIL	Example template for creating a mapper file.

(continued)

Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
MAPPER.DOC	:UTIL	Documentation about creating a mapper file.
MASM.PR, MASM.PS, and MASM.ST	:UTIL	Macroassembler program and permanent symbol file (MASM.PS).
MASM16.PR, MASM16.PS, and MASM.ST	:UTIL	Macroassembler program for 16-bit programs and permanent symbol file (MASM16.PS).
MASMERMES.OB	:UTIL	Error message text for macroassembler errors.
MASMXR.PR and MASMXR.ST	:UTIL	Macroassembler cross-reference generator.
MIRRORINFO.PR and MIRRORINFO.ST	:UTIL	Logical disk mirroring information utility.
MKABS.PR and MKABS.ST	:UTIL	Program to copy an RDOS Save file (program file) onto an absolute binary file.
MSCOPY.BTSFPLK, MSCOPY.CLI, MSCOPY.PR and MSCOPY.ST	:UTIL	MSCOPY modified sector disk backup program files — CLI macro, error message file, program file, and symbol table file.
MSCOPY.COMMAND_HELP	:HELP	Help file displayed while executing MSCOPY.
MV-0000-.MCF	: (root)	Microcode file for your system, shipped on MV/Family system media.
MV2000DC.CSF and MV2000DC.SSF	:SYSGEN	VSGEN spec file for MV/2000 DC or DS/7000-series computers.
MV4000DC_IAC.CSF and MV4000DC_IAC.SSF	:SYSGEN	VSGEN spec file for an MV/4000 DC computer equipped with an IAC.
MV4000DC_MCP1.CSF and MV4000DC_MCP1.SSF	:SYSGEN	VSGEN spec file for an MV/4000 DC computer equipped with an MCP1.
MV4000SC.CSF and MV4000SC.SSF	:SYSGEN	VSGEN spec file for an MV/4000 SC computer.
NEWTASK.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
OP_TEMP.CLI	: (root)	Macro to set up Operator profile, needed to build initial system over XODIAC network (4000-class integrated systems only).
OP_TEMP_PROF	: (root)	Operator profile used by OP_TEMP.CLI.

(continued)

Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
PARU.16.SR	:UTIL	User parameter definitions for 16-bit macroassembler.
PARU.32.SR	:UTIL	User parameter definitions for 32-bit macroassembler.
PARU_LONG.SR	:UTIL	User parameter definitions for system calls used in 32-bit high-level language programs.
PATCH.PR and PATCH.ST	:UTIL and :UPDATE	Patch program to install patches supplied in :UPDATE:n.nn (the update tool uses it).
COPY and PCOPY.ST	: (root)	Stand-alone PCOPY physical copy program,backs up and restores LDUs.
PCOPY.PR and PCOPY.ST	:UTIL	Stand-among PCOPY program, backs up and restores LDUs; runs under AOS/VS.
PED.CLI, PED.PR, and PED.ST	:UTIL	Process environment display (PED) macro and program.
PIDCALL_CHECK.CLI	:UTIL	Macro that checks a program for system calls that may require some change and recompiling in order for the program to run big PIDs.
PIDCALL_CHECK16.FED and PIDCALL_CHECK32.FED	:UTIL	FED input files used by PIDCALL_CHECK.CLI.
PIDSIZE.CLI	:UTIL	Macro that checks a program's PID-size type.
PL1ERMES.OB	:UTIL	Message text for PL/I runtime errors.
PL1ERMES16.OB	:UTIL	Message text for 16-bit PL/I runtime errors.
PLNERMES.OB	:UTIL	Message text for PL/Nichols runtime errors (this is a custom DG version of PL/I).
PM.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro places the user's terminal in page mode.
PMGR.PR and PMGR.ST	: (root)	Peripheral manager (PMGR) program that runs in ring 7; loaded by system at startup.
POSS.CLI and POSS1.CLI	:UTIL	Macros needed by HELPV.CLI.

(continued)

Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
PREDITOR.PR and PREDITOR.ST	:UTIL	PREDITOR user profile editor program to create profiles and assign privileges.
QCMP.PR and QCMP.ST	:UTIL	Queue conversion and cleanup program.
RDOS.OL, RDOS.PR, and RDOS.ST	:UTIL	RDOS-to-AOS and AOS/VS conversion program; converts RDOS files, tapes, and disks to AOS[/VS] format and vice versa.
RELEASE.7.50	:UTIL	AOS/VS Release Notice, describes features and cautions not explained in AOS/VS manuals.
REPORT.PR and REPORT.ST	:UTIL	Program to generate reports from system log files and error log files.
RESOLVE.LB	:SYSGEN	System-generation library to avoid Link errors for devices you omit at VSGEN.
RESTORE.CLI	:UTIL	Macro to restore data backed up by FULL_BACKUP.CLI and INC_BACKUP.CLI (diskettes only).
RESTORE_TAPE.CLI	:UTIL	Macro to restore data backed up by FULL_DUMP.CLI and INC_DUMP.CLI (labeled magnetic tape only).
RINGLOAD.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
RUNTIME.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
SCOM.PR and SCOM.ST	:UTIL	Program to compare program source or text files and display differences.
SED.+	:HELP	Help files for SED text editor. They contain the text for HELP commands in SED (there are 40 files).

(continued)

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
SED.DICTIONARY	:UTIL	Word list the SED text editor uses for spelling assistance.
SED.PR and SED.ST	:UTIL	SED text editor program.
SEDERMES.OB	:UTIL	Error message text for SED text editor.
SETUP.CLI	:UTIL	A macro the System Management Interface (SMI) uses as the default initial IPC file for all profiles. The macro sets the default ACL and search list.
SKIPS.SR	:UTIL	File that defines some handy assembly language macros for skips and graphics instructions.
SLDCU.PR	: (root)	Operating system to run in a DCU sync line controller. Loaded by GSMGR program.
SLISC.PR	: (root)	Operating system to run in an ISC sync line controller. Loaded by GSMGR program.
SMI.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro makes the user's initial directory the working directory and executes the SMI program.
SMI.PR and SMI.ST	:UTIL	The System Management Interface program.
SMI_CLI.OL, SMI_CLI.PR, and SMI_CLI.ST	:UTIL	A special CLI.PR that performs CONTROL @EXEC status commands on behalf of the System Management Interface (SMI).
SMI_DOWN.CLI	:UTIL	A DOWN.CLI macro tailored for systems that use the System Management Interface (SMI).
SMI_ERMES	:UTIL	SMI error message file.
SMI_HELP	:HELP	SMI help text file library.
SMI_TEXT	:UTIL	SMI screen text file library.
SMI_UP.CLI	:UTIL	A modified UP.CLI for systems that use the System Management Interface (SMI).
SON.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
SPEAK.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.

(continued)

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
SPEED.PR and SPEED.ST	:UTIL	SPEED text editor program.
SPEEDERMES.OB	:UTIL	Error message text for SPEED program errors.
SPRED.PR and SPRED.ST	:UTIL	Symbolic Preamble Editor program, to edit program preambles and specify things like the number of pages to load on a page fault.
STACKER.PR and STACKER.ST	:UTIL	Stacker program that EXEC uses to handle punched card images.
STR_FORM	:UTIL	On-line STR form you can copy and use to report problems with any non-AOS/VS DGC product.
STR_FORM_AOSVS	:UTIL	On-line STR form you can copy and use to report problems with AOS/VS or any AOS/VS program or utility.
SYS.PR and SYS.ST	:SYSGEN	AOS/VS starter system.
SYS_REV	:SYSGEN	File with current AOS/VS revision number.
SYSBOOT and SYSBOOT.ST	: (root)	SYSBOOT bootstrap program that loads microcode (if needed) and starts up AOS/VS.
SYSERMES.OB	:UTIL	Error message text for general system runtime errors.
SYSID.16.SR	:UTIL	Definition file for 16-bit system calls.
SYSID.32.SR	:UTIL	Definition file for 32-bit system calls.
SYSTAPE.CLI	:SYSGEN	Macro to create a tailored system tape.
TAPE_BACKUP.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro lets a user back up files to tape.
TAPE_RESTORE.CLI	:UTIL	A macro the System Management Interface (SMI) uses. The macro lets a user restore files from tape.
TIMEOUT.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.

(continued)

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
TBOOT	: (root)	Tape bootstrap program; when copied to file 0 of a tape, allows people to bootstrap from it.
UP.CLI	:UTIL	Macro to bring EXEC and the multiuser environment up.
UP_EXEC.CLI	:UTIL	A macro the System Management Interface (SMI) uses. You can use this file as the default initial IPC file for the master CLI, PID 2.

(continued)

Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
UPDATE+	:UPDATE	A text file and a set of macros that install an update, called by n.nn_UPDATE_SCRIPT.CLI.
URT16.LB	:UTIL	User runtime library for 16-bit programs; contains essential runtime code for 16-bit user programs.
URT32.LB	:UTIL	User runtime library for 32-bit programs; contains essential runtime code for 32-bit user programs.
VSGEN.+	:HELP	Help files for VSGEN commands (14 files).
VSGEN.DATA, VSGEN.PR, VSGEN.QUES, and VSGEN.ST	:SYSGEN	VSGEN data, program, and question files.
WAIT_FOR_NO_PORT.CLI	:UTIL	A macro the System Management Interface (SMI) uses for communicating with EXEC.
WAIT_FOR_PORT.CLI	:UTIL	A macro the System Management Interface (SMI) uses for communicating with EXEC.
WHOS.CLI	:UTIL	A macro the System Management Interface (SMI) uses. A version of ?.CLI, WHOS.CLI displays status of all processes on the system.
WRITE.SR	:UTIL:SYSTEM_CALL_SAMPLES	Sample assembly language program. For more information, see Appendix B of manual *System Call Dictionary (AOS/VS and AOS/DVS)*.
XERMES.OB	:UTIL	Error message file with text for EXEC errors.
XHELP.CLI	:UTIL	Macro to display EXEC Help messages.
XLPT.PR and XLPT.ST	:UTIL	XLPT program, works with EXEC to manage printers and other spooled devices.
XPLT.PR and XPLT.ST	:UTIL	XPLT program, works with EXEC to manage plotters.
XYZZY.PS	:SYSGEN	AOS/VS permanent symbol file, needed for macroassembly during system builds.

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Table C-1. Files Shipped with AOS/VS

Name of File	Home Directory	Description
XYZZY1.SR, XYZZY2.SR, and XYZZY3.SR	:SYSGEN	AOS/VS symbol definition files, may be needed for macroassembly during system builds.
XYZZYERMES.OB	:UTIL	Message file with text for AOS/VS errors.
ZERMES.OB	:UTIL	Message file with text for CLI error messages.

(concluded)

End of Appendix

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Appendix D
Bringing Up AOS/VS on a Blank Disk — Data General DS/7700, DS/7500, and ECLIPSE MV/2000 DC Computers

CAUTION

Please remove and destroy Appendix D. *Do not* follow the instructions in this appendix. ECLIPSE MV/2000 DC and DS/7500 systems now are shipped with a user-friendly operating system already installed on disk (AOS/VS Model 31133). *If you attempt to follow these instructions, you will erase the disk structure on those computers.*

If you have an ECLIPSE MV/2000 DC or DS/7500 system, this manual is intended as a general reference manual for such topics as backup. For normal operations, read *Starting and Running AOS/VS on ECLIPSE MV/2000 DC and DS/7000-Series Systems*, part number 069-000129.

End of Appendix

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