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GUIDE TO THE IBM 3480
AUTOMATIC CARTRIDGE LOADER

GUIDE TO THE IBM 3480 AUTOMATIC CARTRIDGE LOADER

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This document is the result of a residency project at the International Technical Support Center - Santa Teresa. It provides installations with basic guidelines for installation and usage of the IBM 3480 Automatic Cartridge Loader Feature.

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Acknowledgements

Preface

Purpose of the Document

The purpose of this document is to provide installation, migration, and usage guidelines for the IBM 3480 Automatic Cartridge Loader Feature.

This document is primarily addressed to systems engineers consulting with the customer before installation and migration of the IBM 3480 Automatic Cartridge Loader Feature.

It describes which tape applications could be considered for the IBM 3480 Automatic Cartridge Loader Feature and which changes are necessary to get the best benefit from it.

The document has the following objectives:

* Describe the hardware.

* Describe the software support.

* Give configuration planning guidelines.

* Give installation guidelines.

* Give usage guidelines.

* Give recommandations for using IBM program products.

* Give operating guidelines.

Related Publications

* *IBM Input/Output Equipment: Installation Manual - Physical Planning for System/360, System/370, and 4300 Processors, GC22-7064 (TNL GN22-2333)*

* *IBM 3480 Magnetic Tape Subsystem Introduction, GA32-0041*

* *IBM 3480 Magnetic Tape Subsystem Reference: Channel Commands, Status and Sense Bytes, and Error Recovery Procedures, GA32-0042*

* *IBM 3480 Magnetic Tape Subsystem Operator's Guide, GA32-0066*

* *IBM 3480 Magnetic Tape Subsystem Planning and Migration Guide, GC35-0098*

* *IBM 3480 Magnetic Tape Subsystem User's Reference, GC35-0099*

* *IBM Input/Output Device Summary, GA32-0039*

* *MVS/XA Operations: System Commands, GC28-1206*

* *DFDSS: Users Guide and Reference, SC26-4125,*

- *DFHSM: System Programmer's Guide, SH35-0085, TNL SN32-0338*
- *DFHSM: Messages, SH35-0094, TNL SN32-0336*
- *IMS/VS V2 DBRC Guide and Reference, SC26-4209-0*
- *Data Security Controls and Procedures, G320-5649*

Related Program Products

- Data Facility Hierarchical Storage Manager (DFHSM 5665-329)
- Data Facility Data Set Services V2 (DFDSS 5665-3237)
- Resource Access Control Facility (RACF 5740-XXH)

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1.0   Introduction

The IBM 3480 Automatic Cartridge Loader feature (#2511) provides automatic mounting and demounting of cartridges for the IBM 3480 Model B11 and B22 Magnetic Tape Units. Operator productivity may be improved by allowing the operator to premount up to five cartridges per drive in addition to a cartridge already mounted in the drive.

Up to six cartridges per drive may be automatically demounted without requiring operator intervention. For jobs using cartridges that can be automatically mounted, system productivity may be improved by reducing the time those jobs wait for cartridges to be mounted. The elapsed time of long-running jobs could be decreased.[1]

This feature provides automatic cartridge mounting and demounting functions for the two drives in the Model B22 or B11, and may be field installed.

The following sections summarize the software modifications made to support the loader and the highlights of the loader feature.

1.1   Loader Software Support

The following software has been modified to support the IBM 3480 Automatic Cartridge Loader Feature:

- MVS/SP /370 and /XA
- DFP   /370 and /XA
- JES3
- DFHSM

MVS/SP supports premounting of cartridges and displays the presence of the IBM 3480 Automatic Cartridge Loader Feature.

DFP presents the status information of the hardware to the software to support nonspecific mount requests.

JES3 during device setup processing, does not demount a cartridge in a drive with the IBM 3480 Automatic Cartridge Loader Feature.

DFHSM supports an esoteric unit name and display of *empty* DFHSM volumes.

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[1]   This text is taken from the announcement material for the IBM 3480 Automatic Cartridge Loader Feature.

1.2   Loader Highlights

The following are the highlights of the IBM 3480 Automatic Cartridge Loader Feature:

Automatic Cartridge Loader Load Times

- A mount should be completed in less than 4 seconds

  when an automatic mount is initiated with no cartridge currently loaded in the drive. This does not include the normal 3480 load time.

- An automatic demount followed by an immediate mount should be accomplished in less than 7 seconds.

  This time does not include rewind time or 3480 load/unload time. These times may be increased for the first automatic mount after cartridges have been removed from the output tray.

It should be understood that the IBM 3480 Automatic Cartridge Loader Feature is not designed to compete with an operator standing in front of the 3480 watching for the Mount message to appear. This operator could beat the time of the Automatic Cartridge Loader, especially when indexing has to take place to get the cartridge into the feed mechanism.

Operator Productivity Gains

Most operator productivity gains should be realized through the automatic handling of premounted scratch tapes in system mode. Installations with large multivolume data sets may also realize productivity gains by premounting cartridges in a sequence predetermined by the operator and operating the Automatic Cartridge Loader in automatic mode. For a brief description of the modes of operation, see "Hardware Operation Modes" on page 4.

Decreased Elapsed Time

By avoiding interruptions through an outstanding operator mount, the elapsed time of long-running backup tasks could be decreased.

Limited Unattended Operation

The main purpose is to help the installation and the operator by reducing or eliminating the need to be present all the time. At the optimum, the operator has to be present after every six cartridges. With good planning, unattended operation can be achieved with some products, for example DFHSM or DFDSS.

The benefit of using the Automatic Cartridge Loader is seen not in comparing manual mounts with loader mounts but rather in improvement in the overall elapsed time of tape applications.

2.0 Automatic Cartridge Loader Hardware Description

This chapter describes the hardware of the IBM 3480 Automatic Cartridge Loader Feature: its components, its operation modes, and its functional states.

2.1 Hardware Components

The Automatic Cartridge Loader feature attaches to the front of a 3480 tape drive and has the following components:

Indexing Mechanism

forms the input stack and moves the cartridges down to the feed position.

Input Stack

is formed by placing one or more cartridges into the indexing mechanism.

Feed Position

is the lowest slot in the input stack and is located in front of the read/write station; the feed position can be seen as the LOAD/UNLOAD position.

Feed Mechanism

moves the cartridge from the feed position into the load mechanism and retrieves it from the load mechanism and places it back into the feed position.

Load Mechanism

moves the cartridge down into position for threading by the 3480 device. After the cartridge has been unloaded by the 3480 device, the load mechanism raises the cartridge so that the feed mechanism can retrieve it.

Output Stack

receives unloaded cartridges from the feed position. Cartridges in the output stack move down as other cartridges are added to the stack. Cartridges in the output stack move up when any cartridges above them are removed from the stack.

Operator Panel

is located to the left of the input stack and contains switches and indicators:

Mode Selection Switch allows the operator to set the mode of operation of the loader to one of three modes: manual, automatic, or system, as described in the next section.

Start Button initiates the loader activity for the selected mode.

Two Indicator Lights

- The green light indicates that the power is on.
- The attention indicator is not visible unless operator intervention is required or an error is encountered.

2.2 Hardware Operation Modes

The IBM 3480 Automatic Cartridge Loader Feature operates in one of three modes, as set by the operator:

- Manual mode
- Automatic mode
- System mode

See "Setting the Mode Selection Switch" on page 63.

These modes are only hardware settings which determine how the Automatic Cartridge Loader reacts to system requests; the operating system is not aware of the mode of operation of the Automatic Cartridge Loader.

2.2.1 Manual Mode

Manual mode allows either operator mounting of individual cartridges or operator-initiated automatic mounting of a premounted cartridge.

When in manual mode, automatic insertion of cartridges into the drive is disabled. Manual mode may be set in either of two ways:

- Manually, by the operator with the mode selection switch on the loader's operator panel.

- Automatically, if the output stack becomes full.

See also *IBM 3480 Magnetic Tape Subsystem Operator's Guide, GA32-0066*, Chapter 2, Mode Selection Switch and Using Manual Mode.

2.2.2 Automatic Mode

Automatic (AUTO) mode supports automatic mounting of cartridges under control of the Automatic Cartridge Loader.

After a cartridge is placed into the input stack, it is automatically advanced toward the drive's feed position. When a cartridge reaches the feed position, the feed and load mechanisms put the cartridge into the drive's read/write station.

When a 3480 drive unloads a cartridge in automatic mode, the IBM 3480 Automatic Cartridge Loader Feature places that cartridge in the output stack and automatically loads the next cartridge in the input stack to the feed position.

This cartridge is then moved into the 3480 drive by the feed and load mechanisms.

Note: The loading of cartridges occurs under loader control, even if *no system mount request was issued.*

If and when a nonspecific volume request gets allocated to a drive in automatic mode, the premounted cartridge is used. The installation must either be sure that this cartridge is eligible for such a request or provide a way to protect the cartridges. See also "General Tape Protection Concerns" on page 33, Automatic Mode Multivolume Premounting.

If and when a specific volume request gets allocated to a drive in automatic mode and the input stack does not contain the requested volume, all the cartridges in the input stack are flushed[2] through, as the system searches for the specific volume requested.

See also *IBM 3480 Magnetic Tape Subsystem Operator's Guide, GA32-0066,* Chapter 2, Mode Selection Switch and Using Auto Mode.

2.2.3 System Mode

System mode is supported in MVS environments when the 3480 is operated in full-function mode. System mode is also supported when the 3480, operated in full-function mode, is dedicated to an MVS guest under VM. In system mode, automatic mounting of cartridges is under control of host programming.

The support provided depends on whether the JES2 or JES3 subsystem is used:

JES2 Environment

For a nonspecific volume request in system mode, a volume from the input stack is automatically mounted at mount request time (that is, when MVS issues a mount message to the operator).

Allocation automatically mounts a cartridge in the loader in response to a request for a nontemporary, nonspecific volume mount (commonly referred to as PRIVAT).

In JES2, SCRTCH is the term used for a nonspecific temporary data set; SCRTCH data sets are NOT preferred for Automatic Cartridge Loaders. This means, in the JES2 environmet, only M PRIVAT requests prefer Automatic Cartridge Loaders.

JES3 Environment

JES3 does not differentiate between M SCRTCH and M PRIVAT requests. JES3 causes any mount for a nonspecific tape to come up as M SCRTCH. This is why there is no Automatic Loader preference in JES3. M SCRTCH requests may only cause an automatic load when an esoteric for the Automatic Cartridge Loader was used or an Automatic Cartridge Loader device was randomly selected in a generic 3480 environment.

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[2] Flushing means that the cartridges are rejected in turn by the system, until the input stack is empty.

Automatic mounting of tape volumes and manual mounting of specific tape volumes may be intermixed. *System mode is the recommended mode for MVS operation.*

When a 3480 drive unloads a cartridge in system mode, the IBM 3480 Automatic Cartridge Loader Feature places that cartridge in the feed position, but does not put the next cartridge in the input stack into the drive. See also *IBM 3480 Magnetic Tape Subsystem Operator's Guide, GA32-0066*, Chapter 2, Mode Selection Switch and Using System Mode.

2.2.4 Unloading Cartridges in the Three Modes

The action taken after REWIND/UNLOAD is also the main difference between the three modes of operation, as follows:

1. In manual mode, the cartridge is always unloaded to the feed position.

2. In automatic mode, the cartridge is always unloaded to the output stack.

3. In system mode, the next action depends on whether the next mount request is specific or nonspecific, as follows:

    - For a *nonspecific request*, the cartridge in the feed position is put in the output stack.

        The next cartridge in the input stack is put into the drive when a "load display" command is issued by the software indicating that the next cartridge should be mounted. The external indication is that the 3480 drive's LED display is M SCRTCH (for temporary) or M PRIVAT (for nontemporary) data sets.

    - For a *specific request*, the cartridge must be manually removed.

        This is done by the operator who then manually mounts the specific volume. See also "Operator Hints for the Operation Modes" on page 65.

2.2.5 Loading Cartridges in the Three Modes

The cartridges can be placed in any position in the input stack, but the feed position should not be used. The action taken after the START button is pushed depends on the mode, as follows:

1. *In manual mode*, the cartridge is loaded into the read/write station.

2. *In automatic mode*, the cartridge is loaded into the read/write station.

3. *In system mode*, nothing happens.

    The cartridge remains in the slot in which it was preloaded. *Only when the cartridge is in the feed position, will it be loaded into the read/write station* when the START button is pushed.

2.3 Hardware Functional States

The IBM 3480 Automatic Cartridge Loader Feature has two functional states:

1. Installed
2. Active

These two states can be determined by the MVS system. For an Automatic Cartridge Loader to be selected during allocation, the active state is the major criterion in non-JES3-managed environments.

2.3.1 Installed State

The IBM 3480 Automatic Cartridge Loader Feature is in the installed state when the feature has been properly attached to the front of a 3480 device.

The drive presents sense data indicating the installed state of the feature when the drive is recognized by the system as being online. This happens during system initialization, either as a result of a VARY online command or as a reply to an allocation recovery message.

For a description of the sense information and how the installed state is reflected in the unit control block (UCB), see "Installed State Extended Description" on page 73.

Note: The installed state is indicated as:

348S by the DISPLAY UNITS command.
3480S by the DEVSERV command.

2.3.2 Active State

Active loader devices will be preferred by Allocation. The Automatic Cartridge Loader is in the active state on the 3480 device when the unloaded cartridge is not the last cartridge loaded in the input stack; that is, there are other cartridges mounted in the input stack. The drive presents sense data indicating the active state of the feature.

For a description of the sense information and how the active state is reflected in the unit control block (UCB), see "Active State Extended Description" on page 74.

Note: No active indication is given to the operator by either DISPLAY UNITS or DEVSERV. However, the operator may want to have an active Automatic Cartridge Loader eligible for selection. The procedure in "Active and Inactive States" on page 65 describes how the operator can activate the Automatic Cartridge Loader to make it eligible for allocation.

3.0 Automatic Cartridge Loader Software Support

The IBM 3480 Automatic Cartridge Loader Feature is a response to customer requirements to have tape products more automated.

The software support can be viewed as a step towards letting systems distinguish between output and input tape requests. MVS/SP prefers the IBM 3480 Automatic Cartridge Loader Feature for nonspecific output requests in JES2 environments (or in JES3 environments that are not JES3-managed).

Modifications are provided for:

- MVS/SP /370 and /XA
- DFP /370 and /XA
- JES3
- DFHSM

The rest of this chapter contains a summary of the software support provided for the Automatic Cartridge Loader followed by detailed descriptions of the support provided for each product.

3.1 Summary of Software Support

MVS/SP

The following support is provided for the IBM 3480 Automatic Cartridge Loader Feature:

1. Support premounting of cartridges on drives with the IBM 3480 Automatic Cartridge Loader Feature.

   a. Scheduler allocation prefers drives with the IBM 3480 Automatic Cartridge Loader Feature active for allocation to nonspecific, private, 3480-eligible tape requests.

   b. Scheduler allocation avoids, whenever possible, the allocation of drives with the IBM 3480 Automatic Cartridge Loader Feature active to specific volume requests where volume mounting is required.

   c. Scheduler allocation does not demount a drive with the IBM 3480 Automatic Cartridge Loader Feature active during device allocation processing, if the drive was allocated to a nonspecific (PRIVAT) tape volume request.

2. Display the presence of the IBM 3480 Automatic Cartridge Loader Feature installed to the operator in response to a DISPLAY UNITS command.

DFP

The following support is provided for the IBM 3480 Automatic Cartridge Loader Feature:

1. Console services DEVSERV displays the installed IBM 3480 Automatic Cartridge Loader Feature as **3480S**.

2. The device service exit puts Automatic Cartridge Loader installed information into the UCB.

3. The end-of-sense exit puts IBM 3480 Automatic Cartridge Loader Feature active information into the UCB.

4. The message display SVC requests an automatic cartridge load for nonspecific mount requests.

5. OPEN/EOV issues a WTOR when a file-protected cartridge is premounted on an Automatic Cartridge Loader device.

JES3

The following support is provided for the IBM 3480 Automatic Cartridge Loader Feature:

During device setup processing, JES3 does not demount a ready cartridge in a drive with the IBM 3480 Automatic Cartridge Loader Feature installed.

DFHSM

The following support has been included for the IBM 3480 Automatic Cartridge Loader Feature:

1. Addition of an esoteric unit name for tape DFHSM volumes.

2. Display of *empty* ML2 or backup tape volumes for the LIST function.

3. Expansion of the tape volume deletion exit (ARCTVEXT) to be used with a tape management system.

3.2 MVS/SP Support

This section describes the MVS tape support both without and with the IBM 3480 Automatic Cartridge Loader Feature. The MVS/SP support allows special consideration for allocation in JES2 environments for nonspecific, private tape requests to devices with this feature active.

The description in this section generally applies to JES2 environments. Specifics for JES3-managed environments are described in "JES3 Support" on page 16.

Most of the following support applies to both the compatibility and full-function modes of operation.

3.2.1 Tape Support Without the IBM 3480 Automatic Cartridge Loader Feature

Current versions of MVS do not support the premounting of tape volumes for nonspecific volume requests for nontemporary data sets (private requests). In JES2 environments, allocation always demounts a volume if one happens to be mounted on a drive selected for such a request. The JES3 main device scheduler (MDS) always demounts volumes before requesting a volume mount, regardless of the type of request allocated to the drive.

With the IBM 3480 Automatic Cartridge Loader Feature in automatic mode, the above-described demounting would waste the premounting of tape cartridges placed in an input stack.

3.2.2 Tape Support With the IBM 3480 Automatic Cartridge Loader Feature

The automatic tape mounting characteristic of the feature is supported by the elimination of unnecessary tape demounts during MVS/SP device allocation and JES3 device scheduling. Additionally, in full-function mode, the MVS/SP DISPLAY UNITS command output indicates the presence of the feature on a 3480 device.

The following MVS components were changed to support the IBM 3480 Automatic Cartridge Loader Feature hardware:

1. Allocation
2. DISPLAY UNITS command
3. Operator mount messages

The following text describes the changes to all three components.

3.2.2.1 Allocation

Allocation provides support to select units and volumes necessary to satisfy user requests made via JCL DD statements or DYNAMIC ALLOCATION text units. Allocation currently provides support to allocate specific volume requests. The support for IBM 3480 Automatic Cartridge Loader Feature is an extension of this support. For the IBM 3480 Automatic Cartridge Loader Feature, allocation provides support to allocate nonspecific requests for private tapes.

For IBM 3480 Automatic Cartridge Loader Feature, allocation provides support to:

1. Prefer tape drives with the IBM 3480 Automatic Cartridge Loader Feature active for allocation to nonspecific, private tape requests. Nonspecific, private tape requests have the following characteristics:

   a. Status of new and
   b. No volume serial number provided and
   c. Disposition of keep, catalog, or pass.

   (If the disposition is pass, the data set name must be nontemporary.)

2. Eliminate the demount of a premounted cartridge with the Automatic Cartridge Loader active during device allocation, if the drive is allocated to a nonspecific, private tape request.

3. Avoid, whenever possible, the allocation of drives with the Automatic Cartridge Loader active to either:

   a. specific tape requests, or
   b. public tape requests (M SCRTCH).

In order to prefer IBM 3480 Automatic Cartridge Loader Feature drives for nonspecific private requests, the order of processing of requests in allocation has been changed.

Current Order of Processing Tape Requests

1. Demand requests
2. Specific requests to mounted volumes
3. Specific requests
4. Nonspecific private requests
5. Nonspecific public requests

Change to Order of Processing Tape Requests

1. Demand requests
2. Specific requests to mounted volumes
3. Nonspecific tape requests to mounted volumes
4. Specific requests
5. Nonspecific private requests
6. Nonspecific public requests

3.2.2.2 *DISPLAY UNITS Command*

The IBM 3480 Automatic Cartridge Loader Feature support is similar to existing support, for example:

DEVICE	FEATURE	DISPLAY
3330	Mod 11	3331
3330	MSS	333V
3480	#2511 (ACL)	348S

The display device status and allocation (DISPLAY UNITS) command provides the operator with information about the status and the availability for allocation of the devices attached to the system. The command output is modified as follows:

MSG IEE450I is modified to show the presence of the Automatic Cartridge Loader.

              For a 3480 with the IBM 3480 Automatic Cartridge Loader Feature installed, the DISPLAY UNITS command displays **348S** instead of **3480**.

Note: The active state is not displayed.

3.2.2.3 *Operator Mount Messages*

No changes were made to the MVS operator mount message support, but there are differences depending on the environment:

- *JES2 Allocation Environments*

Mount messages are issued only if the drive is not ready when allocation performs device selection for a request being allocated to the drive.

In full-function mode, allocation issues mount messages based on the not ready indicator in the UCB. If the drive is marked not ready when allocation device selection interrogates the bit, a mount message is issued for the drive. For active Automatic Cartridge Loader drives whose cartridge has not yet advanced to the read/write station, the following message is issued:

IEF233A M PRIVAT

The display indicates PRIVAT until the volume serial number is read, at which time the display is updated with the volume serial number.

Note: The 3480 drive displays informational messages with a continuous (non-flashing) display, and action-required messages with a flashing display and attention bars. The loader attention indicator flashes when operator intervention is required and shines continuously when an unrecoverable hardware error is encountered.

For an IBM 3480 Automatic Cartridge Loader Feature drive which has already had a cartridge automatically mounted (the drive is ready), no mount message is issued.

- *JES3-Managed Environments*

  JES3 always issues mount messages for drives with the IBM 3480 Automatic Cartridge Loader Feature.

- *Compatibility Mode Environments*

  Mount messages are always issued and operator intervention is required. Automatic feeding does NOT occur if the Automatic Cartridge Loader is in system mode and the operating system is using compatibility mode.

3.2.2.4 Operator Intervention

In both JES3 and non-JES3 environments, operator intervention for mounting of cartridges is only required if any of the following conditions are met:

- The input stack is empty.
- The output stack is full.
- A mechanical problem has occurred with the drive or with the Automatic Cartridge Loader mechanism.
- The drive is in manual mode.
- A specific volume is requested in system mode.

When MVS issues an operator mount message for a specific volume on a drive with scratch volumes in the input stack in system mode, the Automatic Cartridge Loader does not mount a volume. The operating system waits for the mount of the requested volume by the operator.

Another possibility is that the operator premounts the volume that will be requested. This may require operator information messages[3] in the job stream and TYPRUN = HOLD in the JCL.

3.3 DFP Support

The following components in DFP /XA and /370 were changed to support the IBM 3480 Automatic Cartridge Loader Feature:

1. Console services DEVSERV
2. The device service exit
3. The end-of-sense exit
4. The message display SVC
5. OPEN/EOV

The following text describes the changes to all five DFP components.

3.3.1 Console Services Support DEVSERV

Note: **The following support applies only to full-function mode operation under MVS/XA.**

This support was announced with DFP 2.1.0 for MVS/XA . It allows the console operator to display the current status of the target device and its attendant paths. The current DISPLAY UNITS command only reports logical status based on information contained in the UCB for the target device(s).

The new DEVSERV command, with the PATHS keyword, returns information based on subsystem responses to real I/O. This information is of great benefit in diagnosing I/O subsystem problems.

For the IBM 3480 Automatic Cartridge Loader Feature, the command was expanded to support the feature as 3480S. According to the current family of products (like 3380D and 3380E), the display has five digits whereas the DISPLAY UNITS output still has four digits.

3.3.1.1 Invocation and Use of the DEVSERV Command

If the console operator suspects a possible I/O subsystem failure, the new DEVSERV PATHS command can be issued to display the current status of the device and its attendant paths. For example, it is expected that from information on such things as failing jobs and error messages, the operator will suspect a given device or set of devices to be causing the problem.

If this evidence points to a given device, then a DEVSERV PATHS command can be issued for just that device. If the initial DEVSERV response indicates a path resource that is shared by several drives, or if a set of devices is initially suspected, then a DEVSERV request can be directed against a set of devices. For an example of the command output see Figure 1 on page 69 . For a

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[3] For example, messages could indicate which tapes should be mounted before the job should be released and how to invoke AVR. For a description of such a procedure, see also "Use of Automatic Volume Recognition (AVR)" on page 45.

description of the command syntax see *MVS/XA Operations: System Commands, GC28-1206.*

The system administrator can create a set of error recovery actions which are keyed off of the information returned by the DEVSERV command. For example, if a condition code of 3 is indicated on a path, the operator can be instructed to check all of the path switches. If the switches are set correctly then a customer engineer should be called because a hardware problem is indicated.

3.3.2 Device Service Exit

The device service exit (DSE) for the initialization function issues a sense CCW to obtain the sense indicator from the 3480. The device service exit (DSE) routine indicates the installed state by setting an indicator in the tape segment of the UCB as described in "Installed State Extended Description" on page 73.

3.3.3 End-of-Sense Exit

The active state of the IBM 3480 Automatic Cartridge Loader Feature is indicated when the existing DFP end-of-sense routine sets an indicator in the UCB tape device dependent segment as described in "Active State Extended Description" on page 74.

3.3.4 Message Display SVC

A 3480 device is selected by either allocation or JES3 MDS.

- In JES2, allocation only selects Automatic Cartridge Loader devices when there is a PRIVAT request. See "JES2 Environment" in "System Mode" on page 5.

- JES3 has no Automatic Cartridge Loader preference. See "JES3 Tape Support with the Automatic Cartridge Loader" on page 16.

The message display SVC checks the UCB for the Automatic Cartridge Loader installed.

The message display SVC only requests a mount on a Automatic Cartridge Loader device when it is installed. See "Installed State" on page 7. The SVC determines if there is a mount request for a PRIVAT or SCRTCH volume. For nonspecific requests (PRIVAT or SCRTCH), the SVC sets bit 7 of byte 0 of the message data requesting an automatic mount from the hardware.

3.3.5 OPEN/EOV Support

WTOR message IEC510D is used when a file-protected cartridge is used for output.

This gives the operator a chance to prevent the next cartridge from being loaded (and flushed or overwritten in a system without appropriate protection) when the file-protected cartridge is unloaded. See "General Tape Protection Concerns" on page 33.

3.4 JES3 Support

JES3 provides overall management for devices in a complex of one or more operating systems. As a part of device management, JES3 unloads all premounted volumes that do not reside on permanently resident or reserved devices. With the IBM 3480 Automatic Cartridge Loader Feature installed, premounted cartridges will no longer be unloaded. The preference for active Automatic Cartridge Loader devices is not supported.

3.4.1 JES3 Tape Support Without the Automatic Cartridge Loader

Currently with JES3, if a cartridge is in a drive at verify processing time, a demount I/O command is issued to the device and a mount message is issued to the operator. The demount is currently issued by JES3 because JES3 does not support arbitrary premounting of cartridges, that is, operator mounting of cartridges in the absence of a mount message.

JES3 itself directs the premounting of cartridges on a job basis - within the constraints dictated by the type of setup (job, high water mark, or explicit) chosen by the user. When JES3 finds a cartridge mounted on a unit being set up, then the cartridge is either left over from a previous use or has been mounted on the wrong unit.

3.4.2 JES3 Tape Support with the Automatic Cartridge Loader

For the IBM 3480 Automatic Cartridge Loader Feature, JES3 does not unload cartridges automatically premounted by the loader hardware. The JES3 execution device manager - main device scheduler (MDS) - does not actually unload cartridges premounted on a loader drive, whether those cartridges were mounted by an operator or the loader itself.

Note: There is no way to distinguish between a cartridge mounted by the operator and one mounted by the IBM 3480 Automatic Cartridge Loader Feature.

Main device scheduling (MDS) continues to issue mount messages for volumes. MDS runs on the JES3 global processor only. Since some devices may only be accessible from a local processor, MDS could not determine the status of the IBM 3480 Automatic Cartridge Loader Feature on devices connected only to local processors.

JES3 does not provide support to prefer the IBM 3480 Automatic Cartridge Loader Feature drives for nonspecific requests. It is possible for a combination of SYSGEN or EDTGEN changes and JES3 initialization deck changes to satisfy the user requirement for device selection preference. See "Preferring Automatic Cartridge Loader Drives" on page 38.

There are several JES3 utilities that do their own tape I/O. These were not changed for the IBM 3480 Automatic Cartridge Loader Feature. Refer to "JES3 Utilities" on page 40 for further details.

3.5 DFHSM Support

In order for DFHSM to support the Automatic Cartridge Loader and the system software, DFHSM made changes in three areas:

1. Output volume selection and allocation
2. List of DFHSM volumes
3. DFHSM exits

The changes made for DFHSM are not IBM 3480 Automatic Cartridge Loader Feature specific. They are related to the tape and DASD support as well, so the description is of a general nature. The described changes should be reviewed in *DFHSM: System Programmer's Guide, SH35-0085, TNL SN32-0338* and *DFHSM: System Programmer's Reference, SH35-0083, TNL SN35-0337*.

3.5.1 Controlling Output Volume Selection and Allocation

Currently, when DFHSM allocates a tape migration or backup volume for output, it allocates the volume with the unit name specified on the ADDVOL command for the volume. With the new support, the installation is able to specify a unit name that is to be used when allocating a tape migration or tape backup volume for output, thereby overriding the unit name specified on the ADDVOL command for the volume. In addition, the installation is able to limit the selection of output tape volumes during migration, backup, spill, and recycle processing to volumes that can be mounted on a specific type of unit.

Output Volume Selection and Allocation During Migration Processing:

Currently, DFHSM allows the installation to limit the type of tape level 2 migration volume selected for output during migration processing. This is accomplished via subparameters of the TAPEMIGRATION parameter of the SETSYS command. The current syntax of the TAPEMIGRATION parameter of the SETSYS command is:

```
SETSYS TAPEMIGRATION ( NONE |
                       DIRECT ( TAPE( ANY |
                                      3420 |
                                      3480 ) )
                       ML2TAPE( TAPE( ANY |
                                      3420 |
                                      3480 ) ) )
```

The subparameters of the TAPEMIGRATION parameter are modified to support the specification of a generic or esoteric tape unit name. The unit name is used to control the selection and allocation of tape level 2 migration volumes during migration processing. The new syntax of the TAPEMIGRATION parameter is:

```
SETSYS TAPEMIGRATION < (DIRECT< ( TAPE( ANY | unit) ) > }
                        ML2TAPE< ( TAPE( ANY | unit) ) > }
                        NONE) >
```

For unit, a generic or esoteric unit name may be specified. The following generic unit names are acceptable: 3400-3, 3400-4, 3400-5, 3400-6, 3400-9, and 3480. If an esoteric unit name is specified, it must have been previously defined to DFHSM using the USERUNITTABLE parameter of the SETSYS command.

If the ANY parameter is specified with the DIRECT or ML2TAPE parameters, any type of tape level 2 migration volume is selected for output during migration processing. In addition, when a tape level 2 migration volume is allocated, it is allocated using the unit name specified on the ADDVOL command for the volume.

If a unit name is specified, the selection of a tape level 2 migration volume for output during migration processing is limited to tape level 2 migration volumes that can be mounted and written on the specified type of unit. In addition, the unit name specified with the DIRECT or ML2TAPE parameters is used when allocating the tape level 2 migration volume, overriding the unit name specified on the ADDVOL command for the tape level 2 migration volume.

Note: A unit name of 3420 was accepted with the TAPE subparameter of the DIRECT or ML2TAPE parameters by previous DFHSM releases. If a unit name of 3420 is specified with the TAPE subparameter of the DIRECT or ML2TAPE parameters, it will be translated to 3400-6.

Output Volume Selection and Allocation During Backup Processing:

The BACKUP parameter of the SETSYS command is expanded in a fashion similar to the TAPEMIGRATION parameter. The installation can direct the output of backup processing to either DASD or tape. If the installation chooses to limit the output of backup processing to tape volumes, it can choose to further limit it to tape volumes that can be mounted and written on a specific type of unit.

The complete syntax for the BACKUP parameter of the SETSYS command is:

```
    SETSYS NOBACKUP |
           BACKUP < ( ANY |
                      DASD |
                      TAPE < (unit) > ) >
```

For unit, a generic or esoteric unit name may be specified. The following generic unit names are acceptable: 3400-3, 3400-4, 3400-5, 3400-6, 3400-9, and 3480. If an esoteric unit name is specified, it must have been previously defined to DFHSM using the USERUNITTABLE parameter of the SETSYS command.

For primary volumes with a BACKUPDEVICECATEGORY of DASD specified on the BACKVOL or ADDVOL command, the subparameters of the BACKUP parameter have no control over the type of daily backup volume selected when the primary volume is backed up.

For primary volumes with a BACKUPDEVICECATEGORY of NONE, specified on the BACKVOL or ADDVOL command, the subparameters of the BACKUP parameter control the type of daily backup volume that is selected when the volume is backed up.

- If SETSYS BACKUP(ANY) is specified, the primary volume is backed up to either a DASD or tape daily backup volume.

- If SETSYS BACKUP(DASD) is specified, the primary volume is backed up to a DASD daily backup volume.

- If SETSYS BACKUP(TAPE) is specified, the primary volume is backed up to a tape daily backup volume. The tape daily backup volume selected is allocated using the unit name specified on the ADDVOL command issued for the tape daily backup volume.

- If SETSYS BACKUP(TAPE(unit)) is specified, the primary volume is backed up to a tape daily backup volume capable of being mounted and written on the specified type of unit. The tape daily backup volume selected is allocated using the unit name specified with the TAPE subparameter.

For primary volumes with a BACKUPDEVICECATEGORY of TAPE, specified on the BACKVOL or ADDVOL command, the subparameters of the BACKUP parameter further limit the type of tape daily backup volume that is to be selected when the primary volume is backed up. If SETSYS BACKUP(TAPE(unit)) is specified, the primary volume is backed up to a tape daily backup volume capable of being mounted and written on the specified type of unit. The tape daily backup volume selected is allocated using the unit name specified with the TAPE subparameter.

Output Volume Selection and Allocation During Spill processing:

The SPILL parameter of the SETSYS command is expanded in a fashion similar to the BACKUP parameter. The installation is able to direct the output of spill processing to either DASD or tape. If the installation chooses to limit the output of spill processing to tape spill backup volumes, it can choose to further limit it to tape spill backup volumes that can be mounted and written on a specific type of unit.

The complete syntax for the SPILL parameter of the SETSYS command is:

```
SETSYS NOSPILL |
       SPILL < [ ANY |
                 DASD |
                 TAPE < (unit) > ] >
```

For unit, a generic or esoteric unit name may be specified. The following generic unit names are acceptable: 3400-3, 3400-4, 3400-5, 3400-6, 3400-9, and 3480. If an esoteric unit name is specified, it must have been previously defined to DFHSM using the USERUNITTABLE parameter of the SETSYS command.

If SETSYS SPILL(ANY) is specified, there are no restrictions on the type of spill backup volume selected for output during spill processing.

If SETSYS SPILL(DASD) is specified, then only DASD spill backup volumes are selected for output during spill processing.

If SETSYS SPILL(TAPE) is specified, then only tape spill backup volumes are selected for output during spill processing. The tape spill backup selected is allocated with the unit name specified on the ADDVOL command for the spill backup volume.

If SETSYS SPILL(TAPE(unit)) is specified, the only type of spill backup volume selected for output during spill processing is a tape spill backup volume

capable of being mounted and written on the specified type of unit. The tape spill backup volume selected is allocated with the unit name specified on this command, not the unit name specified on the ADDVOL command for the tape spill backup volume.

Output Volume Selection and Allocation During Recycle Processing:

A new keyword was added to the SETSYS command. The installation is able to limit the type of output volume selected during recycle processing. In addition, the installation is able to limit the unit allocated for the output volume.

The complete syntax for the new parameter of the SETSYS command is:

```
SETSYS RECYCLEOUTPUT( BACKUP < (unit) >
                     MIGRATION < (unit) > )
```

For unit, a generic or esoteric unit name may be specified. The following generic unit names are acceptable: 3400-3, 3400-4, 3400-5, 3400-6, 3400-9, and 3480. If an esoteric unit name is specified, it must have been previously defined to DFHSM using the USERUNITTABLE parameter of the SETSYS command.

If RECYCLEOUTPUT(BACKUP(unit)) is specified, then the selection of a tape spill backup volume for output, during the recycle of a tape backup volume, is limited to tape spill backup volumes that can be mounted and written on the specified type of unit. In addition, the tape spill backup volume selected is allocated using the unit name specified with the BACKUP subparameter of the RECYCLEOUTPUT parameter, overriding the unit name specified on the ADDVOL command for the tape spill backup volume. If no unit name is specified with the BACKUP parameter, there is no restriction on the type of tape spill backup volume that can be selected for output during the recycle processing of the tape backup volume.

If RECYCLEOUTPUT(MIGRATION(unit)) is specified, then the selection of a tape level 2 migration volume for output, during the recycle of a tape level 2 migration volume, is limited to tape level 2 migration volumes that can be mounted and written on the specified type of unit. In addition, the tape level 2 migration volume selected is allocated using the unit name specified with the MIGRATION subparameter of the RECYCLEOUTPUT parameter, overriding the unit name specified on the ADDVOL command for the tape level 2 migration volume. If no unit name is specified with the MIGRATION parameter, there is no restriction on the type of tape level 2 migration volume that can be selected for output during the recycle processing of a tape level 2 migration volume.

If the RECYCLEOUTPUT parameter is specified without any subparameters, no changes are made to the current DFHSM values.

3.5.2 Expansion of the LIST Function

The LIST function is expanded to print a list of empty tape level 2 migration volumes or empty tape backup volumes. This helps the operator in determining which tapes can be placed in the Automatic Cartridge Loader when DFHSM is performing migration, backup, spill, or recycle processing.

The complete syntax for the BACKUPVOLUME parameter of the LIST command is:

```
LIST   BACKUPVOLUME<(volser)>   OUTDATASET(dsname) |
                                SYSOUT(class) |
                                TERMINAL

                                SELECT( <EMPTY> )
```

The complete syntax for the MIGRATIONVOLUME parameter of the LIST command is:

```
LIST   MIGRATIONVOLUME |        BACKUPCONTROLDATASET |
       MIGRATIONLEVEL1 |        MIGRATIONCONTROLDATASET |
       MIGRATIONLEVEL2<(DASD |  BOTH
                    TAPE)> |
       PRIMARYVOLUME |          OUTDATASET(dsname) |
       VOLUME[(volser)>         SYSOUT(class) |
                                TERMINAL

                                SELECT( [EMPTY> )
```

EMPTY specifies whether to list only empty tape backup volumes or tape level 2 migration volumes.

EMPTY is an optional subparameter of the SELECT parameter which specifies that only empty tape backup volumes or empty tape level 2 migration volumes are to be listed.

Note: This subparameter applies only when the BACKUPVOLUME parameter is specified without a volume serial number or when the MIGRATIONLEVEL2(TAPE) parameters are specified.

3.5.3   Expansion of the Tape Volume Deletion Exit ARCTVEXT

The ARCTVEXT is an informational DFHSM exit. The exit is given control under certain conditions and is passed certain data, but DFHSM processing is not dependent upon actions performed by the exit.

The interface to the tape volume deletion exit ARCTVEXT is expanded to supply the necessary information to the exit so it can correctly instruct a tape management product on what action to take. The new items in the interface are flags indicating whether or not the tape needs to be reinitialized and whether the tape is being purged from DFHSM or only reassigned for reuse.

See "ARCTVEXT User Exit" on page 76 for a description of this DFHSM exit.

4.0 Configuration Planning Guidelines

This chapter discusses some basic guidelines to help answer several question regarding use of the Automatic Cartridge Loader. First, the chapter describes some guidelines which might help to determine the number of Automatic Cartridge Loaders required by an installation; however, this decision process depends on the specific needs of the installation. The next question to be discussed is if there is an optimum number of Automatic Cartridge Loaders. The last question concerns the physical location of the Automatic Cartridge Loaders in the existing strings.

4.1 Determining the Number of Automatic Cartridge Loaders

This section describes methods for answering the following question for JES2 environments:

How many IBM 3480 Automatic Cartridge Loader Features should be installed?

Note: These guidelines have been verified for JES2 environments only. Similar rules may apply to JES3 environments.

The IBM 3480 Automatic Cartridge Loader Feature mounts volumes sequentially in the order in which they appear in the input stack. If the majority of tape volume mount requests are nonspecific, which can be expected in many installations, customers will use IBM 3480 Automatic Cartridge Loader Feature primarily for premounting of scratch cartridges.

Some installations may use the term *scratch* for a nonspecific volume request. This document uses the term *nonspecific* volume request. It should be understood that both terms may be used, and we leave it up to the installation to use the one they like best to calculate the required numbers.

The most important critera for determining the number of IBM 3480 Automatic Cartridge Loader Features to install are:

1. Percentage of nonspecific mounts
2. Specific applications requirements

4.1.1 Percentage of Nonspecific Mounts

The prime parameter to understand the number of IBM 3480 Automatic Cartridge Loader Features needed for a given installation is the percentage of all mount requests for nonspecific tape volumes. The figure taken should be based on **peak shift** requirements, rather than gross averages.

Either of two approaches can be used to calculate the percentage of nonspecific mounts:

1. **SM = DO / TV**

    where:

    SM is the percentage of nonspecific mounts.
    DO is the number of tape volumes for new data sets opened for output.
    TV is the total number of tape volumes processed.

    The number of tape volumes can be estimated through the analysis of the system management facility (SMF) data set activity records:

    - SMF record 14 (input data sets)
    - SMF record 15 (all others)

    The resulting percentage is somewhat distorted because existing data sets may be extended to new volumes (nonspecific mount requests at EOV), and new data sets can be written over specifically requested volumes.

2. **SM = NSR / TR**

    where:

    SM is the percentage of nonspecific mounts.
    NSR is the number of times *M PRIVAT* appears in messages *IEF233A* and *IEF501A* (nonspecific requests).
    TR is the total number of mount messages *IEF233A* and *IEF501A*.

    This approach is derived from analyzing the console logs and looking for all *M PRIVAT* messages. This number must be compared with the total number of mounts.

    This second approach does not show the specific mounts satisfied through operator premounting. Therefore, if automatic volume recognition (AVR) is used frequently in the installation, the result of this approach may be misleading.

Once the percentage of nonspecific mounts is determined, the number of Automatic Cartridge Loader features required can be calculated. A *first shot rule of thumb* for this calculation could be:

NA = (INT ((2 * (NT * SM)) + 1) / 2)

    where:

    NA is the number of Automatic Cartridge Loader features needed.
    INT means round up to the next higher integer (Automatic Cartridge Loaders come in pairs).
    NT is the number of 3480 drives installed.
    SM is the percentage of nonspecific mounts as determined earlier.

    For example, if twenty-four 3480 drives (three strings) are installed and the percentage of nonspecific mounts is 60 percent (factor 0.6), the number of Automatic Cartridge Loaders required would be:

- NA = (INT ((2 * (24 * 0.6)) + 1) / 2) = 8

This means that of the twelve units of 3480 A22 (twenty-four drives), eight units (or sixteen drives) could be equipped with IBM 3480 Automatic Cartridge Loader Features.

4.1.2 Specific Applications Requirements

The "first shot" number of IBM 3480 Automatic Cartridge Loader Features should be increased by needs arising from the conversion of some applications to automatic mounting. The number of additional Automatic Cartridge Loaders required depends on how those new applications can run simultaneously with the previously discussed nonspecific mounts. If they should run in parallel with the peak shift and they did not use nonspecific tapes before, a corresponding number of Automatic Cartridge Loaders should be added to the figure calculated earlier.

Some calculation ideas for additional needs for Automatic Cartridge Loaders are shown in the following examples of DFHSM and DFDSS mounts.

4.1.2.1 DFHSM Mounts

The calculation could be based on:

- The number of backup tasks

  Each backup task allocates an output device. A maximum of 15 tasks is given by DFHSM restriction, so not more than 15 loaders can be used at a time. Experience shows, that depending on the CPU size and applications running in parallel, each installation may have its own "optimum".

- The number of DFHSMs running backup tasks

  If multiple CPUs are doing backup in parallel, the "optimum" number of backup tasks per CPU can be added to get the total number of Automatic Cartridge Loaders for the installation.

- An eventual target of "unattended" operation

  The average daily use of tapes per task could be divided by 5 or 4 (to be on the safe side and provide a buffer) to find the appropriate number of Automatic Cartridge Loaders. The first specific mounts can be predicted and the cartridges can be premounted for AVR allocation.

  See also "Unattended Operation" on page 49.

4.1.2.2 *DFDSS Mounts*

The calculation could be based on:

- The number of dump tasks

  DFDSS allocates output devices via JCL. Only one device (Automatic Cartridge Loader) can be used at a time for each dump task. If two tape drives are assigned to a dump task, the second device is allocated when the first device is doing REWIND/UNLOAD for the preceding tape. The two loaders are used in a flip/flop mode. As in the case of DFHSM, each installation may have an "optimum" for parallel tasks.

- The number of CPUs running DFDSS backup tasks

  If multiple CPUs are doing backup in parallel, the "optimum" number of backup tasks per CPU can be added to get the total number of Automatic Cartridge Loaders for the installation.

- An eventual target of "unattended" operation

  If performance is not the criterion, it could be tried to start so many tasks that all available Automatic Cartridge Loaders could be used. Other than with DFHSM, where a limited number of incremental backup can be expected, for DFDSS it should only be considered for logical dumps. The number for physical volume dumps may be too big to run unattended.

  See also "Unattended Operation" on page 49.

4.2 *Optimum Automatic Cartridge Loader Configuration*

After quantifying customer needs, other points should be discussed in order to determine the actual number of drives recommended. Two questions arise:

1. Should Automatic Cartridge Loaders be installed on every 3480 drive?
2. How can the current configuration be optimized by using Automatic Cartridge Loaders without adding more drives?

The number of Automatic Cartridge Loaders may vary according to the needs of the applications and the JES subsystem installed. The following text describes guidelines for answering these questions.

4.2.1 Should Automatic Cartridge Loaders be Installed on Every Drive?

Since specific mounts can be handled equally well on 3480 devices with the automatic loading mechanism, the question arises as to whether it would not be best to install Automatic Cartridge Loaders on every 3480 tape drive. It may appear unreasonable to install loaders for activities where there is no real benefit using them. However, because the type of mount activity may vary considerably with time, one might think that installing loaders everywhere would simplify the configuration and allow for maximum parallelism in tape output.

However, this question has no simple answer. No doubt the installation of loaders on every 3480 might have an advantage for the operators and the job scheduling personnel. The only limitation to the number of jobs which could

be run simultaneously using automatic mounting would be the total number of 3480 devices.

However, especially in a JES3 environment, there is no way to avoid "nonspecific tape mounting" jobs from dominating other jobs using tapes, without partitioning the drives with unit names, even if they are all equipped with loaders. See "JES3-Managed Environments" on page 38 for a description of the missing Automatic Cartridge Loader preference.

In conclusion, in a JES2 environment, if the percentage of nonspecific mounts is high enough, an all-loader configuration may be a good choice.

4.2.2 How Can the Current Configuration be Optimized?

Another consideration is that elapsed time does not decrease just by using more parallelism, that is, installing more drives. On the contrary, the elapsed time may actually increase because of additional contention for system resources or overloading the IBM 3480 Magnetic Tape Subsystem. In such situations the only benefit of parallelism is to **overlap mount wait time[4] and UNLOAD time** with tape processing. The benefit gained through this overlap must be weighed against the throughput decrease due to contention.

It may be appropriate to investigate how much the superior automatic mounting capabilities of the Automatic Cartridge Loader could possibly reduce the mount wait times, and at the same time decrease the total elapsed time. This particular point of view is workload dependent and generally applies to specific tape mounting where the delays for accessing the tape library or selecting the right tape are higher than for nonspecific requests.

Although no specific rule of thumb can be given, premounting nonspecific tapes on loader-equipped drives should reduce the total elapsed time of the tape application. For example, assume that an installation has 16 drives and requires six hours elapsed time for a tape application. If loaders are installed on all drives, the elapsed time could possibly be reduced to five hours. This leads to the following conclusions:

* The original elapsed time (six hours) could be achieved by the use of fewer loader drives (for example, 12).

* It may not be necessary to install new drives when the workload increases somewhat.

Note: The ability to save operator mount wait time through premounting of scratch tapes is only possible with the Automatic Cartridge Loader.

4.3 Automatic Cartridge Loader Physical Installation Considerations

Once the required number of loaders is determined, another question arises:

Which strings and which drives should have Automatic Cartridge Loaders?

---

[4] Mount wait time is the time that elapses between a mount issued by the system and operator mount of the cartridge.

The units equipped with the IBM 3480 Automatic Cartridge Loader Feature will generally be the ones requiring less frequent operator intervention, although this may depend on the concurrent need of input tapes during the relevant shift. The general recommendation should therefore be to place the loader units the **farthest away** from the tape operator desk.

4.3.1   JES2 Environments

No special considerations apply for JES2 environments. Allocation preference normally ensures that operator intervention is minimized on those drives by directing specific mounts away from active loaders (as described in "Allocation" on page 11).

Note however, that in MVS, the system resource manager (SRM) selects the order of tapes inside a given eligible list based on:

- Logical path selection algorithm
- Tape device selection rules

  For nonspecific requests and active Automatic Cartridge Loaders SRM selects only from the active list. If all Automatic Cartridge Loaders are inactive, all are candidates for selection.

The device selection rules can be modified by the installation through the SELTAPE option in SYS1.PARMLIB(IEAOPTxx). If the installation is using the LOWEST option for a reason, there will be a tendency to reuse the devices with the lowest device numbers (addresses) first.

In this case, it may be of some value to pay attention to the position of loaders inside the strings, to ensure that allocation starts with the loaders nearest to the operator. This may not always be possible, depending on other machine room and operator convenience constraints.

4.3.2   JES3 Environments

In JES3 environments, an Automatic Cartridge Loader preference (that is, to request an automatic mount the farthest away from the operator) can only be achieved through unit naming and initialization deck usage as recommended in "JES3 Support" on page 16 and "JES3-Managed Environments" on page 38.

4.3.3   Floor Space and Visibility needs

Although there are no special considerations for the Automatic Cartridge Loader installation, two items need attention:

Service Clearance for Installed IBM 3480 Magnetic Tape Subsystem

The only change to the *IBM Input/Output Equipment: Installation Manual - Physical Planning for System/360, System/370, and 4300 Processors, GC22-7064 (TNL GN22-2333)* is that the 3480 service clearance is increased from 36 inches (914 mm)) to 40 inches (1015 mm) on the front, when the IBM 3480 Automatic Cartridge Loader Feature is added.

If the existing 3480 strings are installed in the minimum clearance, then they must be moved to meet the new loader space requirements.

Visibility of the Display Panels

All message display panels for the IBM 3480 Magnetic Tape Subsystems and the loaders should be visible. The loader attention indicator flashes when operator intervention is needed.

5.0 Installation Guidelines

This chapter contains guidelines for installation of the IBM 3480 Automatic Cartridge Loader Feature. The first section describes items that need attention before installing any Automatic Cartridge Loader. Sebsequent sections describe the implications of programming support and system changes, JES2 and JES3 environment considerations, and, finally, intsallation and SYSGEN changes.

5.1 Suggestions for Automatic Cartridge Loader Installation

In general, there are **no mandatory changes** to use the Automatic Cartridge Loader in any of its supported modes. However, this section describes some items that would need attention before installation. These items are:

- Operater education
- Use of esoteric unit names
- Catalog considerations for tape data sets
- Tape applications review
- General tape protection concerns
- Use of a tape management system

5.1.1 Operator Education

In an Automatic Cartridge Loader environment, operators must still be present, even if they have to pay much less attention to scratch mounting than in today's environment.

It is important to educate the operating staff prior to installing the Automatic Cartridge Loader. Since the unit may be used for other than scratch tape mounting, the operator must understand the precautions needed for multivolume input and for using AVR, as well as the effect of the various loader operation modes.

In addition, the operator must distinguish between:

1. Situations that do or do not need intervention on the loader, and

2. The three loader operation modes.

This operator education should be done in advance, because after the Automatic Cartridge Loader is installed, there is no way to reserve its use for testing short of ensuring that no JCL uses the 3480 generic device type.

See "Operating the Automatic Cartridge Loader" on page 63 for a summary of the changes to the operating environment.

5.1.2 Use of Esoteric Names

Changes can be made to be able to restrict specific applications or operational procedures to the subset of drives with an Automatic Cartridge Loader installed, and force other applications to avoid allocation to such drives.

The use of the new esoteric unit names in installation procedures is dependent on the type of applications and the number of tape drives of each sort available. Some installations may already have a unit name which is suitable for the Automatic Cartridge Loader.

As a general rule, the applications with the following characteristics should be candidates for the esoteric name provided for the drives equipped with the Automatic Cartridge Loader:

- Mainly scratch tape oriented
- Sensitive to scratch mount delays

See "Implication of Programming Support and System Changes" on page 35 for a discussion of the suggested changes for specific environments.

5.1.3 Catalog Considerations for Tape Data Sets

All information on a data set should be retrievable from the catalog. This means that new tape data sets have to be cataloged. However, some installations depend on their operators to label the tapes externally after processing; for example, the operator writes DUMP VOL xxx DAY nnn on an external volume label. This external information on the cartridge is then used to retrieve the correct tape volumes.

The process of correlating the output stack cartridges to be kept with a specific job that finished some time ago is an error-prone procedure. During re-allocation, a job may change the drive used and it is difficult to match a processed tape to an application or job.

In an Automatic Cartridge Loader environment, the operator normally only intervenes when the output stack is full or when the input stack is empty. It does not make sense to save the operator time mounting the cartridges while making his or her task more difficult to sort them out.

Although the presence of the Automatic Cartridge Loader is indicated in the response to MVS display commands, the generic device type for such units is still the same (3480).

Therefore, if a cataloged tape data set is referenced, all 3480 devices are eligible for the specific request for such a data set. This is subject to the allocation preference schemes described in "Allocation" on page 11, and to eventual overriding through JCL.

Naturally, users should be warned not to catalog data sets with esoteric unit names by any means.

No other considerations apply.

5.1.4 Tape Applications Review

Applications, including tape preparation and job scheduling software, should be reviewed to take advantage of the new automatic mounting capabilities.

Typical activities in this area would be:

- Include mode of operation instructions for every job requiring the Automatic Cartridge Loader to be set to a mode other than system mode.

- Provide the list of tapes to be premounted if multivolume input is expected and JES3 fetching is not used.

- Check what kind of unit is being used for dynamic allocations (esoteric or generic).

5.1.5 General Tape Protection Concerns

User management is responsible for evaluation, selection, and implementation of security controls, for administrative procedures, and for appropriate controls in application systems using 3480 tape drives. This may include the use of appropriate access control software to prevent unauthorized access to protected data sets residing on tape.

Since tape is a portable storage media, user management may also wish to ensure that adequate controls exist for the storage, indexing, and retrieval of tapes used on these drives. Additional information is available in the IBM publication *Data Security Controls and Procedures, G320-5649*.

The IBM 3480 Automatic Cartridge Loader Feature by itself does not introduce new general tape protection issues. It is basically an automatic tape operator for preloaded tapes and it is subject to the same kind of errors an operator can make while manipulating tapes not protected by other means.

The fact that, MVS allocation for nonspecific (PRIVATE) requests

- Prefers *active* loaders and
- Does not issue demounts on READY and ACTIVE drives

may lead to tape overwriting *without operator error*. Three cases should be highlighted:

Automatic Mode Multivolume Premounting

If a stack of specific tapes is prepared to match the tape requirement (sequence of volumes) of a job or task and premounted in *automatic* mode in response to the first mount message, any of those tapes except the first could be overwritten by an incoming nonspecific request if the job or task terminates (ABENDs) without having processed all the tapes.

System Mode Multivolume Premounting

The above described case could happen in *system* mode if the operator premounts unprotected tapes which are not scratch tapes. This has to be considered an operations error in the loader environment. It should be treated the same way as today's hazard when an operator mounts a nonscratch tape with a ring in response to a nonspecific request.

A particularly **severe mistake** an operator can make is to first inadvertently set system mode instead of automatic mode when premounting a sequence of specific cartridges, and then walk away. The job needing the cartridges will most probably ABEND with a system 522 code for exceeding the mount wait time limit since the operator is not there to mount the cartridge needed. Then the next nonspecific request may wipe out the remaining cartridges if they were not protected.

Premounting Single Volumes (AVR)

It is worth remembering that the only premounting which saves operator time for specific requests in system mode is when the cartridge is loaded from the feed position before the request is made and recognized through AVR. Then no mount message is issued at all and the job or task can proceed without manual intervention.

The new exposure with the IBM 3480 Automatic Cartridge Loader Feature is that an intervening job requiring a nonspecific mount may override the premounted cartridge without further notice if:

1. The drive is *active*, and

2. The premounted tape was unprotected,

   whereas in standard 3480 a demount message would have been issued in any case.

Therefore, we recommend the following approach:

1. If the installation does not currently protect tape data sets, plan to introduce tape data set protection immediately. RACF 1.7 under MVS/XA is the recommended approach.

   RACF 1.7 provides tape data set protection, but does not provide tape control facilities such as:

   - Automatic tape expiration after a data set is uncatloged, and

   - Protection of a tape from being overwritten by the creator of the tape.

   If an installation requires these facilities, then a tape management system should be used.

2. *Use automatic mode very carefully* until tape data sets are protected.

3. Instruct the operators to premount only scratch tapes in the loaders until tape data set protection is in use.

4. Always wait for the first mount request before premounting nonscratch tapes for a multivolume file.

5. Never premount single nonscratch cartridges before ensuring that the tape drive is in the inactive state; see "Recommendations for the Use of AVR" on page 48.

Remember that all new protection and operational concerns mentioned before can be easily contained if the installation:

- Dedicates the Automatic Cartridge Loader drives to premounted scratch tapes.

- Allows the mounting of specific cartridges only at system request.

- Strictly controls use of modes other than system.

5.1.6 Use of a Tape Management System

The use of a tape management system could help the installation in two areas:

1. Tape protection
2. Scratch pool management

Tape Protection

An efficient tape management system protects its tapes from being overwritten. The installation of such a product would erase the concern discussed in "General Tape Protection Concerns" on page 33.

Scratch Pool Management

In an Automatic Cartridge Loader environment, the majority of mounts are scratch mounts. To have a sufficient number of scratch tapes available, some means of identifying these tapes is necessary.

This scratch tape preparation is especially important for the performance of the applications. Every tape missing at mount time degrades elapsed time.

5.1.7 3480 Full-Function Mode

The *system* mode allows use of drives equipped with the Automatic Cartridge Loader without disturbing normal operations. The IBM 3480 Magnetic Tape Subsystem should be operated in *full-function mode*. The use of the compatibility mode has some restrictions.

Compatibility Mode Note:

In compatibility mode, active stackers are still preferred by MVS allocation but system mode acts the same as manual mode. Therefore, the standard way of using the Automatic Cartridge Loader in compatibility mode should be automatic mode.

5.2 Implication of Programming Support and System Changes

Systems programmers must treat the IBM 3480 Automatic Cartridge Loader Feature as they would a new tape drive. They must consider making changes much the same way they would when installing new drives.

The methods for making such changes are the same ones currently in use:

- SYSGEN
- JCL
- JES3 initialization deck

Depending on the installation's current JES subsystem, different actions must be taken to make the best use of the IBM 3480 Automatic Cartridge Loader Feature.

For JES2 refer to "JES2 Environments" below.

For JES3 refer to "JES3-Managed Environments" on page 38 .

Various combinations of 3480 drive and loader status are possible:

1. 3480 drives without the Automatic Cartridge Loader,
2. 3480 with the Automatic Cartridge Loader active, and
3. 3480 drives with the Automatic Cartridge Loader inactive.

The coexistence of these characteristics may require system programmer action.

For the kinds of changes related to the different operating modes of the Automatic Cartridge Loader systems programmers might make, see "Automatic Cartridge Loader Usage Guidelines" on page 43.

The time required to investigate and make such changes for the loader is equal to that for installing new tape drives.

5.3   JES2 Environments

Allocation prefers active Automatic Cartridge Loaders in system mode. If different loader selection criteria are desired, SYSGEN and JCL changes are necessary. This section describes the possible changes and their consequences.

5.3.1   Automatic Cartridge Loader Preference in System Mode

Without specific JCL and depending on SYSGEN changes, the following DD statement is an example of a nonspecific request which results in an Automatic Cartridge Loader preference in a JES2 environment:

(1) //OUTPUT DD DSN = MASTER(+ 1),DISP = (NEW,CATLG),UNIT = 3480

This preference does not mean that an Automatic Cartridge Loader drive may not be allocated to specific requests. For example, the following DD statement:

(2) //OLDMAST DD DSN = MASTER(0),DISP = OLD   (cataloged as UNIT = 3480)

would be eligible for allocation to any IBM drive with an Automatic Cartridge Loader. If active loader drives are the only drives available when DD (2) above is being allocated, an active loader would be allocated to DD (2). For a description of the active state, see "Hardware Functional States" on page 7.

The use of an Automatic Cartridge Loader for a specific request could interfere with the desired orderly flow of scratch cartridges through the loader input and

output stacks. Therefore, to prevent specific requests from being directed to an active loader in a mixed loader/non-loader environment, other actions such as SYSGEN or JCL changes are desirable.

5.3.2 SYSGEN and JCL Changes

In addition to using system mode for Automatic Cartridge Loaders containing scratch cartridges, the installation may wish to change its JCL and SYSGEN or EDTGEN to eliminate the IBM 3480 Automatic Cartridge Loader Feature from eligibility for some types of requests. This may be done through either SYSGEN changes or JCL changes.

SYSGEN Changes

The installation may already use an esoteric name like TAPE for a subset of drives for new nonspecific private request. If this is the subset where the loaders will be installed, nothing needs to be done.

Otherwise, the installation could either:

- Create an esoteric unit name for Automatic Cartridge Loader drives, for example, STACK, or

- Create an esoteric unit name which excludes Automatic Cartridge Loader drives, for example, NOSTACK.

JCL Changes

The installation should specify:

- STACK for nonspecific volume requests for permanent data sets, and

- NOSTACK for other requests, for example,

```
(3) //OUTPUT DD DSN = MASTER( + 1),DISP = (NEW,CATLG),UNIT = STACK
(4) //OLDMAST DD DSN = MASTER(0),DISP = OLD,UNIT = NOSTACK
    (MASTER(0) is cataloged as UNIT = 3480. Even though DD(4)
    is cataloged as 3480, the NOSTACK specification
    will be used, since it is a subset of 3480.)
```

5.3.3 Consequences of Making SYSGEN and JCL Changes

If the preceding JCL and SYSGEN or EDTGEN changes are made, job steps wait in allocation if they contain DD statements like DD (3) and no Automatic Cartridge Loader drives are available but other, non-loader 3480s are available to satisfy the request. Vice versa, for DD statements like DD (4), Automatic Cartridge Loader drives could be available, but would not be used. These job steps would not wait if the JCL and SYSGEN or EDTGEN changes were not made.

5.3.4 Consequences of Not Making SYSGEN and JCL Changes

The consequences of not making these JCL and SYSGEN or EDTGEN changes would be:

- Premounted tapes on loader drives for nonspecific requests (like DD (1)) may sit unused in the input stack while a single-volume data set (like DD (2)) on a specifically requested volume is processed on a loader device.

  The single-volume data set could have been directed to a non-loader drive. This can happen whenever allocation is selecting a unit for DD (1) that is not in the same step as DD (2). It is highly likely to happen in peak load environments when all drives are allocated.

- Tapes premounted for specific volume requests (for example, a multifile restore job) on active loader drives in automatic mode may be demounted to make way for nonspecific requests. In the worst case, the tapes would not be demounted and may be overwritten in the absence of an adequate protection mechanism. See also "General Tape Protection Concerns" on page 33.

  This happens because allocation prefers the acitve loader drives for nonspecific requests for permanent data sets.

5.4 JES3-Managed Environments

For JES3-managed Automatic Cartridge Loader drives (as with all JES3-managed devices), the unit names used on JCL and dynamic allocation requests must be defined on SETNAME initialization statements in addition to SYSGEN or EDTGEN definitions of generic unit names and esoteric unit names.

For a specific single-volume request, it is better that such requests not be allocated to a drive that is equipped with the Automatic Cartridge Loader. This is especially true when the input stack is loaded with scratch cartridges.

The installation must decide whether or not drives with the Automatic Cartridge Loader should be eligible for allocation to specific requests at all. That is, when there are not enough drives without the Automatic Cartridge Loader available to satisfy a specific request, should drives with the Automatic Cartridge Loader be used, or should the job wait?

If drives with the Automatic Cartridge Loader are made eligible for specific requests, JES3 may select drives with the Automatic Cartridge Loader to satisfy specific volume requests.

5.4.1 Preferring Automatic Cartridge Loader Drives

This section illustrates how a systems programmer could change an existing JES3 initialization deck to cause JES3 to prefer:

1. Loader drives for nonspecific volume requests, and

2. Non-loader drives for specific volume requests.

Assumptions:

- All drives are JES3-managed.

- All nonspecific volume requests specify TAPE in the unit parameter, for example:

(5) //OUTPUT DD DSN = MASTER(+ 1),DISP = (NEW,CATLG),UNIT = TAPE

- The name TAPE includes all 3480s.

- All existing data sets are cataloged as 3480, for example:

  (6) //OLDMAST DD DSN = MASTER(0),DISP = OLD

- All allocation requests for existing data sets use the catalog to obtain unit information.

- The customer installs some Automatic Cartridge Loaders on a subset of the 3480 drives.

Then, to cause JES3 to prefer:

- Loader drives for requests like DD (5), and

- Non-loader drives for requests like DD (6),

the customer must do the following:

1. Change the JES3 initialization deck DEVICE statements for all loader drives to the following:

   DEVICE,XTYPE = (STACK),XUNIT = (----)

2. Change the JES3 initialization deck DEVICE statements for all non-loader drives to the following:

   DEVICE,XTYPE = (NOSTACK),XUNIT = (----)

3. Change the JES3 initialization deck SETNAME statements for TAPE and 3480 to the following:

   Alternative 1:
       SETNAME,XTYPE = STACK,NAMES = (TAPE)
       SETNAME,XTYPE = NOSTACK,NAMES = (TAPE,3480)
       SETNAME,XTYPE = STACK,NAMES = (3480)

   Alternative 2:
       SETNAME,XTYPE = STACK,NAMES = (TAPE)
       SETNAME,XTYPE = NOSTACK,NAMES = (3480)

   Both definitions will work, but the first alternative is more flexible; if TAPE is specifid, a STACK unit is assigned, if available, or a NOSTACK unit but all units can be used with NAME = TAPE. The same will happen if 3480 is specified. First priority is given to NOSTACK, and if none are available allocation will use STACK.

   In the second alternative, the tape units are split into two pools, and, if TAPE is specified, allocation will not accept a NOSTACK device.

With the above initialization setup, JES3 attempts to allocate requests like DD (5) to loader drives, but will allocate non-loader drives if no loader drives are available (and vice versa for DD statements like DD (6)).

5.4.2 JES3 Utilities

JES3 provides certain utilities that perform I/O to tape drives, such as Tape Label, Tape-to-Tape, and Dump Job. The installation has the option of defining drives with the Automatic Cartridge Loader as being eligible to be used by these DSPs. These utilities do their own device mount/demount processing. This may result in either

- An extra unload, or

- A cartridge being re-used by one of the utilities or by MDS after a utility has ended, if the Automatic Cartridge Loader is operated in automatic mode.

The operator may prevent this from happening by setting the Automatic Cartridge Loader in system mode when using its drive for one of these utilities.

5.5 Maintenance Installation and SYSGEN

The software support for the Automatic Cartridge Loader is described in "Automatic Cartridge Loader Software Support" on page 9. To obtain the Automatic Cartridge Loader software support on processors with 3480 drives with the feature attached, customers must apply PTFs as follows:

- In JES2 (XA and 370) environments, support must be applied to the following software products:

    - MVS/SP BCP
    - DFP

- In JES3 (XA and 370) environments, support must be applied to the following software products:

    - MVS/SP BCP
    - MVS/SP JES3
    - DFP

    Note: No device selection preference is provided for JES3-managed drives containing the Automatic Cartridge Loader.

    In JES3 complexes, the PTFs must be applied to any processor that has Automatic Cartridge Loader drives attached.

- In JES2 and JES3 systems with DFHSM, support must be applied to any DFHSM running in the complex.

    See "DFHSM Support" on page 17.

5.5.1 Required PTFs for the Automatic Cartridge Loader

The changes in the System are explained in "Automatic Cartridge Loader Software Support" on page 9. The following system components must be changed:

- MVS/370 1.3.3 and 1.3.5
- MVS/XA 2.1.2 and 2.1.3

- DFP/370 1.1.1
- DFP/XA 1.1.2, 2.1.0, 2.2.0
- JES 3 1.3.4 and 2.1.5
- DFHSM 2.2.0 and 2.2.1

The major PTFs are described in "Appendix C. Major PTFs for the Automatic Cartridge Loader Support" on page 77.

Note: The PTFs described are subject to change and a service representative should be contacted for the latest information regarding the modified modules.

6.0 Automatic Cartridge Loader Usage Guidelines

This chapter provides usage and migration tips and hints for customers to make the best use of the IBM 3480 Automatic Cartridge Loader Feature. Specifically, this chapter describes use of automatic and system mode, automatic volume recognition considerations, and unattended operation.

For general information on installation and migration to the IBM 3480 Magnetic Tape Subsystem refer to the *IBM 3480 Magnetic Tape Subsystem Planning and Migration Guide, GC35-0098*. This publication has been updated to cover the changes related to the IBM 3480 Automatic Cartridge Loader Feature.

6.1 Automatic Mode Use

In automatic mode, the IBM 3480 Automatic Cartridge Loader Feature automatically mounts the next cartridge from the input stack as soon as the cartridge in the drive is unloaded.

In general, automatic mode is not recommended for prestacking scratch cartridges in the input stack. There are two reasons why this should not be done:

1. The software support for the Automatic Cartridge Loader demounts the first cartridge in the inactive state, which generally follows either an

   a. output stack full or an
   b. input stack empty condition.

2. Allocation has to demount a cartrigde for a specific request when all loaders are active or if there are no non-loader drives available.

The demounting does not occur for nonspecific mount requests if the Automatic Cartridge Loader is in the active state and system mode is used. Therefore *system mode should be used whenever scratch cartridges are loaded.*

Automatic mode may be used for special applications like

- Multi-volume input files
- Tape labeling

6.1.1 Multivolume Specific Requests

MVS/SP does not provide any support for using the Automatic Cartridge Loader for automatic volume mounting of multivolume specific requests. If the

loader is to be used for this type of request, the operator must know the exact order of the cartridges on which the data set resides.

As soon as the system issues the operator mount message for the first volume of the file, the operator should set the loader in automatic mode, put the first volume in the drive, and put the remaining volumes in the input stack (or as many as possible) in the order in which they will be requested.

If the operator makes a mistake in the input sequence, stack flushing occurs and stops when the correct cartridge is found.

Note: This flushing occurs if the installation has a sufficient protection mechanism preventing the overwriting of the old data. In the absence of such a mechanism, the old data is overwritten; see also "General Tape Protection Concerns" on page 33.

Whenever stack flushing occurs, time is lost, the output stack must be sorted, and follow-on cartridges must be reinserted. Therefore, automatic mode requires better operator attention than the other modes. For more details on what an operator should be aware of, refer to "Operating the Automatic Cartridge Loader" on page 63.

In JES2-managed environments, the first volume of the data set may be mounted in the drive to try to guide allocation of the data set to a loader drive (provided the loader drive is eligible for the request).

Note: Allocation always looks at eligible units to see if specifically-requested volumes are mounted, see also "Use of Automatic Volume Recognition (AVR)" on page 45.

The problem with doing this is that allocation may pick that unit for a scratch request, which will probably result in the flushing of the input stack. The loader should be put into automatic mode once the cartridges are in the input stack, or else no automatic mounting of the volumes will occur because these are specific requests. This loading of the input stack is wasted if the request gets allocated to a different drive.

A more reliable way of using Automatic Cartridge Loader drives for multivolume data sets is to do the following:

1. Put the SYSGEN-created esoteric name for IBM 3480 Automatic Cartridge Loader Feature on multivolume requests.

2. Wait for the Mount message for the first volume of the data set.

3. Mount the first volume in the drive and place the other volumes - in the correct order - in the input stack.

4. Put the IBM 3480 Automatic Cartridge Loader Feature into automatic mode once the cartridges have been put in the input stack.

Automatic mode is not recommended for cross-step multivolume mounting, because there is no method, short of specific unit requests, to ensure that the same unit will be allocated to requests in different steps.

6.2 System Mode Use

System mode should be the default mode when the IBM 3480 Automatic Cartridge Loader Feature is used in an MVS environment. The Automatic Cartridge Loader should be operated in system mode when the volumes being premounted in the input stack are scratch volumes to be used by nonspecific, private requests, that is, nonspecific volume requests for permanent data sets.

The Automatic Cartridge Loader may also be effectively used for single-volume requests for specific volumes, provided the loader is in system mode.

6.2.1 Single-Volume Specific Requests

When a single-volume specific request is allocated to an active loader drive in system mode with the input stack full of scratch cartridges, no automatic mounting occurs, and the following events take place:

1. A mount message is issued for the specific volume.

2. The system waits for the specific volume to be mounted.

3. When the volume is demounted, it is put in the output stack, and automatic mounting resumes if the next request allocated to the drive is a nonspecific volume request.

If a non-loader drive exists (which would have been better used for a specific request), such use may waste the Automatic Cartridge Loader. This is especially the case if it causes a nonspecific request to be allocated to a non-loader drive. This same scenario occurs if a multivolume specific request is allocated to a loader drive full of premounted scratch cartridges.

6.3 Use of Automatic Volume Recognition (AVR)

Automatic volume recognition (AVR) is standard in MVS and does not need to be changed to fit the Automatic Cartridge Loader environment. However, because MVS allocation was modified for the loader's interactions between AVR and generic allocation,[5] AVR should be reviewed.

The following considerations apply **only to JES2 environments**, because AVR is not supported in JES3 which has its own way of prefetching and premounting.

6.3.1 MVS AVR and Allocation Review

AVR-related processing takes place at two points in time:

1. When a tape device is made ready and
2. When a tape is allocated.

---

[5] Generic allocation is the phase of allocation in charge of allocating units to removable volumes. It takes place after common allocation and before allocation recovery processing.

MVS is presented with an unsolicited device end interrupt whenever an operator or *the Automatic Cartridge Loader in automatic mode* mounts a tape on an *online unallocated* tape device.

The AVR takes place in three steps:

1. The signalling of the unsolicited device end interrupt occurs when the tape reaches the load position and the ready button is on.

   The fact that the unit is free implies that no mount request was issued by the system.

2. The UCB is marked ready.

   Note: The volume serial has not been read yet and does not appear in the response to DISPLAY UNIT or DEVSERV.

3. The volume serial is read and moved into the UCB.

   This is when the actual AVR processing takes place. It happens during the next pass through generic allocation involving this device (or a generic group it is part of). The volume is then considered mounted but is yet unallocated and has no use attribute. From this instant on, the **volume serial** appears on the 3480 message display panel (without blinking) and also in the responses to DISPLAY UNIT and DEVSERV commands.

   A simple operator procedure to check if AVR processing took place is to:

   a. Issue the MVS DISPLAY UNITS or DEVSERV command.

   b. Check that there are no tape allocations in progress.

   c. Start an IEFBR14 task requiring a scratch mount on the 3480 generic.

   As a result of the IEFBR14 job, the premounted tape is recognized and selected by the subsequent job.

Note: AVR reads the volume serials of all eligible free[6] online and ready devices ahead of other generic allocation processing. This guarantees that MVS knows about the presence of the volume before other allocations are attempted on the device on which the volume resides.

When a specific request for a tape volume comes in and the AVR-selected device is still unallocated, the following occurs:

• If the requested volume is mounted on a device in the eligible list, this device is allocated (specific allocation to mounted volumes), **regardless of the active state** and **without any mount message being issued.**

• If the requested volume is not found in the eligible list, allocation proceeds to the " allocation by algorithm" section. The UCB candidate lists are built and eventually SRM invoked until either a unit is found or allocation recovery takes place.

---

[6] In this context, "free" means unallocated, not in use by a system function, and not containing a volume serial number.

The net effect is that through AVR, the operator can use available tape preparation information to mount volumes ahead of the jobs requiring them. The system will, if possible, use them but their use cannot be guaranteed if other tape requests interfere.

6.3.2 AVR in the Presence of Automatic Cartridge Loaders.

Premounting can only occur at two points in time:

Note: Do not confuse premounting through AVR with preloading tapes in the loader; only the first tape in the input stack can be loaded and handled by AVR.

1. After unallocation if the system unloads a tape on a drive in *automatic mode*.

   (EOV or CLOSE do not imply unallocation, because the unit may be needed for the same step or passed through to later ones.) In this case, the state of the Automatic Cartridge Loader is active if more cartridges are in the loader.

2. After the operator intentionally loads a cartridge on a free drive in *any mode*.

   In this case the state will probably (but not always) be inactive.

Since MVS allocation decisions depend on both the ready and the active status of the drives, the chances of interference from other allocations will be different. The following rules apply:

1. MVS allocation tries to eliminate **inactive** Automatic Cartridge Loaders from the candidates for **nonspecific** requests.

2. MVS allocation tries to eliminate **active** Automatic Cartridge Loaders from the candidates for **specific** requests.

3. SRM tries to eliminate the **ready** Automatic Cartridge Loaders from the candidate list passed to is by allocation for **both** type of requests.

4. The nonspecific private tape allocations are done before the specific requests for volumes (that are not yet mounted).

Therefore, the SRM function supporting AVR is dominated by the preliminary MVS decisions based on the active status of the drives to support the Automatic Cartridge Loader. If feasible, SRM is provided only with either active or inactive devices, not both.

This means that if premounting is done on active drives, the interference occurs with scratch allocations. Before the device gets ready, the drive is a prime candidate for scratch allocation. After it is ready, it is still preferred to other inactive loaders, but is allocated after the not ready ones. This makes sense, because active loaders in system mode handle new nonspecific requests until they are all allocated.

On the other hand, premounting on inactive drives may be disturbed by specific allocations avoiding the active ones.

6.3.3 Recommendations for the Use of AVR

The general recommendations for AVR usage in an Automatic Cartridge Loader environment are:

1. Ensure the target devices are online before premounting.

2. If possible, premount while there is no chance for new tape requests.

   For example, hold tape job classes, hold DFHSM recall or backup, and the like.

   If interplay with other tape allocations is not avoidable before the job needing AVR starts, the following procedure offers the best results:

   a. VARY online the maximum 3480 tape configuration.
   b. Set unallocated drives not ready.
   c. Set the Automatic Cartridge Loaders to the same activity state as the AVR target drives.[7]

3. For multivolume input in automatic mode, stack only the number of volumes needed by a data set or job.

   Follow-on cartridges cannot be guaranteed to reach the ready status and AVR processing before the drive being reallocated to service nonspecific requests as equivalent to drives in system mode.

4. In system mode, premount only a specific cartridge followed by scratch ones.

   Specific requests for follow-on volumes require manual intervention and nonspecific requests have priority.

   If, as is expected, the number of nonspecific requests normally outweighs other ones and nonspecific requests are the only good candidates for avoiding operator intervention, the recommendations can be kept more simple. Under these assumptions:

   • Use AVR in priority on the standard 3480s because they are always inactive.

     If the configuration recommendations are followed, the standard 3480s should be the nearest devices to the operator. Finally, they compete only for specific requests.

   • Increase chances of AVR by setting the drive inactive; see "How to Set the Automatic Cartridge Loader State" on page 66.

     This should be done if an Automatic Cartridge Loader is needed and the first volume request is specific, followed by nonspecific requests. Then again it will compete with other specific requests if JCL does not reserve the drive for subsequent tapes. For DFHSM and DFDSS, one task will keep the drive allocated.

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[7] For setting drives active or inactive, refer to "Active and Inactive States" on page 65.

The system may still require the operator to demount the tape just mounted if more requests than predicted or other types of requests intervened.

6.4 Unattended Operation

The IBM 3480 Automatic Cartridge Loader Feature can fulfill the customer requirement for having tape operations more automated. There are two possible limitations for unattended operation:

1. There is no dynamic reallocation at EOV.

   With the design of MVS/SP and DFP, allocation will stay on the first selected device. If a tape is the last tape in the input stack and another tape is requested in the same job step, a mount message is issued for the same loader device.

2. The maximum number of cartridges is six.

   In unattended mode, only six cartridges can be premounted (including the first specific mount request).

These limitations, besides the need of having only nonspecific mount requests in one job step (or, as in the case of DFHSM, a task), may prohibit unattended operation. The optimum would be that each step needs no more than one tape because allocation occurs for the next step. On the other hand, the maximum number of tapes per step is six.

The installation has to check if their applications can run unattended. See "Running DFHSM Unattended" on page 54 and "Running DFDSS Unattended" on page 58, which describe such applications.

7.0 IBM Program Products Recommendations

This chapter gives some basic guidelines as to how the IBM Data Facilty Products DFHSM and DFDSS and the Data Systems Utilities can be used with the Automatic Cartridge Loader.

7.1 Recommended DFHSM Parameters

When using the Automatic Cartridge Loader with DFHSM, the device should be set to the system mode of operation. In addition, when there are 3480 tape units that do not have an Automatic Cartridge Loader feature and the system programmer wants DFHSM to use only 3480 tape units that have the Automatic Cartridge Loader, he or she should define an esoteric device group consisting of 3480 tape units that have an Automatic Cartridge Loader. Assuming the system programmer defined such an esoteric device group, he or she should update the ARCCMDxx member of the PARMLIB data set.

7.1.1 Recommended SETSYS Parameters

This section discusses the recommended setting of various DFHSM parameters. These recommended settings help to ensure effective use of the Automatic Cartridge Loader.

USERUNITTABLE(esoteric)

The USERUNITTABLE parameter must be updated to permit an esoteric name to be used as an eligible DFHSM device.

SELECTVOLUME(SCRATCH)

The SELECTVOLUME option of the SETSYS command should be set to SCRATCH. This causes DFHSM to issue nonspecific volume (PRIVAT) mount requests when an end-of-volume condition is encountered while writing to a tape level 2 migration volume or tape backup volume. The mount PRIVAT causes the Automatic Cartridge Loader to mount the next cartridge automatically.

If the SELECTVOLUME option of the SETSYS command is set to SPECIFIC, the tape mount requests that occur when an end-of-volume condition is encountered while writing to a tape migration or backup volume, are for specific volumes, and the operator has to manually mount the specific tape volumes requested.

UNITNAME (esoteric)

The UNITNAME parameter of the SETSYS command specifies the type of unit to be allocated when DFHSM is initially allocating a scratch tape for use as a daily or spill backup volume when no known volumes are available. To tell DFHSM to use 3480 tape volumes as daily or spill volumes, the UNITNAME parameter of the SETSYS command should specify a generic device type of 3480 or an esoteric device group that consists of 3480 units that all have the Automatic Cartridge Loader.

If SETSYS UNITNAME(3480) is specified, DFHSM uses a unit name of 3480 whenever it initially allocates a scratch tape volume for use as a daily or spill volume. MVS device allocation prefers 3480 units with an active Automatic Cartridge Loader that contains a volume in the input stack when a nonspecific volume allocation is made.

However, specifying SETSYS UNITNAME(3480) does not guarantee that DFHSM will allocate a 3480 unit with a Automatic Cartridge Loader. If SETSYS UNITNAME(esoteric) is specified and the esoteric device group that is specified consists of only 3480 units with the Automatic Cartridge Loader, DFHSM receives a 3480 unit that has a Automatic Cartridge Loader whenever it initially allocates a scratch tape for use as a daily or spill backup volume.

MIGUNITNAME (esoteric)

The MIGUNITNAME parameter of the SETSYS command specifies the type of unit to be allocated when DFHSM is initially allocating a scratch tape for use as a level 2 migration volume when no known volumes are available. To tell DFHSM to use 3480 tape volumes as level 2 migration volumes, the MIGUNITNAME parameter of the SETSYS command should specify a generic device type of 3480 or an esoteric device group that consists of 3480 units that all have the Automatic Cartridge Loader.

BACKUP (TAPE (esoteric))

To tell DFHSM to limit backup processing to 3480 tape daily backup volumes allocated on 3480 tape units with the Automatic Cartridge Loader, issue a SETSYS BACKUP(TAPE(esoteric)) command. The esoteric unit name specified should map to 3480 units that have the Automatic Cartridge Loader.

SPILL (TAPE (esoteric))

To tell DFHSM to limit spill processing to 3480 tape spill backup volumes allocated on 3480 tape units with the Automatic Cartridge Loader, issue a SETSYS SPILL(TAPE(esoteric)) command. The esoteric unit name specified should map to 3480 units that have the Automatic Cartridge Loader.

TAPEMIGRATION(DIRECT(TAPE(esoteric)) or

ML2TAPE(TAPE(esoteric))

To tell DFHSM to limit tape migration processing to 3480 level 2 migration volumes allocated on 3480 tape units with the Automatic Cartridge Loader, issue a SETSYS TAPEMIGRATION(DIRECT(TAPE(esoteric))) or a SETSYS TAPEMIGRATION(ML2TAPE(TAPE(esoteric))) command.

The esoteric unit name specified should map to 3480 units that have the Automatic Cartridge Loader.

RECYCLEOUTPUT(MIGRATION (esoteric))

To tell DFHSM to limit the selection of an output volume, during the recycle of a tape level 2 migration volume, to 3480 level 2 migration volumes allocated on 3480 tape units with the Automatic Cartridge Loader, issue a SETSYS RECYCLEOUTPUT(MIGRATION (esoteric))) command. The esoteric unit name specified should map to 3480 units that have the Automatic Cartridge Loader.

RECYCLEOUTPUT(BACKUP (esoteric))

To tell DFHSM to limit the selection of an output volume, during the recycle of a tape backup volume, to 3480 spill backup volumes allocated on 3480 tape units with the Automatic Cartridge Loader, issue a SETSYS RECYCLEOUTPUT(BACKUP (esoteric)) command. The esoteric unit name specified should map to 3480 units that have the Automatic Cartridge Loader.

The following parameter is not recommended:

TAPEDELETION SCRATCHTAPE

A TAPEDELETION option of SCRATCHTAPE indicates that when a DFHSM tape backup or migration volume no longer contains valid data all information about the volume is to be removed from the DFHSM control data sets and the volume is to be returned to the general scratch pool, making it available for use by other applications.

The use of the TAPEDELETION option of SCRATCHTAPE does not necessarily correspond with the SELECTVOLUME option of SCRATCH (which is recommended). An empty backup tape volume is accepted by DFHSM as well as a scratch. See also the description under the QUERY BACKUP example in "Predicting Tape Volume Candidates" on page 54 .

The TAPEDELETION option of SCRATCHTAPE may be used in an environment where a single scratch pool is used when the tape volumes used by DFHSM are treated identically to the other tape volumes in the installation (for example, reside in the same library, are intermixed with the other tape volumes in the library, and do not have special volume serial numbers indicating they are DFHSM tape volumes).

7.1.2 Predefined DFHSM Tapes

A TAPEDELETION option of HSMTAPE indicates that when a DFHSM tape backup or migration volume no longer contains valid data the volume is to remain under DFHSM control and be reused. The TAPEDELETION option of HSMTAPE and the SELECTVOLUME option of SPECIFIC are intended to be used together when the tape volumes used by DFHSM are treated differently than the other tape volumes in the installation (for example, there is a separate pool of tape volumes for DFHSM that all reside together on separate tape racks or all have similar volume serial numbers identifying them as DFHSM tape volumes).

The installation can choose a TAPEDELETION option of HSMTAPE and a SELECTVOLUME option of SCRATCH. In this case, tape volumes that no longer contain any valid data remain under DFHSM control but the mount requests that occur when an end-of-volume condition is detected during output are nonspecific volume (PRIVAT) mount requests. If a 3480 with a Automatic Cartridge Loader is being used and there is a volume in the input stack, the Automatic Cartridge Loader loads the next volume. The operator may place in the loader input stack a volume that:

- Is already known to DFHSM

  (has been previously added to DFHSM using the ADDVOL command or internally added in response to a mount scratch), and

- Does not contain any valid data

  (as far as DFHSM is concerned the tape volume is empty), and

- Is appropriate to the type of processing that is in process

  (migration or backup tape category).

7.1.3 How to Determine Empty Tapes

If backup or spill processing is using the 3480 tape unit with the Automatic Cartridge Loader, only empty tape backup volumes should be placed in the input stack. If migration processing is using the 3480 tape unit with the Automatic Cartridge Loader, only empty tape level 2 migration volumes should be placed in the input stack.

The system programmer or tape operator can determine the empty tape backup volumes that DFHSM knows about by issuing the command:

    LIST BVOL SELECT(EMPTY)

The system programmer or tape operator can determine the empty tape level 2 migration volumes that DFHSM knows about by issuing the command:

    LIST MIGRATIONLEVEL2(TAPE) SELECT(EMPTY)

7.1.4 Running DFHSM Unattended

Under certain conditions, DFHSM can run unattended. The first mount request for a backup or migration volume will be specific, unless all available tape volumes are flagged as FULL or INUSE.

When the SETSYS parameter SELECTVOLUME(SCRATCH) is set, at EOV of the first cartridge (which was a specific mount), DFHSM requests a scratch cartridge which can be preloaded in the input stack.

7.1.4.1 Predicting Tape Volume Candidates

The initial specific mount request can be predicted for both backup and ML2 migration.

Backup volume candidates

For backup, issue the following:

QUERY BACKUP(DAILY(day))

ARC0164I is issued to show the available and full backup volumes.

```
ARC0164I DAY = 1   VOL001-A VOL002-A VOL003-F VOL004-F etc.
ARC0164I DAY = 1   VOL004-F etc.VOL022-E VOL023-E etc
```

where:

A   indicates that the volume is available.
F   indicates that the volume is full.
E   indicates that the volume is empty.

Those volumes with the A or E flag are selected in the same sequence that they appear in message ARC0164I.

Note: After the initial selection, an available volume (flag A) is rejected by DFHSM if the volume is premounted in the input stack.

Scratch cartridges, unknown to DFHSM, can be placed in the input stack. Scratch cartridges and empty volumes (flag E) are accepted when they are in the input stack.

Migration Level 2 volume candidates

ML1 to ML2 migration is not always done during daily space management, only when some ML1 volume is above its threshold. Hence there is a different level of predictability for migration and its use is less likely in an unattended environment. One loader can be dedicated by premounting a ML2 cartridge. Another method would be to force ML2 migration by flagging ML1 volumes as full(F).

For ML2 migration, issue the following:

QUERY ML2

ARC0227I is issued to show the tape target volumes.

```
ARC0227I ML2 TAPE TARGET VOLS:   DSMIG VOLM01   VOLMIG VOLM03
ARC0227I CONT:                   RECYCLE VOLM04
```

where:

DSMIG   indicates that the volume is available for data set migration.
VOLMIG   indicates that the volume is available for volume migration.
RECYCLE   indicates that the volume is available for RECYCLE of
              migrated data sets.

In the example above, VOLM03 would be selected for volume migration.

Note: The mount request for a ML2 migration can be predicted only if VOLMIG contains a volume (which is the case if ML2 migration was used before). The mount request cannot be predicted if VOLMIG contains
*****

Other limitations to this approach apply. These are different for backup and ML2 migration.

Backup

For backup, multiply the limitation of six by the number of loaders where as many backup tasks could be allowed as necessary. This is again limited to 15 (SETSYS MAXBACKUPTASKS(1-15)). Our experience shows that this is more a theoretical limit; the actual tape volume usage is below the maximum number of tapes.

The tape usage by the started backup tasks is not balanced depending on the updated data sets on a volume. One loader could run empty while from another only one cartridge is used. Either consider providing a buffer over and above the average tape usage per task, or take the risk of a backup task terminating abnormally.

ML2 Migration

Migration is a single task, so the limitation of six cartridges on one loader applies. The installation has to choose a way to stay below this limit.

Note: The ML1 to ML2 migration runs before the primary to ML1 migration. If the ML1 to ML2 task fails after six processed cartridges because no tape gets mounted, the primary to ML1 migration will not start unless a WTO or WTOR exit is not specified to "auto-answer" these questions.

There may be a series of messages:

```
ARC0366A    REPLY Y ONLY WHEN ALL nn TAPE VOLUME(S)
            IS/ARE COLLECTED, N IF ANY NOT AVAILABLE
ARC0310A    CAN TAPE VOLUME BE FOUND AND MOUNTED? REPLY Y OR NO
```

7.1.4.2   Initial Volume Selection and AVR

Messages ARC0164I and ARC0227I indicate which volumes will be selected first. These volumes could be premounted. AVR recognizes them at migration or backup start time. See the process and restrictions for AVR in "Recommendations for the Use of AVR" on page 48.

There is no problem when ARC0164I shows more than 15 volumes (or the MAXBACKUPTASKS limitation) selected by the installation. The first 15 volumes are used and subsequent mount requests are for scratch volumes.

7.2   DFDSS Considerations

DFDSS can use the ability of the Automatic Cartridge Loader to automatically mount tapes. Certain procedures which use specific tape volumes may have to be changed in order to use the loader.

DFDSS is a prime candidate for scratch tape usage only in the **dumping** area. For either

- Physical dumps on a volume base, or
- Logical dumps on a catalog/application base

the output produced normally requires scratch tapes. This may not be the case if the installation uses either

- Closed generation data groups (requiring always the same volume as the oldest generation by using a VOL = REF backward reference), or
- A manually controlled set of specific volumes per backup version.

In this case a meaningful use of the Automatic Cartridge Loader for DFDSS should be preceded by a conversion of the backup procedures to more reliable and automatic procedures. Therefore:

- All tape data sets should be cataloged.
- A data set recovery procedure, based on the catalog, should be in place.
- A tape management procedure should exist to pull out scratch tapes for DFDSS use.

Special attention should also be given, not only to protect DFDSS tapes from inadvertent overwriting, but also to limit the access to those tapes in a consistent manner; see "General Tape Protection Concerns" on page 33.

7.2.1 Using the Automatic Cartridge Loader

If DFDSS is used for performing VOLUME rather than incremental backup for which it lacks the control capabilities of DFHSM, there is a high probability that the majority of dump tapes will be multivolume files.

These files may become candidates for restore in automatic mode on an Automatic Cartridge Loader. Here the use of the Automatic Cartridge Loader is not subject to any other management constraints or procedural conversions, because all customers will use specific requests for restores.

Since the restore activity is not frequent and cannot be planned, the advantage gained through the use of the automatic mode for DFDSS restores will not justify the use of Automatic Cartridge Loaders by itself, but in conjunction with other application needs in the same area.

As explained elsewhere, the advantages of using Automatic Cartridge Loaders lie in the:

- Relief of the operator scratch-mounting burden.
- Improved job flow potential.
- Limited potential for unattended operation.

In the DFDSS environment, such advantages can be used to reduce the duration of the backup window and eventually perform part of it unattended. See "Running DFDSS Unattended" on page 58.

7.2.2 Converting to Automatic Cartridge Loader Usage

Unlike DFHSM, DFDSS is totally JCL controlled and does not use dynamic allocation for its dump output devices. The product needs no modification to make use of the Automatic Cartridge Loader. Therefore, implementation of the Automatic Cartridge Loader is reduced to converting the DFDSS backup procedures to:

1. Use the esoteric name for loaders in order to guarantee their usage.

This is simpler and more efficient than priming the state to ensure allocation preference in JES2, and would work also in JES3 environments.

2. Eventually reorganize the sequence of job steps and DUMP statements.

   This is to match the loader maximal capacity of six cartridges and avoid operator intervention.

3. Adapt the operator handbook to the new procedures.

The restore procedures may have to be changed to:

1. Allow the operator to premount the tapes needed to restore a given volume or application.

   A meaningful way would be to exploit the catalog and naming conventions via an ISPF dialog to list the tapes required.

2. Instruct the operator how to mount the tapes needed in automatic mode via AVR in order to direct the allocation to a loader.

   The use of an esoteric name for this purpose is not meaningful because it would inhibit restoring from available 3480s if all the loaders happen to be allocated when the restore is needed.

7.2.3 Running DFDSS Unattended

The DFDSS tape-related functions are dump and restore. Although multivolume restore is a loader candidate, it needs operator presence. Only backup can be run unattended.

Besides the number of tapes that have to be processed during daily backup, two other major limitations apply:

1. *No unrecoverable errors should occur.*

   Try to intercept error conditions through DFDSS conditional execution facilities and JCL to trigger a recovery step; however, this cannot ensure that a special alternate drive will be selected. For example, specify two loader output devices through JCL and be sure that the input stacks on both devices are full. This is necessary because during allocation every loader device is treated as equal **with no regard to the number of tapes still in the input stack.**

2. *No EOV should occur with the input stack empty.*

   Under this condition, a mount request is issued on the same device and the task may end abnormally if no operator is present to satisfy the request.

   This can only be avoided by limiting the number of tasks using the same drive in order that the total of six cartridges is not exceeded. It can only be achieved by specifically **grouping**[8] dump tasks (through the DDNAME parameter) or dump steps (through the UNIT = AFF JCL parameter) to use the same drive. Additionally, ensure that two such groups never interfere

---

[8] Grouping dump tasks involves putting several dump tasks together and starting them at the same time.

on a drive. In particular, no backup group should be allowed to start after the first job of a preceding group terminates, since then there will be no way to direct it to a different drive if not all cartridges in the input stack have been processed. For allocation, this loader is still active and preferred to any other inactive loader even though its input stack may be full.

This means that DFDSS **unattended backup** needs more careful planning than DFHSM. In particular, two things are important:

1. Know the maximum number of tapes required for each dump task.

   This is relatively simple for full volume backups of current DASD, so two volumes could be grouped on a loader for 3380s. Dumps other than full volume dumps require different approaches and may vary for each installation and application.

2. Start all backups scheduled for the unattended shift in parallel.

   This prevents a new group from allocating the remainder of another, as described in item 2 under "Running DFDSS Unattended" on page 58. This also relates the number of DASD capacity which can be backed up to the number of loaders available for backup. For example, with eight loaders installed and used for backup, a maximum of sixteen full 3380 dumps could be run unattended.

This is in contrast with incremental backup and compaction of DFHSM which could dump more volumes per output tape and will give DFHSM more unattended potential.

7.3 Data Base Utilities

The Data Base Utilities can use the ability of the Automatic Cartridge Loader to automatically mount tapes. If certain IMS, DB2, or CICS implementations use specific tape volumes, then they may have to be changed in order to use the loader.

The main candidates for using the Automatic Cartridge Loader are:

- IMS Log Archiving Function
- DB2 Log Archiving
- Batch DL/I Logging (IMS and CICS)
- IMS Image Copy and Change Accumulation
- DB2 Data Base REORG Utility
- IMS Data Base Reorg (Unload/Reload)
- DB2 Backup and Recovery Utilities
- IMS DC Monitor Output
- IMS Log Tape Recovery
- IMS Statistical Utilities
- DB2 Trace Output

These candidates are described in the following text.

IMS Log Archiving Function

The archiving function is invoked by IMS online operations when the user-defined number of OLDS becomes full. It can also be invoked by command or batch job. The archiving function normally uses scratch tapes for output. The amount of data depends on the size of the OLDS to be archived and is controlled by DBRC.

JCL for the archiving job can be produced through the DBRC GENJCL facility. An esoteric name, for example, UNIT = STACK, can be provided through skeleton JCL.

DB2 Log Archiving

When a DB2 activity log on a disk becomes full, DB2 offloads this log and the bootstrap data set. At DB2 install tailoring time, TAPE can be specified as the archive log medium. The amount of data depends upon the size of the active log, but frequently DB2 sites choose sizes that tend to fill a tape volume.

There is no JCL associated with the archive process. DB2 dynamically allocates the data sets for the output to the unit type specified as the device type on DB2 install panel DSNTIPA.

Batch DL/I Logging

The recommendation of using the tape write immediate mode takes away most of the performance of the 3480. The benefit of using an Automatic Cartridge Loader for logging lies in its limited ability to run unattended. See the description in "Unattended Operation" on page 49.

DBRC keeps track of the logs and output tape volume serials which are allocated through standard JCL, and can be used to address the loader. Any CICS DL/I journal is handled in the same way as a batch log data set.

IMS Image Copy and Change Accumulation

The two recovery and log utilities are more tightly controlled by DBRC, which can be told (by use of parameters) to reuse tapes after having kept a given number of versions. The use of the REUSE optional parameter results in specific requests for tapes. If NOREUSE is used, nonspecific mounts are issued for output, which favors Automatic Cartridge Loader usage and allows for multifile tapes. See the description of the REUSE and NOREUSE parameters in *IMS/VS V2 DBRC Guide and Reference, SC26-4209-0*, in the chapter "INIT.DBDS: Initiating DBRC Control and Recovery of a Data Base Date Set".

DBRC keeps track of the volume serials for use in the data base recovery function, which are generated through the GENJCL.RECOV function. The function selects the right data set for recovery, including the volume. The list of tapes required to perform a data base recovery can be obtained by issuing the GENJCL.RECOV command with the LIST option. See the description of the LIST.HISTORY command in *IMS/VS V2 DBRC Guide and Reference, SC26-4209-0*. Again, skeleton JCL can be tailored to use the Automatic Cartridge Loader.

DB2 Data Base REORG Utility

The REORG utility unloads DB2 table spaces to a temporary data set, frequently tape. It then reloads the table spaces reclaiming free space and rearranging rows of data. The temporary data is kept only until the success of the REORG utility is checked.

IMS Data Base Reorg (Unload/Reload)

These utilities are under sole control of JCL. DBRC just ensures that the data bases used are enqueued properly to avoid conflicts. However, use of these utilities should be rather infrequent so the advantages of using the loader may be less visible. Premounting is only useful for large data bases.

DB2 Backup and Recovery Utilities

The COPY utility creates a backup of DB2 table spaces. This is frequently created on tapes, especially for large spaces. Two kinds of copies are possible:

1. Full image copies, which are the same size as the table space, and

2. Incremental image copies, whose sizes depend on the rate of changes and the frequency of copies.

The RECOVER utility reads the image copies to recover table spaces if needed. The JCL for this utility is normally created by the DB2I utility panel and DSNU CLIST. As a part of this process, the user edits the created JCL and can specify the esoteric name for the Automatic Cartridge Loader.

IMS DC Monitor Output

The monitor uses dynamic allocation and can be told to use the Automatic Cartridge Loader through the MDA parameter. Use of the Automatic Cartridge Loader would prevent data loss for long runs needing many tape cartridges.

IMS Log Tape Recovery

If an I/O error occurs on an archived log tape, the log could be recovered through this utility, which may then need multiple tape input and output volumes. The usage may be infrequent and therefore requires no specific Automatic Cartridge Loader usage recommendations.

IMS Statistical Utilities

These utilities are occasionally heavy tape input consumers and would be subject to standard tape preparation procedures.

DB2 Trace Output

At times, DB2 administrators may use the DB2 Performance and Serviceability traces. Because of the volume of data, the output usually is

sent via GTF to tape. The Automatic Cartridge Loader can be used for this.

In conclusion, the use of the Automatic Cartridge Loader is very dependent on the customer IMS management procedures, the size of its data bases, and data base activity. Besides the REUSE facility avoidance in DBRC, most specific recommendations for the Automatic Cartridge Loader are based on JCL tailoring.

8.0 Operating the Automatic Cartridge Loader

In an environment where the operator is used to working with the 3480, some education should be planned. The new hardware and its different functions must be introduced to acquaint the operator with the new attachment.

The information in this chapter gives some basic guidelines concerning the use of the Automatic Cartridge Loader. It can be used by the operator or as a base for updating an operator handbook. In particular, the following subjects are described:

- Operating differences
- Cartridge handling
- Experiences during testing

For more details on operating the 3480, read the instructions in *IBM 3480 Magnetic Tape Subsystem Operator's Guide, GA32-0066.*

8.1 The Operation Modes

The operator's panel for the Automatic Cartridge Loader can be used to initiate and survey the operating modes of the loader.

Note: Do not confuse the operator's panel for the Automatic Cartridge Loader with the operator's panel for the 3480 drive.

For MVS systems, the default operation mode is system mode. The two other modes (automatic and manual) must only be used by explicit demands.

The operator has to know when a mode other than system mode should be used in MVS systems. According to the applications to be processed, the operator should have been told:

- **Which mode is to be used.**
- **Why this mode has to be used.**

The three modes are discussed in "Hardware Operation Modes" on page 4, "Automatic Mode Use" on page 43, and in "System Mode Use" on page 45.

8.1.1 Setting the Mode Selection Switch

The mode selection switch can be used to select one of the three operating modes:

- Automatic mode
- System mode
- Manual mode

The operator can change modes at any time, but should do so with care. If a read/write function is in progress at the time of the mode change, it completes before the Automatic Cartridge Loader switches to the **new** mode.

- At UNLOAD, the new mode is in effect.

  If a cartridge unloads to the *feed position* after the operator changed the mode, the Automatic Cartridge Loader recognizes that the cartridge has been **processed** and do the action according to the new mode. See "Unloading Cartridges in the Three Modes" on page 6.

- A processed cartridge has to be removed before a new mount can occur.

  When a specific mount is pending, if the operator removes the processed cartridge from the feed position and reinserts it, or replaces it with another one, the Automatic Cartridge Loader recognizes it as a **new** cartridge.

8.1.2 The START Button

After using the mode selection switch to select the operating mode, the operator **must press** the START button to initialize the mode and start the load operation. The START button has several other functions; it is used:

1. To load a cartridge in the different modes.

    See "Loading Cartridges in the Three Modes" on page 6.

2. To restart activity

    after a required action (for example, empty the output stack) has been performed.

3. To allow recovery.

If the START button is pressed when start activity is not required, the start request is ignored.

8.1.3 Determining the Current Mode

The only way the operator knows which mode is currently active is by the position of the **mode selection switch** on the Automatic Cartridge Loader operator panel.

The mode depends on the physical switch position.

Note: The Automatic Cartridge Loader changes the mode to manual when operator intervention is required, for example, if the output stack is full. This is a logical change (the switch remains in its initial position). The operator must press the START button to reinitialize the previous mode after the intervention.

8.1.4 Operator Hints for the Operation Modes

The operator should know the following basic rules:

1. In **automatic mode** the operator must press the START button to start the loading operation in two situations:

    a. Whenever the mode is changed from system or manual to automatic.

    b. After an intervention is required.

2. In **system mode**, the operator should not place a cartridge in the feed position. The feed position should remain empty for the following reasons:

    a. To permit a mount request for a specific volume.

    As a result of a specific request, the cartridge must be removed from the feed position. In system mode, the operator should insert the tape in the feed position and press the START button for a **specific** mount request.

    b. To avoid a cartridge being loaded uselessly in the drive.

    When the operator presses the START button to initialize system mode and a cartridge is in the feed position, the cartridge is loaded in the read/write station. See also "Loading Cartridges in the Three Modes" on page 6.

    For a **nonspecific** mount request, the operator can insert the cartridge(s) anywhere in the input stack and then press the START button. The index mechanism moves the cartridge to the feed position.

3. In **manual mode**, if the operator wants to reuse the same cartridge, which remains in the feed position after unloading, he or she must **remove** and **reinsert** the cartridge.

8.2   The States of the Automatic Cartridge Loader

This section describes when the loader is active or inactive, as well as how the operator can determine and set the state of the loader.

8.2.1 Active and Inactive States

The operating system knows if there are more cartridges in the input stack after a REWIND/UNLOAD command is issued. The rewind/unload is issued either from the **end of job** processing or from the **UNLOAD command**.

The UNLOAD command enables the operator:

1. To make the loader **active** when the input stack is **not empty**.

2. To make the loader **inactive** when the input stack is **empty**.

Note: The use of the **manual UNLOAD switch** or a **VARY ONLINE command** for a drive with Automatic Cartridge Loader does not make the loader **active**.

For more details about the active state, refer to "Hardware Functional States" on page 7.

8.2.2 How to Set the Automatic Cartridge Loader State

For some JES2 installations it might of interest to either "lead" the allocation to active loaders or "prevent" a loader from being eligible for allocation by making the loader inactive. The following **SETSTATE** procedure can be used to change the state of a loader:

1. Load a cartridge manually in an offline device.

2. VARY the device online.

3. UNLOAD the cartridge

    a. To set the loader **active** after loading the input stack.
    b. To set the loader **inactive** after emptying the input stack.

If these simple rules are followed, the operator can determine the state of the loader just by looking at the input stack:

Cartridge in the input stack: *active loader*
No cartridge in the input stack: *inactive loader*

The following rules must be followed to maintain the procedure described above.

1. Never remove cartridges from the input stack without performing the **SETSTATE** procedure.

2. Never use **manual mode.**

    The active state is only important for allocation preference in system and automatic mode.

3. Generate all tape drives offline.

    Set them online through command files and perform the **SETSTATE** procedure after the procedure.

4. After each IPL, perform the the **SETSTATE** procedure on all loaders not assigned to other systems.

If these procedures are strictly followed, any loader which contains a **cartridge in the input stack is always ACTIVE.**

8.3 *Handling the Cartridges*

After the operation mode has been selected, cartridges can be preloaded into the input stack. This section gives hints for inserting cartridges in (input tapes) and removing cartridges from (output tapes) the Automatic Cartridge Loader.

8.3.1 Input Tapes

The cartridges are loaded on the drive sequentially. Cartridges should not be placed in the feed position except for specific volume requests (see "Operator Hints for the Operation Modes" on page 65.).

To insert the cartridges in the input stack, the operator should choose a time when the indexing mechanism is not moving. Otherwise an error may occur, a check code is displayed on the 3480 operator panel, and operator intervention is required. Refer to "Check Code Table" in the *IBM 3480 Magnetic Tape Subsystem Operator's Guide, GA32-0066.*

Based on practical experience, the operator should remember to:

*   Not use damaged cartridges.

*   Place cartridges in adjacent slots in the input stack for more efficient operation.

*   Not put the cartridges in wrong side up or back to front.

*   Not place a cartridge in the feed position when another cartridge is already in the read/write station. This error is not detected until the drive attempts to unload the cartridge.

*   Be sure that the cartridges have been **file protected**.

    In one experience during the tests, a backup job started instead of a restore job . The cartridge in the Automatic Cartridge Loader was **unprotected** (that is, no file protection was provided either with an expiration date or with the file protect selector ON). The file was destroyed.

    The files should be protected because otherwise all the tapes in the input stack could be processed in one stream and all the files destroyed by mistake. This case demonstrates the need of good tape management.

8.3.2 Output Tapes

The operator should remove processed tapes from the output stack to prevent an *output stack full* condition. This condition sets the loader in a "logical" manual mode and requires that the operator restart the actual mode by pressing the START button.

Cartridges from the feed position should also be removed when no more processing is occuring on the drive. Cartridges in the feed position should be considered as processed. During a shift change, the "preloaded cartridges" should be identified to the new shift.

One experience has shown that, in a case where a cartridge was in the feed position and a job started which requested a tape, the operator was confused by the situation. He did not know if the cartridge in the feed position had been processed or not.

In another case, when a job had terminated abnormally (ABEND 522), the operator did not take care and did not look at the log. He thought that the cartridge had been processed and he **stored** it.

Once again, this demonstrates the need of good tape management.

There may be times when the operator needs to unload the tape by issuing an UNLOAD command from the host system. If the command does not successfully unload the cartridge from the drive, then a manual operation is required using the UNLOAD switch of the drive.

Note: The drive could change from active to inactive state during this operation. Refer to "Active and Inactive States" on page 65.

8.3.3 Summary

To maintain the active state of the loader in system or manual mode, the operator should always:

- Keep the input stack from becoming empty.
- Keep the output stack from becoming full.
- Not switch to manual mode.

Note: All the cartridges remaining in the feed position or in the output stack should be considered as processed.

8.4 The Indicator Lights

Two indicator lights can be used to determine the status of the loader. The two indicators on the Automatic Cartridge Loader operator's panel are:

1. The power indicator

   This shows green when the power is on.

2. The attention indicator (located above the power indicator)

   - Indicator is flashing

     The output stack is full or some other operator service is required. See the Automatic Cartridge Loader Recovery Procedure in the *IBM 3480 Magnetic Tape Subsystem Operator's Guide, GA32-0066.*

   - Indicator is on but not blinking

     An unrecoverable hardware error was detected on the Automatic Cartridge Loader and operator intervention may be required. See the Automatic Cartridge Loader Recovery Procedure in the *IBM 3480 Magnetic Tape Subsystem Operator's Guide, GA32-0066.*

8.5 Display Commands

The operator can use the DISPLAY UNITS command or the DEVSERV PATHS command to determine the status of the units.

- DISPLAY UNITS

  The presence of the loader is indicated by a device type of **348S.**

- DEVSERV PATH

The presence of the loader is indicated by **3480S**.

However this status is only indicated *after* the device has been varied online once if it was not online at IPL time.

```
DS P,1C0,16
IEE459I 14.56.02 DEVSERV PATHS 593
UNIT DTYPE M CNT VOLSER  CHPID=PATH STATUS
 1C0,3480 ,F,000,      ,01=& 20=< 11=& 24=&
 1C1,3480 ,F,000,      ,01=& 20=< 11=& 24=&
 1C2,3480 ,F,000,      ,01=& 20=< 11=& 24=&
 1C3,3480 ,F,000,      ,01=& 20=< 11=& 24=&
 1C4,3480 ,0,000,      ,01=R 20=< 11=R 24=R
 1C5,3480 ,0,000,      ,01=R 20=< 11=R 24=R
 1C6,3480 ,F,000,      ,01=+ 20=< 11=+ 24=+
 1C7,3480 ,F,000,      ,01=+ 20=< 11=+ 24=+
 1C8,3480 ,F,000,      ,01=& 20=< 11=& 24=&
 1C9,3480 ,F,000,      ,01=& 20=< 11=& 24=&
 1CA,3480 ,F,000,      ,01=& 20=< 11=& 24=&
 1CB,3480 ,F,000,      ,01=& 20=< 11=& 24=&
 1CC,3480 ,F,000,      ,01=& 20=< 11=& 24=&
 1CD,3480 ,0,000,      ,01=R 20=< 11=R 24=R
 1CE,3480S,0,000,RILT04,01=R 20=< 11=R 24=R
 1CF,3480S,0,000,      ,01=R 20=< 11=R 24=R
*********************** SYMBOL DEFINITIONS *************
F = OFFLINE                  O = ONLINE
+ = PATH AVAILABLE           & = RESERVED TO ANOTHER CU
< = PHYSICALLY UNAVAILABLE   R = PATH AVAILABLE AND ONLINE
```

Figure 1. Example of DEVSERV Command Output

As shown in Figure 1, the unit addresses of the 3480s equiped with Automatic Cartridge Loader are 1CE and 1CF with the **DTYPE 3480S**.

8.6 *Mount and Keep Messages in System Mode*

This section describes the meaning of mount and keep messages when the loader is in system mode.

Mount Messages

When Automatic Cartridge Loaders are installed, most MVS scratch mount messages do not require intervention. However, they still appear as normal tape mounts on the console and are satisfied automatically.

The only way for the operator to know that the 3480 and Automatic Cartridge Loader needs intervention is when:

- **The attention indicator is flashing on Automatic Cartridge Loader.**
- **The attention bars and the message display are flashing on the 3480.**

Keep Messages

On a standard 3480 drive whenever a private cartridge unloads, the panel first displays the unloading message, then the keep message appears both on the console and the message display panel, where it flashes (without the attention bars) until the cartridge is removed.

On a 3480 drive with Automatic Cartridge Loader on the other hand, the keep message does not remain on the panel. In fact, it is immediately overlaid by the

unloading message. After the unload, the "*"(star) steady message appears, indicating that the drive is empty. This is because the cartridge was immediately returned to the feed position and the drive sensors detect the empty status.

Operators are likely to be confused by this difference if they are not properly instructed.

The basic rule is to never mount a cartridge in the feed position unless specifically asked to do so. Every cartridge found in the feed position must be assumed to have been already processed.

The absence of keep messages is not peculiar to system mode, but extends also to automatic and manual modes.

Conclusion

Depending on the mode, during normal processing the cartridges may be loaded in the drive when needed, then unloaded after processing, and so on. The mount requests are automatically satisfied and the mount messages on the 3480 panel appear and disappear quickly. Normally, the operator has nothing to do. However, the operator should watch for flashing lights on the drive and the loader operator panel; these signals indicate that operator intervention is required.

8.7   Unit Affinity on a Automatic Cartridge Loader

The example shown in Figure 2 on page 71 uses the same device with Automatic Cartridge Loader, using the CATLG option and UNIT=AFF in the JCL. This should simplify the operator's work when many cartridges are to be processed for specific jobs. As shown in Figure 1 on page 69, the unit used is 1CE.

```
  ===> Example :
        Backup of many DATASETS, using the CATALOG, in AUTO Mode.
        Several consecutive DUMPS on different Tapes on
        ONE Automatic Cartridge Loader.
        SCRATCH cartridges PREMOUNTED.
------------------------------------------------------------------------
   .                          J E S 2  J O B  L O G  --  S Y S T E M  S 8 4 A
   .09.43.52 JOB  278  $HASP373 RILDSS30 STARTED - INIT  2 - CLASS A -
   .09.43.54 JOB  278  IEF234E D 1CE,RILT03,,RILDSS30,STEP1
   .09.43.54 JOB  278  *IEF233A M 1CE,PRIVAT,SL,RILDSS30,STEP1
   .09.44.20 JOB  278  IEC705I TAPE ON 1CE,RILT04,SL,,RILDSS30,STEP1
   .09.44.30 JOB  278  DSNBIG1 BACKUP SUCCESSFULLY ENDED
   .    1      //RILDSS30 JOB CD12,'RILLITO',MSGLEVEL=(1,1),MSGCLASS=R,
   .           //            NOTIFY=D12GST3
   .           *************************************************************
   .           ***   DFDSS JOB TO BACKUP FILES FROM DISK TO TAPE
   .           *************************************************************
   .    2      //STEP1     EXEC  PGM=ADRDSSU,REGION=4096K
   .    3      //SYSPRINT DD    SYSOUT=*
   .    4      //TAPE1 DD DSN=RIL.DSSTAPE.ALLRIL1,LABEL=(,SL,EXPDT=99365),
   .           //           UNIT=1CE,DISP=(NEW,CATLG)
   .    5      //TAPE2 DD DSN=RIL.DSSTAPE.ALLRIL2,LABEL=(,SL,EXPDT=99365),
   .           //           UNIT=AFF=TAPE1,DISP=(NEW,CATLG)
   .    6      //TAPE3     DD DSN=RIL.DSSTAPE.ALLRIL3,LABEL=(,SL,EXPDT=99365),
   .           //           UNIT=AFF=TAPE1,DISP=(NEW,CATLG)
   .    7      //TAPE4     DD DSN=RIL.DSSTAPE.ALLRIL4,LABEL=(,SL,EXPDT=99365),
   .           //           UNIT=AFF=TAPE1,DISP=(NEW,CATLG)
   .    8      //TAPE5     DD DSN=RIL.DSSTAPE.ALLRIL5,LABEL=(,SL,EXPDT=99365),
   .           //           UNIT=AFF=TAPE1,DISP=(NEW,CATLG)
   .    9      //TAPE6     DD DSN=RIL.DSSTAPE.ALLRIL6,LABEL=(,SL,EXPDT=99365),
   .           //           UNIT=AFF=TAPE1,DISP=(NEW,CATLG)
   .   10      //SYSIN     DD *
   .ICH70001I D12GST3  LAST ACCESS AT 09:40:58 ON FRIDAY, JUNE 6, 1986
   .IEF236I ALLOC. FOR RILDSS30 STEP1
   .IEF237I 1CE   ALLOCATED TO TAPE1
   .IEF237I 1CE   ALLOCATED TO TAPE2
   .IEF237I 1CE   ALLOCATED TO TAPE3
   .IEF237I 1CE   ALLOCATED TO TAPE4
   .IEF237I 1CE   ALLOCATED TO TAPE5
   .IEF237I 1CE   ALLOCATED TO TAPE6
   .DSNBIG1 BACKUP SUCCESSFULLY ENDED
   .IEF285I    RIL.DSSTAPE.ALLRIL1                               CATALOGED
   . DUMP   OUTDDNAME(TAPE1) DATASET(INCLUDE(RIL.ANY*.DSNBIG))
   .        IF LASTCC = 0 -
   .          THEN WTO 'DSNBIG1 BACKUP SUCCESSFULLY ENDED'
   .          ELSE WTO 'DSNBIG1 BACKUP-ABNORMAL TERMINATION'
   .        SET LASTCC = 0
   . DUMP   OUTDDNAME(TAPE2) -
   .          DATASET(INCLUDE( RIL.ANY*.DSNBIG2))
   .        IF LASTCC = 0 -
   .ADR454I (001) FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
   .               RIL.ANY.DSNBIG1
   .........and so on.
   .ADR013I (001) 86157 09:44:30 TASK COMPLETED RETURN CODE 0000
```

Figure 2.   Example of DFDSS Job Using Unit Affinity

8.8   No SWAP at End of Volume

At end of volume, a mount request is issued on the same unit. In an Automatic
Cartridge Loader environment one might get the idea to use SWAP to switch
from an empty loader to a full one.

There is no difference between a SWAP command issued during a job in progress on a IBM 3480 Magnetic Tape Subsystem with the loader and a SWAP issued during a job on a 3480 without the loader.

The example in Figure 3 is given only as a reminder that the SWAP command cannot be issued at the end of a volume during a job using multivolume files. If a SWAP is required, the command should not be issued during an OPEN/CLOSE or EOV. The messages in the figure are self-explanatory.

As shown in Figure 1 on page 69, the units used are at the addresses 1CE and 1CF.

```
===> SWAP test
                        COMMAND : SWAP 1CE,1CF
            *** Same Test done with 3480 without loader
===> SWAP Command

                  00000080   SWAP 1CE,1CF
------------------------------------------------------------------------
IGF513I   DEVICE 1CE INVALID FOR SWAP - UNSUPPORTED USE
IEF196I IGF513I   DEVICE 1CE INVALID FOR SWAP - UNSUPPORTED USE
IEF196I IGF512I   SWAP FROM 1CE TERMINATED - OPEN/CLOSE/EOV
IN PROGRESS
IGF512I   SWAP FROM 1CE TERMINATED - OPEN/CLOSE/EOV IN PROGRESS
```

Figure 3. SWAP Test with the Automatic Cartridge Loader

Appendix A. Hardware Functional States Sense Information

The IBM 3480 Automatic Cartridge Loader Feature has two functional states:

1. Installed
2. Active

These two states can be determined by the MVS system through sense information obtained from the hardware.

A.1 Installed State Extended Description

The IBM 3480 Automatic Cartridge Loader Feature is said to be installed when the feature has been properly attached to the front of a 3480 device.

- **Hardware**

   The drive presents sense data indicating the installed state of the feature when the drive is recognized by the system as being online. This happens during system initialization, as a result of a VARY online command, or as a reply to an allocation recovery message.

   In the case described above, the device service exit (DSE) for the initialization function issues a sense CCW to obtain the sense indicator. Sense bits are set as follows:

   - If the Automatic Cartridge Loader is installed,
     bit 7 of byte 25 is on.

   - If the Automatic Cartridge Loader is not installed,
     bit 7 of byte 25 is off.

- **Software**

   The DFP device service exit (DSE) routine indicates the installed state by setting an indicator in the tape segment of the UCB:

   - Bit UCBCSL is on (in byte UCBTFL1 in the tape segment of the UCB) for each drive with a IBM 3480 Automatic Cartridge Loader Feature installed.

   - Bit UCBCSL is off (in byte UCBTFL1 in the tape segment of the UCB) for each drive without a IBM 3480 Automatic Cartridge Loader Feature installed.

A.2 Active State Extended Description

The IBM 3480 Automatic Cartridge Loader Feature is said to be active on the 3480 device when the unloaded cartridge is not the last cartridge loaded in the input stack, that is, other cartridges are mounted in the input stack.

- **Hardware:**

  The drive presents sense data indicating the active state of the feature as follows:

  1. When the drive is recognized by the system as ready, the subsystem saves the active state of the drive.

  2. A REWIND/UNLOAD command to that cartridge causes the active state information to be passed to the operating system via ERA (Error Recovery Action) = 2B.

     Note: A VARY online command for the 3480 does not make it active, only an UNLOAD command does this.

     Sense bit 5 of byte 2 contains the active state information as follows:

     a. If the IBM 3480 Automatic Cartridge Loader Feature is active, bit 5 of byte 2 is on.

     b. If the IBM 3480 Automatic Cartridge Loader Feature is not active, bit 5 of byte 2 is off.

- **Software:**

  The active state of the IBM 3480 Automatic Cartridge Loader Feature is indicated when the existing DFP end-of-sense routine sets an indicator in the UCB tape device dependent segment.

  a. Bit UCBCSLAC is on (in byte UCBTFL1 in the tape segment of the UCB) if sense bit 5 of byte 2 is on (loader active).

  b. Bit UCBCSLAC is off (in byte UCBTFL1 in the tape segment of the UCB) if sense bit 5 of byte 2 is off (loader not active).

  Note: There is no active indication by either DISPLAY UNIT or DEVSERV. The procedure in "Active and Inactive States" on page 65 describes how the operator can activate the Automatic Cartridge Loader.

Appendix B. DFHSM Modification Summary

This appendix summarizes the changes made to DFHSM publications and modules to support the Automatic Cartridge Loader, and describes use of the ARCTVEXT user exit in more detail.

B.1 Publication Changes

The follwing documents were updated to support the IBM 3480 Automatic Cartridge Loader Feature:

DFHSM: System Programmer's Guide, SH45-0085, TNL SN32-0388

DFHSM: System Programmer's Reference, SH45-0083, TNL SN35-0337

DFHSM: Messages, SH45-0094, TNL SN32-0336

DFHSM: Installation and Customization Guide, SH45-0084

DFHSM: Diagnosis Reference Volume 1, LY35-0076

DFHSM: Diagnosis Reference Volume 2, LY35-0077

B.2 Identification of Changed Modules

The following modules were modified to support the IBM 3480 Automatic Cartridge Loader Feature:

ARCCPLMC - LIST Command Processor

ARCLISTM - HLIST Command Processor

ARCCPLM2 - Printing non-data set output from CDSs

ARCCPDLV - DELVOL Command Processor

ARCCPSET - SETSYS Command Processor

ARCCPQRY - QUERY Command Processor

ARCSELBV - Select a Backup Volume

ARCSELMV - Select a Tape Migration Volume

ARCCBS - Initial LOAD of MCVT

ARCMSG - Message Processor

B.3 ARCTVEXT User Exit

The ARCTVEXT is an informational DFHSM exit. The exit is given control under certain conditions and is passed certain data, but DFHSM processing is not dependent upon actions performed by the exit.

```
@data area
@return code
```

@data area: The data area contains a six-byte volume serial followed by a 16-bit field. The bits are defined as follows:

- The first bit is on if the tape is being purged from DFHSM and off if the tape is unassigned.

- The second bit is on if the data sets on the tape volume have been expiration date protected by DFHSM. Because the data sets on the tape volume have been expiration date protected by DFHSM, the tape volume may need to be reinitialized if it is being purged from DFHSM control.

- The third bit is on if the data sets on the tape volume have been password protected by DFHSM. Because the data sets on the tape volume have been password protected by DFHSM, the tape volume may need to be reinitialized if it is being purged from DFHSM control.

- The remaining 13 bits are reserved.

@return code: No change. A nonzero return code indicates that this exit should not be taken any more.

Defaults: By default, exits are not taken.

Appendix C. Major PTFs for the Automatic Cartridge Loader Support

Note: The PTFs described herein are subject to change and a service representative should be contacted for the latest information regarding the modified modules.

C.1 Base IBM 3480 Automatic Cartridge Loader Feature PTFs

```
*****************************************************************
*       BASE AUTOMATIC CARTRIDGE LOADER PTFs
*       WITH NEW & CHANGED MODULES & MACROS
*****************************************************************
*
*
*  PTF NO.   SYSTEM   RELEASE    COMPONENT ID   MODULES
*  --------  -------  -------    ------------   ----------------
*
*  UZ81933   370    DFP 1.1    5665-29501   IFG0194F
*  UZ81934   370    DFP 1.1    5665-29514   IGX00030
*  UZ81935   370    DFP 1.1    5665-29527   IGGSNS02
*  UZ81968   XA     DFP 1.2    5665-28401   IFG0194F
*  UZ81973   XA     DFP 1.2    5665-28414   IGX00030
*  UZ81974   XA     DFP 1.2    5665-28427   IGGSNS02
*  UZ81976   XA     DFP 2.1.0  5665-28401   IFG0194F
*  UZ81977   XA     DFP 2.1.0  5665-28414   IGX00030
*  UZ81978   XA     DFP 2.1.0  5665-28427   IGGSNS02
*  UZ81981   XA     DFP 2.1.0  5665-28463   IGUDSP02
*  UZ90492   370    SP 1.3.3   5752-SC1C4   IEE21110
*  UZ90494   XA     SP 2.1.2   5752-SC1C4   IEE21110
*  UZ90496   XA     SP 2.1.2   5752-SC1B4   IEFAB436, IEFAB475,
*                                           IEFAB478, IEFAB479,
*                                           IEFAB489
*  UZ90497   370    SP 1.3.3   5752-SC1B4   IEFAB436, IEFAB475,
*                                           IEFAB478, IEFAB479,
*                                           IEFAB489
*  UZ90498   XA     JES3 2.1.5 5752-SC1BA   IATLVVR
*                                           IATYSET        -MAC
*  UZ90499   370    JES3 1.3.4 5752-SC1BA   IATLVVR
*                                           IATYSET        -MAC
*****************************************************************
```

C.2 Extended Tape Support PTFs

```
*****************************************************************************
*  BASE  3422 PTFs WITH NEW & CHANGED MODULES & MACROS
*****************************************************************************
*
*  PTF NO.   SYSTEM  RELEASE   COMPONENT ID  MODULES
*  --------  -------  -------   ------------  -----------------------
*
*  UZ82156   370     SP 1.3.3  5752-SC1CE    IGFCCHCR, IGFTMCHK
*  UZ82157   370     SP 1.3.5  5752-SC1CE    IGFCCHCR
*  UZ82158   370     SP 1.3.3  5752-SC1C3    IEAVNP02, IECVDPTH,
*                                            IEAVGENA, IECVIOPM
*  UZ82159   370     SP 1.3.5  5752-SC1C3    IECVGENA
*  UZ90437   370     DFP 1.1   5665-29501    IGC0009A, IGE0000I
*                                            IGE0001E
*  UZ90438   370     DFP 1.1   5665-29527    IECDINIT, IECLMSG6
*                                            IECLMSG7, IECL0TA6,
*                                            IECTDSRV, IECTTRAP,
*                                            IECVPRNT, IECVXT6S,
*                                            IECVXT6U, IGGSNS02,
*                                            IECDRDCI       -MAC
*  UZ90439   370     DFP 1.1   5665-29504    IODEVICE, SGFDSP01, -MAC
*                                            SGFDSP07, SGIDSP01, -MAC
*                                            SGIDSP07, SGSETDIT -MAC
*  UZ90440   370     DFP 1.1   5665-29514    IECVDDTR, SGFDSP06, -MAC
*                                            SGIDSP06         -MAC
*  UZ90441   370     DFP 1.1   5665-29513    IECDDCE          -MAC
*  UZ90442   XA      DFP 1.2   5665-28401    IGC0009A, IGE0000I
*                                            IGE0001E
*  UZ90443   XA      DFP 1.2   5665-28427    IECDINIT, IECLMSG6
*                                            IECLMSG7, IECL0TA6,
*                                            IECTDSRV, IECTTRAP,
*                                            IECVPRNT, IECVXT6S,
*                                            IECVXT6U, IGGSNS02,
*                                            IECDRDCI       -MAC
*  UZ90444   XA      DFP 1.2   5665-28404    IODEVICE, SGFDSP01, -MAC
*                                            SGFDSP07, SGIDSP01, -MAC
*                                            SGIDSP07, SGSETDIT -MAC
*  UZ90445   XA      DFP 1.2   5665-28414    IECVDDTR, SGFDSP06, -MAC
*                                            SGIDSP06         -MAC
*  UZ90446   XA      DFP 1.2   5665-28413    IECDDCE          -MAC
*****************************************************************************
```

```
*************************************************************************
*  BASE  3422 PTFs WITH NEW & CHANGED MODULES & MACROS (CONT.)
*************************************************************************
*
*  PTF NO.   SYSTEM  RELEASE   COMPONENT ID  MODULES
*  --------  ------- -------   ------------  ----------------------
*
*  UZ90447    XA   DFP 2.1.0  5665-28401   IGC0009A, IGE0000I
*                                          IGE0001E
*  UZ90448    XA   DFP 2.1.0  5665-28427   IECDINIT, IECLMSG6
*                                          IECLMSG7, IECL0TA6,
*                                          IECTDSRV, IECTTRAP,
*                                          IECVPRNT, IECVXT6S,
*                                          IECVXT6U, IGGSNS02,
*                                          IECDRDCI       -MAC
*  UZ90449    XA   DFP 2.1.0  5665-28404   IODEVICE, SGFDSP01, -MAC
*                                          SGFDSP07, SGIDSP01, -MAC
*                                          SGIDSP07, SGSETDIT -MAC
*  UZ90450    XA   DFP 2.1.0  5665-28414   IECVDDTR, SGFDSP06, -MAC
*                                          SGIDSP06       -MAC
*  UZ90451    XA   DFP 2.1.0  5665-28413   IECDDCE        -MAC
*  UZ90459   370   SP 1.3.3   5752-SC1C3   IEAVNP02, IECVDPTH,
*                                          IECVGENA, IECVIOPM,
*                                          IECDDT, IEFUCBOB,  -MAC
*                                          IOSDDSE        -MAC
*  UZ90460   370   SP 1.3.5   5752-SC1C3   IECVGENA
*                                          IEFUCBOB,      -MAC
*  UZ90461   370   SP 1.3.3   5752-SC1CE   IGFCCHCR, IGFTMCHK
*  UZ90462   370   SP 1.3.5   5752-SC1CE   IGFCCHCR
*  UZ90463    XA   SP 2.1.2   5752-SC1CE   IECVDPTH, IECVIOPM,
*                                          IOSRMIHL, IOSRSLH,
*                                          IOSVNPTH, IOSVSWAP
*                                          IEFUCBOB, IOSDDSE, -MAC
*                                          DSECALL, IECDDT   -MAC
*  UZ90464    XA   SP 2.1.3   5752-SC1C3   IEFUCBOB        -MAC
*
*************************************************************************
```

C.3   DFHSM PTFs

The follwing APARs and PTFs include the DFHSM support:

> UZ90500
> UZ82624
> UZ82418
> UZ82274
> UZ50395
> UZ48577
> UZ50945

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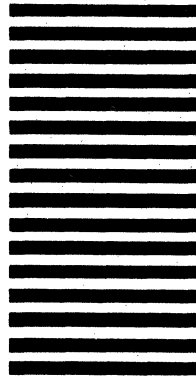
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