17. Archive Management

The Storage Management software component of the Data Server Subsystem (DSS) provides management services for storing and accessing File Storage Management System (FSMS) data files held in FSMS. The storing of the data is the main focus of the FSMS described in this section. This storage capability is implemented by both custom and commercial off the shelf (COTS) file storage management systems. The FSMS consists of the main storage and a browse facility. This system utilizes two types of archive robotic units, Storage Technology (STK) 9310 Powderhorn Library Storage Module (LSM) and an EMASS Automated Media Library (AML). A grouping of STK storage silos combine to form the main data tape storage facility. An EMASS AML/2 unit implements the browse functionality.

The main storage STK Powderhorns have a maximum capacity of 6000 cartridges each depending on the configuration of the silo. The cartridges have a capacity of 50 Gigabytes each non-compressed, and 100 Gigabytes if compressed. This gives each library an approximate capacity of 300 Terabytes of data. The dual arm robotic unit is capable of 300 to 400 cartridge exchanges per hour. The library utilizes STK Redwood SD3 helical scan tape drives. The main data storage facility houses Level 0-4 data, ancillary data, command history, algorithms, engineering data, calibration data, systems and applications software.

The EMASS browse unit utilizes 6 optical disk units for two media types. Currently, there are three 2.6 Gigabyte Hewlett Packard and three 9.4 Gigabyte drives. This archive is under configuration at this time. A single picker arm unit operates as a robot for both media types. The EMASS browse unit contains metadata reference data available in the main archive storage facility. It allows the user to search for one specific type, category, or grouping of data. By performing this function for the system, it allows the main storage facility to concentrate on the ingesting, storing, and distribution of the data products.

17.1 Custom Software Items

The following custom software items reside on the Storage Management Server:

1. EsDsStArchiveServer The Archive Server moves files in and out of the FSMS via the Archival Management and Storage System (AMASS) cache. It is the front end to the FSMS. The Archive Server has three services to perform on behalf of its clients:

    - Store: Move the listed files from staging disk to mass storage cache. AMASS moves the files from cache into the archive.
    - Retrieve: Request files from the archive when files are available.
    - Delete: Request that references to the files be deleted from the AMASS database. A request includes a file list (1 to N) on which the service is performed. The request is handled as a transaction, the action will occur for all files in the list or not at all.

2. EsDsStStagingDiskServer The Staging Disk Server provides a full set of directory services against the physical storage. The server process manages all access to the staging disk. By maintaining allocation data with each use of the area. The directory services are:

    - list a file
    - allocate space for a file
    - extend an allocation
    - link files
    - copy in/out
    - delete
    - create subdirectory. Requests that cannot be handled immediately due to insufficient space are queued and then fetched from the queue for completion when the space is available.

3. EsDsStStagingMonitorServer The Staging Monitor Server is a persistent server that moves files from FSMS and monitors the read only cache area. It also tracks the staging disk access counts.

4. EcDsStFTPDisServer The FTP Distribution Server distributes files via ftp and file push into the appropriate servers.

5. EcDsStPullMonitorServer The Pull Monitor Server constantly monitors the contents of the pull area. It also provides mechanisms to delete data objects from the pull area and report utilization of the pull area.

6. EcDsStIngestFtpServer The Ingest FTP Server transfers files from external provider to staging disk. Request includes source host, source directory, source file, target host and target directory.

7. EcDsStmgtGUI Provides access to the Storage Management GUIs.

8. EcDsSt8MMServer EcDsSt4MMServer EcDsStD3Server EcDsStCDROMServer Controls reads and writes to the appropriate units.

17.2 COTS Software

The FSMS relies on software from both STK and EMASS for management of data files held in their mass storage systems. ECS reliance on COTS software is prevalent in the FSMS system. The FSMS utilizes three COTS software packages for control functions of archive management, AMASS, GRAU Distributive AML Server (DAS), and STK Automated Cartridge System Library Software (ACSLS).

AMASS acts as the main control and interface to the FSMS. It serves as a UNIX file system that manages removable media jukeboxes. AMASS integrates with DAS to manage the EMASS robotics and with ACSLS to manage the STK robotics.

Each of the two robot control packages, ACSLS and DAS, are furnished by their respective hardware vendors, STK and EMASS, and are bundled with the hardware delivery. ACSLS runs on a SUN SPARC5 workstation and, in turn, relies on an ORACLE Database. The ORACLE database also resides on the SPARC5 and while the ACSLS is a tool which is not administered, ORACLE must be backed up periodically and may need to be restored or repaired. DAS is the ACSLS equivalent for the EMASS robotics and it resides on a built-in PC, on the EMASS AML.

Figure 17-2 depicts the software configuration of the FSMS subsystem.

STK Main Storage Facility	**EMASS Browse Facility**
DSS Software with Storage Management GUI	DSS Software with Storage Management GUI
AMASS Software	AMASS Software
ACSLS Software	DAS Software

Figure 17-2. FSMS Software Configuration

The Activity Checklist depicted in Table 17.2-1 provides an overview of the COTS Software section. Column one (**Order**) shows the order in which tasks should be accomplished. Column two (**Role**) lists the Role/Manager/Operator responsible for performing the task. Column three (**Task**) provides a brief explanation of the task. Column four (**Section**) provides the Procedure (P) section number or Instruction (I) section number where details for performing the task can be found.

Table 17.2-1. COTS Software Activity Checklist

Order	Role	Task	Section
1	DAM/DIT/SA	AMASS	(I) 17.2.1
2	DAM	Media Control	(I) 17.2.1.1
3	DAM/DIT	Data Integrity	(I) 17.2.1.2
4	DAM/DIT	Cache	(I) 17.2.1.3
5	DAM/DIT	AMASS On-line Database	(I) 17.2.1.4
6	DAM	Rebooting the AMASS Database	(P) 17.2.1.4.1
7	DAM/DIT	Off-Line Media Management	(I) 17.2.1.5
8	DAM/DIT	File Size Limitations	(I) 17.2.1.6
9	DAM/DIT	Distributive AML Server (DAS)	(I) 17.2.2
10	DAM/DIT	Automated Cartridge System Library Software (ACSLS)	(I) 17.2.3

17.2.1 AMASS

The FSMS utilization of robotic systems requires the implementation of a FSMS to control functions and data archiving. AMASS provides this function for ECS.

Since AMASS is implemented at the virtual file system (VFS) layer of the host operating system, it is transparent to other software programs. The VFS layer is designed for this approach and is the layer where other UNIX file systems attach, such as UFS, NUS, and RFS. Because AMASS is implemented at this level, you do not have to modify the host operating system.

The system call transparencies provided by this implementation allows the host computer running AMASS to be a server to an entire network of homogeneous or heterogeneous systems. The networking software runs without modification on top of AMASS so that the host can run whatever networking protocols are available, including NFS, RFS, TCP/IP, DECnet, or HYPER channel.

Because AMASS is implemented at the UNIX operating system level, it isolates the integration of the removable media drives and libraries from the specific applications that use it. In this case the application is DSS storage management (STMGT) software. Because AMASS supports applications by providing access to the files using standard file system semantics, programs that currently run on standard UNIX file Systems can use AMASS without modification.

The AMASS file system is designed to conform to all the standard UNIX data integrity functions and conventions. This conformity is beneficial when creating file systems with the potential size of an AMASS file system.

AMASS provides transparent access to the files stored in the AMASS file system. AMASS makes the drives and media (volumes) normally considered off-line storage appear as a single, online, logical device with a single, mounted, file system. Therefore, the extensive storage provided by a library appears as one large file system.

The AMASS file system is mounted as a single mount point in the host file system tree. With this single mount call, the entire AMASS file system capacity is brought online and made available for

use. Although your clients may think their files are located on the AMASS server, in reality they may be stored on multiple libraries or even on off-line storage.

FSMS supports the transport of files from the UNIX server, Silicon Graphic Incorporated (SGI) Challenger Series CPU, where it is installed, onto robotic libraries and standalone drives. AMASS allows system administrators to manage libraries, drives, and volumes. These elements can be logically sub-divided into user-definable groups, if desired. To users, the files, no matter where they reside, appear as a single, mounted file system. AMASS treats each tape or optical disk as a volume.

Moving and mounting volumes are transparent to both the host and the client accessing data. Consequently, access to data stored in an AMASS system is identical to accessing data on a mounted, magnetic disk file system.

17.2.1.1 Media Control

The Archive Manager enters either a bar code ID or a volume label ID when a new volume is introduced to AMASS with the ***volnew*** command. At the same time, AMASS also assigns this new volume a unique numerical ID. From then on, AMASS tracks the volume by this unique identifier and verifies the volume by using either bar codes or headers.

With AMASS, volumes from one or more libraries are allocated into groups, called volume groups. Then these volume groups are assigned to serve a particular subdirectory tree. Because these volume groups are assigned to directory subtrees, similar to mounting a file system, they are considered to be logical mount points. This allows the system administrator to assign volumes for specific purposes within AMASS without losing the benefits of a single file system and a single mount point that spans media.

The following types of volume groups are assigned; numerical group (#0 through 2047), space pool, and the cleaning group. After a volume group has been defined for a set of volumes, all writes to the volume group directory and its subdirectories go to the specified volumes. No other data is placed on these volumes. Therefore, when all the volumes are filled up, subsequent writes fail because the volume group is full. However, you can add volumes to the group as needed or allow the volume group to automatically grab more volume from a special volume group called the space pool. For more information on volume groups, refer to the *AMASS System Administrator's Guide*. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

When a volume is full, AMASS automatically rolls to the next available volume to continue its operations. The volumes that make up AMASS are subdivided, into multiple groups (logical file systems or mount points) called volume groups.

In a library environment, there are many volumes but only a few drives. If several requests come in for many different volumes, the potential exists for AMASS to spend most of its time moving media and little of its time actually performing useful Input / Output (I/O). But because AMASS simultaneously handles many random and simultaneous I/O requests, this design prevents thrashing (overworking the robot arm due to multiple requests) and optimizes I/O tasks. These

items combine to minimize library operations and maximize the number of simultaneous operations that can be handled by the library.

Volume verification is extremely important in both standalone drives and libraries. Both types of devices are subject to operator error and automated systems can suffer from hardware malfunctions leading to incorrect volumes being loaded into the drives. AMASS supports multiple types of volume verification.

In libraries, media can be left in the drives if a system crash occurs. AMASS uses the volume bar codes or volume headers to identify the volumes and automatically put the volumes away.

17.2.1.2 Data Integrity

AMASS provides data integrity in several ways. Write operations to files are allowed to complete to the cache, including sync, rsync, and synchronous I/O. AMASS tracks these operations and completes the I/O to the removable media in the event of a system crash. This tracking provides a level of data integrity consistent with standard UNIX file systems

17.2.1.3 Cache

The AMASS cache resides on the magnetic disk of the UNIX server where AMASS is installed. The cache implementation follows all UNIX file system conventions for synchronous I/O, sync, and fsync functions. The caching of data provides the following benefits; greater system performance, protection against thrashing, facilitates the simultaneous access of library file system data by both multi-user and multi-tasking applications.

After files are in the cache, multiple file-writes to the same volumes are grouped into single large I/O operation that minimizes volume movement and maximizes I/O throughput. Therefore, a high aggregate throughput is achieved through the following items; grouping write operations in the cache, prioritizing reads-from volumes over writes-to-volumes.

The AMASS cache was designed to solve the disparity between the input of data streams from clients through the AMASS server and the output to a library. The data caching function of AMASS is used in conjunction with read-ahead and write-behind algorithms to optimize the I/O block sizes and the amount of data read and written after the media is positioned for I/O.

Because all operations completed to the cache are recovered in the event of a system crash, the write operations complete after a cache-write is done. Multiple cache partitioning allows the AMASS cache to be a maximum of 256 2-GB sized partitions. This large cache allows more data to remain resident in the cache for a longer period of time thereby increasing throughput and performance. In addition, a large cache allows large files to be cached faster before being moved to a secondary device. which increases throughput.

The cache size is configured to take advantage of both the application being used and the system environment where AMASS is installed. Because the cache size does not impact maximum file size, the cache can be very small. On the other hand, applications running database tables in the library, may need a larger cache configuration to optimize the number of cache hits and allow

updates to table headers to be predominantly cache I/O. The cache parameters are configured during installation. For information on sizing the cache, refer to AMASS document; *Installing and Configuring AMASS*.

17.2.1.4 AMASS On-line Database

AMASS keeps a magnetic, disk-resident database of attributes called metadata pertaining to directories and files resident in its file system, (attributes consist of access time, user id, etc.). This database grows as files and directories are added to the AMASS file system.

The AMASS online database allows common file system utilities and system calls to operate very quickly, in many cases faster than even the host's native file system. Basic commands such as directory listings (ls), changing the working directory (cd), and even searching through part or all of the file system for files of given attributes, operate in AMASS without having to access the media in the library.

A secondary benefit of the online database is less media contention in the library when multiple users are accessing the AMASS file system. Because only the actual read- and write-data system calls need access to the library, more operations can be completed without waiting for media changes. This minimizes the number of media changes, greatly enhancing total I/O throughput capability.

Most UNIX file Systems require fsck (a file system integrity check) of all file systems mounted at the time of a system crash This checking can be very time-consuming. The AMASS database, eliminates the need for this file system check associated with other file system designs. On system reboot, AMASS corrects the database based upon the journal files and brings the system back online. Typically, this function takes less than 30 seconds to complete.

Rebooting the AMASS Database

The AMASS file system may need to be rebooted during certain anomalous conditions. A few reasons to reboot AMASS could be if the system gets hung, if it is not communicating with ACSLS or DAS, or if one of the required daemons has aborted. To check the health of AMASS while it is still running, execute the **healthcheck** command. AMASS needs to have the following daemons running at all times:

libio_tape, amassmain, daemons/lm_ip -a fslock, qset

To verify they are running, simply search for the AMASS processes.

Ex. **ps -ef | grep amass**

In order to reboot AMASS you must have root privileges. The following procedure demonstrates the steps to reboot AMASS. Table 17.2-2 presents the steps required to follow the reboot process. If you are already familiar with the procedure, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Log in as **root** and enter the ***password***.

2. Kill daemons by typing: **killdaemons**
3. If you want to test AMASS before restarting, go to step 4, otherwise, enter:

   amass_start
4. To test the AMASS filesystem prior to starting AMASS type:

   install_tests

   - Tests the operation jukebox operation and cache partitions, then restarts AMASS.

Table 17.2-2. Rebooting the AMASS Database

Step	What to Do	Action to Take
1	Log in as **root**	press **Return**
2	**killdaemons**	press **Return**
3	**amass_start**	press **Return**
4	**install_tests**	press **Return**

17.2.1.5 Off-line Media Management

Off-line media is supported through the online database. Because the file system's database is resident on the magnetic disk, all files and directories are always visible to clients and application programs. In robotic library environments, the online database allows media to be removed from the library without losing track of the files and directories resident on the media. Directory and file listing commands as well as all system calls, except read and write files, succeed on files even though media has been removed from the library. If a file's data is needed, AMASS uses the online database to quickly identify which of the off-line volumes must be reintroduced in order to access the data.

17.2.1.6 File Size Limitations

Within AMASS, file sizes are limited only by the host operating system's limitations. This means that files larger than the capacity of one volume can be stored in its file system (for example, a 2 GB-file can be stored on 5.25 inch optical disks that have a 300 MB-per side capacity). The file system and directory sizes of AMASS are virtually unlimited. Although every attempt is made to keep files of a directory on a single volume, both files and directories can span media boundaries. Therefore, file and directory sizes are not limited to media size. Consequently, a directory can reside on one or more volumes.

Even though files can reach 2 GB, regardless of the physical volume size to AMASS, the entire volume set appears as a single logical device of very large capacity. You can configure the file system to consist of any number of volumes (tapes or optical disks); the default is 65,000 volumes. On IRIX Versions 5.3 and 6.2 as well as Solaris 2.5, AMASS supports a 64-bit file system, which allows files greater than 2 GB.

17.2.2 Distributive AML Server (DAS)

AMASS supports mixed media in EMASS Automated Media Libraries (AMLs), using the DAS software on the Archive Management Unit (AMU). During the AMASS installation, unique media types are configured as if they were in separate libraries.

DAS is a COTS product with both client and server components. The server component is installed on the AMU OS/2 server, and the client component is embedded in AMASS. For DAS installation and operation on the AMU, refer to the *DAS Installation and System Administration Guide*. The DAS guide can be viewed using Adobe Acrobat and is available electronically on servers g0acg01 and g0acg05 in /usr/amass/books.

DAS is designed to provide shared access to the family of AMASS Automated Mixed-Media Libraries. An unlimited number of heterogeneous networked clients can be configured within a DAS environment. DAS provides customers with the ability to optimize their automation strategies, throughout the enterprise, and leverage their AML acquisition decision. DAS provides the ability to share AMLs with many clients.

DAS is integrated with backup, tape management and/or hierarchical storage management (HSM) applications on the client to direct automated removable media activity through the DAS server to the library. A DAS client may be any system requiring AML services. A client may be granted complete or restricted access to AML resources. AML resources are defined as drives, volumes and insert/eject areas and may be marked as shared or private to each client. Through client registration, the administrator function in DAS is able to control client access and privileges.

The DAS server component runs within the AMU on the AML. The DAS server converts client requests into complete AMU requests. It also creates journal entries of all requests, for recovery purposes, and sends request status back to the client. DAS may be installed as a standalone AML connection or be configured to share an AML with MVS or other, EMASS supported, host attachments.

17.2.3 Automated Cartridge System Library Software (ACSLS)

Storage Tek's UNIX-based ACSLS, allows applications based on the client systems access and manage information stored in an automated cartridge system (ACS). Client access appears as if the libraries were operating exclusively under the control of each client system. ACSLS performs library command processing on the client's behalf, as well as processing operator commands issued by the library system administrator. Library requests and messages move across a network which is a client-independent control path that connects client systems and the operator's console with the ACS.

ACSLS consists of a system administration component. The system administrator component provides an operator interface to control and monitor the ACS, including access control. A batch user interface allows automated scheduling of storage management functions, such as cartridge entry and eject, according to client processing requirements.

A programmatic interface allows client applications to direct specific library service requests to the ACSLS. These service requests include cartridge mounts, dismounts, enters, and ejects. Additional requests allow client applications to determine and change the status of cartridges and ACS components.

Basic library management facilities of ACSLS includes command and message processing, maintenance of the contents and configuration data base, Cartridge Access Port (CAP) management, event log recording, scratch-pool management and access control.

ACSLS facilitates data security with administrator-assigned volumes and limited command access.

The centralization of operations support reduced storage management requirements and facilitates lights-out data center management. The FSMS supports multiple media. Table 17.2-3 identifies the different types of archive media used within the FSMS system. Archive media consist of tape and optical disk cartridges. Each tape or disk cartridge is identified by means of a bar code label that shows the media number. This number provides the means to produce an archive catalog that tracks the location of each cartridge within the library. The catalog numbering is based on information provided to the robot arm mounted laser bar code reading scanners.

Table 17.2-3. FSMS Media Types

Media	Media Purpose	Archive
2.6 Gigabyte Optical Disk 9.4 Gigabyte Optical Disk	Archive Storage	EMASS
50 Gigabyte D3 Tape Cartridge	Archive Storage	STK

17.3 Archive Configuration

The ability of the FSMS to absorb and to serve data at required rates depends on a well integrated, well tuned combination of high performance archival hardware and software. All the ECS DAACs have the same architecture and constituent components. The DAACs differ only in the size and particulars of equipment.

Figure 17.3-1, depicts the overall configuration for the STK main storage. For a representation of RAID attachment see Figures 17.3-2.

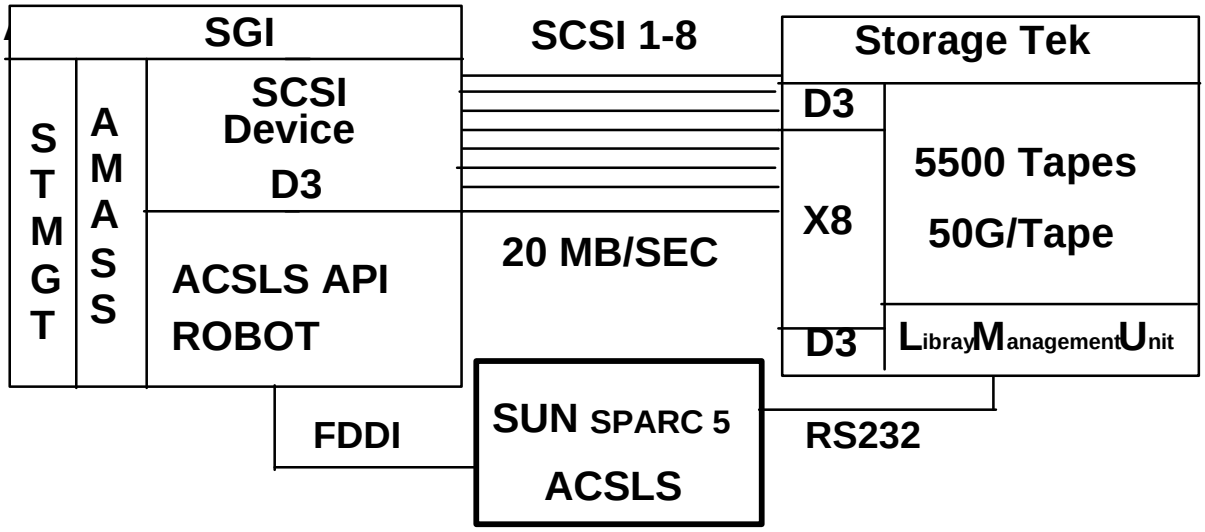

Figure 17.3-1. Archive Hardware and Software Configuration for STK

AMASS controls the physical storage of the data in the repository and is hosted on a SGI multiprocessor Challenge class server. The data collection resides in the STK Powderhorn robotic silo and is recorded using D3 helical scan tape drives from Storage Tek. SGI RAID is used for the temporary caching of data en route to and from the robotic silo.

As shown, the tape drives (D3) residing in the Storage Tek robotic silo are directly connected to the SGI Host via Fast-And-Wide SCSI II channels. Each channel is individually capable of the throughput of 20 MB/sec. Each of the eight tape drives is rated by the manufacturer capable of 11.2 MB/sec sustained throughput.

The control of the robotic mechanism of the silo (loading and unloading of the tapes) is affected via the STK ACSLS interface software running on a SPARC 5 SUN workstation. AMASS addresses the ACSLS through a network connection. ACSLS controls the robot directly via an RS232 line.

Figure 17.3-2, RAID Configuration, illustrates the configuration as of 8/19/97. The RAID level configuration is 3.

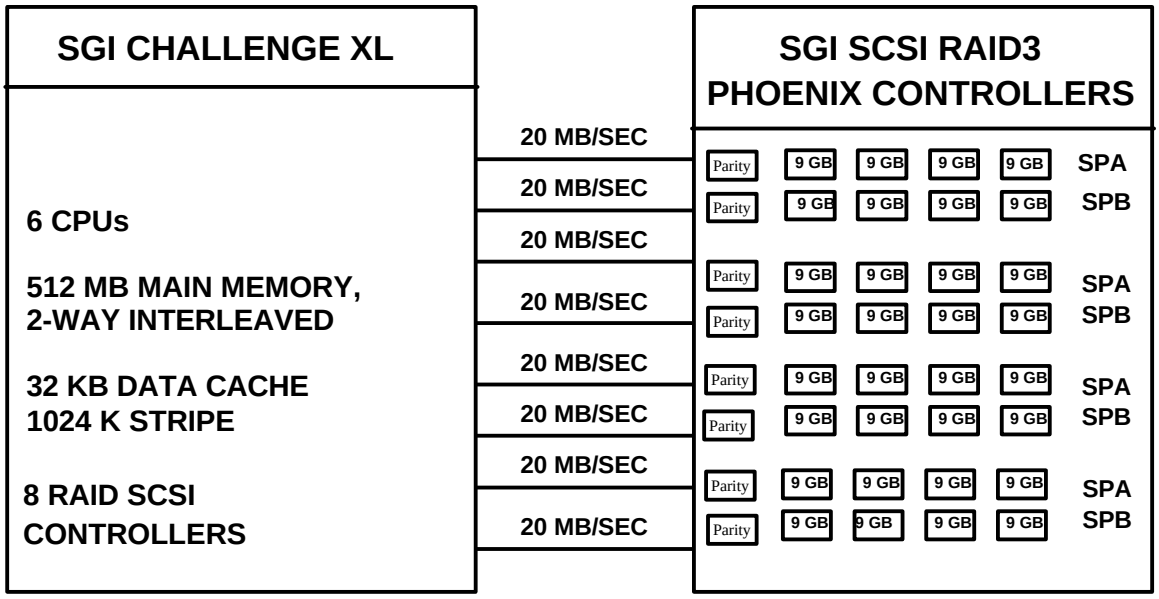

Figure 17.3-2. RAID Configuration 8/19/97

Note

This configuration is the same for the EMASS browse system.

ECS browse capabilities depend on its ability to serve data to its users at required rates on a well integrated, well tuned combination of high performance archival hardware and software. Figure 17.3-3, depicts the overall configuration for the EMASS browse system. For a representation of RAID attachment see Figures 17.3-2.

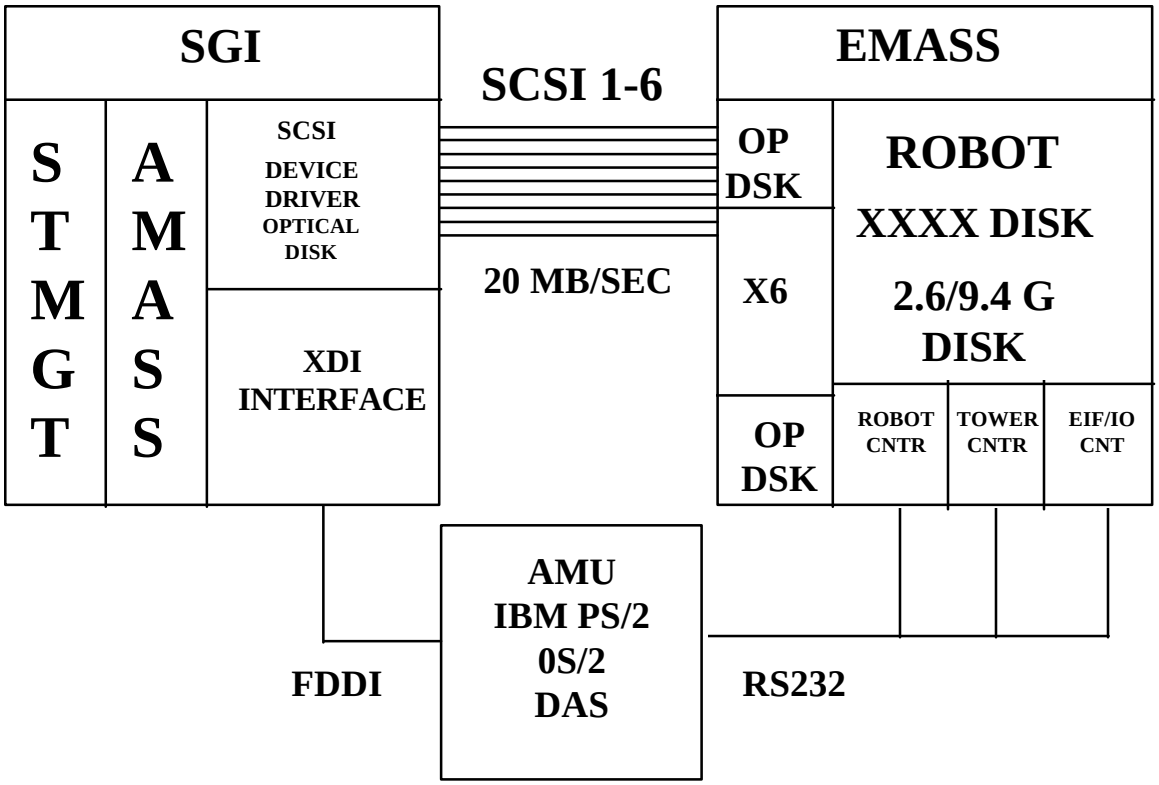

Figure 17.3-3. Archive Hardware and Software Configuration for EMASS

AMASS controls the physical storage of the data in the browse unit and is hosted on a SGI multiprocessor Challenge class server. The data collection resides in the EMASS AML/2 and is recorded using a combination of optical disk drives, 2.6 Gigabyte and 9.4 Gigabyte, by Hewlard Packard and TBD. SGI RAID is used for the temporary caching of data en route to and from the AML.

As shown, the optical disk drives residing in the AML are directly connected to the SGI Host via Fast-And-Wide SCSI II channels. Each channel is individually capable of the throughput of 20 MB/sec. The 2.6 G drives are capable of 3.4MB per sec read and 1.7MB per sec writes with a 25 msec average seek time. The 9.4 G drives capabilities are not yet known.

The control of the robotic mechanism of the AML (loading and unloading of the disks) is effected via the GRAU DAS interface software running on a IBM PS/2 with OS/2. AMASS addresses the DAS through a network XDI interface connection. DAS controls the robot directly via an RS232 line.

17.4 Graphical User Interface (GUI)

Both custom and COTS software are supplied with a configurable X-Windows/Motif GUI interface. Many functions available on the command line can also be performed from the GUI.

The GUI is configured by editing a button file. The System Administrator can comment out certain buttons, thus removing those functions from a user's GUI. The button file is then provided to the user and appropriate paths are set to locate the GUI interface button file and executables.

Data that are inserted into the archive can be received from a number of sources including the Ingest Subsystem, Processing Subsystem, other DAACs, and Authorized Users. The Data Ingest Technician (DIT) or other operators can monitor the insertion of data into the archive using the Data Server Subsystem (DSS) GUIs.

1. DDIST Graphical User Interface (GUI).
2. STMGT GUIs

The Activity Checklist depicted in Table 17.4-1 provides an overview of the Graphical User Interface section. Column one (**Order**) shows the order in which tasks should be accomplished. Column two (**Role**) lists the Role/Manager/Operator responsible for performing the task. Column three (**Task**) provides a brief explanation of the task. Column four (**Section**) provides the Procedure (P) section number or Instruction (I) section number where details for performing the task can be found.

Table 17.4-1. Graphical User Interface- Activity Checklist

Order	Role	Task	Section
1	DAM/DIT	Graphical User Interface	(I) 17.4
2	DAM/DIT	Launching DSS GUIs Using UNIX Commands	(P) 17.4.1
3	DAM/DIT	Storage Management Control GUI	(I) 17.4.2
4	DAM/DIT	AMASS GUI	(P) 17.4.3
5	DAM/DIT	AMASS GUI File Function	(I) 17.4.3.1
6	DAM/DIT	AMASS GUI Tasks Function	(I) 17.4.3.2
7	DAM/DIT	AMASS GUI Admin Function	(I) 17.4.3.3
8	DAM/DIT	AMASS GUI Preferences Function	(I) 17.4.3.4
9	DAM/DIT	AMASS GUI Help Function	(I) 17.4.3.5

17.4.1 Launching DSS GUIs Using UNIX Commands

The following procedure demonstrates how to bring up a DSS GUI. It is expected that eventually the ECS DAAC desktop will be configured to allow access to the DDIST and other GUIs using icons. In the interim, access to the DSS GUIs must be gained through the use of UNIX commands. In any case, launching the GUIs starts with the assumption that the applicable servers are running and the operator has logged in. Table 17.4-2 presents the steps required to follow the procedure. If you are already familiar with the procedure, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Access the command shell.

- The command shell prompt is displayed.

NOTE: Commands in Steps 2 through 12 are typed at a UNIX system prompt.

2. Type **xhost +** and then press the **Enter** key.
3. Start the log-in to the DDIST client server by typing either **telnet *hostname* (e.g., g0dis02)**, **rlogin *hostname***, or **rsh *hostname*** in the second window and then press the **Enter** key.
    - If you use the **telnet** command, a Login: prompt appears; go to Step 5.
    - If you use either the **rlogin** or **rsh** command, the system uses the User ID currently in use; go to Step 6.
4. When a login: prompt appears, log in as yourself by typing your ***UserID*** and then pressing the **Enter** key.
5. At the Password prompt type your ***Password*** and then press the **Enter** key.
6. Type **setenv DISPLAY *clientname*:0.0** and then press the **Enter** key.
    - Use either the terminal/workstation IP address or the machine-name for the clientname.
7. Type **cd /*path*** and then press the **Enter** key.
    - Change directory to the directory path(e.g., **/usr/ecs/*mode*/CUSTOM/utilities**) containing the DSS command files (e.g., EcDsDdistGui).
    - The *mode* will most likely be one of the following operating modes:
        - OPS (for normal operation).
        - TS1 (for testing).
        - TS2 (for other uses).

    Note: the separate subdirectories under /usr/ecs apply to different operating modes.
8. To launch the Data Distribution Requests GUI, type the following command: **EcDsDdistGuiStart** and then press the **Enter** key.
    - The Data Distribution GUI is displayed.
9. To launch the Storage Management Control GUI type the following command: **EcDsStmgtGuiStart** and then press the **Enter** key.
    - The Storage Management Control GUI is displayed.

Table 17.4-2. Launching DSS GUIs Using UNIX Commands

Step	What to Do	Action to Take
1	xhost	press **Return**
2	**telnet *hostname***	press **Return**
3	***UserID***	press **Return**
4	***Password***	press **Return**
5	**setenv DISPLAY *clientname*:0.0**	press **Return**
6	**cd /usr/ecs/*mode*/CUSTOM/utilities**	press **Return**
7	**EcDsDdistGuiStart**	press **Return**
8	**EcDsStmgtGuiStart**	press **Return**

17.4.2 Storage Management Control GUI

This tool enables operations to manage various data storage functions. These functions include the capability to set and modify configurations of various Server Types (e.g., 4mm tape, Archive Server, D3 tape), manage data location within the archive and on disk, configure stacker slots, display storage events which possibly require operator actions, and view backup/restore failures with the ability to restart a backup/restore operation. AMASS has to be up in order for the Storage management Tool to archive and retrieve files. Moreover the FTP server on the ACP host has to have debug logging enabled to write the filename of pulled files into the syslog for pull notification to the pull monitor.

The Tool is used to perform the following operator functions listed in Table 17.4-3.

Table 17.4-3. Common ECS Operator Functions Performed with This Tool

Operating Function	Command/Script or GUI	Description	When and Why to Use
Configure Server Devices	Storage Config Tab	Allows operators to organize and configure various Server Devices and manage data flow in and out of various archives.	As needed to add, delete, or modify the configuration of a set of Servers or a Server Device.
View the current cache statistics for the Pull Monitor cache.	Cache Stats. Tab	Allows the operator to view the Pull Monitor cache and view the statistics on its use. Operator can delete expired files.	Used when warning is displayed in the message area informing the operator the cache is getting too full.
Search Event Log	Storage Events Tab	Allows operators to find events from selected parameters	As needed to locate events.
View current requests and manage tapes	Resource Schedule Tab	Allows operators to display the storage management view of the current requests	Used to select a specific request, manage tape group, stacker and slot configurations.

Storage Management Control can be operated from any one of the 4 tabs which control the 4 components as listed above (Table 17.4-3). The operator can select the following menu functions for each component tab from the menu bar items at the top of the window:

- **File** contains the exit command to close application
- **Options** allows operator to set the polling rate for the event log for the current execution of the application.
- **Backup** allows operator to set up data files as a backup at the operator site and at operator off-sites, to view backup files and to restart backup files.
    - **Setup** allows operator to set up files for backup to on site or off site areas.
    - **Restart** shows the location of failed files and provide a restart capability, see figure 4.10.2-14 (Restart Backup).

Menus named **Selected**, **Edit**, and **View** are also present at the top of the window, but functionality to be associated with them has not yet defined. They will be used in future releases.

For a detailed description of the Storage Management GUI, refer to the 609 document Section 4.10.2.

17.4.3 AMASS GUI

Note

The AMASS GUI is a System Administrator tool, to be used only for monitoring the displayed information at this time. The GUI experiences intermittent problems known to the manufacturer and is due for complete functionality in a later software revisions 5.0.

The AMASS software provides DAAC Operations personnel with a GUI to access the functionality of AMASS utilities and command line functions.

AAWin (AMASS Administrator Window) provides the use of the AMASS GUI. This allows the menu functions of the GUI to become queries to the on-line index and facilitates the following functions:

- Assign and delete volumes.
- Modify volume characteristics.
- Modify volume groups.
- View volume/volume group usage statistics and monitor system performance.
- Reuse a volume.

The GUI performs a subset of the administration commands. The above tasks can be done with the AMASS administration commands, which are issued from the command line. Use the following procedure to start the AMASS GUI (AAWin). Table 17.4-4 presents the steps required reboot the AMASS database. If you are already familiar with the procedure, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Login as **amass** and enter the **password**.

2. Verify that AMASS is running.

   At the prompt, type: **amassstat -c**

   A message will display a message indicating the status of AMASS.

3. The GUI is accessible through the AMASS directory, **/usr/amass/bin/**. To start the AMASS GUI, type: **aawin**

   Note: only one aawin session can be up at a time.

4. To exit, select the menu path: **File/Exit**

For a complete description of these commands, refer to the manual *Managing the AMASS File System*.

Table 17.4-4. Starting The AMASS GUI

Step	What to Do	Action to Take
1	amass	press **Return**
2	**amassstat -c**	press **Return**
3	**/usr/amass/bin/aawin**	press **Return**
4	**File/Exit**	press **Return**

AMASS GUI menu selections are described in sections 17.4.3.1 through 17.4.3.5. Additional menu keys provide help information to the user and a quit GUI option key.

17.4.3.1 File

This pull down menu has the following selections:

- Exit- Exits AAWin. Closes all windows except the *sysperf* window.
- Clear Workroom- Clears the Workroom of all icons.

17.4.3.2 Tasks

This pull down menu has the following selections:

- Add Volumes- SCSI (This appears when there are SCSI-attached libraries.)
- Modify a Volume Group

Displays volume status and information. Volume, volume group, juke, position, label/barcode, status, used space, available space, dead space, and number of errors are displayed in this selection. The user is allowed to perform various functions on a single or combinations of volumes using this selection . These functions are the following:

⇒ Enable or disable space pool.

⇒ Add or remove directories.

⇒ View volume group information.

- Modify a Volume

Displays volume status and information. Volume, volume group, juke, position, label/barcode, status, used space, available space, dead space, and number of errors are displayed in this selection. The user is allowed to perform various functions on a single or combinations of volumes using this selection . These functions are the following:

⇒ Toggle status active or inactive

⇒ Toggle volume on-line or off-line

⇒ Changing label

⇒ Delete volume

⇒ Introduce new volume to archive

⇒ Quick or normal formatting of volume

17.4.3.3 Admin

This pull down menu has the following selections:

- Scheduler - Opens the Scheduler Status Window.
- Sysperf - Opens the sysperf window displaying the AMASS I/O activity.

17.4.3.4 Preferences

This pull down window has the following selection:

- Show/Hide Detail Windows - These windows give a brief description of the items the mouse pointer is touching.

17.4.3.5 Help

- Opens the Help Window.

Detailed explanations of the GUI functions are located in the AMASS guide; *Using the AMASS GUI*. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

17.5 Command Line Functions

Some but not all archive functions can be accomplished using a GUI. The operator should however become familiar with all command line utilities and commands. The following table provides a list of AMASS commands and utilities.

Table 17.5-1. Common ECS Operator Functions Performed with AMASS (1 of 2)

Operating Function	Command or GUI	Description	When and Why to Use
activate or deactivate the AMASS filesystem	• amassstat • AA Win GUI	displays or toggles the status of AMASS (ACTIVE/INACTIVE)	used to inactivate the file-system for maintenance and/or to reactivate it
add a volume	• volnew • AA Win GUI	introduces a new volume to AMASS and assigns a volume number	to add storage space for data
add space to a volume group	• volnew volgroup • AA Win GUI	adds additional volumes to an existing volume group	when more space is required in an existing volume group
create a space pool	• volnew	one or more volumes assigned to a special volume group of "SP"	to allow AMASS to automatically add space (volumes) to volume group that has run out of space
create a volume group	• volgroup setvolgrp • AA Win GUI	partitions the volumes in AMASS	to assign volumes for specific purposes within AMASS
delete a volume	• volstat voldelete • AA Win GUI	removes a volume and its files from the archive	to delete a volume and any files it contains
generate a report	• amassreport	generates formatted report and/or raw output	to extract information about files and directories from the AMASS index
back up the AMASS index	• amassbackup	performs full or partial back up of the AMASS index	any time that the system needs to be backed up other than what AMASSs automatic backup provides
put a drive into service	• drivelist drivestat • AA Win GUI	displays the current status of the drives and to change the status	when an INACTIVE drive is ready to return to service
recover dead space	• volspace volcomp volformat	compresses a selected volume	to recover dead space on volumes
reinitialize the AMASS index	refer to the vendor documentation for the command and procedure	clears out the existing index and reinitializes it to an empty index	only when AMASS is not running
reintroduce an offline volume	• vollist volslot bulkinlet volloc	reintroduces an offline volume to a jukebox	if data from an offline volume needs to referenced for read access

Table 17.5-1. Common ECS Operator Functions Performed with AMASS (2 of 2)

Operating Function	Command or GUI	Description	When and Why to Use
Remove a volume or volume group	• vollist, voloutlet, volloc	removes a volume or an entire volume group from the jukebox	to make room for new volumes or because data not being used needs to be retained
remove space from a volume group	• vgroot #VG • setvolgrp /path #VG • volgroup	removes space from one volume group to add it to another	when space is needed in another volume group
replace a full backup volume	• voloutlet 1, • bulkinlet 0, • vollabel {to rename} • tapelength 1 2 • volformat -b 256k 1 • amassbackup -fv	initializes a new backup volume and performs a full backup	when the backup volume is 95% full
restore the AMASS database	• amassrestore	restores the index either completely or to the point of the last full or partial backup	• when the index is corrupt on the magnetic disk • do not use the amassrestore command when AMASS is running
retrieve system usage by user	• amassreport	displays the number of files and directories owned by a user and the amount of space they take up	to get statistical information on the amount of space used by an individual(s)
retrieve system usage by volume	• adf	displays volume group, jukebox reference number, position of volume, amount of used space, number of directories and files on volume, amount of free and dead space	to get statistical information about the usage of a particular volume
reuse a volume	• (volcomp, volstat, volclean, volformat	compresses and moves existing data to another volume, then reformats the volume	when a volume contains data no longer needed or contains mostly dead space
take a drive out of service	• drivelist, drivestat	displays and changes the status of the drive	when a drive has excessive failures or for maintenance

For a full explanation of all AMASS commands see the *AMASS System Administrator's Guide*. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

The Activity Checklist depicted in Table 17.5-2 provides an overview of the Command Line Fuctions section. Column one (**Order**) shows the order in which tasks should be accomplished. Column two (**Role**) lists the Role/Manager/Operator responsible for performing the task. Column three (**Task**) provides a brief explanation of the task. Column four (**Section**) provides the

Procedure (P) section number or Instruction (I) section number where details for performing the task can be found.

Table 17.5-2. Command Line Functions - Activity Checklist

Order	Role	Task	Section
1	DAM/DIT	Formatting a Volume	(I) 17.5.1
2	DAM/DIT	Formatting a Tape Volume	(P) 17.5.1.1
3	DAM/DIT	Formatting an Optical Disk Volume	(P) 17.5.1.2

17.5.1 Formatting a Volume

To format a volume, it must be online. A volume is placed online using the **volloc** command. If the volume is a tape cartridge, you must first set the tape length using the **tapelength** command. Formatting a volume will destroy any files on that volume. Before formatting a volume, check to make sure it does not have any files which should be saved. Tables 17.5-3 and Table 17.5-4 present the steps required to follow the formatting process. If you are already familiar with the procedure, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

17.5.1.1 Formatting a Tape Volume

1. Put the volume online using the following command:
volloc -n *volnumber*
- **volnumber is the number of the volume**

2. Verify there are no files on volume.
volfilelist *volnumber*

3. Set the tape length.
Tapelength *2 volnumber*
- **2 is the value used to set tape length for 50G tape.**
- **volnumber is the number of the volume**

4. Format the volume.
volformat -b 262144 *volnumber*

5. Verify status of the volume
volprint -a *volnumber*

Table 17.5-3. Formatting a Tape Volume

Step	What to Do	Action to Take
1	volloc -n *volnumber*	press **Return**
2	volfilelist *volnumber*	press **Return**
3	Tapelength *2 volnumber*	press **Return**
4	volformat -b 262144 *volnumber*	press **Return**
5	volprint -a *volnumber*	press **Return**

17.5.1.2 Formatting an Optical Disk Volume

1. Put the volume online using the following command:
volloc -n *volnumber*
- **volnumber is the number of the volume**

2. Verify there are no files on volume.
volfilelist *volnumber*

3. Format the volume.
volformat -b 1024 *volnumber*

4. Verify status of the volume
volprint -a *volnumber*

Table 17.5-4. Formatting an Optical Disk Volume

Step	What to Do	Action to Take
1	volloc -n *volnumber*	press **Return**
2	volfilelist *volnumber*	press **Return**
3	volformat -b 1024 *volnumber*	press **Return**
4	volprint -a *volnumber*	press **Return**

17.6 Storing New Data in Archive Repository

Storing new data in the archive repository is largely an automated process that does not normally require operator interaction and occurs as a result of operations such as ingest and data production. Any operations involvement would be to support archive administration operations, resolve problems, periodically monitor working storage and archival operations, and coordinate with the appropriate external/internal sources to resolve schedule conflicts.

Because of the automated nature of this process, step-by-step procedures are not required however, a typical archive scenario is shown.

Insert Data into the Archive Scenario

NOTE: The scenario that follows describes the insertion of data into the Data Server at an ECS DAAC and is derived from document 605-CD-002-001, Release B SDPS/CSMS Operations Scenarios for the ECS Project (March 1996).

Data and associated metadata can be received from numerous sources. This scenario focuses on a routine data insert from the Science Data Processing subsystem. It assumes that all components are active and not in any degraded modes of operation, that ESDT data collection types have been established, and that the data server's nominal activity rate is 50% of capacity.

Initiate the session between the Processing Subsystem and the Data Server.

The Processing Subsystem sends a Data Insert Request to the Science Data Server.

Receipt of the request is logged (via MSS Logging Services) and a request identifier is associated with the Data Insert Request.

The content of the request is validated; if successful, it is queued for later processing. If unsuccessful, a rejection message is issued.

The operator may examine the progress of a request by following menu path Other Screens→Logs & Reports (MSS). In the Data Server Subsystem, open Storage Manager (DSS-OSM) to browse the log files provided by the Management Services Subsystem (MSS); see next section for details.

Transfer data from Processing Subsystem to Data Server.

The queued Data Insert Request is reached and processing begins.

Associated data granules and metadata are transferred from the Processing Subsystem to the Data Server working storage.

Data transfer status, including recoverable errors, are indicated in the event log via MSS Logging Services.

The operator may check request status at any time using the DSS-OSM Request Screen.

Validate metadata received from the Processing Subsystem.

The metadata update file(s) produced by the associated product PGEs are validated for completeness and correctness.

Validation success or failure is logged via MSS Logging Services with the associated Data Insert Request Identifier and the appropriate status message is returned to the Processing Subsystem.

Store data granules in the permanent archive.

Upon successful validation of the metadata update file, Science Data Server sends a Data Storage Request to Storage Management.

The data granules in working storage associated with the Data Storage Request are stored.

The Archive Activity Log (via MSS Logging Services) records each data product being stored and storage status of each storage operation.

A checksum value is calculated for each data object associated with each granule.

The checksum value, storage status, and other selected metadata are forwarded to the Science Data Server in a status message upon completion of the Data Storage Request.

Store metadata.

Science Data Server receives and logs the Data Storage Request status message from Storage Management.

The additional metadata items are validated.

The PGE produced metadata update file and the storage management provided metadata are loaded into the metadata database.

The status of the metadata load is entered in the event log.

The operator may examine the progress of the insert by following menu path Other Screens→Logs & Reports (MSS) in the DSS-OSM to browse the log files provided by the MSS.

Report Data Insert Request status.

The Science Data Server logs completion of the Data Insert Request in the event log and reports completion of the Data Insert Request to the Data Archive Manager, the operator console and to the insert Requester (the Processing Subsystem in this scenario).

Each of the above entities would also be notified if the request failed and reason(s) for failure identified.

Process subscriptions based on newly inserted data.

The Science Data Server will then examine the event list for all subscriptions for that event.

Subscription notifications are sent to the appropriate entities as appropriate and distribution processing is initiated.

The Science Data Server sends an Advertisement Update Message to the Advertising Server to advertise the new data.

17.6.1 Monitor Insertion of Data into the Archive

Data that is inserted into the archive can be received from a number of sources including the Ingest Subsystem, Science Data Processing Subsystem, other DAACs, and Authorized Users. The DIT can monitor the insertion of data into the archive using the Ingest GUI or, by going to the appropriate server (e.g. g0drg01) following archive directory and doing a list: **/dss_stk1/*mode*/*datatype*** where *mode* is the operating mode i.e. **TS1**, **TS2, SHARED** or, **OPS** and *datatype* is the type of data being archived, i.e. **aster** or **modis**. For detailed information on the functionality of these GUIs, review the 609 User's Guide document.

17.6.2 Monitor Insertion of Data into the Archive using AMASS

AMASS provides a capability to monitor the system with a number of commands. Table 17.6-1 provides a list of helpful AMASS software commands that may be used to monitor insertion of data into the FSMS system. These commands are accessible through the /usr/*amass/bin* directory.

Table 17.6-1. AMASS Monitoring Commands

amassstat	_view or toggle AMASS status
dirfilelist	_view subdirectories or files under a directory
drivelist	_Listing and status of the drives.
jobs	_displays jobs pending and status of jobs completed
quedisplay	_displays request in the que and volumes allocated to the drives
sysperf	_system through put and individual drive data rate performance, drive status, and volume mounts
vglist	_view attributes for a volume group
vgroot	_view relative path for a volume group
volstat	_view status (active or inactive) or, change status of a volume
volusage	_view statistics for all volumes
vollist	_Listing and status of the volumes in library.
volspace	_view volumes with a specified percentage of dead space

The AMASS GUI is available for the DAM to view drive, file, file system, volume, and juke box statuses. The GUI is to be used for monitoring only. All drive juke, file or volume changes should be done through command line operations. The GUI is accessible through the AMASS directory, /usr/amass/bin/gui.

17.6.3 Monitor Archive Status Using ACSLS

ACSLS provides the capability to monitor the Storagetek portion of the FSMS system. Although ACSLS does not keep track of data files, equipment and media status may indicate any problems in accessing the data. Table 17.6-2 provides a list of ACSLS software commands that are useful in monitoring the system. These are query commands that can be used to status specific items, or all in the category specified. These commands are accessed through the command procedure shell window of the ACSLS workstation.

Table 17.6-2. ACSLS Monitoring Commands

query server all	_display status of all servers
query request all	_display status of all request
query volume all	_display status of all volumes
query drives all	_display status of all drives
query lsm all	_display status of all lsms
query cap all	_display status of all caps
query acs all	_display status of all acs
query port all	_display status of all ports

17.6.4 Monitor Insertion of Data into the Archive using DAS

DAS provides the capability to monitor the status of the EMASS portion of the FSMS system. Table 17.6-3 provides a list of DAS Administration commands that are useful in monitoring the system. These are query commands that can be used to status specific items, or all in the category specified. These commands are accessed through the command procedure shell window of the DAS workstation or from the PC located on the AML.

Table 17.6-3. DAS Monitoring Commands

list	_requests DAS to list currently active requests
view	_displays the status of a volume
listd	_display status of drives
robstat	_display or change status of robot
qvolsrange	_display list of accessible volumes within the specifies range

17.6.5 Fault Notification

The fault notification process in the archive begins with an error condition arising with software, hardware, or data related faults. The problem notification between the DIT and the DAM will most likely be verbal, although electronic notification may be necessary at times.

The DAM or DIT will use the trouble ticket system available on site to officially notify the DAAC of warranted archive problems. The trouble ticketing procedures are found in the Problem Resolution section of the DID 611 document (section 8). The DAM or DIT may notify appropriate DAAC personnel while still in the error evaluation mode and before the trouble ticket creation process. This stipulation allows for the timely notification process to begin before an official document is issued. Table 17.6-4 presents the steps required to follow the fault notification process. If you are already familiar with the fault notification procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Identify problem with the ingest, archive, or data distribution subsystems.

2. Investigate error messages or problem indications.

3. Notify DAM of problem via person, phone, or electronic means.

4. DAM identifies and evaluates severity of problem. DAM must determine downtime and production impact, if any. Some problems may require a software reboot or simply putting damaged hardware off-line and continuing until servicing is possible.

5. DAM investigates error messages or problem indications: software, hardware, data related.

6. Evaluation should determine if the problem is repairable or if repair requires attention of the specified maintenance contractor.

7. Solve problem if possible.

8. Notify personnel deemed necessary if severity warrants via phone, in person or by electronic means (optional step). Some circumstances deemed severe enough may require notifications to DAAC staff in evaluation stage before a trouble ticket is created. This does not circumvent the trouble ticket process. It only allows for the repair effort process to start without addition downtime awaiting official notices.

9. Create Trouble Ticket.

10. DIT/ DAM officially notify DAAC of a problem and severity with a trouble ticket.

11. Notify service personnel required to repair problem if appropriate.

Table 17.6-4. Fault Notification-Quick-Step Procedure

Step	What to Do	Action to Take
1	DAM or DIT Identify problem with the archive system	investigate error messages or problem indications
2	DAM notified of problem	oral, phone or electronic notification
3	DAM identifies and evaluates severity of problem	investigate error messages or problem indications: software, hardware, data related
4	Repair problem in timely manner if possible	Solve problem if possible
5	Notify personnel deemed necessary if severity warrants (optional step)	oral, phone or electronic notification

6	DIT/ DAM officially notify DAAC of a problem and severity	Create Trouble Ticket in Remedy and or DDTS
7	Notify service personnel required to repair problem if appropriate.	Notify appropriate personnel

17.6.6 Recovery from Failure to Store or Retrieve Data

When a storage failure occurs, the request is failed and the reason for failure is returned to SDSRV. The Storage Management Control GUI as well as AMASS commands and utilities permit the operator (e.g., Data Ingest Technician) to review the error messages. The operator can also monitor system tail logs in UNIX windows in order to track storage activity. For AMASS based archives, the most likely cause of a failure will be file copy errors due to network problems, mount point problems, AMASS being down, or failure to associate a volume group with a directory in the AMASS cache. AMASS will not report write errors even if all of the drives are off-line. Only when there is no media in AMASS will a write error be reported. Table 17.6-5 presents the steps required to follow the fault notification process. If you are already familiar with the procedure, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. **Login as** amass **or** root **and enter the** *password*
   - Remember that your password is case sensitive.
2. Use the **amassstat** command to determine if AMASS is running.
3. Use the **amass_log** script and **SYSLOG** to display AMASS errors.
   - The amass_log script is located in the /usr/amass/tools directory.
   - The SYSLOG is located in the /var/adm/ directory. It may be necessary for the operator to look at the syslog on the host where the file is located to see if there are error messages which may explain the failure to access a file.
   - Each AMASS entry in the system log file has a date and time stamp. Several days' worth of messages may exist in the log. When reviewing the output to determine if any of these messages might indicate the cause of the problem, make sure that the messages being looked at are for the correct date and time.
4. See the "Error Messages" in the appendix of the *AMASS System Administrator's Guide, Version 4.9,* for probable causes and possible solution to the problem. The AMASS document can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.
5. After the corrective action has been performed, see if the problem is corrected.
6. If the problem persists further problem diagnosis should be attempted starting with the procedures below in sections 17.6.6.1 (Write errors) or 17.6.6.2 (Read errors).

Table 17.6-5. Recovery from Failure to Store or Retrieve Data Quick-Step

Step	What to Do	Action to Take
1	**amass** or **root**	press **Enter**
2	**amassstat**	press **Enter**
3	**amass_log**	press **Enter**
4	Correct the problem	
5	Verify correction	

17.6.6.1 Diagnoses and Investigation of Write Errors

Write errors to the archive should be infrequent. If the archive is a robotic library which is fronted by the AMASS software, error messages in /var/adm/syslog will show the error messages from the AMASS software. If the archive is a disk based archive, then the software will receive the write errors and report them via operator notification and MSS error logging.

17.6.6.1.1 Causes of Write Errors

With AMASS

AMASS off-line - software will capture the error and log this since the directory that is being written to will not exist. However, the nature of the write error will not be detected.

All Drives off-line - Cache space will fill up, write requests will be accepted but, all new data sent to cache will not be captured. The data transfer requests hang and do not return an error. Current code does not allow for detection of this condition. Write requests to AMASS can not be killed. The operator will have to diagnose this condition after being notified by Tivoli that AMASS drives are off-line or by noticing problems while looking at the log files.

No media associated with the directory - will cause a write error which is detectable by the software. The nature of the error will not be detected.

Without AMASS:

Disk Partition Filled up - software will capture this condition although the error condition will not be known.

With or without AMASS

Directory does not exist - will cause a write error

Undetected write errors

AMASS: media write failure - will cause the drive to go off-line and the media volume to go off-line as well. The error will be written to /var/adm/syslog. No error will be detected by the application software. The operator can execute a /usr/amass/bin/drivelist to see which drive has been put off-line.

17.6.6.2 Diagnoses and Investigation of Read Errors

When a read error is encountered by AMASS, both the drive and the tape will be taken off-line. The application will be notified of the read failure. The Archive Server will log an error message when the read failure is returned. The log message will include the name of the file, the secondary path for the file, the checksum for the file, and a reason for the failure. If the reason for failure is a checksum mismatch on retrieval, then the file will have to be restored. If the reason for failure indicates the media was off-line, then further investigation will have to take place to determine why the tape was off-line. This could be the result of a write error, a read error on the file, or a read error on a another file that caused AMASS to take the tape off-line. For a tape that is off-line, visual inspection or more likely, the need to have vendor maintenance remove the media from the drive, will indicate that a tape is damaged. Any requests for files on that tape will fail or be served from backup. It will be important that the list of files that will be created for restoring a tape from backup be kept and searched when new files are reported missing. This should reduce the number of times that certain procedures have to be performed.

This operations concept builds on the operations concept for reviewing a read error in the first case, and the concept of determining which file was damaged in a situation where data has been recovered from damaged tape.

17.6.6.2.1 File was not successfully retrieved

1. The operator will be notified of Retrieval errors on the STMGT GUI (NCR 16497), the reason for the failure, and the file path for which the file was accessed.
2. The operator will use the path and filename to get the volume id by using the AMASS command **fileprint *fullpathname***.
3. Once the tape is found, then a vollist given the volume id will indicate the state of the tape. If the tape is not active, then investigation using the AMASS logs will have to be done to determine if there was a drive error on the read which took the tape and a drive off-line. If the tape is on-line then the operator will have to determine the cause of the read error from the STMGT GUI.
4. The Operator must now decide whether the effected tape is still useable or not:
    - In the event that the tape appears not to be physically damaged and only a small number of files on the tape have reported read failures recovery of those files alone can be attempted. This should use the procedure “Data Recovery Procedure for Known Files” in section 17.9.2.2. A small number of files from more than one tape may also be handled together at this stage.
    - Alternatively if the tape is visibly damaged or is suffering multiple read failures recovery of the entire tape can be attempted. This should use the procedure “Data Recovery Procedure for an Entire Tape” in section 17.9.2.1.

17.6.7 Deleting Files From the Archive using the AMASS GUI

Deleting files from the archive can be an automated process, with a window provided to show files available for deletion based on system requirements. The AMASS GUI provides a window that allows file deletions. For detailed instructions see AMASS document *Using The AMASS GUI.*

17.7 Archive Backup

AMASS gives you the ability to manage archive and backup applications from a variety of hosts on the network using one or more protocols and any backup solution that can write disk files, for example, tar or cpio.

Because the online AMASS database is the database to the media contents of an AMASS volume set, it must be protected. AMASS provides an automated procedure to back up the database to a dedicated volume in the library. The backup process supports both full and partial backups and can be run either automatically by AMASS or manually by the system administrator. However, for standalone drives you must manually backup the database. Text to insert in 17.7/17.6.6:

Archive data recovery and restoration requirements create backup tapes for storage at local as well as designated remote sites. The arrangement eliminates a single point of failure in data recovery and restoration for the individual DAACs.

Operational staff create these tapes at regular intervals by the using manual commands or automated scripts. The backup procedure creates a tape for local storage in the archive and on-site. The second backup transfers to tape for shipping or to a temporary file for transmit to the designated off-site storage location.

GDAAC sends its backup data to a location at Goddard, but separate from the GDAAC.

Backup data stores that data that which would be hard to reproduce if needed. This data includes the following types: ancillary, metadata, algorithms, engineering, calibration, systems and application software, and selected other data depending on need.

Because the above recovery functions are automated and can be executed from the startup script upon system reboot, the AMASS recovery, startup, and file system mount can all be done in the same fashion as the handling of other UNIX file systems.

Archive data backup is largely an automated process. Automatic and manual backup and restore operations ensure data integrity and safety. Backups are called on automatically to satisfy Read requests where the Read from Primary has failed. As a clarification of terms, backup is used in two contexts.

The first context involves a fully automated process and is set up by the System Administrator via a *cron* job. This process backs up the AMASS database with options, full (File System Index and Journal Files) or partial (Journal Files only) database backup. This same process can also be duplicated using a AMASS software command. This process backs up the AMASS database at

the operators convenience or when necessary for performing maintenance or troubleshooting on the system.

A second context of backup pertains to the backup of actual archive data. This data is selected for backup by the severity of efforts to recover in event of its loss. This data is saved in the archive, saved to a local site, and saved to a remote site. This replication is essential to data safety.

The actual data backup is performed with the custom software provided or by manual operations. The custom software automatically backs up selected data types. Configured software will transfer the backup data simultaneously with the actual data transfer to the archive parent volume or store the data in cache for a later transfer to backup volumes.

The Activity Checklist depicted in Table 17.7-1 provides an overview of archive data backups. Column one (**Order**) shows the order in which tasks should be accomplished. Column two (**Role**) lists the Role/Manager/Operator responsible for performing the task. Column three (**Task**) provides a brief explanation of the task. Column four (**Section**) provides the Procedure (P) section number or Instruction (I) section number where details for performing the task can be found.

Table 17.7-1. Archive Data Backup- Activity Checklist

Order	Role	Task	Section
1	DAM/DIT/SA	AMASS Database Backup	(I) 17.7.1
2	System Administrator (SA)	AMASS Automated Backup	(I) 17.7.1.1
3	DAM/SA	AMASS Manual Backup	(P) 17.7.1.2
4	DAM/SA	AMASS Database Manual Restore	(P) 17.7.1.3
5	DAM/SA	ACSLS Database Backup and Restore	(P) 17.7.2
6	DAM	Backing Up Archive Data	(I) 17.7.3
7	DAM	Generate List of Data to be Backed Up	(P) 17.7.3.1
8	DAM/SA	Creating Local Backup Tapes	(P) 17.7.3.2
9	DAM/SA	Creating Off-Site Backup Tapes	(P) 17.7.3.3

17.7.1 AMASS Database Backup

AMASS software provides two backup procedures. One, fully automated, performs a full backup on the first day of each month along with selectable full or incremental backups at regular intervals set by the system administrator. The current setup initiates a partial backup every evening at 2 a.m. A selection of a full backup involves Journal and File System Index files. The second procedure is partial backup involving only Journal files.

The AMASS software also provides a manually performed backup procedure, **amassbackup** that performs the same functions as the automated backup except with manual intervention.

17.7.1.1 AMASS Automated Backup

The online database of AMASS needs protection. It is the index to the media contents of the AMASS volume sets. This procedure performs automatically without outside intervention. The Systems Administrator can modify the frequency of these backups and add partial backups for another time by changing the *cron* job which initiates the backup.

17.7.1.2 AMASS Manual Backup

This second procedure involves logging into AMASS and commanding the backup script, **amassbackup**, which utilizes either full or partial options. This command also includes capability to transfer to a tape device or to a designated archive volume. Since the system performs the automated backup without intervention, only the second procedure is be described below.

This backup procedure utilizes a backup volume or tape device. Please note that both methods only back up the File System Index and Journal files. If you are already familiar with the procedures, you may prefer to use the quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. **At the UNIX prompt, type** amass **or** root **and enter the password.**
   - Logs you into AMASS
2. Enter AMASS command:

   amassbackup [-fv]

Table 17.7-2. AMASS Backup Command-Quick-Step Procedure

Step	What to Enter or Select	Action to Take
1	**amass** or **root**	press **Return**
2	**amassbackup [-fuv] [-d tapedevice]**	press **Return**

Further explanation of the command is found in the AMASS System Administraors Guide. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

17.7.1.3 AMASS Database Manual Restore

Restoring the AMASS database is a manual process which must be initiated by either the System Administrator or, the DAM. The AMASS database is restored using the AMASS command, amassrestore. The amassrestore command will restore the last full backup, the last partial backup and all journal transactions that occurred since the last backup. Upon execution, the amassrestore command will create a sub-directory under filesysdb called journal. All restored files will be copied to the journal directory.

This restore procedure utilizes a backup volume or tape device. Please note that both methods only restore the File System Index and Journal files. If you are already familiar with the procedures, you may prefer to use the quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. **At the UNIX prompt, type** amass **or** root **and enter the password.**
   - Logs you into AMASS
2. Enter AMASS command:

   amassrestore [-fuv]

Table 17.7-3. AMASS Backup Command-Quick-Step Procedure

Step	What to Enter or Select	Action to Take
1	**amass** or **root**	press **Return**
2	**amassbackup [-fuv]**	press **Return**

Further explanation of the command is found in the AMASS System Administrators Guide. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

17.7.2 ACSLS Database Backup and Restore

The ACSLS databases are located on disk on SUN workstations; each library silo having it's own dedicated SUN. ACSLS provides a script to perform its database backup. This script is run from the ACSSA cmd_proc window. The ACSLS database should be backed up periodically. StorageTek recommends that you use bdb.acsss to back up the database to tape after any of the following conditions:

- Running acsss config
- Importing or converting the database.
- A significant number of enters or ejects.
- A large number of scratch mounts.
- A significant number of volume state changes, such as from scratch to data or from locked to unlocked.
- Any database recovery.

You can only use backups created by bdb.acsss to restore the ACSLS database and you must use rdb.acsss to restore it. Similarly, you can only use the db_export.sh, and db_convert.sh database utilities to export, and convert/import, the ACSLS database. For more information on exporting and converting the ACSLS database refer to the *ACSLS Installation and Configuration Guide.*

To ensure that you recover an accurate and consistent database, always use the most current database backup.

After you upgrade to a new version of ACSLS, do not use database backups or exports created with previous versions. Make sure, however, to create a new backup as soon as you have upgraded.

Use the bdb.acsss utility to back up the ACSLS database.

When the server disk that contains the database reaches a predefined limit, ACSLS automatically creates a checkpoint backup file to disk. You should also, however, periodically run the bdb.acsss utility to manually create checkpoint files (especially to create tape backups that can be stored offsite). During ACSLS operations, transactions with the library create redo log files. Table 17.7-2 describes the database checkpoint and redo log files. If the database fails, you can recover the database using the rdb.acsss utility. Retain all utility event logs. These logs will help StorageTek to resolve any problems.

Table 17.7-3. Checkpoint and redo log files.

File Type	Definition and Use
checkpoint files	Provides a point-in-time snapshot copy of the entire database
redo log files	Transaction records of database changes made since the last checkpoint. During database recovery using rdb.acsss, these files are applied sequentially to the checkpoint to re-create the database including all transactions since the checkpoint.

17.7.2.1 ACSLS Database Backup Script

If you are already familiar with the procedures, you may prefer to use the quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Log in as acsss **and enter the** *password***.**

- Logs you into acsss

2. Load tape into backup drive.

3. If you enter bdb.acsss with no options, the backup utility defaults to the default tape device attached and configured to the ACSLS server. At acssa prompt, enter:

- **bdb.acsss**

- The bdb.acsss utility backs up the ACSLS database and miscellaneous library resource files.

4. For backup to a specific drive or file; enter the utility and options:

_ **bdb.acsss [-f *filename* or tape~device] [-o]**

- **-f tape_device**

  specifies any tape device attached and configured to the ACSLS server.

- **-f *filename***

  specifies a UNIX file to contain the ACSLS database. You must have write permissions to the file.

- -0 is ignored; provided for compatibility with previous 11 ACSLS versions.

Table 17.7-4. Create ACSLS Back Up - Quick-Step Procedures

Step	What to Enter or Select	Action to Take
1	**acsss**	press **Return**
2	**bdb.acsss** [-f db_file I tape~device] [-o]	press **Return**

17.7.2.2 ACSLS Database Restore Script

ACSLS provides the rdb.acsss utility to restore the database in case of severe disk or data problems. Provided you have made regular backups, you should be able to restore the database with little or no loss of data. It will probably be necessary to restore the database in any of the following situations:

- After a system crash.
- Anytime the database can not be started.
- Anytime there is a physical or logical error in the database.

If you are already familiar with the procedures, you may prefer to use the quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Log in as acsss **and enter the** *password.*

- Logs you into acsss

2. Load the restore tape into backup drive.

3. If you enter bdb.acsss with no options, the backup utility defaults to the default tape device attached and configured to the ACSLS server. At acssa prompt, enter:

   rdb.acsss

   - The rdb.acsss utility restores the ACSLS database and miscellaneous library resource files.

4. To restore from a specific drive or file; enter the utility and options:

rdb.acsss [-f *filename* or tape~device] [-o]

- **-f tape_device**

  specifies any tape device attached and configured to the ACSLS server.

- **-f *filename***

  specifies a UNIX file to contain the ACSLS database. You must have read permissions to the file.

- -0 is ignored; provided for compatibility with previous 11 ACSLS versions.

Table 17.7-5. Create ACSLS Restore - Quick-Step Procedures

Step	What to Enter or Select	Action to Take
1	**acsss**	press **Return**
2	**rdb.acsss** [-f *db_file* I *tape~device]* [-o]	press **Return**

17.7.3 Backing Up Archive Data

During normal operations, data will be backed up automatically to volume groups according to parameters set in the ESDT. When an ESDT is loaded into the system, part of the information that is given is the Archive Id, Backup Archive Id, and off-site id. The Archive Id and Backup Archive Id dictate where the file will be stored for the primary and backup copies. Backup Archive Id and off-site id may be empty strings, in which case no backup is done.

The Archive Id and Backup Archive Id are both comprised of two parts: the server key and the logical volume group indicator. The server key is used by the code to attach to the correct archive server when data for the ESDT is ingested or acquired. The logical volume group indicator is used by the archive server to write the file to the correct volume group in the archive. The off-site id is a three character id of the DAAC which is doing off-site storage for that ESDT. The software supports having the three character designation for the local DAAC be the off-site id. In this case, the file will be backed up to a volume group within the local archive. The STMGT operations GUI can be used to get information about the pathnames in AMASS that map to the different logical volume group identifiers. Logical volume group identifiers are also configured via the GUI.

For various reasons however, it may be necessary to manually backup data. To backup specific data, the DAAC Archive Manager (DAM) will generate or will have generated for him/her a list of data types which are designated for local or off-site backup. At the time the files are archived they are written to specific volume groups which correspond to the specific data type(s). Only files belonging to the data type are written to the tapes in a specific volume group. Hence, by knowing which data types are designated for backup, the DAM can determine the tapes which should be backed up locally and for off-site storage. This can be accomplished using the AMASS administration **vollist** command. The DAM can determine how many tapes must be backed up by using this command.

If there are other files designated for local and off-site backup which have not been written to a specific volume group, the DAM can use the appropriate AMASS administration commands, **dirfilelist** and/or **volfilelist**, to locate the appropriate archive volume which contains the designated archived files.

For more information about these AMASS commands, refer to the *AMASS System Administrators Guide*. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

17.7.3.1 Generate List of Data to be Backed Up

Certain volume groups are dedicated for storing backup data. Using the AMASS administration commands and UNIX utilities, the DAM generates a sorted list of files contained on each volume in a backup volume group. It is important to sort the list by volume number to minimize the number of volume mounts and dismounts. The sorted list is edited to remove files which are not desired to be backed up.

Table 17.7-6 presents the steps required to generate a list of data to be backed up. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. At the UNIX prompt, type; amass **or** root **and enter the password.**

- Logs you into AMASS.

2. To generate a list of all files on a backup directory type:
dirfilelist *pathname*

- **pathname is the path of the backup directory i.e., /dss_stk2/modis/backup.**

3. To generate a list of the files on each volume, type:
volfilelist *volumenumber*

- The volume numbers used should be the ones designated for data backup.

Table 17.7-6. Generate List of Data to be Backed Up - Quick-Step Procedures

Step	What to Enter or Select	Action to Take
1	**amass** or **root**	press **Return**
2	**vollist**	press **Return**
3	**volfilelist** ***volumenumber***	press **Return**

17.7.3.2 Creating AMASS Local Backup Tapes

Using the output from section 17.7.3.1 as input, create local backup tapes using the appropriate UNIX commands to copy all of the files to a designated volume group. After creation of the backup tapes, remove the tapes from the AML if required.

Although some backup volumes may be stored locally external to the Powderhorn LSM, most will be stored within a library silo. Table 17.7-7 presents the steps required to create a volume group to be used for the creation of local backup tapes. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. **At the UNIX prompt, type;** amass **or** root **and enter the password.**
   - Logs you into AMASS.

2. **Create the subdirectory (if not already created) by entering the following:**
   a) mkdir /dss_stk1/vg22/local_backup/
   - The directory above is only an example, actual directory structure is determined by the System Administrator.

   b) Press Return.

3. **Create a volume group and associate it with the subdirectory just created by typing:**
   setvolgrp path volumegroup
   - Path is the full UNIX system path name of the directory whose directory tree is being assigned to the volume group.
   - Volumegroup is a number between 0 and 2047 assigned to the volumes by the volgroup command.
   - Ex. setvolgrp /dss_stk1/vg22/local_backup 22

4. **The operator goes to the** Configure **tab in the STMGT GUI and selects the appropriate** archive server**.**

5. **The operator then selects** Add Volume Group **and enters in the volume group identifier and the path for the volume group.**

6. **The operator then selects** Backup **from the pull down menu at the top of the STMGT GUI and selects** Setup**.**

7. **The operator sets the site id to be the three character specification for the local site.**

8. **The operator has to then go into the STMGT database and update the off-site table with the volume group name that was created to hold the data that needs to be backed up for off-site storage. (GUI doesn't cover this yet, see System Administrator for help).**

9. **Add tape volumes to the volume group as needed using the** *volgroup* **command or, enable the space pool for that volume group with the** *vgpool* **command.**
   - For more information on using AMASS commands, see AMASS System Administrator's User Guide. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

Table 17.7-7. Create Local Back Up - Quick-Step Procedures

Step	What to Enter or Select	Action to Take
1	**amass** or **root**	press **Return**
2	**mkdir /dss_stk1/vg22/local_backup/**	press **Return**
3	**setvolgrp *path volumegroup***	press **Return**
4	**cp *filename pathname***	press **Return**
5	**ADD volume group**	enter **volume group identifier**
6	**Select Backup/Setup**	
7	**Set id to be 3 character designation**	
8	**Update STMGT database backup table with volume group name**	
9	**Add tapes to volume group as needed**	**volgroup / vgpool**

17.7.3.3 Creating AMASS Off-Site Backup Tapes

ESDTs whose files have to be backed up should have the backup archive id and off-site id configured in SDSRV at installation time. Since cross DAAC transfer of data is not supported in the current delivery, the off-site id should be the same as the local site.

Using the output from section 17.7.3.1 as input, create the backup tapes using the following procedures. Table 17.7-8 presents the quick steps required to follow the procedure. If you are already familiar with the procedure, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. **At the UNIX prompt, type;** amass **or** root **and enter the password.**
   - Logs you into AMASS.

2. **The operator creates a new volume group in AMASS. Create the subdirectory (if not already created) by entering the following:**
   a) mkdir /dss_stk1/*mode*/offsite_backup/
   - The directory above is only an example, actual directory structure is determined by the System Administrator.

   b) **Press** Return.

3. **Create a volume group and associate it with the subdirectory just created by typing:** setvolgrp *path volumegroup*
   - Path is the full UNIX system path name of the directory whose directory tree is being assigned to the volume group.
   - Volumegroup is a number between 0 and 2047 assigned to the volumes by the volgroup command.
   - Ex. setvolgrp /dss_stk*n*/modis/

4. **The operator goes to the** Configure **tab in the STMGT GUI and selects the appropriate** *archive server***.**

5. **The operator then selects** Add Volume Group **and enters in the volume group identifier and the path for the volume group.**

6. **The operator then selects** Backup **from the pull down menu at the top of the STMGT GUI and selects** Setup**.**

7. **The operator sets the off-site id to be the three character specification for the local site.**

8. **The operator has to then go into the STMGT database and update the off-site table with the volume group name that was created to hold the data that needs to be backed up for off-site storage. (GUI doesn't cover this yet, see System Administrator for help).**

9. **Add tape volumes to the volume group as needed using the** *volgroup* **command or, enable the space pool for that volume group with the** *vgpool* **command.**

Table 17.7-8. Creating AMASS Off-Site Backup Tapes

Step	What to Enter or Select	Action to Take
1	**amass** or **root**	press **Return**
2	**mkdir /dss_stk1/*mode*/offsite_backup/**	press **Return**
3	**setvolgrp *path volumegroup***	press **Return**
4	**Configure/*Archive Server***	Select from STMGT GUI

5	**ADD volume group**	enter **volume group identifier**
6	**Select Backup/Setup**	
7	**Set id to be 3 character designation**	
8	**Update STMGT database off-site table with volume group name**	
9	**Add tapes to volume group as needed**	**volgroup / vgpool**

17.7.3.3.1 Close out AMASS Off-Site Backup Volume Group

Follow this procedure in the event that a different volume group is to be used for backup so that the original volume group can be exported. Table 17.7-9 presents the quick steps required to follow the procedure. If you are already familiar with the procedure, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. The operator repeats steps 1 and 2 from the procedure above.

2. The operator selects **Modify Volume Group** and enters the logical volume group identifier for the off-site backup (may have to look up in the database)

3. The operator enters the **new path** created in step 1 for the new path for the volume group identifier.

4. The old volume group can now be exported using AMASS commands. Remove volume and send to distribution for shipment. Along with the AMASS backup tape, a metadata file is exported to the off-site facility using vgexport.

    - For more information on using AMASS commands, see AMASS System Administrator's User Guide. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

Table 17.7-9. Create Off-Site Back Up - Quick-Step Procedures

Step	What to Enter or Select	Action to Take
1	**amass** or **root**	press **Return**
2	**mkdir /dss_stk1/vg22/local_backup/**	press **Return**
3	**setvolgrp *path volumegroup***	press **Return**
4	**Select appropriate archive server from STMGT GUI**	
5	**Add volume group**	**enter group identifier and path**

6	**Select backup/setup**	
7	**Set off-site ID**	**Enter 3 characters for local site**
8	**Update off-site table with backup volume group**	
5	**Add volumes to group as needed**	**volgroup, vgpool**

17.8 Media Quality Control

The Archive Manager is responsible for the quality of data found in the archive. This encompasses not only getting quality data to the media, but also assuring this same data is available to users for a number of years.

Each archive manager will have to develop the media QC schedules and methods depending on the needs of each DAAC. Each DAAC has its own production loads and special needs. DAAC's with light loads can perform QC functions without impacting normal production timelines. DAAC's under heavy loads have to take this into consideration when scheduling QC functions.

The archive software provides command line instructions to access data such as; drive errors, databases that record when data is first recorded, when data is last retrieved, and number of times that data has been accessed by the users. Some AMASS commands which are useful for monitoring status and errors are: *amassreport, adf,* and *drivelist*. AMASS also provides scripts that can be run to view system logs such as *amass_log* and *amass_snap*. They can be used to ascertain if the data has problems or possibly degrading. For detailed information on these commands see *AMASS System Administrator's Guide*. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

The D3 tape media is new to the market, but indications are that the data will have a shelf life of at least ten years. This means that the oldest data will have to be periodically tested from the storage area as well as the physical archive itself. The object is to find a comfort range of data storage limits before tapes have to be copied to other media.

If a tape resides off-line, the tape can be retrieved from storage and inserted into the archive to be copied to a volume group or copied to another media using an upcoming improvement to the *volcopy* command. This will have new tape to tape as well as disk to disk capabilities.

It is important to realize the difficulty in recovering data and take the care to handle cartridges properly. If a cartridge shows physical damage, it should be removed from the archive or storage and assessed for damage before using. Drive safety is of extreme importance in the evaluation of tape usage. Physical breakage, cracks or visible problems with the tape outer cartridge should be carefully assessed. Cartridges should be free of dust, dirt and moisture.

Damage to the physical tape; crinkles, scratches, tears, etc., are not a matter of '*how bad is it'*. Any of these warrant a tape not being loaded onto any drive. Damaged tape can wrap around of rollers and the heads causing considerable damage especially to the rotating heads of a drive. The following are instructions on handling of cartridges.

The Activity Checklist depicted in Table 17.7-1 provides an overview of the Graphical User Interface section. Column one (**Order**) shows the order in which tasks should be accomplished. Column two (**Role**) lists the Role/Manager/Operator responsible for performing the task. Column three (**Task**) provides a brief explanation of the task. Column four (**Section**) provides the Procedure (P) section number or Instruction (I) section number where details for performing the task can be found.

Table 17.8-1. Media Quality Control - Activity Checklist

Order	Role	Task	Section
1	DAM/DIT	Handling a Cartridge	(I) 17.8.1
2	DAM/DIT	Inspecting a Cartridge	(I) 17.8.2
3	DAM/DIT	Storing Environment for Cartridges	(I) 17.8.3
4	DAM/DIT	Operating Environment for Cartridges	(I) 17.8.4
5	DAM/DIT	Cleaning Cartridges	(P) 17.8.5

17.8.1 Handling a Cartridge

The following instructions on handling a cartridge are to be observed in order to prevent cartridge tape damage:

- Make sure the leader block is latched every time you pick up a cartridge.
- Keep cartridges clean.
- Inspect a cartridge each time it is used and never put a damaged cartridge into a transport.
- Do not expose the tape or cartridge to direct sunlight or moisture.
- Do not expose a recorded cartridge to magnetic fields. Such exposure will destroy data on the tape.
- Do not release a leader block and pull tape from a cartridge unless you are repairing the leader.
- Do not handle tape that is outside the cartridge. The tape could be damaged.

17.8.2 Inspecting a Cartridge

Before a cartridge is loaded into a transport, look for the following problems:

- Cracked or broken cartridge
- Liquid in the cartridge
- Dirty cartridge
- Broken leader block

- Broken leader block detent springs
- Damaged write-protect selector
- Gum label loose or extending over the cartridge edge

Cartridges need a stable environment in order to last their full expected life. Unstable environment conditions such as bad temperature control and or humidity problems can degrade tapes being stored. These conditions can affect the binding between the oxide and backing of the tape. This allows the oxide to flake off the backing and leave gaps in the oxide surface which wholes the actual data stored on tape.

Not only do you lose data but the flaking of oxide while running on a drive can effect the rollers control of tape motion. This can also lodge itself on spinning heads causing degraded read and write conditions. The following are basic rules for stabilizing the cartridge environment. These are standards found in the STK D3 Operators Guide.

17.8.3 Storing Environment for Cartridges

When storing cartridges:

- Store cartridges in a clean environment. The preferred temperature for storage is 50C to 320C (400F to 900F) with a relative humidity of 40% to 60%.
- Keep cartridge tapes in the operating environment for at least 24 hours before you use them.
- Keep a cartridge tape in its protective wrapping until you are ready to use it.

17.8.4 Operating Environment for Cartridges

When using the cartridges, the recommended temperature range is 15^0C to 27^0C (59^0F to 81^0F) with a relative humidity of 30% to 60%.

Since the environment has a direct affect on the tape stability, following is a listing of the operational, storage, and device specific requirements found in Release B Environmental Control Plan for the ECS Project, 532-CD-002-00l.

Environment Restraints

Area / Device	Temperature	Humidity
Computer Room	41-113 F (5-45 C) degrees	20-80 %
Archive Room	59-77 F (15-25 C) degrees	30-70 %
D3 cartridge /operating	60-90 F (16-32 C) degrees	20-80%
D3 cartridge /storage	40-90 F (4-32 C) degrees	5-80 %
EMASS AML/2 range	60-90 F (16-32 C) degrees	15-80%
EMASS AML/2 recommended range	70-75 F (21-24 C) degrees	40-60 %
STK Powderhom	60-90 F (16-32 C) degrees	20-80 %
STK Redwood SD-3 drive	59-81 F (15-27 C) degrees	30-60 %

The QC function involves the operational duty of cleaning tape drives. Tape drives need regular cleaning to ensure the inserted and retrieved data to the archive is of good quality. Tapes are subject to problems inherited from dirty drives. Dirty drives can leave hazardous material on the loaded tape or damage the tape due to the slippage or sticking of roller surfaces. ACSLS software automatically cleans the drives when each reaches the set usage time which is tracked by the software. Cleaning tapes are kept on each archive for this purpose.

17.8.5 Cleaning Cartridges

The main cause of errors on tape is debris embedded in the tape and dirty drive heads. To reduce the chance of a tape becoming corrupted, the FSMS employs cleaning tapes to regularly clean the drive heads. Cleaning tapes are unknown to the AMASS database to prevent them from being used as data tapes. The STK Redwood SD3 helical scan tape drives are pre-set by STK to request a cleaning tape after 100 hours of head use. A cleaning tape has a set number of times it can be used before ACSLS will not use it anymore. The current value is set to 10. This value can be changed using the **set clean** command. There will be times when the operator wants to clean drives between this cycle. The ACSLS command **mount** allows the operator to load cleaning tapes to drives to perform this function. The following procedure lists the steps to clean a drive. If you need further information refer to the ACSLS System Administrator's Guide. Table 17.8-2 presents the steps required to follow the process. If you are already familiar with the procedure, you may prefer to use the quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. **Enter an ACSSA window on a SUN Workstation:**
   Login as acssa **and enter** *password*
   - **ACSSA mode entered and cmd_proc window opened.**

2. **Load a cleaning tape to the desired drive.**
   Type: mount *vol_id drive_id* **where *vol_id* is the volume id of the cleaning tape and *drive_id* is the id of the drive to be cleaned.**
   - **The cleaning tape is loaded to the specified drive and the cleaning tape cleans the heads upon tape mount.**

3. **Dismount the tape from the drive.**
   Type: dismount *vol_id drive_id*
   - **The tape is dismounted and placed in it's home slot.**

4. **Perform this step only if you want to change the number of times a cleaning tape can be used. Type:** set clean *max_usage vol_id* **where *max_usage* (e.g. 10)is the maximum number of uses for that volume and *vol_id* is the volume id of that cleaning cartridge.**

Warning

Please note that the command line instruction ,*Volclean*, actually erases data from the tape and is not for the purposes stated in the above text. Do not confuse the terms.

Table 17.8-2. Cleaning Cartridges

Step	What to Do	Action to Take
1	acssa	press **Enter**
2	**mount *vol_id drive_id***	press **Enter**
3	dismount vol_id drive_id	press **Enter**
4	**set clean *max_usage vol_id***	press **Enter**

17.9 Archive Data Restoration after Failure

This section deals with the permanent restoration of Archive data primary copy where it has been otherwise permanently lost or corrupted. It does not deal with the real-time use of backup data, where it exists, to satisfy Read requests for which the Read of the primary file has failed. That process happens automatically and is covered in section 17.7.

Whilst the Archive hardware is highly reliable errors e.g. due to tape or drive failure must be expected to occur albeit at an extremely low rate as a function of the archived data volume. Where errors have occurred and data has been lost from the archive and can not be restored from backup there may exist the potential to recover and re-archive equivalent data by one of the following means:

copying from backup onto the original or a new primary,

replacing damaged or corrupted volumes with vendor restored or backup volumes,

re-generation by reprocessing,

obtaining replacement data from the original external provider.

This section defines the procedures to follow for such data recovery. Details of technical actions are presented in the enclosed or referenced sub-procedures. This section does not deal with restoring the AMASS system database which is described in section 17.7.1.3.

The procedure described can be performed for a single file, or for multiple files. It is expected that for a single or small number of files the files to restore will be the result of failed file Read requests for which the entry point to these procedures is section 17.9.2.2. Recovery of large numbers of files may be required, for example, after failure of an entire tape. For this the procedure starting point is 17.9.2.1.

The Activity Checklist depicted in Table 17.9-1 provides an overview of archive data restoration. Column one (**Order**) shows the order in which tasks should be accomplished. Column two (**Role**) lists the Role/Manager/Operator responsible for performing the task. Column three

(**Task**) provides a brief explanation of the task. Column four (**Section**) provides the Procedure or Instruction section number where details for performing the task can be found.

Table 17.9-1. Archive Data Recovery/Restoration - Activity Checklist

Order	Role	Task	Section
1	DAM	Manual Data Recovery from Damaged Cartridge	17.9.5
2	DAM/SA	Manual Data Recovery from Local Backup Tapes	17.9.4.1
3	DAM/SA	Manual Data Recovery from Off-Site Backup Tapes	17.9.4.2
4	DAM/DIT	Data Re-Generation or Re-Supply	17.9.2.3

17.9.1 Data Recovery Process Overview

For the specific procedure steps for data recovery see section 17.9.2. This section should be used as a guide and overview of the process only.

Data re-generation and re-ingestion are not purely Archive internal activities and hence this process involves other ECS sub-systems, namely the SDSRV and PDPS as well as STMGT. The storage device vendor, (Storage Technologies Inc., known as Storage Tek or STK) , is also involved.

Storage Tek offer a service to recover remaining good blocks on tapes which have started to fail. Use of this service is the first step to recover entire tapes.

Storage Management (STMGT) is the point of failure detection in the event of data loss from the ECS archive. STMGT, as part of DSS, deals with data only as named files.

Science Data Server (SDSRV) manages the ECS metadata inventory. The inventory database relates archive files with the ECS data "granules" of which they are part. ECS sub-systems other than DSS manage data in terms of granules and hence must manage data loss and replacement likewise. SDSRV is used, within this process, to serve STMGT with archive 'volume IDs' and file checksums and to serve PDPS, with metadata defining the granules related to lost files.

The Planning and Data Production System (PDPS) manages production within the DAAC. PDPS plans and runs PGEs as DPRs (Data Processing Requests) the outputs of which are new granules which are stored in the archive. Where lost archive files were from granules generated within the local DAAC PDPS may be able to re-generate them by repeating the appropriate DPRs,

For the purposes of overview only the following define the major tasks of each ECS sub-system in recovery of lost archive data.

Archive (STMGT):

1. Detect the failure, i.e. of a drive or tape.
2. Optionally attempt to recover files still readable from the effected tape(s), e.g. up to the point of physical failure.

3. Interface to SDSRV to determine location and checksum metadata for files effected by a failure (using the "Effected File List").
4. Interface to Storage Tek for recovery of files on the tape where possible by application of their (Storage Tek's) in-house procedures.
5. Verify correctness of files thus recovered using checksums.
6. Recover additional files from local and remote tape backups where applicable.
7. Pass to second SDSRV procedure list of residual files lost and not recovered (using the "Lost File List").

Archive (SDSRV):

1. Service STMGT requests for file details for recovery from backup and post file recovery verification (SDSRV sub-procedure "SDSRV Retrieval of File Location metadata for STMGT").
2. Determine list of Granules effected by otherwise permanent file loss, from "Lost File List".
3. Determine Granules which can potentially be replaced by re-generation by PDPS based on retrieving a valid local Production History (PH) file UR for the Granule.
4. Retrieve metadata for such granules required by PDPS, including PH UR, and pass to PDPS (using the list "Granules for PDPS Re-Generation").
5. Return list of remaining granules effected by file loss to the calling procedure ("Residual Granules to Recover").

PDPS (PLS):

Search for and then Acquire from SDSRV the actual PH granules (tar files) related to the granules to be re-generated.

Extract from those PCFs the parameters of the lost granules production and create corresponding new Production Requests (PRs) for granule re-generation using them.

Verify that resulting PRs can and should be run (e.g. version of lost data justifies regeneration; applicable version of PGE is 'qualified' for operational version of ECS etc.).

Insert resulting PRs into production plan sequenced as necessary (e.g. regeneration of lost granule 'B' may be dependent on earlier regeneration of lost granule 'A').

Activation of the resulting plan then leads via the normal PLS/DPS production process to granule regeneration and insertion.

Return list of any granules not re-generatable by this instance of PDPS to the calling procedure (as "PDPS Residual Granules").

17.9.2 Data Recovery Process

For an overview of the procedures referenced from this section and their interfaces see Section 17.9.1. The entry point to these procedures is usually from the analysis of Read errors in Section 17.6.6.

17.9..2.1 Data Recovery Procedure for an Entire Tape

This procedure is to be utilized when an entire tape has been damaged or corrupted such that it has had to be removed from the Archive and can not be re-inserted ‘as-is’. The aim of the procedure is to recover or regenerate as much of the tape’s contents as possible.

Note that at this point specific failed Read requests against files on the tape which have backups will have been satisfied by the read of the backup data. This procedure therefore has only to be concerned with *permanently recovering* the primary copy of such backed up data, not with satisfying pending Read requests.

1. Execute the Archive (STMGT) procedure for Manual Data Recovery from Damaged Tape in section 17.9.5. That procedure includes use of the SDSRV procedure for “Retrieval of File Location Metadata” (17.9.6.1), the Storage Tek tape recovery procedure and optionally an attempt to directly recover data from the beginning of the failed tape to the point of first failure.

2. As output of the above step the operator must have the following information and should use it as input to the “Data Recovery Procedure for Known Files” 17.9.2.2:

- the output of the SDSRV “Retrieval of File Location Metadata” procedure (17.9.6.1) which will contain a list of all files originally on the failed tape, their Archive IDs (primary and backup and off-site if applicable) and,

- a list of those files remaining to be recovered i.e. which were *not* successfully recovered within the scope of step 1. (e.g. which did not pass checksum verification on the tape returned by Storage Tek).

17.9.2.2 Data Recovery Procedure for Known Files

This procedure can be executed for residual files not recovered within the "Data Recovery Procedure for an Entire Tape", 17.9.2.1, or for any other individual or set of known files which need to be recovered.

As part of the input to this process the Operator needs the following information for each file to be recovered:

the file "Archive unique filename",

ArchiveIDs i.e. primary plus local and off-site backup ArchiveIDs if valid,

file checksum.

The above data are either supplied by the preceding process or can be generated for a list of files using the SDSRV procedure "Retrieval of File Location Metadata" (17.9.6.1).

For all files for which a backup exists, as indicated by the backup Archive IDs, the procedures (local and off-site) for "Manual Data Recovery from Backup", 17.9.4 should be attempted.

Files thus recovered should be removed from the list of remaining files. For remaining files re-generation of the effected Granules can now be attempted. This is achieved by the following steps.

Using the list of remaining files as input execute the SDSRV procedure "SDSRV Retrieval of Granule Production History Metadata" in section 17.9.6.2. This will output a file of metadata related to the specified *files* which is needed by PLS to re-generate the equivalent *granules*.

Pass the output of the above step to the PDPS/PLS process to "Re-Generate Granules Effected by Loss of Files from the Archive" in section 13.1.6 of this document. That procedure will result in the generation of new Production Requests to replace locally generated granules.

The PDPS/PLS procedure will also generate a list of "PDPS Residual Granules". The SDSRV procedures may also return Granules with no known Production History. All these are Granules, related to the lost files, which cannot be recovered within the above procedure steps. They should be input to the procedure following for "Recovery of Granules from other sources".

17.9.2.3 Recovery of Granules from other sources

Residual Granules from the procedure for "Data Recovery Procedure for Known Files", 17.9.2.2, represent granules not recovered by the above described procedures. These should fall into the following classes:

- data to re-ingest,

- granules remotely inserted/acquired from another DAAC,
- granules for which re-generation has been deemed unnecessary, and
- errors in the recovery process.

The residual granule lists should be concatenated and passed in turn through the following sub-procedures.

17.9.2.3.1 Sub-procedure: Data to Re-Ingest

1. Based on ESDT ShortName INS or Archive Operators must select from the list those lost granules which were input into this DAAC via the INS.
2. The resulting list of Ingested Granules should be sub-divided by data source.
3. With reference to the applicable ICD and using the Granule metadata from the list (as generated by SDSRV or PDPS) the required data re-supply requests should be initiated as per the ICD defined re-supply process for those data suppliers able to re-supply data.
4. Note that some data suppliers, e.g. Landsat-7 have decided not to support such re-supply of data.

17.9.2.3.2 Remotely Inserted Granules

Remote Insert of granules is a special case for Granule recovery because they have been Archived at a DAAC other than the producing DAAC and (generally) not archived at the producing DAAC. Note that Remote Insert of granules is not supported in the applicable versions of ECS (Drop 4). However the following procedure should serve to recover them when applicable:

1. The procedure is as for locally produced granules up to this point, i.e. the non-locally produced granules will be identified in the output of the SDSRV procedure ("SDSRV Retrieval of Granule Production History Metadata") as known to the local SDSRV but without an associated PH granule.
2. Divide the residual granules list by ESDT ShortName and identify those granules which are remotely Inserted i.e. supplied to this DAAC by other DAACs.
3. By source DAAC forward the granule metadata lists to the source DAAC.
4. At the source DAAC this list should be used as input to the PDPS/PLS procedure ("Re-Generate Granules Effected by Loss of Files from the Archive" in section 13.1.6). This is necessary because currently for remotely Inserted granules the PH granule will be inserted at the producing DAAC only and not at the Archive DAAC.
5. As a result the lost granule itself will not be found by the QA monitor search (within the PLS procedure) at the producing DAAC. To find the PH granule the operator must instead search on the short-name of another granule created by the generating PGE. Once the PH granule has been thus found the PLS process can continue to granule re-generation without variation.

Note that for remotely Acquired granules there is no issue of Archive recovery as these are granules Archived only at their producing DAAC but Acquired, as required, by processing at other DAACs.

17.9.2.3.3 Permanently Lost Data and Errors

Remaining granules effected by the archive tape failure and not recovered by one of the above means will fall into one of the following categories:

- lost files which have, by design, been deleted from the SDSRV databases during this recovery procedure,
- granules the re-generation of which was determined not to be necessary within the PDPS procedure,
- Ingested granules which were not included in Archive backup or re-deliverable by the supplier (e.g. Landsat Level 0 data),
- an error either in the recovery processes, actions or in system configuration e.g. in the configuration of backups.

As an example in this final category the outputs of SSI&T should always be included amongst those files configured for automatic backup within the Archive. Where this is not the case and the primary copies are effected by Archive failure re-SSI&T of the effected PGEs will be required.

In addition it is essential that granules which are necessary inputs to the recovery process itself, e.g. the Production History (PH) as input to PLS re-generation, must be assigned to backed up volume groups. If PH granules are lost and not backed up then the science granules to which they correspond will not be re-generatable by PDPS.

Compound failure of the archive backups may also result in a permanent data loss.

17.9.3 Results of File and Granule Recovery

The result of file or granule recovery are slightly different depending on whether the lost file was recovered, e.g. from backup, or the corresponding lost granule had to be re-Archived, e.g. after re-generation by PDPS.

Files which are recovered within the Archive/STMGT procedures are re-archived under the same name such that the effected granule(s) are restored as per before the failure.

Where file recovery within STMGT control is not possible the resulting Granule recovery, e.g by PDPS re-generation or via-INS re-ingestion, results in the insertion of a new granule. This new granule will have a new UR and a new 'Production Date and Time'. Particularly where granule re-generation is required, i.e. by PDPS, exact re-production of the original granule (data byte-for-byte) is not guaranteed.

17.9.4 Manual Use of Backup Data for Recovery

The following procedures present the steps required for manual use of local or off-site backup data for recovery. These procedures assume the backup data is available on tape.

17.9.4.1 Manual Data Recovery from Local Backup Tapes

The following procedure presents the steps required for manual data recovery from local backup tapes. This procedure assumes the tape is on-line and in the Powderhorn LSM. Volume groups and tapes are transparent to the automated file and storage management system. As long as the AMASS database is aware of the files, the operator moves data using standard UNIX commands. Table 17.9-2 presents the steps required to follow the process. If you are already familiar with the procedure, you may prefer to use the quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. **The operator goes to the STMGT GUI and uses the** Configure **tab.**

2. The operator chooses the **Archive Server** that is associated with the **ServerKey** portion of the **Archive ID**. Example: EcDsStArchiveServerDRP1

3. The operator selects **View Volume Groups**.

4. The operator clicks on the volume group **identifiers** that are specified for primary and secondary storage in the archive.

5. Once the operator knows the location of the backup file and the location of the primary file, he/she can issue a copy command (or dd) from the Unix command line to copy the file from the backup version of the file to the primary version.

6. If this recovery is one of a set of files to be restored, e.g. because they were lost from a damaged tape, files recovered from backup should be removed from the list of files to be recovered by other means.

Table 17.9-2. Manual Data Recovery from Local Backup Tapes

Step	What to Do	Action to Take
1	Configure	Select from STMGT GUI
2	**Archive Server**	Select from STMGT GUI
3	**View Volume Groups**	Select from STMGT GUI
4	**identifiers**	Select from STMGT GUI
5	**Copy file to primary**	cp *path path*

17.9.4.2 Manual Data Recovery from Off-Site Backup Tapes

The following presents the steps required for manual data recovery from off-site backup. Initially, GDAAC off-site backup tapes will be stored at Goddard in another building. If in the future, backup data is sent to Langley, this document will be updated to reflect that procedure. Table 17.9-3 presents the steps required to follow the data recovery process. If you are already familiar with the procedure, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

To determine whether or not the file exists in the tape library:

1. The operator runs the AMASS fileprint command giving as input the filename and pathname into AMASS cache.

   fileprint <*filepathname*>.

2. The output from fileprint will be a structure of information displayed on the terminal. The operator needs to check on the volume id. There may be two ids, in which case the file is split over volumes.

3. The operator issues an AMASS vollist command giving the volume id as input.

   vollist <*volumenumber*>

- If the volume is active and in a juke box (as displayed in the output from the vollist command), then the operator can move the file to the primary and secondary archive locations by following the same process as in the operations concept for restoring the file from the local backup (essentially this is a case where there are two local backups).
- If the volume is inactive and not in a juke box (as displayed in the out put from the vollist command), then the operator will have to request the tape(s) from the off-site storage.

4. After requesting and receiving the required data from off-site backup, mount the tape and bring it on-line.

   a) **Insert the tape following procedures in section 17.10.1 STK Media Interface.**

   - The AMASS database will have a record of the data.

5. **Using an appropriate UNIX command, copy the file(s) from the off-site backup tape(s) to the correct archive directory.**

6. If this recovery is one of a set of files to be restored, e.g. because they were lost from a damaged tape, files recovered from backup should be removed from the list of files to be recovered by other means

Table 17.9-3. Manual Data Recovery from Off-Site Backup Tapes

Step	What to Do	Action to Take
1	**fileprint <*filepathname*>**.	press **Return**
2	Check volume id	Review fileprint
3	**vollist <*volumenumber*>**	press **Return**
4	Mount tape	Procedure 17.9.1
5	Copy file(s) to primary directory	cp *path path*

17.9.5 Manual Data Recovery From Damaged Cartridge

Manual recovery of AMASS generated data from the D3 cartridge will be necessary in the event that a tape volume becomes damaged. In the course of operations it is possible for a tape to become physically damaged or accidentally overwritten. Some indications of a damaged tape are AMASS read/write errors, or AMASS may determine the volume is unreadable and mark it inactive. In that event, a manual recovery of AMASS generated data from the STK Redwood (D3) cartridge must be attempted.

Due to the technical complexity of the D3 tape recovery, it will be performed by STK personnel. A listing of all the files on tape and the associated start block numbers must be generated and provided to the recovery personnel in order to proceed with the recovery. The archive operator needs to invoke a *perl5* utility script and respond to the scripted prompts. The utility will generate three ASCII files, that must be provided to the STK recovery personnel along with the damaged tape. The files are: filelist_*volnumber*, start_block_listing_*volnumber*, and README_*volnumber*, where *volnumber* is the volume number of the requested tape volume.

The script utility, **DsStFilesPerVolume**, is located in the utilities directory. The script will initially output directory information followed by three files.

Example directory information output:

/data1/data/:BR:Browse.001:1170:1.BINARY
/data1/data/:BR:Browse.000:1170:1.BINARY
/data1/data/:SC:MOD00:65001:1.CCSDS
/data1/data/:SC:MOD00:65002:1.CCSDS
/data1/data/:SC:MOD00:20001:1.CCSDS
/data1/data/:PH:PH.001:2000000076:1.BINARY
/data1/data/:PH:PH.000:2000000076:1.BINARY
/data1/data/:QA:QA.001:1003:1.ASCII
/data1/data/:QA:QA.001:1004:1.ASCII

/data1/data/:QA:QA.001:1005:1.ASCII
/data1/data/:OR:OR.001:2100:1.ASCII
/data1/data/:OR:OR.001:2101:1.ASCII
/data1/data/:OR:OR.001:2102:1.ASCII
/data1/data/:OR:OR.001:2103:1.ASCII
/data1/data/:AN:AN.001:3100:1.ASCII
/data1/data/:AN:AN.001:3101:1.ASCII
/data1/data/:AN:AN.001:3102:1.ASCII
/data1/data/:AN:AN.001:3103:1.ASCII

The three files produced by DsStFilesPerVolume are as follows:

A readme file (README_TAPE_RECOVERY)

A list of all files on the tape (filelist_v#)

A list of file starting blocks on the tape (start_block_listing_v#)

Where '#' stands for the AMASS designated volume number being recovered. The 'filelist_v#' file output is in the form of one file name per line e.g.

/dss_stk2/joel/TestStdSeq6_0_10.wrt
/dss_stk2/joel/TestStdSeq6_0_10.wrt
/dss_stk2/joel/TestStdSeq6_0_10.wrt
/dss_stk2/joel/TestStdSeq6_0_10.wrt
/dss_stk2/joel/TestStdSeq6_0_10.wrt

If you are new to the system, you should use the following detailed procedure. If you are familiar with the system, you may prefer to use the quick-step table 17.9-4.

1. **Login as** amass **or** root **and enter the** *password*

2. **Verify AMASS is running using the** amassstat **command.**

3. **Run vollist and grep for the volume label in order to get the volume id.**
   vollist|grep *SG0003*

4. **Remove the volume from the library using the voloutlet command.**
   voloutlet *volumenumber*
   - AMASS will move volume to the Cartridge Access Port (CAP) and mark it offline.

5. **The DAM will inspect the physical cartridge and tape for damage, see section 17.7.4.2 Inspecting a Cartridge. Any creasing, scratches, snapping, or stretching of the tape may warrant keeping the volume offline and sending it STK for replacement.**

6. If the DAM determines that the tape is damaged, it is shipped to STK for recovery along the three files generated by the DsStFilesPerVolume **utility script. In order to run the script you must be logged in as** amass **or** root**.**

a) To start the perl utility script, enter:

/usr/ecs/*mode*/CUSTOM/utilities/DsStFilesPerVolume

- You will be prompted to enter the AMASS volume number for which you wish to generate listings.

a) Enter the volume number of the AMASS volume.

- A message will display informing you when the listings are complete.

b) (optional) If the tape is damaged towards the end of the tape, it will be possible to copy files from the tape using the start_block_listing_v(nn) file generated above. The file to be copied must first be renamed using the Unix mv command and the copied to the original filename (mv a b; cp b a). It is important that the file remain within the volume group. Care must be taken while doing this procedure. Reading from the part of tape which contains the damaged area may cause damage to the drives. Recovering data in this manner will limit the amount of regeneration of data that may need to be performed. The list of files that are recovered should be kept so that further attempts to regenerate them will not be started. A copy of the list of files that need to be recovered should be kept as well so that any files which fail to be retrieved can be checked against the list first before investigation commences.

7. Send the volume to STK along with the files generated by the perl utility.

- STK will copy all uncorrupted data to a new tape and insert filler data blocks to replace the lost data.
- The filler data is inserted using the original block sequence so that the remaining data can be accessed by AMASS.
- After the data has been copied to a new cartridge, it is shipped back to the DAAC archive with the original volume label and a report indicating which data blocks were replaced with filler data.

8. After receiving the recovered tape back from STK, load the tape into the library using the bulkinlet command:

bulkinlet *volgroupnumber*

- AMASS will read the volume label and place the volume in it's home slot.

9. **Put the volume online using the *volloc* command**

volloc -n *volumenumber*

10. **Make the volume active using the *volstat* command**
volstat -a *volumenumber*

11. **Using the report provided by STK, determine which files have had data blocks replaced and delete those files from the database using standard UNIX commands. All such files must be recorded on a list of non-recovered files.**
rm *filepathname*

12. **If the DAM determines that the amount of dead space created on the tape exceeds the allowed threshold, the files can be copied to another volume within the volume group and the tape can be reformatted. See Recycle a Volume in the *AMASS System Administrator's User Guide*. The AMASS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.**

13. **Once the tape has been returned from STK, the list of files that are on the tape (i.e. the file 'filelist_v#' described above) must be used as input to the SDSRV procedure for "Retrieval of File Location Metadata", as specified in section 17.9.6.1, to recover the ArchiveIDs and checksum for each file.**

14. **These checksums, and other STK output if available, are then used to validate the files on the returned tape. All files which fail these tests must be deleted as described in point 11, above. They must also be added to the list of non-recovered files.**

- **For files with a non-zero checksum returned by SDSRV the checksum of the recovered file must be validated with the Unix command '**
  cksum *filepathnam*
  This command returns one line with three parameters per input file. The file checksum is the first column. For all files where the returned checksum does not match the SDSRV generated checksum the file has failed the checksum test and must be deleted.
- **For remaining files, for which the SDSRV returns a checksum of zero, the checksum can not be use to verify validity of the file on the returned tape. If STK have supplied information detailing the corrupt blocks on the tape then that may be used with the data in the "start_block_listing_v#" file to determine which of the files have been corrupted and the remaining files recovered. Alternatively all zero checksum files should be assumed to be corrupted and not recovered, i.e. they must be deleted.**

15. **The list of non-recovered files then serves as input to subsequent file recovery by other means, i.e. as specified in section 17.9.2.2.**

Table 17.9-4. D3 Cartridge Data Recovery - Quick-Step Procedures

Step	What to Enter or Select	Action Taken
1	**amass** or **root**	press **Return**
2	**amasssstat**	press **Return**
3	**vollist|grep *SG0003***	press **Return**
4	**voloutlet *volumenumber***	proceed to step 5
5	Check for Physical tape damage	Tape Damage ? Y- run DsStFilesPerVolume script N- Enter cartridge into archive
6	ship to STK with files	
7	**bulkinlet *volgroupnumber***	press **Return**
8	**volloc -n *volumenumber***	press **Return**
9	**volstat -a *volumenumber***	press **Return**
10	**rm *filepathname***	proceed to step 5
11	Run SDSRV procedure	
12	Send retrieve request to SDSRV	

17.9.6 SDSRV Procedures in Support of Data Recovery

This section details steps in the recovery of lost archive data which must be executed against the SDSRV database. It contains two procedures. The first returns file metadata including file checksums to the Archive/STMGT operator for use with file recovery from tapes. The second generates granule metadata for use by the Planning sub-system, PLS, in re-creating granules from which files have been irrecoverably lost.

The “lists” which form the interfaces between these procedures should be exchanged as electronic

These operations procedures are valid for ECS Release B drop 4PL7 and subsequent 4Pn drops. They should be used in conjunction with the related Archive/STMGT procedures (17.9.5) and overview procedure (17.9.2.1, 17.9.2.2).

17.9.6.1 SDSRV Retrieval of File Location Metadata

For information on the context of this procedures and its interfaces see section 17.9.1. The usual entry point to this process is the Archive/STMGT procedure for “Manual Data Recovery from Damaged Cartridge” (section 17.9.5). It returns its output to its calling procedure.

The input to this procedure is a list of the unique file names of files in the Archive effected by a tape failure e.g. as generated within procedure 17.9.5 by the script DsStFilesPerVolume. The list is called the “Effected File List” and is referred to below as the EFL. The example file name used for it is “eflfile.txt”. The file names in the EFL will match the DsMdFileStorage.internalFileName column within the SDSRV metadata database.

The output from this procedure is a list of file metadata (archiveIDs and checksum) for each file named in the input. It is called the "Effected File Metadata" list and is referred to below as the EFM. The example file name used for it is "eflmetadata.txt". It is used to determine the backup locations, if any, of lost files and to verify the checksum of files restored via tape drive vendor (StorageTek) support.

This procedure has the following dependencies:

- The operator is working on a machine from which SQL connections can be made to the SDSRV SQL server, e.g. 't1acg0' and that server recognizes the sybase account EcDsScienceDataServer.
- The Unix account in use has execute permission on the required scripts, the 'path' shell variable set to include a directory where the command '
  (Sybase 'home') environment variable set appropriately (e.g. setenv SYBASE /tools/sybOCv11.1.0).
- The operator knows the password for the SDSRV Sybase user EcDsScienceDataServer

Procedure:

1. Receive the Effected File List (EFL) generated by the procedure e.g. as generated by the utility DsStFilesPerVolume (see section 17.9.5) as an electronic file. Save a local copy of the file with the name 'eflfile.txt' or similar.
2. Execute the shell script DsDbSrFileLocMetadata at the Unix prompt against this file as follows:

   DsDbSrFileLocMetadata *eflfile.txt eflmetadata.txt*

3. At the prompt enter the Sybase password for the Sybase account EcDsScienceDataServer.

For each of the "internalFileNames" in the input "Effected File List" the script retrieves from the SDSRV database the file primary archive ID and checksum and the backup and offsite archive IDs if they are set.

4. Check that the output file is not empty (i.e. of zero length) using the 'ls' command. If the file is of zero length either the input file was of zero length or an unexplained error occurred.

   ls -l *eflmetadata.txt*

5. Visually inspect the file to verify success of the command (using e.g. 'more'). The output file will be in two sections. First the Effected File metadata found within SDSRV Inventory database. Lines in this section appear as follows:

   InternalFileName_found_in_SDSRV_Inventory_Metadata_Database Tue Jan 5 18:26:07 EST 1999

:BR:Browse.001:1170:1.BINARY
DRP1_TS3:VG1 NOT_SUPPLIED NOT_SUPPLIED "NONE" 0 1000 BRBrowse.0011170

:SC:MOD00:65001:1.CCSDS
DRP1_TS3:VG1 NOT_SUPPLIED NOT_SUPPLIED
"Oct 10 1996 12:02:00:000AM" 0 1000 SCAST_04.00120001

:PH:PH.001:2000000076:1.BINARY
DRP1_TS3:VG1 NOT_SUPPLIED NOT_SUPPLIED "NONE" 0 65536 PHPH.0012000000076

:QA:QA.001:1003:1.ASCII
SGI_RCCLAB1DEV:VG1 NULL NotSupported "NONE" 0 0 QAQA.0011003

:OR:OR.001:2100:1.ASCII
RECOV_TEST:VG1 NOT_SUPPLIED NOT_SUPPLIED "NONE" 0 0 OROR.0012100

:AN:AN.001:3100:1.ASCII
RECOV_TEST:VG1 NOT_SUPPLIED NOT_SUPPLIED "NONE" 0 0 ANAN.0013100

Second files not found within SDSRV. This section will usually be empty.

6. It is advisable to check for errors in the output of the script using the Unix ‘
   This is done by searching the output for occurrences of the strings ‘
   this execute the following at the Unix prompt:

   grep –i msg *eflmetadata.tx* | wc -*l*

   grep –i error *eflmetadata.tx* | wc -*l*

If no errors occurred these commands will both output ‘0’ (zero). Any other output means there were errors in the process. If errors are found they must be diagnosed based on the error message(s) and the procedure repeated after correction of the input file.

7. When the output file passes the above tests it should be passed back to the calling procedure.

17.9.6.2 SDSRV Retrieval of Granule Production History Metadata

For information on the context of this procedures and its interfaces see section 17.9.1. The entry point to this process is the Archive/STMGT procedure for “Data Recovery Procedure for Known Files” (section 17.9.2.2). Its input is a list of files remaining to be recovered, referred to below as the “Lost File List” (LFL). Its output serves as input to the PDPS/PLS procedure for granule regeneration, “Re-Generate Granules Effected by Loss of Files from the Archive”, in Section 13.1.6.

Note this procedure assumes that:

- the Algorithm Package information has been inserted into the SDSRV for all associate datatypes. This is populated by SSI&T processing. There may be a period of time in the "granules" lifetime when this information is not populated. Attributes PGEName and PGEVersion are affected

The goal of this procedure is to list PLS required granule metadata for those granules which the local PDPS should be able to re-generate. This decision is based on finding valid Production History URs for the 'lost' granules in the local SDSRV database.

Output from this procedure is a file containing:

- "Granules for PDPS Re-generation" - those found within SDSRV. These are passed to the PLS operators for re-generation using the procedure "Re-Generate Granules Effected by Loss of Files from the Archive" (section 13.1.6).
- "Residual Granules to Recover" - those not found within SDSRV inventory. This is passed back to the top-level procedure. This may include granules that have been removed by the "Physical Delete" service within SDSRV.

Procedure:

1. Receive the "Lost File List" (LFL) e.g. as generated by the procedure in section 17.9.5, as an electronic file. Save a local copy of the file with the name 'lflfile.txt' or similar.

   Execute the shell script DsDbSrFileLocMetadata at the Unix prompt against this file as follows:

   DsDbSrGranPHMetadata *lflfile.txt lgrmetadata.txt*

2. At the prompt enter the Sybase password for the Sybase account EcDsScienceDataServer.

   The output file will be divided into two sections:

   - Granule metadata found within SDSRV Inventory database for use with e.g. PDPS granule re-generation.
   - Residual files to recover. Those files not found within SDSRV.

   For each of the "internalFileNames" in the input "Lost File List" for which related Granule metadata is found in this SDSRV the script retrieves the following pertaining to the Granule of which that file was part:

   - the "GeoID" (partial UR),

   - the UR of its associated Production History granule, if available,

   - the ESDT shortname and versionID,

- the granule beginning date and time and ending date and time.

1. Verify that the metadata extraction was successful by applying to the output file (lgrmetadata.txt) the tests as specified in steps 4, 5 and 6 of section 17.9.4.1, above. Lines in this section appear as follows:

```
Granule_metadata_found_within_SDSRV_Inventory_database Tue Jan  5 18:26:53 EST 1999


:BR:Browse.001:1170:1.BINARY
0 1000 BRBrowse.0011170 PGEName 1       "None" "None" "NONE" "NORMAL"
PH_Does_Not_Apply

:SC:MOD00:65001:1.CCSDS
0 1000 SCAST_04.00120001 PGEName 1
"Jan  1 1997 12:00:00:000AM" "Jan  1 1997 12:00:00:000AM" "Oct 10 1996 12:02:00:000AM"
"NORMAL" 2
NO_PH

:PH:PH.001:2000000076:1.BINARY
0 65536 PHPH.0012000000076 PGEName 1       "None" "None" "None" "NORMAL"
PH_Does_Not_Apply

:QA:QA.001:1003:1.ASCII
0 0 QAQA.0011003 PGEName 1       "None" "None" "None" "NORMAL"
PH_Does_Not_Apply

:OR:OR.001:2102:1.ASCII
0 0 ORQR.0012102 PGEName 1       "None" "None" "None" "NORMAL"
PH_Does_Not_Apply

:AN:AN.001:3100:1.ASCII
0 0 ANAN.0013100 PGEName 1       "None" "None" "None" "NORMAL"
PH_Does_Not_Apply

Granule_metadata_not_found_within_SDSRV_Inventory_database Tue Jan  5 18:26:53 EST 1999
```

2. When the output file passes the above tests it should be passed back to the calling procedure.

Note:

- For the at-launch system (Drop 4P*), granule metadata for recovered files will produce "logical duplicate" metadata, one set for the original "lost" files and another for the "re-

- Granules for recovered files will by definition have a different granuleUR (dbID).

17.10 Operations of Archive Media Interfaces

Operations of archive media interfaces involves the insertion and removal of archive media cartridges, tapes, or optical disk. Archive media insertion and removal from the library is an automated or manual function. The method used is dependent upon the amount of media involved. Large amounts of media is loaded or unloaded manually. Small amounts are handled automatically. Archive media is added or removed via the Cartridge Access Port (CAP) on the STK, the EMASS Entry Interface Facility (EIF), or the EMASS I/O Unit depending on the model used.

The term manual loading can have one of two meanings. The first is the loading of cartridges directly into the archive storage slots. The second is the loading of media into the CAP, EIF or I/O Unit and commanding the robotic units through the EIF keypad or operator terminal to insert the tapes into the archive.

The STK CAP and EMASS EIF or I/O Units also have fully automatic operational function. These functions allow an operator to set an operational mode that inserts media into the archive after loading and closing of the CAP, EIF, or I/O. In this mode, the system inserts without operator intervention.

The Activity Checklist depicted in Table 17.10-1 provides an overview of the operations of the archive media interfaces. Column one (**Order**) shows the order in which tasks should be accomplished. Column two (**Role**) lists the Role/Manager/Operator responsible for performing the task. Column three (**Task**) provides a brief explanation of the task. Column four (**Section**) provides the Procedure (P) section number or Instruction (I) section number where details for performing the task can be found.

Table 17.10-1. Operations of Archive Media Interfaces - Activity Checklist (1 of 2)

Order	Role	Task	Section
1	DIT	STK Media Interface	(I) 17.10.1
2	DIT	Manual Insertion of STK Media	(I) 17.10.1.1
3	DIT	Insertion of STK Media Using Bulkload	(P) 17.10.1.1.1
4	DIT	Insertion of STK Media Using Bulkinlet	(P) 17.10.1.1.2
5	DIT	Automatic Insertion of STK Media	(P) 17.10.1.2
6	DIT	Manual Ejection of STK Media	(I) 17.10.1.3
7	DIT	Commanding Ejection of STK Media	(P) 17.10.1.3.1
8	DIT	Manually Removing STK Media from the Powderhorn Library Storage Module (LSM)	(P) 17.10.1.3.2
9	DIT	EMASS Media Interface Units	(I) 17.10.2
10	DIT	Inserting Media into the EMASS EIF	(P) 17.10.2.1
11	DIT	Automatically Loading EMASS Archive Media	(P) 17.10.2.2
12	DIT	Manually Loading EMASS Archive Media	(P) 17.10.2.3
13	DIT	Ejecting EMASS Archive Media Using AMASS	(P) 17.10.2.4

Table 17.10-1. Operations of Archive Media Interfaces - Activity Checklist (1 of 2)

Order	Role	Task	Section
14	DIT	Ejecting EMASS Archive Media Using DAS	(P) 17.10.2.5
15	DIT	Removing Media from the EMASS EIF	(P) 17.10.2.6
16	DIT	Manual Ejection of EMASS Media	(P) 17.10.2.7
17	DIT	Removing Problem Media from the EMASS EIF	(P) 17.10.2.8
18	DIT	EMASS I/O Unit	(I) 17.10.3
19	DIT	Inserting Media into the EMASS I/O Unit	(P) 17.10.3.1
20	DIT	Ejecting Media from the EMASS I/O Unit	(P) 17.10.3.2
21	DIT	Removing Problem Media from the EMASS I/O Unit	(P) 17.10.3.3

17.10.1 STK Media Interface

The STK employs a CAP as an interface unit. The CAP is the access door to the storage unit as well as the means of inserting and ejecting media for the archive user. The CAP mode controls how a CAP will be used for cartridge enters and ejects. CAP modes are manual and automatic. In manual mode the CAP is locked when not in use. This is the initial mode for all multi-cartridge CAPs. When in manual mode, you can enter or eject cartridges only after issuing a command. In automatic mode, the CAP is unlocked when not in use. While in automatic mode, you can enter or eject cartridges without explicitly issuing an enter command. The enter is initiated when you open the CAP door, place a cartridge inside and close the CAP. Whether the CAP mode is in manual or automatic, you must explicitly issue an eject command to eject a cartridge.

17.10.1.1 Manual Insertion of STK Media

The robotic unit retrieves cartridges from the CAP in two modes, manual and automatic. Manual mode requires the operator to request robot intervention in inserting media by issuing a command. This section discusses the manual insertion of media into the STK silo. The following procedures details how to insert tape cartridges by entering the silo, and by loading the CAP. Note that the ejection of media is always an operational request.

Note: If using an ACSLS or DAS command to insert media, be aware that AMASS will not know of it's existence.

17.10.1.1.1 Insertion of STK Media Using Bulkload

Since the CAP functions as an access door, manual loading of media into storage slots is possible. When inserting a large number of tapes, it is faster to enter them directly into the silo by entering through the CAP. This is normally only done when populating a new silo.

Table 17.10-2 presents the steps required for manual insertion of media using the CAP. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Open an ACSSA window on the SUN Workstation:

Login as acssa **and enter** *password*

- ACSSA mode entered and cmd_proc window opened.

2. **Enter** vary lsm 0,0, offline

- There will be an audible click and the door will unlock

3. **Unlock CAP door with key**

- Safety light red, caution

4. **Set latch for safety light to become green. Lock the latch and remove the key**

- Prevents personnel from being locked inside.

5. **Enter the LSM and load or eject cartridges manually**

6. **Close CAP door**

7. **Lock door with key, lock latch, wait for robotic diagnostic completion**

8. **From an ACSSA cmd_proc window, enter** audit

9. **ACSLS will scan every volume label and update the ACSLS database.**

10. **Enter** bulkload -s

- AMASS will synchronize it's database with ACSLS

Table 17.10-2. Manual Insertion using CAP as an Access Door

Step	What to Enter or Select	Action to Take
1	enter ACSSA window on SUN Workstation	
2	**vary lsm 0,0 offline**	audible click, door unlocks
3	unlock CAP door with key	safety light red, caution
4	set latch for safety light to become green	OK to enter
5	load or eject cartridges manually	
6	close CAP door	
7	lock door with key, lock latch, wait for robotic diagnostic completion	
8	**audit**	audit performed
9	**bulkload –s**	database sync

17.10.1.1.2 Insertion of STK Media Using Bulkinlet

Manual insertion of STK media through the CAP requires the operator to place tape cartridges into the CAP. The CAP has a capacity of 21 cartridges, three rows of seven each as shown in Figure 17.10-1. Insertion of cartridges must begin at the left hand corner of the top rack. If this is not done, the system will not insert the media. No spacing is allowed between media slots. The system interprets the space as the end of media for insertion. It stops input operations until door is opened and cartridges are input again.

The bulkinlet command is used to load multiple volumes through the mailbox, create entries in the AMASS database for *new* volumes, and mark volumes Online in the AMASS database. For tracking purposes, AMASS assigns each *new* volume a unique volume number. If you attempt to load several volumes at one time and one volume fails to load, AMASS will not load the remaining volumes after the first failure. For example, if you load volumes 1 through 6 and volume 3 is unsuccessful, AMASS successfully loads volumes 1 and 2 but does not load volumes 3, 4, 5, and 6.

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21

Figure 17.10-1. Cartridge Insertion Order into CAP

Table 17.10-3 presents the steps required for manual insertion of media using the CAP. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. **Login as** amass **or** root **and enter the** *password*

2. **Load volumes into the CAP mailbox. Make sure to start in the upper left slot and fill slots to the right and close the CAP.**

3. Enter the following AMASS command:

bulkinlet *volgroup*

- volgroup is the number of the volume group where the volumes are to be assigned. Options are: 0-2047, SP, and CL
- audible click indicating the CAP is unlocked
- AMASS assigns a unique volume number to each volume.

a) All new volumes in the AMASS database have an initial status of unformatted (U) and inactive (I). If the inserted volumes are new (unknown to AMASS), prepare the volumes so AMASS can read or write to them using the format procedure in section 17.5.1.

Table 17.10-3. Manual Insertion Using bulkinlet

Step	What to Enter or Select	Action to Take
1	Login as amass or root	
2	Load volumes into the CAP mailbox	
3	Enter **bulkinlet *volgroup***	audible click, door unlocks
4	For new volumes set tapelength, format and activate see section 17.5.1	see AMASS System Administrator's Guide

17.10.1.2 Automatic Insertion of STK Media

Automatic insertion of STK media into the CAP is accomplished without operator intervention.

Table 17.10-4 presents the steps required for automatic insertion of STK media using the CAP. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Enter ACSSA window on SUN Workstation:
Login as acssa **and enter** *password*
- ACSSA mode entered and cmd_proc window opened.

2. If already in automatic mode go to step 3. If not, enter:
set cap 0,0,0 mode automatic
- audible click indicating door is unlocked

3. Open CAP media door

4. Load cartridges into the door , top left slot first

5. Close CAP door

- Robot inserts media without operator intervention.

6. **If entering new media (unknown to AMASS) update the amass database using the command:**
volnew *volgroup slot vollabel*

ex. volnew SP NET SG0009

Table 17.10-4. Automatic Insertion of STK Media

Step	What to Enter or Select	Action to Take
1	enter ASCCA window on SUN Workstation	
2	enter set cap 0,0,0 mode automatic	audible sound from CAP, CAP unlocked
3	open CAP media door	
4	load cartridges into the door	top left slot first
5	close CAP door	robot inserts media without operator intervention
6	**volnew *volgroup slot vollabel***	

17.10.1.3 Manual Ejection of STK Media

As mentioned previously, ejection of STK media is always requires manual intervention. Manual ejection can be by means of issuing commands or physically entering the Powderhorn LSM and removing a tape. Keep in mind that when a tape is physically removed from archive, the AMASS and ACSLS databases will think the tape is still in the LSM.

17.10.1.3.1 Commanding Ejection of STK Media

Table 17.10-5 presents the steps required for comanding ejection of STK media using the CAP. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Determine which volumes you want to remove, utilizing the volume number. If necessary to review volume numbers and other information, log into the AMASS host, type **vollist** and then press the **Enter** key.

2. If there are only a few volumes to remove, then for each volume to be removed type: **/usr/amass/bin/voloutlet #**, where # is the volume number, and then press the **Enter** key.

   - AMASS marks the volume off-line and the volume is transferred to the CAP.

3. For the STK Powderhorn, open the recessed latch on the Cartridge Access Port (CAP) door and remove the tape(s)

Table 17.10-5. Commanding Ejection of STK Media

Step	What to Do	Action to Take
1	**Vollist**	Press **return**
2	**voloutlet *volnumber***	Press **return**
3	Open CAP and remove tape	

17.10.1.3.2 Manually Removing STK Media From the Powderhorn Library Storage Module (LSM)

Table 17.10-6 presents the steps required for manual removal of media from the STK Powderhorn using the CAP as an access door. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Enter ACSSA window on SUN Workstation:
Login as acssa **and enter** *password*

- ACSSA mode entered and cmd_proc window opened.

2. Enter vary lsm 0,0 offline

- audible click indicating door is unlocked

2. Unlock CAP door with key and open the access door.

- Safety light red, caution

2. Set latch for safety light to become green by locking the CAP.

3. Enter the Powderhorn LSM and load or remove cartridges manually

4. Close CAP door

5. Lock door with key, wait for robotic diagnostic completion

Table 17.10-6. Manually Removing STK Media From the LSM

Step	What to Enter or Select	Action to Take
1	enter ASCCA window on SUN Workstation	
2	**vary lsm 0,0 offline**	Listen for audible click
3	unlock CAP door with key	safety light red, caution

4	set latch for safety light to become green	OK to enter
5	load or remove cartridges manually	
6	close CAP door	
7	lock door with key	wait for robotic diagnostic completion

17.10.2 EMASS Media Interface Units

There are two EMASS media interface units for data archiving being utilized. Different media I/O interfaces exist for these units. The instructions in this section describe the manual procedures for operating either the Entry Interface Facility (EIF) or I/O Unit. The procedures include the insertion and removal of media before automated loading or after automated ejection from the archive.

The GODDARD DAAC EMASS AML/2 incorporates an EIF. Smaller capacity EMASS models may incorporate an I/O Unit.

17.10.2.1 Inserting Media into the EMASS EIF

The Goddard DAAC EMASS unit utilizes an Entry Interface Facility (EIF). The EIF is a media handling I/O unit. It utilizes three sections. Two of these sections allow the operator to input and output media. This is for archive storage as well as Foreign media. Foreign media have no bar-code number for storage to the archive. The media travels directly from the Foreign box to a selected drive for operations. When completed, it returns to the Foreign box for removal from the system.

A third section allows for the ejection of media classified as Problem media from the archive storage. The Problem box is a separate entity populated by the archive system. Removal of Problem media is an operator function.

Media are inserted into and ejected from the EMASS archive system through the EIF. Cartridges are loaded by hand into hand-carry racks, each with a capacity of 30 half-inch tape cartridges or 22 optical cartridges. The robot system physically moves each cartridge from the EIF to the AML. EMASS recommends that you turn ON the Auto Import option for each library. With this option on, you only need to place media into the EIF and close it.

The EIF uses a keypad with a display for commands. Figure 17.10-2 depicts the configuration for the EIF keypad configuration. The EIF handling boxes for Insert/Eject/Foreign Media compartments are fully selectable for either operation.

COMMAND KEYPAD	Section 1 (TOP) PROBLEM BOX Manual ROTATING TRAY [9 available slots per side]
	Section 2 (MIDDLE) INSERT/EJECT/FOREIGN MEDIA 4 ROTATING HANDLING BOXES [120 available slots] [keypad entries1-4]
	Section 3 (BOTTOM) INSERT/EJECT/FOREIGN MEDIA 4 ROTATING HANDLING BOXES [120 available slots] [keypad entries 5-8]

Figure 17.10-2. EIF Keypad Configuration

Table 17.10-7 presents the steps required for inserting media into the EMASS EIF. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Verify that the Main Menu on the EIF keypad is active

- Display is lit

2. Select Insert **with cursor keys**

- Insert is highlighted

a) Press **Enter**

- Display shows selection for, handling box number entry

3. Select handling box (1-8)

- Selection is displayed

a) Press **Enter**

- Handling box selected is rotated, into access position

4. Select Open Door **with cursor keys**

- Display prompts for reply to open door for access

a) Press **Enter**

- Door opens

5. Put media in Insert I/O box selected

- Option 1 Take out handling box and load with media
- Option 2 Load handling box while in place
- Make sure box is seated correctly

6. Select Close Door **with cursor keys**

- Display prompts for reply to close door

a) Press **Enter**

- Door closes, tray rotates 180 degrees

Table 17.10-7. Inserting All Media Types into EIF - Quick-Step Procedure

Step	Action to Take	Verification
1	Verify Main Menu is active on the EIF	Display is lit
2	Select **Insert** with cursor keys	Insert is highlighted
3	Press **Enter**	Display shows selection for, handling box number entry
4	Select **handling box (1-8)**	Selection is displayed
5	Press **Enter**	Handling box selected is rotated, to into access position
6	Select **Open Door** with cursor keys	Display prompts for reply to, open door for access
7	Press **Enter**	Door opens
8	Put media in Insert I/O box selected	Options: 1) Take out handling box and load with media 2) Load handling box while in place Make sure box is seated correctly
9	Select **Close Door** with cursor keys	Display prompts for reply to close door
10	Press **Enter**	Door closes, tray rotates 180 degrees

17.10.2.2 Automatically Loading EMASS Archive Media

Table 17.10-8 presents the steps required for inserting media into the EMASS EIF. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. To log in, type **amass** or **root** and then press the **Enter** key.
   - A password prompt is displayed.
2. Enter the ***Password***, then press the **Enter** key.
   - Remember that Password is case sensitive.
   - You are authenticated (as amass or root) and returned to the UNIX prompt.
3. Remove the left box to insert or remove tape media, and/or remove the right box to insert or remove optical media.
4. Write down or note the bar code numbers on the labels of the cartridges, insert the cartridges in the removed box(es), reinsert the box(es) in the EIF, and close the door.
   - The robot scans all the volumes.

5. At the AMASS host, type **/usr/amass/bin/bulkinlet SP** and then press the **Enter** key.

   - Data for the newly inserted media are displayed, including bar codes, associated volume numbers, and, in the flag column, the letters IUO, indicating that the volumes are inactive (I), unformatted (U), and offline (O).

6. For any newly inserted media, it is necessary to issue a formatting command. For tapes, type **volformat #**, where # is the volume number. For optical cartridges, type **volformat -p #**, where # is the volume number. You can enter more than one, separating each number from the preceding one with a space.

Note: You may wish to use the & (to run the process in the background) for formatting tapes as well as for optical cartridges. It is highly recommended for formatting optical cartridges, because of the length of time required.

7. A message requests confirmation that you wish to continue.

8. Type **y** and then press the **Enter** key.

   - A message is displayed requesting further confirmation, stating that The following volumes will be formatted: and listing volume numbers, followed by (Y-N).

9. Type **y** and then press the **Enter** key.

   - After a few minutes (or, for optical cartridges, about an hour for each), a message; Completed formatting all volumes is displayed.

10. To verify that the volume(s) are inserted, type **/usr/amass/bin/vollist** and then press the **Enter** key.

11. Data for the media are displayed; the flag column shows that the newly formatted volumes are inactive (I).

12. To activate the media for use, type:

    volstat -a

13. Data for the media are displayed; the flag column shows that the volumes are now active (A).

Table 17.10-8. Automatically Loading EMASS Archive Media - Quick-Step Procedure

Step	What to do	Action to Take
1	**amass** or **root**	Press **return**
2	Insert or remove media	Remove left tape box for tape media or right box for optical media
3	Load cartridges	Note lables, load boxes and insert into EIF
4	**/usr/amass/bin/bulkinlet SP**	Press **return**
5	**volformat (-p)** ***volnumber***	Press **return**
6	Confirm format	Enter **Y**
7	**/usr/amass/bin/vollist**	Press **return**
8	volstat –a	Press **return**

17.10.2.3 Manually Loading EMASS Archive Media

With the bulkload command, you bypass the EIF and manually load media directly into the library bins. Typically, this will only be done at the initial load of the system with large numbers of media volumes. The bulkload command enables AMASS to determine what type of media have been placed in the library and to convey this information to the AMASS database. The following procedures are applicable. Table 17.10-9 presents the steps required for inserting media into the EMASS bins. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

Warning

If it is necessary to enter the AML after AMASS is started, the following step (Step 1) must be performed first to avoid hazard and ensure safety of personnel and equipment.

1. Turn the **Operation Mode** switch, located above the AMU keyboard shelf, to **manual** by rotating it to the horizontal position.

   - The Control Off amber light comes on.
   - All power to the robot and tower is then turned off and it is safe to enter the enclosed area.

2. Press the **Illumination On** button.

   - The overhead light in the AML comes on.

3. Turn the **key** to the access door two full turns **clockwise** to open the door.

   - Physically enter the library and load the desired media into the bins.

Caution

The following step (Step 4) must be performed before leaving the enclosed area to ensure proper functioning of the AML robot.

4. Before leaving the enclosed area, straighten the robot arm so that it is parallel to the main hallway and pointing to the front of the AML.

Warning

To avoid hazard and ensure safety of personnel and equipment, the following step (Step 5) must be performed before Step 6.

5. On leaving the area, lock the door by turning the **key** two full turns **counterclockwise**.

6. Turn the **Operation Mode** switch, located above the AMU keyboard shelf, to **automatic** by rotating it to the **vertical** position.

   - The Control Off amber light goes off.

7. From a DAS command line, execute the **inventory** command, DAS will scan all AML media and update the archive catalogue.

   - The archive catalogue can be viewed with the **list** command.

8. At the AMASS host, type **bulkload -s SP** and then press the **Enter** key.

   - The AMASS database is populated with data for the volumes in the AML.

9. To view a list of media in the AML, type **medialist [-#]** (where # is the jukebox identification number), and then press the **Enter** key.

   - If you do not specify a jukebox number with the -# option, the default is 1, which specifies the EMASS AML optical disks.

- If you want to specify a different jukebox, specify -2 to indicate the EMASS AML tapes.
- The utility reads the library element status stored in the library, and information about the library contents, including the status (FULL or EMPTY) of the elements.

Table 17.10-9. Manually Loading EMASS Archive Media - Quick-Step Procedure

Step	Action to Take	Verification
1	Turn **operational mode** switch to **manual**	Control Off amber light comes on
2	Press the **Illumination On** button.	The overhead light in the AML comes on
3	Turn key two full turns **clockwise**	Enter library and load media
4	Turn the **Operation Mode** switch to **Automatic**	The Control Off amber light goes off
5	**Inventory**	DAS scans media
6	**bulkload -s SP**	AMASS database is updated

17.10.2.4 Ejecting EMASS Archive Media Using AMASS

Ejecting media from archive is always a manual operation. Problem media however, may be moved to the Problem Box automatically. Table 17.10-10 presents the steps required for ejecting EMASS archive media using AMASS commands. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Determine which volumes you want to remove by utilizing the volume number. If necessary to review volume numbers and other information, log into the AMASS host, type **/usr/amass/bin/vollist** and then press the **Enter** key.
2. If there are only a few volumes to removed; for each volume to be removed type: **/usr/amass/bin/voloutlet #**, where # is the volume number, and then press the **Enter** key.
   - AMASS marks the volume off-line and the volume is transferred to the EIF.
3. Remove the left box to remove tape media, and/or remove the right box to remove optical media.

Table 17.10-10. Ejecting EMASS Archive Media Using AMASS - Quick-Step Procedure

Step	What to do	Action to Take
1	**/usr/amass/bin/vollist**	Press **return**
2	**/usr/amass/bin/voloutlet #**	Press **return**
3	Remove media	Remove the left box to remove tape media, and/or remove the right box to remove optical media

17.10.2.5 Ejecting EMASS Archive Media Using DAS

Ejecting media from archive is always a manual operation. Problem media however, may be moved to the Problem Box automatically. Table 17.10-11 presents the steps required for ejecting EMASS archive media using DAS commands. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Determine which volumes you want to remove by utilizing the volser label. If necessary to review volser labels, log into the DAS host, type dasadmin list and then press the Enter key. For more information on the use of DAS commands, see the *DAS Administration Guide*. The DAS guide can be viewed using Adobe Acrobat and is available electronically on servers g0drg01 and g0drg02 in /usr/amass/books.

2. After determining which volumes to remove, type:

   dasadmin eject (ej) [-c] [-t media-type] volser-rangearea

   - DAS marks the volume ejected and the volume is transferred to the EIF.
   - See Table 17.10-12 for parameter descriptions.

3. Remove the left box to remove tape media, and/or remove the right box to remove optical media.

Table 17.10-11. Ejecting EMASS Archive Media Using DAS - Quick-Step Procedure

Step	What to do	Action to Take
1	**dasadmin list**	Press **return**
2	**dasadmin eject (ej) [-c] [-t media-type] volser-rangearea**	Press **return**
3	Remove media	Remove the left box to remove tape media, and/or remove the right box to remove optical media

Table 17.10-12 provides an explanation of DAS command parameters. Table 17.10-13 provides a list of media types specified by the parameter *media-type*.

Table 17.10-12. Parameter Explanation

-c	The optional parameter -c indicates to DAS a complete eject operation requested (volser will be removed from the archive catalog)
media-type	The optional media-type parameter allows the specification of a media type (see table 9-13).
volser-range	The volser-range specifies one or more volsers to be ejected. The volser range must be in one of the following formats: volser | volser, volser,... | volser-volser.
area	The area specifies the eject area name in the I/O unit to which the volume(s) are moved (e.g. E01).

Table 17.10-13. Media Types

Media Types	Type Explanation	AMU-Types
3480 3480 and 3490 and 3490E	Cartridges	C0
3590 3590/8590	Cartridges	C2
OD-THIN	Optical disk Reflection (9 mm)	O0
OD-THICK	Optical disk 512, MO/WORM (11mm)	O1
CD	CD-ROM disk (CD-Caddy)	C6
TRAVAN	TRAVAN cartridge	V5
BETACAM	BETACAM cartridge	V8
DECDLT	TK-85 Digital Linear Tape (DLT)	C1
8MM	D8 cartridge (8 mm)	V1
4MM	DDS or DAT cartridge (4mm) (Digital Data Storage)	V2
VHS	VHS cartridge	V0
D2	Small and medium cartridge	V3 (V4)
DTF	DTF small and medium cartridge	V6 (V7)

17.10.2.6 Removing Media from the EMASS EIF

Table 17.10-14 presents the steps required for removing all ejected media types from the EIF. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you

are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Verify that the Main Menu on the EIF keypad is active
   - Display is lit
2. Select **Eject** with cursor keys
   - Eject is highlighted
3. Press **Enter**
   - Display shows selection for, handling box number entry
4. Select **Eject handling box (1-8)**
   - Selection is displayed
5. Press **Enter**
   - Handling box selected is rotated, into access position
6. Select **Open Door** with cursor keys
   - Display prompts for reply to open door for access
7. Press **Enter**
   - Door opens
8. Remove media in Eject I/O box.
   - Option 1 Take out handling box and unload media
   - Option 2 Unload handling box while in place
   - Make sure box is seated correctly
9. Select **Close Door** with cursor keys
   - Display prompts for reply to close door
10. Press **Enter**
    - Door closes

Table 17.10-14. Removing All Ejected Media Types from EIF - Quick-Step Procedure

Step	Action to Take	Verification
1	Verify Main Menu is active on the EIF	Display is lit
2	Select **Eject** with cursor keys	Eject is highlighted
3	Press **Enter**	Display shows selection for, handling box number entry
4	Select **Eject handling box (1-8)**	Selection is displayed
5	Press **Enter**	Handling box selected is rotated, to into access position
6	Select **Open Door** with cursor keys	Display prompts for reply to, open door for access
7	Press **Enter**	Door opens
8	Remove media in Eject I/O box selected	Options: 1) Take out handling box and unload media 2) Unload handling box while in place Make sure box is seated correctly
9	Select **Close Door** with cursor keys	Display prompts for reply to close door
10	Press **Enter**	Door closes

17.10.2.7 Manual Ejection of EMASS Media

As mentioned previously, ejection of STK media is always requires manual intervention. Manual ejection can be by means of issuing commands or physically entering the Powderhorn LSM and removing a tape. Keep in mind that when a tape is physically removed from archive, the AMASS and ACSLS databases will think the tape is still in the LSM. Table 17.10-15 presents the steps required to eject EMASS media. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Determine which volumes you want to remove, utilizing the volume number. If necessary to review volume numbers and other information, log into the AMASS host, type **vollist** and then press the **Enter** key.

2. If there are only a few volumes to remove, then for each volume to be removed type: **/usr/amass/bin/voloutlet #**, where # is the volume number, and then press the **Enter** key.

   - AMASS marks the volume off-line and the volume is transferred to the CAP.

3. For the STK Powderhorn, open the recessed latch on the Cartridge Access Port (CAP) door and remove the tape(s)

Table 17.10-15. Ejecting EMASS Archive Media Using DAS - Quick-Step Procedure

Step	What to do	Action to Take
1	**Vollist**	Press **return**
2	**/usr/amass/bin/voloutlet #**,	Press **return**
3	Remove media	Open the recessed latch on the Cartridge Access Port (CAP) door and remove the tape(s)

17.10.2.8 Removing Problem Media from the EMASS EIF

Table 17.10-16 presents the steps required to remove Problem media from the EIF media interface unit. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Verify that the Main Menu on the EIF keypad is active

- Display is lit

2. Press F1 **key**

- Audible click, Problem Box unlocks

3. Open doors

- Swing open both doors to full extent

4. Manually spin tray **180 degrees, clockwise**

- Expelled tapes are now accessible to operator

5. Remove media

- Remove tapes from tray

6. Close Door

- Swing doors closed

Table 17.10-16. Removing Problem Media - Quick-Step Procedure

Step	Action to Take	Verification
1	Verify Main Menu is active on the EIF	Display is lit
2	Press **F1** cursor key	Audible click, Problem Box unlocks
3	Open doors	Swing open both doors to full extent
4	Manually spin tray 180 degrees, clockwise	Expelled tapes are now accessible to operator
5	Remove Media	Remove tapes from tray
6	Close doors	Swing doors closed

17.10.3 EMASS I/O UNIT

The I/O Unit is the media interface on EMASS models not located at the Goddard facility. The unit consists of three media compartments. The top compartment is the Problem Box reserved for system ejected media. The middle and bottom compartments are the operational insertion and ejection compartments for storage and Foreign media. The unit has EMERGENCY STOP, ON, and OPERATION buttons. There is also a shutter system that isolates the I/O compartments from the robotics unit.

Figure 17.10-3 displays the basic layout for the EMASS I/O Unit.

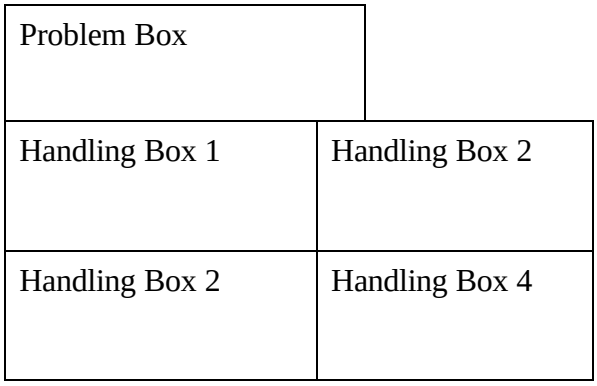

Figure 17.10-3. EMASS I/O Unit Layout

17.10.3.1 Inserting Media into the EMASS I/O UNIT

Table 17.10-17 presents the steps required inserting media into the EMASS I/O Unit. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Press ON **push-button**

- Generates door opening request
- **Shutter closes**
- **At closing of shutter, OPERATION push-button illuminates**
- **ON push-button goes off**

2. Open I/O door as far as possible, 15 sec timer
   - I/O media compartment is now ready
   - If timer is not met, shutter closes, Step 1 has to be repeated

3. Remove Handling box or boxes
   - **Audible Click from seating switch**

4. Insert tapes into box starting with the left slot in bottom row

5. Insert the handling box into the I/O
   - Place the box correctly, tapes face toward the rear or unit, a seating switch will click if done properly

6. Close the I/O door
   - Audible latch at door closing
   - OPERATION light pulses if handling boxes are not seated correctly
   - Shutter closes automatically
   - OPERATION and ON push-buttons turn off

Table 17.10-17. Inserting All Media Types into I/O Unit - Quick-Step Procedure

Step	Action to Take	Verification
1	Press **ON** push-button	Generates door opening request: 1) Shutter closes 2) At closing of shutter, OPERATION push-button illuminates 3) ON push-button goes off
2	Open I/O door as far as possible, 15 sec timer	I/O media compartment is now ready: 1) If timer is not met, shutter closes, Step 1 has to be repeated
3	Remove Handling box or boxes	Audible Click from seating switch
4	Insert tapes into box starting with the left slot in bottom row	
5	Insert the handling box into the I/O	Place the box correctly, tapes face toward the rear or unit, a seating switch will will click if done properly
6	Close the I/O door	1) Audible latch at door closing OPERATION light pulses if handling boxes are not seated correctly 3) Shutter closes automatically OPERATION and ON push-buttons turn off

17.10.3.2 Ejecting Media into the EMASS I/O UNIT

Table 17.10-18 presents the steps required for removing all ejected media types from the EMASS I/O unit. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Press ON **push-button**

- Generates door opening request
- **Shutter closes**
- **At closing of shutter, OPERATION push-button luminates**
- **ON push-button goes off**

2. Open I/O door as far as possible, 15 sec timer

- I/O media compartment is now ready
- If timer is not met, shutter closes, Step 1 has to be repeated

3. Remove Handling box or boxes

- Audible Click from seating switch

4. Remove tapes from box

5. Insert the handling box into the I/O
    - Place the box correctly, tapes face toward the rear of unit, a seating switch will click if dc properly

6. Close the I/O door
- Audible latch at door closing
- OPERATION light pulses if handling boxes are not seated correctly
- Shutter closes automatically
- OPERATION and ON push-buttons turn off

Table 17.10-18. Removing All Ejected Media Types from I/O Unit - Quick-Step Procedure

Step	Action to Take	Verification
1	Press ON push-button	Generates door opening request: 1) Shutter closes 2) At closing of shutter, OPERATION push-button luminates 3) ON push-button goes off
2	Open I/O door as far as possible, 15 sec timer	I/O media compartment is now ready: 1) If timer is not met, shutter closes, Step 1 has to be repeated
3	Remove Handling box or boxes	Audible Click from seating switch
4	Remove tapes from box	
5	Insert the handling box into the I/O	Place the box correctly, tapes face toward the rear of unit, a seating switch will click if done properly
6	Close the I/O door	1) Audible latch at door closing 2) OPERATION light pulses if handling box is not seated correctly 3) Shutter closes automatically OPERATION and ON push-buttons turn off

17.10.3.3 Removing Problem Media from the EMASS I/O UNIT

Table 17.10-19 presents the steps required for removing media from the EMASS I/O Unit Problem Box. If you are already familiar with the procedures, you may prefer to use this quick-step table. If you are new to the system, or have not performed this task recently, you should use the following detailed procedure:

1. Press ON **push-button**

- Generates door opening request
- **Shutter closes**
- **At closing of shutter, OPERATION push-button luminates**
- **ON push-button goes off**

2. Open I/O door as far as possible, 15 sec timer

- I/O media compartment is now ready
- If timer is not met, shutter closes, Step 1 has to be repeated

3. Remove tapes from Problem Box

4. Close the I/O door

- Audible latch at door closing
- OPERATION light pulses if handling boxes are not seated correctly
- Shutter closes automatically
- OPERATION and ON push-buttons turn off

Table 17.10.-19. Removing Problem Media from I/O Unit- Quick-Step Procedure

Step	Action to Take	Verification
1	Press **ON** push-button	Generates door opening request: 1) Shutter closes 2) At closing of shutter, OPERATION push-button luminates 3) ON push-button goes off
2	Open I/O door as far as possible, 15 sec timer	I/O media compartment is now ready: 1) If timer is not met, shutter closes, Step 1 has to be repeated
3	Remove tapes from Problem Box	
4	Close the I/O door	1) Audible latch at door closing 2) OPERATION light pulses if one of the handling boxes are not seated correctly 3) Shutter closes automatically 4) OPERATION and ON push-buttons turn off

17.11 Archiving Application Log Files to AMASS

The purpose of this Operations Procedure is to support permanent archiving of ECS Application Log files (ALOGs) to the AMASS archive device as and when required. Use of this procedure is DAAC optional. However if application logs are to be written to the archive it is recommended that this procedure be adhered to.

The ECS system ALOG files capture messages from ECS code on requests, responses and status. One ALOG file is generated per individual ECS custom code component (see ECS software baseline documentation, e.g. 910-TDA-007). Under normal operating conditions the ALOG files are not saved but are over-written by continuous process logging when they reach their maximum size. The procedure documented here should be employed whenever it is decided that at a particular time a log file or files need to be preserved.

The overall process is straightforward. Initial set-up must be completed by DAAC AMASS Operators. Individual file archiving and retrieval is then undertaken using a Unix account created for this purpose: “alogxfr”. ALOG files are copied on the application server to the home alogxfr” and then, on a STMGT host which mounts the AMASS cache, from there into the archive in the form of a specific Volume Group in AMASS. The Volume Group and its internal directory structure must be pre-configured as must the account “

File uniqueness in the archive and retrieval from the archive rely on (i) division of the volume structure by sub-system and application, (ii) preservation of default ALOG file naming in writing to the archive and (iii) where necessary file name extension with unique numbering.

Table 17.11-1. Archiving Application Log Files - Activity Checklist

Order	Role	Task	Section
1	DAM/DIT	Configuration	(I) 17.11.1
2	DAM/DIT	Amass Volume/ Volume Group set – up	(I) 17.11.1.1
3	DAM/DIT	Secure Shell ALOG file transfer account setup	(P) 17.11.1.2
4	DAM/DIT	ALOG file archiving	(I) 17.11.2
5	DAM/DIT	Verify/ create required Archive Volume Group and Subdirectory	(P) 17.11.2.1
6	DAM/DIT	Verify/create subsystem/application specific subdirectory	(P) 17.11.2.2
7	DAM/DIT	Copy ALOG file and write to archive	(P) 17.11.2.3
8	DAM/DIT	ALOG file retrieval from archvive	(P) 17.11.3

17.11.1 Configuration

Use of these procedures requires (i) the setting up of a system wide account to support ALOG file copying over the network and (ii) initialization of a specific AMASS Volume Group in which to archive the files.

17.11.1.1 AMASS Volume / Volume Group Set-up

The following Volume Group assignment must be made, and the directory structure created, before ALOG files are archived. Failure to do this will imply that the files are either not archived correctly or will not be retrievable from the documented locations.

The Volume Group “mss” should be pre-configured in the local archive. If it is not it needs to be defined. This Volume Group may also be used for archiving of certain MSS ESDTs. However that usage and this archiving of ALOGs should not interfere with one another. For first usage the Volume Group will also require the addition of an initial Volume (tape).

In the following the local/applicable AMASS cache mount point may differ from that shown i.e. “/dss_stk1/OPS”. Check your local DAAC configuration. Below that directory a sub-directory for the volume group should be found named “mss”. Within that directory a specific directory for archiving of ALOG files by this procedure is required i.e. “ALOGs”. Sub-directories below that shall be used for ALOG files from each ECS sub-system by three-letter abbreviation in upper-case, i.e. “IDG”, “MSS”, “DSS”, “PLS”, “DPS”, etc. Hence, as an example, to archive DPS ALOG files the following directory must exist in the AMASS cache:

“/dss_stk1/OPS/mss/ALOGs/DPS/”

Note: If this procedure is heavily used DAAC Operations may optionally insert additional levels of sub-division under the “ALOGs” directory, for example by calendar year of the date-stamp of the ALOGs archived, e.g.:

“/dss_stk1/OPS/mss/ALOGs/1999/DPS/”

17.11.1.2 Secure shell ALOG file transfer account Set-up

The following account for use with this procedure should be pre-defined. If it is not the likely cause is that the ECS baseline configuration changes related to this procedure have not yet been propagated to your environment. Refer to the ECS CCB and/or MSS sub-system support for guidance.

The account for ALOG file transfer is called “alogxfr”. This must be defined as a network (i.e. NIS) account. It may be configured for secure access (i.e. use of “
password) to all local ECS custom code application servers. To enable this configuration refer to local System Administration support (i.e. to set-up secure shell connection without password entry).

17.11.2 ALOG File Archiving Procedure

The following procedures explain how to properly verify and create the required archive and Volume Group for the archiving of operational ALOG files. Complete steps are provided, that step through the process of creating and logging ALOG files to the archive. Quick steps are provided for reference, after the operator has developed an understanding of the following procedures.

17.11.2.1 Verify/create required archive Volume Group and sub-directory

As described above ALOGs are to be archived by sub-system and application to specific AMASS sub-directories within the “mss” Volume Group.

1. As input to this procedure you will need to know the following information:
   - The name of the ALOG file to be archived and its full file path if non-standard.
   - The name of the application server from which the ALOG file is to be copied.
   - How to determine the ALOG file’s applicable ECS sub-system and application.
   - Which STMGT hosts mount the AMASS cache and the local name of the mount point for that cache.
   - The alogxfr account *password* (for copying ALOG files from the application servers).
   - For actions within this section support of an AMASS operator and/or root (i.e. for initial configuring of the archive).
2. Select the STMGT host for use in this activity. It must mount the AMASS cache e.g. directory: /dss_stk1

   Within this procedure this mount point will be referenced as “
3. Login as alogxfr to the chosen STMGT host and enter the *password*
   - Remember that your password is case sensitive.

mkdir /<acmountp>/OPS/mss/ALOGs

This may require permissions of the AMASS operator or root. If the directory is not owned by “alogxfr”(e.g. it has just been created) its ownership must be set. This may require root permission.

chown alogxfr /<acmountp>/OPS/mss/ALOGs

Repeat the ‘ls –l’ command above to check the directory’s ownership and permissions.

Table 17.11 - 2. ALOG file archiving procedure – Quick-Steps

Step	What to Do	Action to take
1	Login to Storage Management Host	Type login alogxfr
2	Determine if AMASS is running	Type ammassstat
3	Check that the required archive group exists	Type ls –l /<acmountp>/<mode>/mss
4	Check that the required subdirectory exists	Type ls –l /<acmountp>/OPS/mss/ALOGs

17.11.2.2 Verify/create Sub-system/Application Specific Sub-directory

The procedure may start with this step if the “mss” archive volume and “
have previously been verified and/or created as above.

1. If you are not already logged in as “alogxfr” set your userid to this user with use of the command ‘su’ as follows:

su - alogxfr

Note the '-' is separated by white-space from the alogxfr'. Enter the ' password when prompted. Verify that you are now user 'alogxfr' with the command

2. ALOG files have a standard file naming format as follows:

   <ApplicationName>.ALOG.<timestamp>

   To archive this ALOG file from the ApplicationName determine the sub-system and application to which the log belongs, e.g. file:

   EcDsScienceDataServer.ALOG.19981014232357

   is from the sub-system DSS and application "ScienceDataServer". Refer to ECS system software overview documentation for guidance.

3. Verify that the required sub-system sub-directory exists and has the correct ownership and permissions by use of the command e.g.:

   ls -l /<acmountp>/OPS/mss/ALOGs/DSS

   If it does not exist use "mkdir" to create it. It must be owned by user "

4. Check that the required application sub-directory exists by use of the command e.g.:

   ls -l /<acmountp>/OPS/mss/ALOGs/DSS/ScienceDataServer

   Be sure to avoid missing directories because of case sensitivity. If the directory does not exist use "mkdir" to create it. It must also be owned by user "

Table 17.11-3. Verify/Create Subsystem specific subdirectory – Quick-Steps

Step	What to Do	Action to take
1	Verify that you are logged in as alogxfr	Type whoami
2	Determine subsystem to which ALOG belongs	Refer to ECS software documentation for guidance
3	Verify that subsystem subdirectory exists and has correct permissions	Type ls -l /<acmountp>/OPS/mss/ALOGs/DSS
4	Check that the required application sub-directory exists by use of the command	Type ls -l /<acmountp>/OPS/mss/ALOGs/DSS /ScienceDataServer

17.11.2.3 Copy ALOG file and Write to archive

The procedure may start with this step if the sub-system and application specific archive sub-directory has previously been verified and/or created as above.

4. Change directory to the appropriate sub-directory location within the “mss” volume group for this file. For example for file

EcDsScienceDataServer.ALOG.19981014232357

Change directory to the sub-system DSS and application "ScienceDataServer" sub-directory i.e.:

cd /<acmountp>/OPS/mss/ALOGs/DSS/ScienceDataServer

5. **NOTE** that only one copy of a given ALOG file name can be preserved within a single directory in the archive. Uniqueness of ALOG files is determined by their ".<timestamp>" component. This value (format ".YYYYMMDDHHMMSS" e.g. ".19981014232357") identifies to the second the date and time of the file's creation. To enable multiple instances of the same named ALOG file (i.e. with the same file name including the timestamp) to be archived the file name in the archive should be extended with an operator entered three-digit numbering extension, e.g. ".001".

6. Check for pre-existence in the archive of an identically named file with the command:

   ls –l ./<alogfile>.???

   If any such files are found select the next available three-digit file extension number, i.e. ".nnn".

7. Write the ALOG file to be archived to the AMASS cache. **NOTE** currently (Feb. 1999) this action must **NOT** use the normal Unix 'cp' command. Instead the ECS command EcUtCopyExec" must be used. To write the first instance of a specific ALOG file (normal activity) use:

   EcUtCopyExec ~alogxfr/<alogfile> .

To write a new instance of the file (i.e. because the ALOG file name has not been updated by server restart sinc previous copy of the log was archived) use:

EcUtCopyExec ~alogxfr/<alogfile> ./<alogfile>.<nnn>

8. The EcUtCopyExec action commits the file to the archive but the copy in ~alogxfr must now be removed.

   Check that the file has been successfully copied with command:

   ls –l ./<alogfile>

   The file size should be the same as that in ~/alogxfr i.e. compare the output from the above 'ls' with the output from:

   ls -l ~/<alogfile>

   The local copy of the ALOG file made in ~alogxfr must now be removed. Move to the home directory of user alogxfr, check the existence of the local ALOG file copy, remove it and check on its deletion with the following commands:

   cd

   ls <alogfile>

rm <alogfile>

ls <alogfile>

This completes the procedure for archiving of an ALOG file.

Table 17.11-4. Copy and write ALOG file to Archive– Quick-Steps

Step	What to Do	Action to take
1	Verify that you are logged in as alogxfr	Type whoami
3	Login to remote host	Type ssh <remote host name>
4	Verify existence and sizeof of ALOG file in directory	Type ls –l /<alogdir>/<alogfile>
5	Copy the file to the home directory user alogxfer	Type cp –p /<alogdir>/<alogfile> ~
6	Exit the secure shell session	Type exit
7	Compare the file transfer results	Type ls –l ~/<alogfile>
8	Change directory to the appropriate sub-directory	cd /<acmountp>/OPS/mss/ALOGs/DSS/ScienceDataServer
9	Check for pre-existence in the archive of an identically named file	Type ls –l ./<alogfile>.???
10	Write the ALOG file to be archived to the AMASS cache	Type EcUtCopyExec ~alogxfr/<alogfile>
11	Check that the file has been successfully copied	ls –l ./<alogfile>
12	Remove the local copy of the ALOG file made in ~alogxfr.	rm <alogfile>

17.11.3 ALOG File Retrieval from Archive

This procedure supports retrieval from the archive to the home directory of the “
of a specific instance of an ALOG.

1. As input to this procedure you will need the following information:
   - The name of the source ECS application which created the ALOG file and which ECS sub-system it belongs to.
   - To know which STMGT hosts mount the AMASS cache and the local name of the mount point for that cache.
   - The alogxfr account *password* (for writing local copy of the ALOG file).
2. Select the STMGT host for use in this activity. It must mount the AMASS cache e.g. directory: /<acmountp>/OPS/

Within this procedure this mount point will be referenced as “

3. Login as alogxfr to the chosen STMGT host and enter the *password*
   - Remember that your password is case sensitive.
4. Use the **amassstat** command to determine if AMASS is running. If it is not you can not continue until AMASS has been restarted. Contact the AMASS Operator.
5. Check that the required top-level Volume Group “mss” can be accessed by use of the command:

   ls /<acmountp>/OPS/mss

   For modes other than “OPS” substitute the required mode abbreviation. If this command fails then contact STMGT/Archive operators to check on the Volume Groups availability.
6. Check that the next required level of sub-directory also exists i.e.

   ls /<acmountp>/OPS/mss/ALOGs

   If it does not then no ALOG files have been correctly entered into the archive using the above procedure or the AMASS archive database has been lost or corrupted.
7. Determine the ECS Sub-system and Application names for the ALOG file being sort. You can also use the commands ‘ls’ and ‘cd’ to search the sub-directories under volume group “mss” for available archived ALOGs.
8. ALOG files follow a standard naming convention of:

   <ApplicationName>.ALOG.<timestamp>

   This file naming is preserved when they are written to the archive by the above procedure (with the optional addition of a three-digit numeric identifier). In particular from the “ApplicationName” the originating sub-system and ECS application name can be derived. The timestamp identifies the date and time at which the ALOG file was created.
9. For example for ALOG file:

   EcDsScienceDataServer.ALOG.19981014232357

   the related sub-system is “DSS” and application name “ScienceDataServer”. These values are used to define the sub-directory in which applicable ALOG files have been archived, e.g. in sub-directory “/<acmountp>/OPS/mss/DSS/ ScienceDataServer”.
10. Change directory to the location where the required ALOG file(s) reside, e.g.

    cd /<acmountp>/OPS/mss/ALOGs/DSS/ ScienceDataServer
11. Search for matching ALOG files with ‘

    ls < ApplicationName >.ALOG.*

12. Select the ALOG file(s) required. Where multiple instances of the identically named (i.e. including time-stamped) file were archived they should be differentiated by a numerical file name extension, e.g. ".001", and by their file creation time (time of file copying into the archive).

13. Read a copy of the ALOG file from the archive. **NOTE** currently (Feb. 1999) this action must **NOT** use the normal Unix 'cp' command. Instead the ECS command EcUtCopyExec" must be used. To copy a specific ALOG file (normal activity) to the

    EcUtCopyExec <alogfile> ~

14. The ALOG file copy should now be available in the home directory of user " further use, i.e. can be found with one or all of the following commands:

    ls -l ~/<alogfile>

    ls -l ~alogxfr/<alogfile>

    cd; ls -l <alogfile>

    The file size should match that in the archive copy. This completes the procedure for reading ALOG files from the archive.

Table 17.11-5. ALOG file retrieval from Archive – Quick-Step Procedures

Step	What to Do	Action to take
1	Login to Storage Management Host	Type login alogxfr
2	Determine if AMASS is running	Type ammassstat
3	Check that the required top level Volume Group can be accessed	Type ls /<acmountp>/OPS/mss
4	Check that the next required level of sub-directory also exists	Type ls /<acmountp>/OPS/mss/ALOGs
5	Change directory to the location where the ALOG file(s) reside.	cd /<acmountp>/OPS/mss/ALOGs/DSS/ ScienceDataServer
6	Search for matching ALOG files	ls < ApplicationName >.ALOG.*
7	Copy a specific ALOG file to alogxfr	EcUtCopyExec <alogfile> ~

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