



Metalogic Technical Document TRIM and Robotic Tape Libraries

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Introduction

This note describes the enhancements currently available in Metalogic TRIM software that support the DSI and Storagetek Automated Tape Library systems on Unisys A-Series and Clearpath systems. There are many variants of the hardware available to customers but these TRIM interfaces provide additional functionality by communicating only with the software components of both systems.

It should be noted that this is a working document and revisions would be applied on a regular basis. Updated versions will be made available on the Metalogic web-site and upon request.

In the case of Storagetek tape subsystems, currently available from Unisys, TRIM interfaces only with the Unisys CSC Library 2.1 (version 43.015) or greater. This CSC software, written by the University of Washington, emulates the Unisys TAPESERVER interface which is driven through a MCP interface; this is discussed in more detail later. The software currently supports many variants of the Storagetek systems (e.g. Nearline, TimeberWolf, Powderhorn) using various drive technologies such as DLT4000, DLT7000. However, it should be noted but TRIM is no longer compatible with sites using the older CSC software (version 2 or earlier) which used StorageTek's own proprietary interface and is totally different from the TAPESERVER implementation.

With DSI systems, as far as is known, TRIM will interface directly to their TapeManager software, irrespective of software version.

It cannot be emphasized strongly enough that the basic TRIM package already supports a variety of Cartridge Tape Library (CTL) systems, without specific enhancement, because TRIM receives tape scratch, creation and usage notices directly from the MCP as with conventional tape subsystems. This means that, as to the operating system itself, such CTL systems appears to the TRIM software in the same way as any other tape subsystem. Therefore, the following TRIM activities still apply:

Tape creations/scratches are captured in real-time

Auto-purging and purge protection using Metalogic's own
TAPEMANAGER

OPAL scripts used to generate database reports will work without recompilation or modification

LOGREADER utility will check for and process any "missed" cartridge creations in the event of a restart

TRIM rules will operate as before with the usual expiration and movement controls

Daily reports and TP CONFIRM phases operate as normal

Full TP interrogate/modify command functionality

The following notes describe both general and specific enhancements to TRIM for both DSI and StorageTek systems. Much of the information that follows has not yet been applied to the Metalogic TRIM reference manual, but is readily available in the METANOTES files that are included with every software release and are available, in the Software Changes section, on the Web site. <http://www.metalogic.eu.com/Main/docum/dnotes/index.htm>

Implementation

To enable TRIM support for DSI and Storagetek automated tape libraries, two changes to Supervisor must be applied. A Supervisor use option, SILO, must be set using the USE command; from a COMS Supervisor window enter:

```
TT USE SILO <silO spec>
```

<silO spec> determines how Supervisor/Trim interfaces with Silo software.

With reference to the DSI software, some previous knowledge of how their software functions is required to understand the different modes of operation. There are five possible settings:

<silO Spec>	Description
UNISYS	TRIM provides additional enhancements for the Unisys CSCLIB version 2.1 software, as used by the various StorageTek ATL systems currently available on Clearpath and A-Series.
DSI	<p>This setting provides enhancements for the DSI Cartridge Tape Library. By default, all tape assignments are passed through to the DSI CSCLIB library by Metalogic TAPEMANAGER, for processing by DSI's own TAPEMANAGER library. A TM STATUS will show the operational mode as ACTIVE.</p> <p>In all the DSI settings it is assumed that Metalogic's own TAPEMANAGER library is SL-ed to the TAPEMANAGER function; this is necessary to support auto-purging and purge protection facilities provided by TRIM.</p>
DSI_SERIALNO	<p>This setting is similar to DSI, except that tape assignment requests are only passed to the DSI library if a tape serial number has already been assigned in the request.</p> <p>If a tape has both a SERIALNO and SCRATCHPOOL assignment, the SCRATCHPOOL setting is automatically removed.</p>

DSI_NOTM	This setting allows the DSI TAPEMANAGER to still run in ACTIVE mode but any tape assignment requests will NOT be passed to the DSI software by Metalogic TAPEMANAGER.
DSI+UNISYS	For site with both libraries installed. The TM DSIPOOL command must be used to specify scratch pools which identify DSI tapes.

For example, to implement support for Unisys/StorageTek ATLS and DSI Libraries:

```
TT USE SILO DSI+UNISYS  
TT TM DSIPOOL DSI1,DSI2
```

Tape purge requests are NEVER passed to DSI software regardless of the operating mode.

General enhancements

Several major enhancements have been made to TRIM to support these robot systems. This is not a definitive list but the more important changes are discussed below.

TRIM now supports all currently known tape densities though the retention of this information in the METATAPELIB database needs some explanation. The DENSITY field of a tape entry in the database is numeric and stores two subsets of values. The first set includes the values 1250, 6250, 38000 and 11000 which are actual density settings still used on many old and new Unisys systems.

The second subset includes the integer value of the density attribute for the tape. For example, a value of 8 for DENSITY means 36TRK, 9 is FMTDDS2, 10 is QIC1000, 11 is FMTDDS3, 12 is FMT128TRK, 13 is FMTDLT3, 14 is FMTDLT6, 15 is FMTDLT10, 16 is FMTDLT20 and 17 is FMTDLT35. It should be noted that this is only of importance to the OPAL DENSITY attribute in the TAPEDB context.

Attributes in the PER and TAPEDB contexts have been updated to reflect these changes and a new attribute DENSITYID will return the DENSITY mnemonic e.g. BPI1250, FMTDLT35, FMT128TRK etc. The normal responses to TP interrogation and TP FIND SCR commands will always show the correct density.

With the arrival of large capacity tape drives which can hold very large databases on a single reel, it is now very likely for database audit dumps to be created whilst an on-line dump is still running. In earlier TRIM releases, if rules were being used to "link" the audits with the master database dump, this would cause the audit to become linked to a previous database dump. This was because the TRIM system only received the tape creation notice once the on-line dump was complete. Although this problem relies on the customer using "linked" rules, this is a very common of handling database dumping and Metalogic decided to address this important issue in the following way.

Instead of just tracking tape creation at the time the label notice was produced, TRIM will now detect specific LOG VOLUME events for new tapes which have just been opened for output. A "raw" tape entry is written into the TRIM database, which will be assigned a creation date and time for the tape reflecting the actual open time. Although termed "raw", rules are applied automatically and the tape entry is virtually complete except that job and task name attributes are marked as "TAPE_IN_USE".

When a tape creation notice is generated by the MCP the job and task attributes are updated in the TRIM database entry but the creation date and time is NOT changed. The event entries in the TAPELOG will appear as:

```
01:39:15 Evt: CREATED [000026] DEV99021A by FLEX
01:30:18 Evt: NEW VOL [000026] DEV99021A by FLEX
```

In the above example, the response for a TP 26 command would show the true creation time to be 01:30:18 whereas earlier TRIM systems would have shown a time of 01:39:15. This important change protects the linking mechanism by allowing any potential new linkees to always have a master tape to which they can link.

Where an application creating the tape is aborted before completion, the "raw" entry will remain in the database unless the caller does a programmatic CLOSE with PURGE. An example of this is a normal COPY JOB which was terminated before any files were copied to the tape; here, MCP automatically purges the tape as part of its clean-up.

For both DSI and StorageTek systems, a simple TP interrogation will also return whether the cartridge is currently present in a library:

```

P MT0001
**** Reply from BOBW2KMCP ****
----- METATAPELIB: MT (MT0001) -----
Volume : ASSIGNED (MT0001)
ASSIGNED to host BOBW2KMCP. on 06/06/2014 at 03:00:53
Cycle      : 1                      File Section : 1
Version    : 0                      Density       : FMTDLT35
Owner      : MTO
Scratch pool : DLT35POOL
Location   : PHQ                      Sent date    : 01/01/2001
Created at  : 00:19:00 on 01/01/2007
Savefactor  : Unknown
Expiry date is UNKNOWN
Volume last accessed : 00:06:00 on 02/02/2008
Created by task 00002 : OBJECT/MTO/ONE
Owned by job no 00001 : MTO/WFL/ONE
Usage count : 6 times
Marked as   : PGOK, ASSIGNED
Rule info   : EXCEPTION
Notes      : METALOGIC TEST OPAL TAPE
REGISTERED in ACSLS

```

The most important enhancement for both DSI and Storagetek systems is the GETSCRATCH function, which is discussed in the next section.

OPAL GETSCRATCH attribute function

The implementation of the GETSCRATCH attribute allows the control and allocation of scratch tapes, optionally designated by density and scratchpool. This feature allows a SUPERVISOR OPAL program to allocate the FIRST eligible tape belonging to a selected subset of tapes and assign it for "future use".

```

_GETSCRATCH  _( <density> , <scratchpool> ) [ , INSILO ]

```

The <density> string should conform to a known Unisys density.

The <scratch pool> parameter should be a valid scratch pool name up to 17 characters in length: if longer, the string is truncated. The reason that <density> is a string is to allow MX=WAITING OPAL programs, scanning for REQUIRES MT waiting entries, to easily extract any specified density from the RSVP directly into the GETSCRATCH attribute. Both parameters can be empty strings.

If a tape is found that matches the given <density> and <scratchpool>, GETSCRATCH will return the serialnumber as a string. If no matching tape is found, GETSCRATCH will return one of the following error strings:


```

ERR:INVALID DENSITY
ERR:DB OFFLINE
ERR:DB OPENERR
ERR:NO SERIALS

```

Once a tape has been "assigned" by the GETSCRATCH attribute, it is not "unassigned" until the tape has been used for output. Until this time, the assigned tape can be tracked by using several new variants of the TP command. In particular, assigned status can be viewed using the TP ASSIGNED or TP SCRATCH find commands. For tapes that have been assigned for too long a period, the TP <serial> UNASSIGN command can be used to revert assigned tapes to their normal scratch state.

During assignment, several tape attributes are changed: the ASSIGNED flag in the database entry is set to TRUE, and the attributes ASSIGNDATE and ASSIGNTIME are set to the date and time of assignment. Because these attributes are available to OPAL programs, it is possible to monitor for tapes that remain assigned over a long period of time. An example OPAL is available in the OPALS/TPDB file called:

TPDB_ASSIGNPOLL

For example, GETSCRATCH could be used to determine a scratch tape for mounting on a CTL subsystem. Such mount requests can take time to be satisfied so the use of GETSCRATCH avoids the possibility of collisions by marking tapes as assigned and, therefore, ineligible for other assignments.

The following OPAL code handles a REQUIRES MT waiting entry of the form:

```

----Job--Task-Pri---Elapsed----- 5 WAITING ENTRIES -----
8892\ 8893 50      1:55 *LIBRARY/MAINTENANCE
LOGDUMP/FILE000 REQUIRES MT #1 (DLT3) SCRATCHPOOL=DLTPOOL1

```

This code will automatically assign the serial number of the tape returned by GETSCRATCH to the waiting entry using the FA SERIALNO command.

Once an assigned tape has been processed by an application, the assignment status is removed: the ASSIGNED, ASSIGNDATE and ASSIGNTIME attributes are all set back to null values.

An example OPAL, called TPDB_SILOW, may be found in the OPALS/TPDB source file available on the Metalogic release container:

```

TT DEFINE + SITUATION TPDB_SILOW(MX=W) :

(RSVP Incl " REQUIRES " And Decat(RSVP,"REQUIRES ",1) Incl "MT " And

%% IMPORTANT: Put your list of valid scratchpools in the following list

RSVP INCL {"SCRATCHPOOL=DLT7","SCRATCHPOOL=STK"} And

Not RSVP Incl "]" #")          % Not got a SERIALNO already

    Or

(RSVP Hdis "NO FILE " And (RSVP Incl "(MT)" And Not

                                RSVP Incl "FIND ON ") )

TT DEFINE + ODTSEQUENCE TPDB_SILOW(MX) :

%For SILO sites using StorageTek libraries

%This ODTS is triggered for NO FILE(1) and REQUIRES MT(2) conditions

% (1)... Uses TAPENAMESERIALS to get best serialno match

% (2)... Uses GETSCRATCH, passing waiting entry SCRATCHPOLL and

%         DENSITY extracted from the RSVP (if present)

% Doing the FA SERIALNO triggers the StorageTek to handle mounting.

If RSVP Hdis "NO FILE " Then

    Odt(MIXNO,"FA SERIALNO=",TAPENAMESERIALS("(" &USER&)" "&

        Head(Decat(RSVP,"NO FILE ",1),Not " "))

ELSE

BEGIN

    Store("POOL",Head(Decat(RSVP,"SCRATCHPOOL=",1),Alpha));

    Store("DEN",Empty);

    If RSVP Incl "(" And RSVP Incl ")" Then      % Got a density

        Store("DEN",Decat(Decat(RSVP,")",4),"(",1));

    Store("SN", GETSCRATCH(Getstr("DEN"),Getstr("POOL")));

    IF Getstr("SN") Hdis "ERR:" Then

        DISPLAY("NO AVAILABLE SCRATCH FOR ",MIXNO,,GETSTR("SN"))

```

```
ELSE
    Odt (MIXNO, "FA SERIALNO=", Getstr("SN"), "");
END;

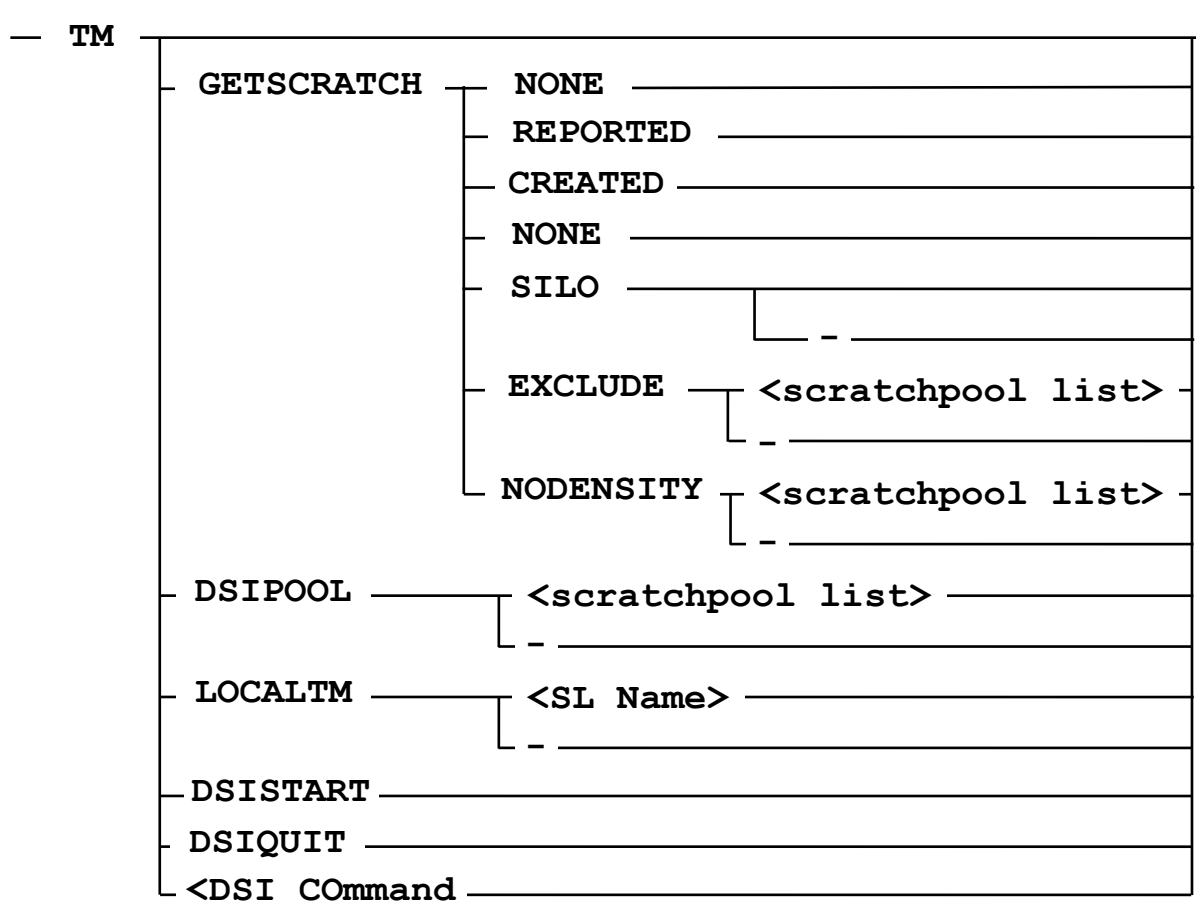
TT WHEN TPDB_SILOW DO TPDB_SILOW
```

This OPAL detects waiting entries for both input and output tapes. For output tape requests which have the appropriate scratch pool, the ODTSequence will automatically FA the serialnumber of a suitable scratch/PGOK tape changing the status of the waiting entry. This change is detected by both DSI and CSCLIB software and will automatically initiate tape mounts.

Tapemanager scratch tape assignment.

It is possible to have Tapemanager assign scratch tapes, instead of running an Opal. This is controlled via the TM command.

TM command:



The TM command is only valid if the Metalogic TapeManager is SLed.

It is used to set options controlling the Metalogic Tapemanager and optionally to pass commands to DSI tape library software.

A TM command on its own will return all of the current TapeManager settings.

```

TM
----- TM settings ----- see HELP TM
SILO SUPPORT                : DSI+UNISYS
(USE SILO)                  :
DSI ScratchPools           : METAPool
(TM DSIPOOL                 ) :
(<scratchpool list>)       :
Local Tape Manager         : TESTAPEMANAGER
(TM LOCALTM <SL function>) :
Getscratch                 : enabled
  Order                    : Used
  (TM GETSCRATCH           ) :
  (USED/REPORTED/CREATED) :
  (NONE                    ) :
  Silo                     : required
  (TM GETSCRATCH           ) :
  (SILO/SILO-             ) :
  Excluded pools           : ARCHIVEPOOL
  (TM GETSCRATCH EXCLUDE) :
  (<scratchpool list>     ) :
  No Density pools         : None
  (TM GETSCRATCH NODENSITY):
  (<scratchpool list>     ):

```

GetScratch options

NONE	Turns off the assignment of scratch or scratchable tapes for tape assignment requests.
------	--

The next four options determine how scratchable tapes are selected.

REPORTED	means select the tape with the oldest SendDate.
CREATED	means select the tape with the oldest creation date.
USED	means select the tape with the lowest use count.
SILO	means only tapes currently in a tape library will be selected.
SILO -	removes the restriction.

Other GetScratch Options

EXCLUDE	is used to specify a list of scratchpools which are excluded from GETSCRATCH handling.
EXCLUDE -	deletes the list.
NODENSITY	is used to control whether density will be used in selection of Scratchable tapes. Any request with a ScratchPool which appears in the specified list will not have density specified when searching for a scratch tape.
NODENSITY -	deletes the list.

 Other Options

DSIPOOL	is used in mixed DSI/Unisys environments to identify the ScratchPools allocated to DSI libraries.
DSIPOOL -	deletes the list.
LOCALTM	is used to specify the function name of an SLed library. If specified Tapemanager will call the entrypoint CHECK_TAPE_ASSIGNMENT before performing its own CHECK_TAPE_ASSIGNMENT to allow local settings such as ScratchPool and Density.
LOCALTM	Turns off the option.
DSISTART	is used to start the DSI libraries, normally only required after a DSIQUIT.
DSIQUIT	is used to Quit the DSI libraries without bringing down the TapeManager.
<DSI Command>	may be any valid DSI command. Only valid if DSI has been selected in the USE SILO command.

A tape assigned by TapeManager when the TM GETSCRATCH option is set, is marked as assigned in the same way as when using the GetScratch attribute.

DSI-specific enhancements

Similar to the interfaces provided by Supervisor and TRIM, DSI offers a variety of interfaces into their tape management software. In particular, a large subset of commands using the TM prefix can provide useful information about the status of tapes in the library and the hardware itself.

Using standard Supervisor interfaces, TRIM can use the same TM command set to provide user communication with the DSI hardware from Supervisor COMS windows or Remotespos and OPAL programs. In particular, the Opal KEYIN function can capture TM responses and automatically process information in OPAL scripts; for example, see the DSI_INVENT script which uses the TM LIST INVENT command to return inventory information from the robot and compare the information held in the METATAPELIB database.

Also applicable to OPAL, several new attributes for the TAPEDB context are available:

CARTINSILO

CARTSLOT

CARTLIBRARYID

These attributes allow any TAPEDB OPAL program to check if an individual cartridge is present in the library and can return its slot number or library identifier (if multiple systems are present). These attributes are of particular importance for handling automatic tape ejection for cartridges that need to be moved to secure offsite locations.

When a TM command is used or a cartridge attribute referenced for the first time, SUPERVISOR invokes a subtask called DSIHANDLER, which handles linkage to the DSI libraries to satisfy the request. Any reference to the CART attributes within an OPAL script, as described above, causes the calling Supervisor slot to appear with a status of WAIT SILO in the response to a WHEN ? command. This status is only temporary, as soon as DSIHANDLER has processed the request, the WHEN will continue as normal.

A new variant of the DELINK command allows the graceful delinking of Supervisor from the DSI system libraries, CSCLIB and TAPELIBRARYSUPP:

TT DELINK DSILIB

Working with DSI libraries

Several Metalogic customers are now using DSI software with TRIM in an effective manner, controlling offsite movement and tape library inventory using OPAL scripts. There are example scripts in the standard OPALS files provided on the Metalogic release container:

(METASOFT) OPALS/TPDB

There are example scripts, whose names are prefixed by DSI_, which provide examples of an inventory check (DSI_INVENT) and for handling tape export lists (DSI_EXPORT).

It is strongly recommended that TRIM rules are used to control tape expiration and movement; in particular to assist with off-site storage if required. By using a default location of say, DSI_ROBOT, to signify that a cartridge should remain in the library any OPAL script handling the export can automatically generate an export by checking the current location of the tape from the database.

It is recommended that Supervisor be used to assign An example, OPAL, TPDB_SILOW, shows how the GETSCRATCH function can be used for waiting entries requiring output tapes with a SCRATCHPOOL assignment. To ensure that only tapes from the DSI robot are loaded, all the tapes used by the robot would need to be SN-ed or PG-ed with a SCRATCHPOOL assigned.

The TM GETSCRATCH command is now the preferred way to do this

By necessity, requirements will vary from site to site but these example scripts are a good basis for local customisation.

Storagetek-specific enhancements

As stated earlier, the Clearpath interface to Storagetek ATLS is provided by the CSCLIB library software. Although this software emulates the Unisys Robohost TAPESERVER implementation, the actual functionality is somewhat limited for both support of OPAL and an operator interface. The Storagetek ATL support is controlled by setting the USE SILO option (TT USE SILO UNISYS)

If the UNISYS operational mode is active then SUPERVISOR automatically links to the TAPESERVER entrypoint in the MCPSUPPORT SL function. The TK command subset is available here, allowing interrogation of cartridge details and the ad-hoc changing of some individual attributes in the silo.

As with DSI, a separate task is invoked to handle the library linkage, TK commands and CARTINSILO requests. As with the DSI implementation, TAPEDB attribute support is available which to retrieve cartridge status information from the robot hardware.

A small subset of commands, using the TK prefix, allows user to interrogate, eject or change the scratch status of cartridges registered in the silo. This interface will only work with Unisys CSCLIB 2.1 or later (version 43.015):

```

HELP TK
----- SUPERVISOR HELP -----
TK command:

For Unisys/StorageTek tape silos only. TK commands are passed to
a process called SILOHANDLER which translates the commands into
TAPESERVER library calls. The full list of commands is shown below:

---- TK --+---- <serialno> --+-----+-----+-----+-----+
                                +-+ +--+--+-----+-----+
                                +-+ -  +-+
                                |
                                +-+ EJECT -----+-----+

Using TK <serialno> without any modifier returns the registered
status in the silo of the specified cartridge.

The SCRATCH modifier allows the scratch flag for any tape resident
in the silo to be changed to ON or OFF.

The EJECT modifier allows the tape to be requested for ejection
from the silo hardware.

```

A TK <serial> interrogation only returns if the cartridge is present in the silo. Even though it is possible to change the SCRATCH and POOL attributes using the syntax shown, the new values cannot be interrogated.

```

TK MT0001

---- Cartridge status ----
Cartridge MT0001 is REGISTERED

```

This limitation is also reflected in the lack of attributes that is available to OPAL scripts. A single attribute is available to the TAPEDB context, although very important:

CARTINSILO

This attribute allows an OPAL script to determine if a cartridge is currently registered in a silo; this fact can be used for controlling automatic off-site tape movement and tape input/output handling. It is possible that in the future, the CSCLIB software may be enhanced to support more TAPESERVER entrypoints. Since TRIM already implements many of these calls, there are numerous cartridge attributes which already exist and may become useful.

As with the DSI implementation, all TK commands and responses to Supervisor windows are written to the TAPELOG and are retrievable through the TP LOG command.

Working with Storagetek libraries

The automated handling of Storagetek libraries is quite similar to that of DSI; once a waiting entry has been modified to pick up a specific tape (using the FA SERIALNO command), the CSCLIB software automatically initiates a mount of the specified cartridge. It is not necessary for Supervisor to action a SEND TS MOUNT command. Again, it is very important that TRIM rules are used to control tape expiration and movement.

In practice, the TPDB_SILOW Opal example, described in the GETSCRATCH section, is a good start for handling most ATL-based silo requests whether input or output. As usually recommended by Unisys, adopting a SCRATCHPOOL strategy is a good way of controlling cartridge usage especially where mixed tape environments prevail.

As with DSI, there example OPALS files on the Metalogic CD, (METASOFT)OPALS/TPDB, which can be used for handling off-site tape movement. In practice, a very small number of highly customisable OPALS, in particular TPDB_SILOW and TPDB_EJECT, are sufficient for automating ATL operation.

The TPDB_SILOW Opal has been discussed earlier. As with DSI the TM GETSCRATCH command is the preferred method to control the assignment of scratch tapes. The TPDB_EJECT OPALS assume that an offsite tape movement would be necessary for cartridges whose pending location was currently set to a value other than STORAGETEK or SCRATCHPOOL. These OPALS would usually be executed after the daily reports phase and before TP CONFIRM:

```
TT DEFINE + SITUATION TPDB_EJECT(TAPEDB=PENDING):
% This OPAL checks for tapes moving to an off-site location and
% will issue TK <serial> EJECT commands where needed.
% 1. It MUST be run between the TPDB_DAILYREPORTS and CONFIRM
%   phases since pending locations are being checked.
% 2. The implementation assumes that TRIM rules are set up
%   for all cartridges that are resident in the silo have a
%   LOCATION of STORAGETEK. This may be changed by the site.
REPORTED And
Not PENDINGLOCATION Hdis {"STORAGETEK", "SCRATCH POOL"} AND
LOCATION Hdis "STORAGETEK" And
CARTINSILO % This takes time, check it
last

TT DEFINE + ODTSEQUENCE TPDB_EJECT(TAPEDB):
If Not LASTEVAL And SUM ("COUNT", 1) > 0 Then
  Odt ("TT TK ", SERIALNO, " EJECT")
Else
If Get ("COUNT") > 0 Then
  DISPLAY ("Cartridges queued for EJECT: ", Get ("COUNT"))
Else
  DISPLAY ("No cartridges EJECTed for off-site movement");

TT EVAL TPDB_EJECT DO TPDB_EJECT
```

Each pending offsite tape is ejected using the TK EJECT command.

Working with both DSI and Unisys.

Trim is capable of working with both DSI and Unisys libraries at the same time.

TT USE SILO DSI+UNISYS

In order that Trim can distinguish between DSI tapes and Unisys tapes, the TM DSIPPOOL command should be used to specify a list of ScratchPools assigned to DSI libraries.

If running on multiple hosts with a Master/Slave setup, the DSIPPOOLS should be set on all systems.