

# CONVERTING ANALOG VIDEOTAPES TO DIGITAL

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## INTRODUCTION:

The purpose of this document is to clarify what must be done to transform an analog videotape archive to a digital video archive. With the advent of digital, archivists with video in their collection will have to learn new procedures and new technologies and break some old paradigms. These archivists will find it useful to think of their digital archive as an Active Archive. This means that digital material will not be sitting on shelves gathering dust. Digital material will be either on-line and used often or available to be on-line.

For many years, I have advocated the transfer of old videotapes to digital because the old videotape recorder machines used for playback are no longer being made--except for the consumer VHS.

A few years ago, we were given two good media choices for digitally archiving video. These two are LTO DataTapes and Hard Disk Drives (HDDs). Both media have proven to be good choices, but neither is perfect. There is no ideal medium for archiving video and there may never be. Do not wait for the perfect technology and do not adopt the latest, but unproven, technology.

In the past, video archivists had to cope with preserving both the media and the machines to play the media. With digital, software is a third element. Digital technology has been changing much faster than the previous analog technology. Introduction of digital into the storage equation means coping with software and its frequent updates. A major problem is that future software may not be able to play the media/formats that were previously used to digitize your archive. This paper will outline a plan for coping with the problem of ever-changing software and also options for media and long-term preservation.

Again, I emphasize that converting legacy videotape collections to digital is an absolute necessity because the old analog videotape equipment is no longer being manufactured.

For incoming video that is in a digital format (born digital), the archivist must develop a plan to either leave this new digital material in its original format or convert it to the same digital format used in the rest of the collection.

## 2. COMPARISION OF THE TWO RECOMMENDED DIGITAL MEDIA:

Consider whether to use HDDs or LTO DataTapes as the new digital medium.

HDD = Hard Disk Drive

LTO = Linear Tape Open (a datatape format)

### 2a Capacity:

Both HDDs and LTOs have versions that can store over 1 TB (1 TerraByte = 1,000 GigaBytes) per unit. That is over 13 hours of un-compressed SDTV (Standard Definition TV)

## 2b Reliability:

In recent years, both have proven to be dependable, but neither is 100 percent reliable, which is why it is recommended to make two copies of all of the material in your video collection.

## 2c Storage Space:

Both occupy a very small storage volume.

Both HDDs and LTOs should be stored vertically if stored on shelves.

## 2d Storage Environment:

HDDs can be stored in a room with minimal temperature control and no humidity control.

ARCHIVAL LTO tapes must be stored in a temperature and humidity controlled environment.

ALL LTO Tapes should be stored in an area with at least some temperature and humidity control.

## 2e Life of the Media:

LTO datatapes have some contact points with tape guides when they are used. Normally, this will not cause problems but, if the same section is used many times, there is the possibility of tape damage.

HDDs stored on shelves and not running will last for many years.

## 2f Maintenance:

HDDs are self-contained and sealed so they require zero maintenance.

LTO playback machines have tape heads and guides that will wear and also must be cleaned frequently.

## 2g Access Time:

HDDs are disks so access time is fast.

LTOs are tapes, so it takes time to search for a particular video.

## 3. STORAGE and ACCESS on SHELVES or IN RACKS or IN A ROBOTIC SYSTEM:

Both HDDs and LTOs may be stored either on-line and mounted in special 19 inch-wide racks or off-line and on shelves. In order to be played, either type of medium stored on a shelf must be retrieved by a human being and placed in a playback device. Either type of medium stored in a rack can be played upon command by a computer.

The main advantage of storing your video collection on shelves is that it is the cheapest method.

### 3a Playing a Single Unit:

HDD playback requires only a small enclosure/control unit sitting on a desktop and connected to a computer.

LTO tapes require a tape machine for playback.

### 3b Automated Playback Capability for Multiple Units:

HDDs can be stored in racks on-line in a RAID or MAID configuration with no robotics and can be played from the archive computer. (See Section 6, "More about Access".)

LTOs can be on-line in a mechanical robotic system. This is expensive.

### 3c On-line/off-line:

HDDs on-line in racks can be on all the time with disks spinning so that they can be read instantly.

The most common configuration for this is called RAID. Another on-line system is for the disks to be mounted in racks but not spinning. The most common configuration for this is called MAID. In a MAID configuration and for HDDs on shelves, the moving parts within each HDD are used only when

that particular HDD is accessed, so these HDDs will have a much longer life than HDDs that are always spinning.

### 3d Cost of Equipment with Media Stored on Shelves:

HDDs: A desktop enclosure that will house and play four HDDs costs around \$300. HDDs can be taken off the shelf and plugged into the desktop enclosure. One 1 TB HDD costs about \$150.

LTOs: A read/play unit that will play one LTO cassette at a time will cost about \$2,800. One LTO-4 (800 GB) cassette costs about \$130.

I favor HDDs for archiving digital video, so the remainder of this paper will be about use of HDDs.

## 4. GETTING STARTED:

Once you have general knowledge about the choices in media type, storage, and access, hire a consultant to help you through the digitizing process and the management of digitized material.

### 4a Videotape Consultant

This may be a person or a company that specializes in restoring old analog videotapes. This expert is necessary because he/she will know what formats you have in your collection and where to find useable videotape recorders for playback. Also, some of your videotapes may not be playable without some restoration work. Videotapes that have not been played for many years may have problems and may get damaged if playback is attempted without first performing the necessary restoration work.

### 4b Digital Consultant

The future usability of your digital video collection depends on the maintenance plan developed by your digital consultant. This person must be willing to follow the advice in the following section "Keeping Out of Trouble".

## 5. KEEPING OUT OF TROUBLE

### 5a Duplicate ALL of Your Electronic Equipment:

The military and NASA always require redundant electronics because failure is a certainty. So, how do you make electronics in the archive redundant? The answer is to start with three identical computers. Three are recommended because it is very likely that at least one of these three will be usable 10 or more years from now.

At first, only one of the three computers is used. The other two are backups and are not powered. When your primary computer does have a failure, switch over to one of the other computers and have the first computer repaired without doing any software or hardware upgrades. About once each year, power up the back-up computers and check that they are working properly.

### 5b Think of Your Archive as an Isolated Island:

To deal with the possible future problem that new software may not be able to play the material in your collection, think of your archive as being isolated from the rest of the world. Your isolated island includes your archive room, playback equipment, and the computers or workstations being used in your archive. The material in your archive can be distributed to the outside world by way of copper wire or fiber-optic cable or physical media, such as DVD. The archivist who is responsible for this isolated island does not need to manage and upgrade the computers and equipment in the same way that the outside world does.

### 5c. Verify Before Upgrading Software:

It is extremely important that the archivist and digital consultant NOT upgrade the software on the computers or workstations that are dedicated to playing videos in the archive until compatibility (playability) has been verified. This means testing samples of every type of media in the archive using the new software upgrade. Test on one of the backup (spare) computers on which the upgrade has been installed but which otherwise has software and hardware that is identical to the primary computer used to read/play the material in the archive.

### 5d Archive Media Maintenance:

Develop a schedule to migrate or refresh over a period of a few years, or migrate/refresh about every five years.

Migrate means changing from an old format to a new format.

Refresh means to re-record the data on the same type of physical medium.

## 6. MORE ABOUT ACCESS:

Most archivists cannot afford to put their entire collection on-line, so several alternatives are listed below.

6a The cheapest alternative is to place all HDDs on shelves. A HDD can be played by removing it from the shelf and putting it in a small desktop HDD enclosure/control unit connected to the archive computer. Enclosures are available for a single HDD or four HDDs.

6b Another alternative is to mount HDDs in a 19 inch rack and make them accessible on-line. On-line can mean either accessible to people at your archive or it can mean accessible to anyone on the internet. It is advisable to have each archival HDD powered off until it is told to run by the main computer.

6c Another alternative is to place the rarely-used material on shelves and put the often-used material on-line.

6d RAID-5 (Redundant Array of Independent Disks) is the most common on-line storage configuration for HDDs that are turned on all the time. But, RAID-6 has much better failure protection than RAID-5. Also, RAID-0 (mirroring) is a good method for archiving HDDs.

6e MAID (Massive Array of Idle Disks) is an on-line system comparable to RAID except that the HDDs will last much longer because they are powered off until a HDD is accessed. MAID-6 and MAID-0 are recommended for archival material.

## 7. VIDEO QUALITY

Video content CAN be sampled and compressed in order to save storage space. This is no longer necessary, however, because the cost and space requirements for storing digitized video have greatly decreased. For archival purposes, video should never be compressed because the common compression methods are lossy, and the sampling eliminates fine details in subjects such as hair, grass, and fluffy clouds. Also, all forms of compression require special software and a hardware card, and these may be difficult or impossible to obtain ten, twenty, or forty years from now.

## 8. PRESERVATION, ACCESS, AND DISTRIBUTION (PAD)

DVDs can be useful for Access and Distribution. They are inexpensive and small. Up to 100 can be kept in a small desktop carousel costing only \$130. A request, placed on a computer attached to the carousel, will cause ejection of the designated DVD, which can then be inserted into a player.

CDs have been suggested for storing video for access. However, CDs were designed to record music, not video. They can record video but in an extremely compressed form and are not recommended for this.

DVDs also compress video but not as severely as CDs. DVDs compress as much as 100:1, so fine detail in the video is lost.

Neither DVDs nor CDs should be used for Preservation (archival storage) of video, but DVDs are ideal for Access and Distribution.

## 9. CONCLUSION:

There never has been an ideal way to archive video. However, digital has opened up new possibilities for using your collection as well as preserving it. Your priority should be to hire a consultant to develop a program to both preserve your collection and to make your material available to more people.

With an Active Digital Archive, you need to think differently than you did with your passive analog collection. Your digital consultant must develop guidelines for future-proofing your collection. Your digital expert is the key to the future of your archived material.

In the future, a new technology may become available that is a better archival medium. At that time, the archivist of the future can transfer the collection to that new medium.

No matter which method you chose, you can change to one of the other methods at any time.