

**AMIA** the association of moving image archivists

## "Video Q & A"

### Answers to Frequently Asked Questions on Video Formats and Preservation

#### Introduction

In the tradition of history's famous sparring partners - Lincoln and Douglas, Siskel and Ebert, Calvin and Hobbes - AMIA's own Jim Lindner and Jim Wheeler collaborate on a regular AMIA Newsletter feature in which they debate video preservation questions and issues raised over the years by AMIA members. The first "Video Q & A" column appeared in the October 1994 issue of the AMIA Newsletter.

#### About the Authors

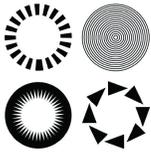
Jim Lindner is the President of VidiPax (New York) and has restored hundreds of old videotapes. He has done many special projects for 60 Minutes, NBC News Archive, President Clinton, etc., and probably has seen every tape problem there is.

Jim Wheeler is President of Tape Archival & Restoration Services (Belmont, California) and has 32 years experience at Ampex as a tape engineer. He was a design engineer on most of the Ampex videotape recorders and responsible for tape handling and longevity. Jim also tested all types of tapes on all of the Ampex videotape recorders in all types of abuse and environments.

IPI is an academic research laboratory cosponsored by the Rochester Institute of Technology and the Society for Imaging Science and Technology. IPI's research helps to support ANSI and ISO. In addition, several IPI publications directed at archivists and curators are essential reading in two important aspects of archival film storage: cellulose acetate deterioration and color dye fading. While ANSI standards provide very useful guidelines for storage of newer materials, IPI's research helps us to understand not only what happens to older films having a history of substandard storage but what can be done to lengthen their useful life. In this sense, ANSI and IPI publications complement each other.

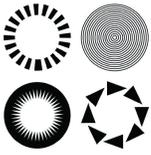
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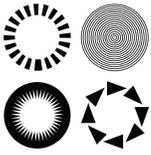
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32. I've got a 60 minute Fuji Beta-SP tape that sounds like it's being flogged when I play it. Major creaking, rhythmic rubbing sound (kind of kinky). The tape has only been played maybe 5 times since being mastered 2 months ago. There is a submaster, thankfully, but any ideas what's up? Is this hard on my UVW, or just the tape's lubrication system screwed up? (Fall 1996)
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56. There have been relatively few new video formats introduced in the past few years. Is this a trend and is the market finally consolidating on a few formats? (Winter 1999)

57. What environment do you recommend for storing old tape recorders and electronic equipment? (Spring 1999)

58. I have a large collection of posters to which I would like to have more immediate access. Should I capture them with a digital camera (I have access to a Sony Mavica) or store them as single frames on a videotape? How should I do this - laser video disc, CD, DVD, computer disk? What about storage space? (Spring 1999)

## The Answers

**(from AMIA Newsletter #26, October 1994)**

**Question 1: I am going to tape an event at our organization and I do not know what kind of tape to purchase for my Hi-8 camcorder. The most expensive is called ME tape. Is this what I should use?**

Lindner: Not if you want to be able to play the tape back in the not too distant future. ME or Metal Evaporated tape is manufactured using a different process than "conventional" technology. Metal Evaporated tape is actually a microscopically thin layer of metal which has been deposited on a base film. Because it is so thin, it can wear extremely easily so applications like editing or long-term storage are not recommended. One option that several people are using is to capture images on ME tape, and transfer to normal MP tape for editing and storage.

Wheeler: ME (Metal Evaporated) tape is used only on Hi-8. ME tape produces a better picture but it is NOT durable and is not recommended for editing or archiving.

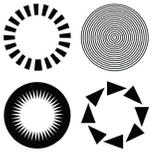
**Question 2: What is the difference between component and composite tape recording, and does it matter?**

Lindner: Component recording separates the color from the black and white. When the tape is played back, the color information is added back to the picture. When making copies of component tapes, it is possible to maintain the separation of color and black and white information. Composite recordings have the color information mixed in with the black and white information, and the quality degrades faster when making copies. If you have a choice, a component recording is the better option.

Wheeler: Composite video is the normal single cable video we are so used to. Composite video consists of both horizontal and vertical TV synchronization information, black/white video, and color information. Component video splits the black/white and color and puts them on two separate wires. When component video is recorded on two separate channels on the tape, the playback picture is better quality because the signals don't interact with each other during the recording process. Composite video usually interacts during the record process and adds unwanted artifacts to the video.

**Question 3: What is the point of exercising tapes? If I have to do it, should I play the tapes, fast forward them on my machine, or buy a rewinder?**

Lindner: Exercising tapes is a good idea provided it is done with good equipment in the correct fashion. If done with poorly adjusted equipment it is quite easy to destroy the tape. One might reasonably ask: "Why exercise tapes in the first place?"



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The idea behind exercising tapes is to essentially re-tension the pack of tape so that it does not develop uneven tension. It is also thought in some circles that this process allows air to be "sandwiched" in between the layers and allow out-gassing (although I have never seen any REAL research that talks about this). The technical jargon goes something like "....to minimize the possibility of the tape taking an unwanted set due to stepped or scattered winding, the tape should be given a continuous wind or rewind before storage." Tape should be stored in a fully wound or rewound condition. More information will be available very shortly (October - November 1994) with the revision of SMPTE RP103, 1993 for the "Care, Storage, Operation, Handling and Shipping of Magnetic Tape for Television."

Wheeler: If your tapes are stored in a room environment, the recommended practice is to rewind them every year or two. This is a very conservative and I have been recommending five to ten years. If you store the tapes at 40 F (like I recommend), they never need rewinding. The purpose of the rewinding is to relieve the stresses in the tape pack and these stresses don't occur at low temperature. In a severe case, the tape layers will slip and eventually cause cinching in the tape pack. Back-coated tapes are less likely to have pack slippage problems because of the increased layer-to-layer friction. A tape that is cinched should not be run at high speed. Play it at normal play speed and leave it on the take-up hub for a few days to relieve the pack stresses.

I have heard of bad experiences with tape winders.

#### **Question 4: Should we make copies of our important videotape for long term storage on recordable CD-ROM?**

Lindner: The jury is still out on this one. CD-ROM's do offer several advantages including non-linear access, but there is not enough experience with the media over long periods of time to really know how they will hold up (accelerated aging tests are not always reliable). In addition to potential problems with the actual media there is the potentially difficult issue of software incompatibility with CD-ROM's. Quality issues are very important on CD-ROM, with different compression schemes offering different levels of quality and image size. In general, the quality is very poor when compared with tape at this point in the technology.

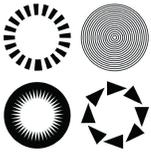
Wheeler: CD-ROMs are great for fast access but I don't recommend them for long-term storage. It depends on the manufacturer and how the CD-ROM is made as to whether it can be considered archival. CD-ROM's take up a lot of storage space and will cost much more when compared with tape. One VHS size videotape has the equivalent data of about 40 CD-ROMs.

Some CD-ROMs are using compressed video but that is not recommended for archival purposes. Any compression over about a factor of five has a high probability of losing information. Whatever you do, never discard your original!

#### **Question 5: How come I can play back the video on my 8mm cassette but I can't hear the sound? It was fine on the camera when I recorded it. What happened?**

Lindner: In many of the new video recording systems -- particularly with ones that are called "High Fidelity," the audio information is actually encoded into the picture portion of the signal. If the tracking is off slightly, it is possible to get a picture that looks OK, but the audio information is not able to be decoded properly, therefore no sound. In many cases a camcorder can get out of alignment so that it is not making a "standard recording." When this happens, it is possible for the camcorder to play back its own recording, but any other machine may not be able to play back the recording.

Wheeler: It is difficult to advise about such a problem without more information. My first guess would be that the auto-tracking is not working properly.



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**(from AMIA Newsletter #27, January 1995)**

**Question 6: What should I do with my tapes that have shedding debris on them?**

Lindner: Tapes that show visible signs of shedding need to be handled very carefully for two reasons. First, if mishandled, the tape could easily be destroyed and the information lost forever. Second, it could destroy the heads of the machine, along with the tape.

The fast answer is: Throw it out if it is not an important tape. If it is important, the only solution is restoring the tape and transferring it to another format.

Wheeler: You can run the tape through a special tape cleaner. This is a tape cleaner with a vacuum head and/or pellaon wipe. The cleaners with the "razor blade" should be avoided for fragile tapes with shedding problems. Or, send your tapes to a lab that specializes in cleaning tapes and understands the delicate nature of shedding tapes.

**Question 7: I have some quad tapes, but no quad equipment. How do I get them transferred to a usable tape format?**

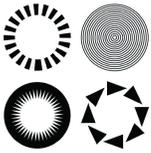
Lindner: Quad machines are fast disappearing, and people who really know how to operate them are even harder to find. Quad machines are definitely not "plug and play" and require significant maintenance effort and expertise. If quality is not an important issue, you may have some luck hunting around at local TV stations in small markets across the U.S. Some of these stations may have a machine still in service or able to be turned on. If the master is of value, a professional restoration company is your least expensive option.

Wheeler: There were several different quad formats, so you don't just put the tape on any quad machine and expect a good picture. You can find labs in the telephone book under "Video Duplicating and Transfer Services," but chances are slim that you will find one that knows very much about quad. New York, San Francisco, and Los Angeles are where the specialty labs are located.

To determine if the lab understands quad, ask them if they can play low-band quad. If the answer is "huh" then try another lab.

**Question 8: How can I accurately measure temperature and humidity in my vault?**

Lindner: Accuracy and budget travel together on these types of products. You also have to consider logging the information over a period of time either manually or automatically. My experience is that having a very accurate reading is less important than looking at cycles that may be occurring in the vault over time periods. These problems often happen when you are not there, perhaps when a HVAC system is automatically turned off at night or on in the morning. For this reason, my current favorite toy is a data logger. These devices are available from a number of sources and allow you to "poll" temperature and RH with an IBM PC at basically any interval you want. The results can be plugged into a spreadsheet and viewed as a graphic. In this way, it is very easy to see cycles. The old equivalent is to use a chart recorder, but I believe that a data logger offers a great deal more and for only a little greater price.



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By the way, here is an idea: If you have off-site storage, it is usually next to impossible to really know what the temperature and RH is in the vault, despite what the operator tells you. It is very important to find out for yourself. Next time you send something into the vault, send a chart recorder (many are battery powered) inside a big video box. This will tell you how your materials are really being stored and can be very useful in negotiating with the vendor for reduced rates.

Wheeler: I use a chart recorder sold by Omega (800-826-6342) that sells for about \$600. It uses an 8-inch diameter chart with a red pen for temperature and a blue pen for humidity. You can get charts for 24 hours, one week, or one month per chart revolution. Temperature can be in either Celsius or Fahrenheit. It works off internal battery or power line. I have used one for several years and I really like it.

Be sure to check several areas in your vault.

**Question 9: I can smell vinegar in my film/tape storage vault. Will that harm the tapes in the vault?**

Lindner: Assuming that your staff has not opened a salad bar in the vault, out-gassing or "vinegar syndrome" from old film will probably not hurt the tape, but it will not help it either. The concentrations of acid in the air are very dilute and would have to be very strong for a long time to do serious damage. By the time this occurs, your film will be a solid hockey puck, and you won't be able to find a machine to play the tape anyhow.

Wheeler: The vinegar is acetic acid and will eventually attack everything in the vault. I suggest placing the tapes in another room. The vinegar degradation of film and the hydrolysis degradation of tape are both slowed by low temperature and low humidity.

**Question 10: I hear that digital is the best videotape format. Is there a reasonably priced digital videotape recorder on the market?**

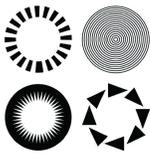
Lindner: I suppose it depends on your pocketbook. The least expensive digital recorders are in the mid-\$30,000 range (after driving a hard bargain with the vendor). If a consumer digital video recorder shows up soon (there are several working prototypes rumored), this would be the least expensive option. While attractive, be aware that the market will again determine which of these new consumer digital formats will eventually be successful. One thing to always consider with these types of investments is the operating cost as well as the cost of the machine. The videotape for professional digital videotape recorders is two to three times as expensive as the tape for other formats.

Wheeler: No. Digital videotape is definitely the best storage method for your videos but there is no really "reasonably" priced digital videotape recorder at this time. D3 is the cheapest but it's difficult to foresee how long it will be popular.

**(from AMIA Newsletter #28, Spring 1995)**

**Question 11: Several companies are now selling polypropylene sleeves for videotape that are "archival." Do they work?**

Lindner: Polypropylene is clearly more inert than a plastic like styrene and does not out-gas, but these products will do little if anything to protect your tapes, and nothing to preserve them. In cassette media, the tape is housed in the cassette shell and depending on the format and manufacturer, the quality of the plastic in these shells varies from the extremely poor to quite good resin-based shells. Sleeves also are unsealed, and as a result leave the cassette exposed to air, water, and dirt.



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For long term storage, I recommend containers called "shippers." These containers are designed to be used when media is to be shipped from one location to another. Generally speaking they are very sturdy and are made either with inert plastics, or have a minimal amount of plastic directly in contact with the media. Shippers are usually sealed well enough to keep out high levels of humidity during transport, but they are not usually perfectly sealed, and therefore can out-gas over time. Most often shippers need to be ordered when the tape is purchased in the first place, however some sizes may be ordered from the manufacturer by special order. My current favorite shipper is the 3M version. The design has evolved over the years (several earlier attempts were less successful), and the current models are inert blow-molded polyethylene in an excellent "clam shell" configuration.

Wheeler: The polypropylene sleeves are a great improvement over cardboard. They also reduce the effects of handling of the cassette, such as greasy fingers, but these sleeves are not meant to protect the tape itself.

If your tapes are subject to radical variations in humidity and/or high humidity, I suggest sealing the tapes in their own micro-environment. This can be done with shippers or with one or two thick freezer quick-seal bags.

Warning! Before sealing a tape in its own environment, the tape must first be thoroughly dried out. This can be done during the time of year when your local climate is at its lowest humidity or you can rent a humidity controlled environmental chamber. About a week at a humidity below about 30% RH is adequate.

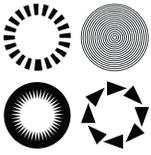
**Question 12: We would like to do some oral histories on video and are planning to use Hi-8 Video. Is Hi-8 a good choice for this use?**

Lindner: I strongly recommend AGAINST using Hi-8mm as an archival format. Hi-8 offers several advantages as a format. Hi-8 is very compact, offers good resolution, is a component format which means color information is separated from black and white information which is a quality advantage, and Hi-8 is relatively inexpensive with consumer camcorders in the under \$1,000 range. The problem for Hi-8 in archival applications is that the tape has a great deal of information in a very small physical space, and as such any small problem becomes a big problem very quickly. Dropouts which usually are caused by small defects in the magnetic coating are a problem with Hi-8, and because the tape is fragile the format cannot be used reliably in editing where the tape gets shuttled back and forth. I do not consider Hi-8 to be a "robust" format, meaning that Hi-8 is not fault tolerant and problems cannot be easily corrected. For example, Hi-8 machines do not have tracking control for the most part, and many people have lost the sound track for their video due to tracking and alignment error in the machine. An alternative for archival applications is to record on Hi-8, and copy the sections that you wish to edit or store onto another format like Betacam-SP.

Wheeler: Hi-8 is okay as long as you use a good quality MP (Metal Particle) tape and don't use ME (Metal Evaporated) tape. ME tape is not archival. It is very difficult to edit with Hi-8 so many people "bump it up" to a higher quality videotape format for editing.

**Question 13: I would like to buy a camcorder, and one of the things I would like to do is to videotape the image on my computer monitor. Any suggestions?**

Lindner: There are several ways to tape images from computers, depending on the type of graphics card and computer, and the quality required. If you require a direct video of the information (you do not wish to see the monitor), the best thing to



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use is a scan converter. These devices electronically convert the signal from the computer to a video signal you can record. These devices have gotten much less expensive recently and are available from video dealers and some computer dealers. Often they can be rented as well.

If you wish to tape directly off the screen with your camcorder, look for a camera with an electronic shutter that has a variable speed. Recently several models have come out that allow you to vary the speed so that you do not have a roll bar in the picture. I have not personally worked with one of these cameras, but I have heard that they do a good job.... and the price is right.

Wheeler: There are two major problems with videotaping directly off the computer screen. First, you can get a vertical "bar" rolling through because the computer synchronizing signals occur at a different rate than those of the camcorder. You can purchase a card for your computer that will produce a synchronizing signal for your camcorder. The problem with this is that you must have a professional camcorder that has a sync input connection on it. Second, the resolution of the computer screen image is much better than the NTSC TV system used by the camcorder. The result will be that the recorded image will not have the sharp image you are used to with your computer screen.

Both of these problems can be overcome by using a scan converter that takes the computer video and converts it to an NTSC signal for your camcorder.

**Question 14: When inserted in a playback machine, my tape will not advance, and when you take it out you can see that the tape is not broken. What do I do?**

Lindner: Sometimes cassettes can get jammed by being wound too tightly. If you look at the bottom part of a VHS cassette (the place where the hubs are where the machine moves the tape) you will see a round hole roughly in the center of the cassette. This hole is the "brake release" for the reels. Sometimes releasing the brakes slightly will reduce the pressure enough to allow the cassette to work. Simply place a round object like a pen and push lightly; you may hear a little clicking sound. Remove the pen and try playing the cassette again. If it does not work after releasing the brakes, you may have another problem that is more serious, and you may need to get some help.

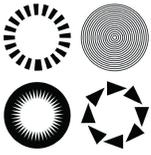
Wheeler: First, I assume the tape player will play other tapes okay. The most common problem for a tape not moving is that the tape surface finish has been polished as a result of being used many, many times. You will require a technical person to help you with this problem.

Clean the rubber pinch roller using isopropyl alcohol and clean the steel capstan with a stronger chemical. I normally use the chemicals sold for cleaning tape recorder heads. Don't allow the head cleaning chemical to contact the rubber pinch roller and also use it only in a well-ventilated area.

**(from AMIA Newsletter #29, Summer 1995)**

**Question 15: What type of tape should I buy?**

Lindner: Tape is manufactured from many ingredients as a continuous process, and for this reason there are varying levels of quality from each and every manufacturer. It is quite possible to purchase the same brand of tape from one batch and have



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very good results, and purchase another batch from the same vendor and have problems. For this reason, recommending a specific vendor or tape type is a risky proposition. Generally I feel that you should stay with a major manufacturer who has customer support that you can find in case of a problem, and a vendor that is in the tape business, not some other business. By this I mean that it is generally a good idea to stay away from "private" labels that are manufactured by an anonymous vendor. Purchase your tape at a store that sells it in large volume, and has a rapid inventory turnover -- you do not want tape that has been sitting around for two years. Buy it either in spring or fall, stay away from tape that has been transported or warehoused in temperature extremes if you can. As far as the "grade" of tape, for general purposes, a middle range is usually adequate. For mastering purposes go with the premium grade.

Wheeler: Certainly use a recognized name brand. Most tape manufacturers market at least two grades of tape with professional usually being the name used for the best grade. If the professional grade has been improved, the better version may have a title like "super professional." If you can afford to, it is good practice to buy the best grade. An exception to this rule is when the tape is an entirely different formulation, such as, Metal Evaporated (ME) or chrome (used for audio). Both ME and chrome tapes have better signal output but are not considered good archival choices.

**Question 16: Is it okay to freeze magnetic tape?**

Lindner: NO!! Most manufacturers strongly recommend against freezing tapes. Many problems can befall tape that has been frozen including problems with the wind due to tape pack loosening and "sagging" and lubricant migration. Occasionally tape must be transported in below freezing temperature, but try not to. Do not intentionally store tape below freezing, and if you have received tape that has been very cold, allow it some time to acclimate to the room temperature before using it and beware of condensation during acclimation.

Wheeler: No! Most tapes have a fatty acid lubricant which will migrate to the tape surface if frozen.

**Question 17: My video playback is unstable. Can it be stabilized?**

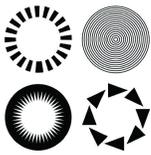
Lindner: Instability can be caused by many things, and the remedies can vary widely. In many cases the instability is being caused by a playback machine in poor alignment.... try playing the tape in another machine. Older formats often have instability "built in" relative to new formats and need to be professionally corrected. Copy protection can also cause this problem if unauthorized duplicates are made from a protected master. In general, most instability problems can be fixed, but require professional attention.

Wheeler: Most cases of unstable video can be stabilized by using a time base corrector (TBC) or a video processor. There are many different types of TBCs and Video Processors and some work better with certain tape formats. Both the tape format and the nature of the problem will dictate what equipment will stabilize the video.

**(from AMIA Newsletter #31, Winter 1996)**

**Question 18: I don't use video equipment very often. Should I buy, lease, or use someone else's facility?**

Lindner: One should look at the purchase of video equipment in a similar fashion as in the purchase of other equipment for your institution. The decision should be dictated by the amount of use of the equipment, and the amount of internal expert-



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ise necessary to produce the product that you need. If you have a regular need for this equipment and have internal support, it may be best to purchase. If you have a short term project that requires intensive need followed by a low level of utilization, rental may be the best option if internal expertise is available. For specialized needs or specific projects, an outside facility is probably the most effective option.

Wheeler: If you are using a consumer-grade videotape format (VHS), the equipment is very affordable and easy to operate. The Industrial-Grade 3/4-inch U-Matic, S-VHS and Hi-8 equipment is more expensive and sometimes more complicated but still within the budget of most facilities. Professional video equipment is much more expensive. If you have only an occasional use for the equipment, it would be better to lease it or to take your tapes to a facility with the proper equipment.

**Question 19: Is S-VHS a good format to use?**

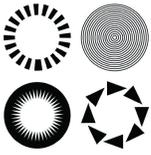
Lindner: I have never been a big fan of S-VHS, but I have softened my position recently. My problem with S-VHS is that it has been a commercial flop in the mass consumer market, and because there are a number of high quality new formats becoming available for the consumer and "prosumer" market very soon, I am concerned that S-VHS could disappear quickly. On the other hand, there are many "event videographers" (you know, the people who do weddings) who are very happy with it, and use it regularly. Since there is not much editing Hi-8 equipment out there either, and since Hi-8 has had problems with editing applications due to the frailty of the tape, there are not too many options at this end of the marketplace right now. So all things considered..... well, I suppose it does have a place for certain applications -- but I predict that it will be one of the faster formats to disappear once something better comes along!

Wheeler: S-VHS produces a much better quality video than VHS and therefore can tolerate some degradation before it becomes objectionable. This safety margin is beneficial because you can produce about two generations of copies before the picture quality is comparable to VHS. This safety margin is also beneficial if the playback VCR is not aligned the same as the VCR that recorded the tape (which will cause the signal to be somewhat degraded). The S-VHS format is very popular for special industrial/educational markets. For example, about 60,000 S-VHS VCRs have been sold in the U.S. as ADAT recorders. This is a high quality, low-cost, audio tape format.

**Question 20: Throughout the years I have heard that one should not house audio tapes on metal shelves. Is this an old-wives tale? Is it necessary to place audio and/or video tapes on wooden shelves or in wooden file cabinets? The reason given for not using metal shelves or file cabinets is because of electromagnetic fields erasing the tapes. Is this really possible?**

Lindner: I think this "wives tale" stems from a paper by A. G. Pickett and M. M. Lemcoe entitled "Preservation and Storage of Sound Recordings," Library of Congress, Washington, 1959, p.62 (although I have not seen the article, it is cited every now and then). This is a very old paper and I am very suspicious of the conclusions considering the age and what we now know about magnetics. I have even heard that one should electrically ground shelves if they are metal and hold magnetic media.

I can think of no rational basis for recommendations for wood instead of metal shelving, and many reasons to stay away from wood shelves in general including out-gassing from sealers and paints, fire issues, and generally poor load-handling characteristics. For choosing metal shelves, I would follow the recommendations of those using shelving for photographic elements and stay away from paints with solvents that out-gas over time. From a "magnetics" point of view, it takes a relatively strong field to record or erase tape.... analog audio and old video formats require a lower strength field than more modern formats, but



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they are still quite strong. Exposure to lower strength fields over long periods of time can have a cumulative effect, but then again I can't think of how one would magnetize shelving to that high a level unless it was either done in manufacturing or done by having a device like a motor on the shelf.

The electrical grounding does not make any sense from a magnetic or static electricity perspective; the concern may be for safety if a hot leg were somehow to touch the metal and make it hot... you could become the ground. That is a general electrical safety issue and would probably apply (or not apply) no matter what the use of the shelving was.

Wheeler: Steel shelves will not affect magnetic tape. It would take an enormous magnet to magnetize such a large hunk of steel. Steel is a much better shelving for an archive because of its strength and durability. Wood is bad because it burns.

### **(from AMIA Newsletter #32, Spring 1996)**

#### **Question 21: There are two new digital videotape formats on the market: DV and DVC-PRO. Are these okay for archival use?**

Lindner: There are many new digital formats that are just being introduced, many of them are designed for the corporate and high end consumer markets. These formats include DV (Sony), DVC and DVC-PRO (Panasonic), and Digital-S (JVC). In most cases these formats are not compatible (the exception being that DVC-PRO can also play DVC tapes). The JVC appears to have the least compression of the new formats at approximately 3:1, the other formats are around 10:1. These are the first generation of digital video recorders that come close to being affordable and as such will be sold very heavily.

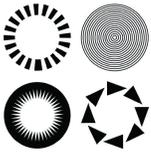
Compression at these levels may not be suitable for archival purposes, but the fact is that there is no experience with these formats, so taking a wait-and-see attitude is probably prudent. What is clear is that not all of these formats will survive long term, and so it is probable that some of these will become "orphan formats" in the not too distant future. Although remastering onto these formats is probably not appropriate at this time, you can be sure that some of the tapes will eventually turn up in your collection as masters.

Wheeler: The good news is that these are affordable digital videotape formats. The bad news is that they both use compression and very thin tape. As a result, neither of these formats are recommended for archival use.

#### **Question 22: I am considering buying a Digital Betacam as our archival format. Any problems with this format?**

Lindner: Digital Betacam is a professional format (as opposed to the high-end consumer formats mentioned above) that has a relatively low 2:1 level of compression. There is also a new version of Digital Betacam that has much higher compression and is designed as a field acquisition format. These are very expensive systems compared to the ones above, and it is probable that not all of these formats will be able to co-exist long term. Although Sony has been somewhat successful selling this format, it is not a runaway success, and the machine population is still modest compared to other formats. It is too early to determine which formats will ultimately be successful, but Digital Betacam also has competition from Panasonic from digital formats without compression (D3 and D5) which are probably preferable for re-mastering purposes -- depending on the needs of the organization.

Wheeler: The good news is that Digital Betacam is a fairly popular format. The bad news is that it uses compression. Compression is okay for normal videotape usage but it is not good as an archival format. This is because the loss of a single



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bit may mean the loss of as much as 256 bits -- if that is a key bit pointing to a "look up" table. Also, most compression techniques have trouble with high frequency information, such as, tree leaves, bushes, and grass.

**Question 23: My old 1/2-inch EIAJ reel-to-reel videotape recorder no longer plays back a picture -- only noise off the tape. What is the problem?**

Lindner: 1/2-inch reel-to-reel tapes are almost all effected by binder breakdown, and it is probable that the heads became clogged which does not allow the signal to be properly played back. Tapes of this era need professional help to be properly cleaned and re-mastered. Beware of "home" solutions which can destroy these tapes forever. We have seen some interesting home solutions which included putting talcum powder on the tapes -- no it didn't work!

Wheeler: The problem is either clogged video heads or worn-out video heads. Try playing the tape on another machine. If you get only noise on the second machine, the problem is shedding tape (which clogs the video heads). If you get a good picture on the second machine, the problem is bad video heads.

No one makes video heads for any of the videotape recorders of the sixties -- with the exception of quad. CMC still repairs quad heads and you can call Bill Fitts at 408-562-9820 for details. I recommend copying all videotapes using these obsolete formats because of the problems of maintaining the machines and getting replacement parts -- like video heads.

**Question 24: Do you recommend using a tape cleaner for cleaning old tapes?**

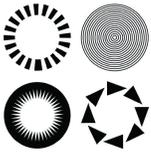
Lindner: At VidiPax, we have constructed several cleaners for different formats and different types of problems. We also use commercial tape cleaning machines that have been modified by us, and in some cases we have unique machines that are designed for specific formats with specific problems.

There are some tape cleaners that are better than others, but few of them can deal with complex problems that occur when tapes are old. Most of these machines are sold to companies who sell "recycled" videotape, and as such, the major function of the machines are to evaluate relatively new tapes for recycling and not to properly clean them when they are old. As such, some cleaning machines have been quite efficient at totally destroying tapes.

Wheeler: A tape should not be cleaned unless it is shedding or clogging heads. Clogged heads shows up as tearing video or noise instead of video. Shedding is detected by carefully looking at the audio heads for signs of excessive debris buildup. If you only have a few tapes to clean, it is best to send them to a company that specializes in cleaning tapes. If you have a large quantity of tapes to clean, I recommend calling Tapeography in Brampton, Ontario at 905-455-1915. Tapeography makes good tape cleaners for all videotape formats.

**Question 25: I have mold on my tapes. How do I eliminate it?**

Lindner: There are many different types of mold, some of which can cause severe lung irritation. For that reason, always wear protective clothing and respiration equipment and be sure that all staff members and other collections are protected from any mold outbreak. Mold can spread quickly through a collection through airborne spores and cause a great deal of damage. If the materials are not unique, proper disposal is probably the best route for tapes that have been attacked by mold. Valuable masters need to be remastered by professionals who specialize in this type of work.



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Wheeler: Think of mold as being a deadly toxin -- like botulism. Only a few of the thousands of fungi are actually toxic, but it is best to have the tapes cleaned by someone who has the equipment and knows how to deal with mold.

Mold sometimes occurs if the tape is stored in a humidity of 60 percent RH and higher. Mold will usually start growing a few weeks after a tape has been soaked in water due to a flood or a water pipe break. Water soaked tapes should be rinsed off in cold water and stored in water below 52 degrees F (11 C) until they can be dried properly. A few ice cubes in the water will keep the temperature down but don't let the temperature drop below about 40 F.

**(from AMIA Newsletter #33, Summer 1996)**

**Question 26: No one on staff is technical. How do I keep my tape recorders maintained?**

Lindner: Routine preventative maintenance is critical for the proper playback of materials as well as to minimize the risk of damage to a collection due to faulty operation of a machine.

One technique that many professionals use is to have a reference tape that has either been made by the manufacturer or been made by the equipment when it is new or after being properly serviced. Viewing this reference tape on a regular basis should indicate when the performance of the machine is not optimal.

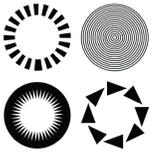
Depending on your location, you should be able to find a company that specializes in servicing "professional" equipment. Often these are the companies that sell or rent professional equipment. If there is not a local vendor of this type, sending the machine to the manufacturer is often the only recourse. For the most part, I do not recommend local service companies that repair "consumer" equipment. These companies often do not have the specialized training required and they usually do not have the test equipment and "jigs" required to make accurate measurements and adjustments to the equipment.

Wheeler: I recommend using a cleaning cassette about once a month. The cleaning cassettes I have used have a white porous material called Pellon and will not harm anything in the tape recorder. Reel-to-reel videotape machines should not be cleaned by staff unless they have been trained precisely how to clean the delicate video heads mounted on the rotating scanner. Reel-reel audio recorders can be cleaned with very little training.

Read the Maintenance section of the maintenance manual that came with the equipment and see how often the manufacturer recommends a thorough cleaning and maintenance check. I suggest taking it to an expert once a year if your machine is used often and about every three years for low-usage equipment.

The most important test for a videotape recorder is the "Interchange" test -- sometimes referred to as "Video Alignment". This test requires using a special pre-recorded tape. The tape is played and the off-tape signal is observed on an oscilloscope.

An expert maintenance person/company can be found by talking to other people in your area who have professional tape recorders. Talking to technicians at TV stations should give you some leads. Don't pick just anyone out of the Yellow Pages.



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**Question 27: I can't afford to install a dehumidification system and my tape storage room gets up to 60 % RH at times. Is this bad for the tapes?**

Lindner: Yes, particularly if the humidity levels are not constant! Dehumidification does not have to be expensive, and a room dehumidifier can make a significant difference in a vault. I recommend units that allow a hose to be attached to them for draining so that emptying the dehumidifier does not become a daily task. Dehumidifiers can cost as little as \$250 and can be purchased at major department stores like Sears. I always recommend the model that has the highest amounts of moisture removal which is usually rated as "pints per hour" being removed from the air. Generally these units are better built and only slightly more expensive.

Wheeler: A humidity over about 50 % RH can cause fungus growth. For about \$600, you can buy a portable dehumidifier from companies like Sears. If one unit isn't sufficient, than buy two. They can be bought with a hose drain or an internal bucket. The hose method requires a nearby drain but is a lot more convenient if you have a lot of water each day.

**Question 28: I would like to transfer my audio tape collection to a digital format. What do you recommend?**

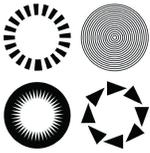
Lindner: Both audio and video formats seem to multiply by the day, which makes determining which is most suitable for preservation a very difficult task. There are many factors to consider, not the least of which is how the materials are going to be used. My suggestion is to "spread the risk" and record on at least two formats simultaneously, of these at least one should be a simple analog recording. We have good experience with longevity and analog audio formats, but have very little experience with digital audio, and for that reason it is prudent to be cautious about only committing to digital formats.

Wheeler: It is common archival practice to transfer to reel-to-reel archival tape for long-term preservation and to DAT for day-day use. Many of us are concerned about the long-term durability of DAT so I don't recommend using DAT only. ADAT (with S-VHS) is a good format -- IF you use Professional grade S-VHS tape and a Professional S-VHS machine. Recordable CDs are a good choice but you must buy recent CDs and buy them from a big name manufacturer. Later this year, CD-R-2 will be on the market and it will be better. That's because not all players can play CD-Rs but the new CD-R-2 will be playable on all CD players, as well as, on the new DVD machines.

**Question 29: I hear that the FCC will adopt a new TV standard. What effect will that have on our existing TV standard and equipment?**

Lindner: Advanced Television or ATV has been a multi-billion dollar question mark for at least 10 years. Field tests of the proposed standard have been completed and await approval from the FCC. Part of the problem will be allocating additional spectrum for the new broadcasting technology. It is expected that there will be a transition period of 15-20 years between the old and new technology, and because of strong political lobbies it is unclear exactly how (or if) implementation will occur. In any event, I would not look for any announcements in a Presidential election year.

Wheeler: In the beginning, the proposed Advanced TV (ATV) system was going to be backward compatible with the existing NTSC system in the U.S., Canada, etc., but that ideal has changed. It now looks like the FCC will require all terrestrial NTSC transmitters to shut down and switch to digital ATV transmission around the year 2006. For \$150 to \$300, you will be able to buy a small converter which will convert the ATV signal to NTSC so you can continue to use your old NTSC receiver. Cable and satellite TV transmitters will still be able to transmit NTSC signals.



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For those few who will be able to afford a high-cost digital videotape recorder, the ATV will provide superior picture quality. Panasonic has indicated that they will provide a box that will convert and compress the ATV signal so that it can be recorded on a D5 digital videotape recorder.

### **Question 30: Is it okay to store film, magnetic tape, and paper in the same small room?**

Lindner: I have not seen any research that examines this subject in depth despite the fact that very few vaults are single media vaults. General thought on the subject is that it is a bad idea to mix media, particularly film and paper. This is because as film breaks down it can produce acetic acid and paper often contains sulfites. At sufficient concentrations these acids can severely damage the media. Another reason to have separate facilities is because optimal temperature and humidity conditions differ dramatically for these three different media types.

Wheeler: Acetate film will eventually break down and form acetic acid. Find someone with a very sensitive nose and have them smell your stock. If they don't detect a vinegar smell, you should be okay. Newly manufactured magnetic tapes may still have some residual solvents that have not evaporated but I would assume that your archival tape stock would have only older tapes which are fully out-gassed. I have been told by tape chemists that the solvent out-gassing is not harmful.

### **(from AMIA Newsletter #34, Fall 1996)**

### **Question 31: I have a videotape that was accidentally over-written. Is it possible to recover the information?**

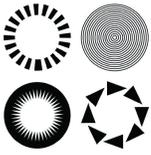
Lindner: Theoretically, and depending on which format was used, it is possible to recover video that has been erased. As a practical matter it is not possible to do. When most video is re-recorded, a flying erase head goes over the previously recorded track before the new information is recorded making recovery an extremely challenging (but not impossible) problem to solve. All the more reason to make sure that masters are protected by using the record lock out tabs on cassettes.

Wheeler: Unfortunately, the erase heads in tape recorders are extremely efficient. Not even the CIA or FBI were able to read the 18 1/2 minute erased section of the Nixon Watergate tapes.

### **Question 32: I've got a 60 minute Fuji Beta-SP tape that sounds like it's being flogged when I play it. Major creaking, rhythmic rubbing sound (kind of kinky). The tape has only been played maybe 5 times since being mastered 2 months ago. There is a submaster, thankfully, but any ideas what's up? Is this hard on my UVW, or just the tape's lubrication system screwed up?**

Lindner: Problems of this type often are caused by the cassette container or "shell". There are many things that can go wrong with shells including a faulty brake mechanism that could cause very serious problems for the machine and the tape. Sometimes the molding of the reels that hold the tape are not perfect causing uneven rotation inside the shell... I would not be surprised if you started to notice some picture problems as the reels rubbed against the shell housing changing the tension and causing all sorts of problems. Sometimes a picture problem can coincide with the sound that the shell is making.

You basically have two choices, one is to re-shell the tape and to continue to use it hoping that little damage has been done, and the other is to make a protection copy while you still can and throw out the damaged tape. Considering that there already is a submaster (a copy one generation away from the master), and that the tape already has been damaged, I would suggest you make a copy, and strongly consider throwing out the tape (or getting a blank replacement from Fuji).



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There are only a few situations where I would recommend throwing out a master, and unfortunately this may be one of them. Playing this tape in the future could cause serious equipment damage and I would expect that the shell would eventually damage the tape so seriously that it would not be able to be played no matter what was done. I might add that if a submaster did not exist, you would have no other choice but to do the best you could to recover the damaged tape, so it is imperative to always have a protection master which ideally is geographically separated from the original.

Wheeler: This sounds like a problem with the plastic brakes inside the cassette. Each tape hub has a "brake" that prevents the hub from rotating when the cassette is not in the machine. When inserted in the machine, the brakes should disengage from the hubs. It appears that at least one of the brakes in your cassette is not fully releasing. Taking a cassette apart should only be done by someone who has had previous experience with springs flying across the room.

**Question 33: I am about to embark on a video history project and would like to know the latest update on what video tape company to trust for quality?**

Lindner: I would like to help you, but as a policy I do not recommend one vendor over another. There are a lot of reasons for this. Basically they all have problems at different times and all have good runs of product as well. My general recommendation is to pick a vendor that is a "major", meaning that you don't purchase "uncle Louie's" made-in-the-garage brand. Stick with companies who you feel will support you if there is a problem, those are usually companies that have help lines. If you have the time, call the help lines up and see how much help they really are. Choose tape that is fresh and has not been sitting in a hot warehouse for a couple of months. Usually places that have a large turnover have fresh stock because it is not a very high margin item so they do not inventory much of it.

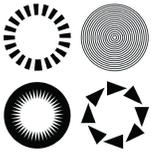
On a project basis I like to choose a couple of different tape manufacturers. Occasionally a manufacturer will have a batch problem that is not apparent until many years later. By choosing multiple vendors you are less likely to experience a total loss.

Wheeler: My opinion here is by no means intended as any kind of official endorsement, but in many years as a tape engineer, I have found Ampex (Quantegy), Fuji, and Sony tapes to be consistently good. Each company should be listed in the Business section of your nearest large city and they will send you product information. I found a web page for Quantegy at [www.quantegy.com](http://www.quantegy.com). I have not been able to find a web page for Sony or Fuji tape products.

**Question 34: How should I go about copying some videos of official government proceedings? They were taped on cheap tapes some years ago and their condition is generally pretty bad already.**

Lindner: Many towns make a videotape of public meetings, usually with a consumer VHS public record. They are accessed frequently and often stored in the local library in poor environmental conditions. Making good copies from a deteriorating tape that is a poor format to start with is a tough task requiring professional equipment and is probably best left to a professional, but making a copy that meets lower quality standards has gotten easier recently.

I suggest you purchase a high quality S-VHS/VHS deck that has a built in "Time Base Corrector," make sure the deck allows you to change the video levels (there are several controls here), and audio levels. Several new machines come with Time Base Correctors, and they will do an adequate job stabilizing the picture and some of them will even remove some of the "drop outs" or white snow that appears on the tape. I suggest that you get a setup tape from a local production company that is



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essentially a recording of color bars and audio tone. Hook up the Time Base Correcting deck as the playback deck and another deck of good quality (but not necessarily as good as the deck with the Time Base Corrector) as the record deck. Playing back your setup tape, set the levels of the video and audio in such a fashion so that they are the same in both decks. As a practical matter, the only controls you may be able to do this with are the output of the Time Base Corrector inside the playback deck. The slow but effective way to do this is to play the setup tape while making a recording, then play back the recording (preferably on the new deck with the Time Base Corrector) and make any corrections that you need to. Do this several times and eventually you will have the correct settings and you should be able to get a recording that is adequate for the task at hand.

Wheeler: Not an easy answer. There are two possible low cost videotape formats to transfer to: S-VHS and Betacam-SP. The S-VHS is about \$2,000 US for a good Industrial grade machine and the Betacam-SP is as low as \$10,000 US for a machine. The problem with the S-VHS is that it is not very popular. This means that the format may be discontinued in a few years and then it will be difficult to get parts for the machines.

If you don't have the equipment to transfer tapes, you can look in the yellow pages for someone who will do it. You need to check them out to be sure they are reliable and do good work. A local TV station might do it for you.

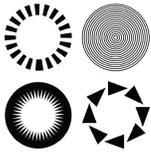
Many old tapes are shedding and when the tape is run on a machine, the shedding debris clogs the video heads on the machine. If that happens, the machine must be stopped immediately. The tape must be rewound and removed and the machine must be cleaned. The tapes must be baked or cleaned to make them playable.

**(from AMIA Newsletter #35, Winter 1997)**

**Question 35: What is the difference between Professional/Industrial, HGX professional, and Broadcast Quality VHS tapes?**

Lindner: The technical differences between different tape stocks may not matter for archival purposes, and in most cases the differences are not ones that are visible as lower or higher picture quality. Some tape stocks (generally professional stocks) are manufactured for editing applications. In an application like linear videotape editing videotape is shuttled back and forth and is given much more abuse than a tape that is used just for simple recording and playback. Professional and "Industrial" tapes are designed with these purposes in mind, and are supposed to hold up better to these tough applications better than lower level stocks. Generally, the higher grade stocks are also ones that are supposed to have a lower amount of dropouts and other defects although this is not always the case in reality. If one is doing simple recording and playback or providing access copies the additional expense of professional stocks are probably not cost justified, if you are shooting original material or editing it is a relatively small premium to pay for the professional products and most professionals use these materials for that purpose. There is an old industry saying that the cheapest thing in a film (video) shoot is the film (videotape). That is essentially true, and so most professionals use professional film and stock hoping to avoid problems.

There are, however, differences in the product sold by different tape manufacturers both in the quality of the tape and the quality of the "shell" or cassette that the tape is in. This is actually most evident in the VHS format where there are so many millions of cassettes that are sold for different markets. Some tape is extremely inexpensive and has extremely poor quality which will mean high drop out count and other problems that you generally want to stay away from. These tapes may be designed for the mass duplication market at very low price levels. Other duplication tape is extremely high quality and the cost of the blank tape stock may be far higher than the cost of a mass duplicated tape with a prerecorded program on it! For access copies,



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I recommend a good quality duplication stock made by a major manufacturer who will support you if you run into trouble. These tape stocks are reasonable in cost and will provide good service. And for mastering..... I recommend staying away from the VHS format with any type of tape.

Wheeler: There is no industry standard about classifications of tapes. Each tape manufacturer makes up their own categories. The cheapest tapes MAY be just as good as more expensive ones. The difference usually is that only one or two samples of the low cost tapes were tested whereas more samples were tested for the more expensive tapes. The top-of-the-line tapes usually are made differently, such as, with a double coating and usually have more output. More output is a plus for archival tape because it gives you a little more safety margin in playing back a poorly recorded or damaged tape. To measure tape output requires a technician to connect an oscilloscope to the proper test point in the VCR to measure the RF level.

How the tape is actually made is proprietary but you may get some guidance about the categories by calling the tape manufacturer representative for your region.

At the Library of Congress hearing in March, I made the point for a need for a national tape testing lab. Sort of like Consumer Union with an annual report comparing all tape types.

**Question 36: Should I use de-ionized water to clean a tape that has had wine spilled on it?**

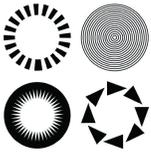
Lindner: After the alcohol has evaporated, the majority of the sticky stuff on your tape is essentially sugar. Water will not remove the sugar unless it is heated, and you will have to heat the water far too much to actually remove the sugar. Sugars and other foods that get on tapes need to be removed with solvents and cleaning agents other than water, and the process often involves a certain amount of experimentation to determine which solvent works best on the food, and does not damage the tape in the process. In addition to damaging the tape, an accident of this sort will almost certainly cause damage to the cassette shell so trying to play the tape back without cleaning the tape properly and replacing the shell is not a good idea even if the tape looks clean after it has dried.

Wheeler: I recommend using Isopropyl Alcohol. Depending on where the residue is located, I would apply it with a Q-Tip or an artists brush. The IPA will evaporate within a few minutes.

**Question 37: Am I safe in assuming that any 1/4-inch reel-to-reel tape that I have in my archive is audio tape and not video tape?**

Lindner: No, although most archives will not come across 1/4-inch video too frequently. There have been a few video formats that have actually used 1/4-inch tape that looks exactly like (and sometimes is) sound tape. Akai had several of these formats which were actually quite popular for a period of time since the machines were relatively small and easy to carry. Many of the recordings on this format have been lost, but some of those that have survived are very interesting to watch because the portability of the equipment allowed video to be recorded in unusual locations.

There have been other video formats that have used audio tape to record on as well. In particular an interesting camcorder called "Pixelvision" was sold as a children's toy by Fisher Price and the Pixelvision system actually recorded on audio cassettes! In the last couple of years, some video directors have decided that they like the "look" that these cameras had and



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are actually using them in commercial production. There is currently an active collectors market for this format with a Pixelvision camera selling for many times it's original price.

Wheeler: MOST 1/4-inch reel-to-reel tapes are audio and ALL 1/4-inch reel-to-reel tape on large (10-inch) reels are audio. A couple of video formats used the smaller 7-inch and 5-inch audio reels. In the fifties and sixties, some data tape formats used 1/4-

**Question 38: Can I use a VHS cassette to record S-VHS?**

Lindner: Although not advised, in an emergency the answer is yes. If you look at the bottom of a VHS and a S-VHS cassette shell you will see that there are holes that are present in the S-VHS cassettes that are not present on the VHS cassette. Other than these holes the cassette shells are identical. In an emergency, people have used awls and other objects (heated paper clips) to make these holes and "fool" the machine into thinking that there is actually S-VHS tape in the cassette. There are several problems in doing this, one of which is getting little pieces of plastic inside the cassette which will damage the tape as well as potentially damaging the machine. I once saw a brochure from a company that sold a device that created these holes without letting the plastic get inside the shell, ostensibly to allow a producer to save money on purchasing tape. S-VHS tape IS different than VHS tape and the recording may be of lower quality, but if a videographer was on location and could not find S-VHS tape, it would not be totally surprising to find out that they bought a VHS cassette at the local supermarket and did a little "customization." This is not unique to VHS and S-VHS either. Other formats use the same media with different holes punched to tell the equipment which format the tape is for. Both Betacam-SP and Digital Betacam use the same basic cassette shell as BetaMax with the major difference being the location of the wholes. In addition, some manufacturers will use a cassette shell designed for one format and record an entirely different format on it. For example, there are military formats that use the U-Matic 3/4-inch cassette and record an entirely different proprietary format on it that cannot be played back on a 3/4-inch U-Matic machine.

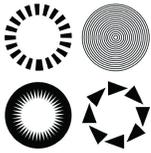
Wheeler: Yes and no. A VHS tape can record on a S-VHS VCR but the quality of the recording will be VHS quality -- NOT S-VHS. That's because the VCR has sensors which recognize the tape as being VHS and it automatically changes the electronics to VHS.

**(from AMIA Newsletter #36, Spring 1997)**

**Question 39: Should tapes be stored tails-out?**

Lindner: "Tails-Out" means that the tape is stored on a reel after it has been fast forwarded as opposed to being stored on the reel after being rewound, and is the preferred way of storing reel-to-reel audio tape. Audio reel-to-reel tapes should be stored tails out to minimize print-through which is essentially a magnetic transfer from an area of high energy on the tape to an area of low energy. For example if the section of a tape that had a cymbal crash was laying directly on a section of tape that had no sound, the energy of the cymbal would tend to "print through" to the silent area of the tape leaving an exact copy of the sound -- but at lower energy or volume. This will still occur when the tape is stored tails-out but the effect will in effect be "backwards" and therefore not very noticeable.

Sometimes when you open the box after a tape has been wound tails out it is hard to know exactly what is going on. There is also something called "B Wind" tape where the side of the tape that has the information recorded on it is on the reverse side of the tape that it is normally recorded on -- tapes that are "B Wind" are normally wound on the reel in the reverse fash-



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ion. And sometimes people make a mistake and actually "flip" the tape on the reel, and audio tape reels are usually the same on both sides so that you can put them on the machine with either side facing the machine. If this seems confusing and difficult to describe -- it is! Imagine getting a reel of B Wind tape that is tails out and flipped and trying to figure out how many tracks it is, which side the audio is recorded on and which is the head or tail of the tape?

Wheeler: Professional audio people always store master audio tapes tails out -- for two reasons. The main reason is that print-through will be heard as an echo rather than a disturbing advance notice of the recorded signal. The second reason is because the tape must be rewound before playing it and the rewinding reduces the level of print-through. If the print-through is still annoying, the tape should be wound a couple of more times.

Consumer video machines like VHS, S-VHS, and Hi-8 may not pack the tape properly when rewound. In that case, the tapes should be played to the end and kept on the take-up hub.

Videotape recorders rarely have audio print-through problems.

**Question 40: Are reel-to-reel audio tapes better than cassette tapes for long life?**

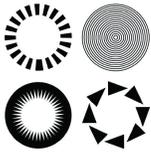
Lindner: Yes, cassette tapes are not acceptable for long term preservation purposes for a variety of reasons. The standard for audio preservation has been 1/4-inch reel-to-reel either full or half track. There are some indications that CD-R may be an appropriate alternate choice, and several committees are discussing this at the present time.

Wheeler: Yes. The audio cassette tape format was not intended for high quality voice/music and is not a "robust" format. If you must use audio cassettes, buy a good tape product and use only an "industrial" grade machine -- like a Nachimichi.

**Question 41: How often should tapes be rewound?**

Lindner: In the past, there have been recommendations regarding "exercising" tapes on a regular basis. The recommended amount of time between such rewinds depends on the temperature and humidity of storage conditions. This recommendation exists because it is generally agreed that the tape wind condition and "pack tension" (or the stress caused to the tape by being coiled so tightly for many years) is an extremely important factor in tape longevity. The idea is to have a good wind in storage -- no areas of uneven wind, no edges popped out of the side, etc. There is also thought that by exercising the tape, you are letting some air in between the layers which may do some benefit -- but I have not seen any research that supports this idea, or determines whether such an effect is actually beneficial or not.

In my opinion there are several "reel world" problems with a tape exercise program. Since it is generally agreed that wind is so important, my experience is that often the tape wind is worse AFTER it has been in an exercise program than before. Often the equipment that is available for a rewind program is not the best equipment in the facility and often is the worst equipment because the best equipment is in use for production. An archive may not even have such equipment in good shape after the format has gone obsolete, and often the people doing the rewinding (if there are resources to do this) are not properly trained to keep the equipment absolutely clean and in alignment. My opinion is that if a tape has a good wind, let it be. If a tape has a bad wind, fix it and store it with a good wind. If you have the resources to inspect and rewind tapes in an organized fashion on good equipment, well maintained, with skilled personnel -- a rewind program is probably not a bad idea. If all



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of these conditions cannot be met I would inventory the collection to determine those tapes with a bad wind and fix them, and keep an eye on the general collection over time while fixing tapes that seem to have problems over the years.

Wheeler: I recommend not winding tapes unless they have a bad pack. I have heard of too many cases where tapes were damaged on the winding machine. My suggestion is to do a visual inspection of each tape about every five years. One fifth of the collection can be inspected each year.

There are basically two types of bad packs to look for. One is where the pack is too loose and that can usually be detected by looking at the pack through the reel flange windows. See if you can see light between any layers or notice any wrinkles or bunched layers of tape; if so, then the pack is too loose. Another method for determining a bad pack is to hold the reel hub stationary while pulling on the outer layer of tape. If the pack freely rotates, it is too loose and must be rewound.

The second type of bad pack is when the tape is packed too tight. This can be determined by looking for distortions in the pack -- the pack is solid but you can see distortion patterns radiating out from the hub. Also, if you pull on the outer layer, the pack will not rotate.

A properly packed tape will rotate a little when the outer layer is pulled.

Be sure that the machine used for winding your tapes is properly aligned and will pack tape at the proper tension.

**Question 42: What format do you recommend I transfer my old video and audio tapes to?**

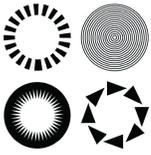
Lindner: There is no single universal ideal format to migrate audio and video tapes to for preservation purposes at this time, and it is unlikely to exist due to market conditions in the near future. For this reason I suggest transfer to multiple formats to insure that the tape will be able to be played back properly in the future. Such a transfer should be to both analog and digital uncompressed formats (assuming that the original is analog). The choice should also depend on the equipment available at an institution as well as the format originally used, and other such factors. For audio I would consider BOTH 1/4-inch reel-to-reel and CD-R, and for video BOTH Betacam-SP and D3. The copies should be stored in geographically different locations in proper temperature and environmental conditions.

Wheeler: How much money do you have to spend on the machine? Also, look at the price of tape for each format -- it varies from about 10 dollars for two hours of S-VHS to 90 dollars for one hour of D2.

AUDIO: Many archives are transferring to both reel-to-reel and DAT. The reel-to-reel is shelved and not used and the DAT is used to make copies.

VIDEO: Betacam-SP is widely used and has a good reliability record. The cheaper versions have poor audio so do not buy one until you have had the audio checked for interchange with other machines and also made a couple of generation copies.

If you cannot afford Betacam-SP, then S-VHS is a possibility. If you do buy a S-VHS machine, only buy the more expensive "industrial-grade" machine because it is built to handle tape gently. A concern about S-VHS is how long the manufacturers will continue to manufacture the equipment.



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If you can afford it, D3 is a good digital format and it is very popular. D3 machines are about twice the price as Betacam-SP machines.

**(from AMIA Newsletter #38, Fall 1997)**

**Question 43: I have an audio recording where I cannot understand what is being said by some people in the room. Can this be enhanced so the conversations are intelligible?**

Lindner: Depending on the recording, there are some simple and relatively inexpensive things that can be done to dramatically improve the intelligibility of recorded speech. An audio equalizer is part of most audio mixers sold today, and equalizing the audio by boosting or reducing certain frequency bands can have a very dramatic effect. Think of an audio equalizer as a more specific version of the "tone" control and you get the idea, but in addition to being able to boost or reduce the Treble or Bass, you can control individual groups or bands of frequencies. Reducing very high frequencies may reduce hiss, and boosting frequencies in the 2000 to 4000 cycle band can make a recording sound much clearer relative to the background noise. As one might expect there are many kinds of equalizers that have different capabilities. Digital audio workstations often have equalization capability as well as the ability to actually edit out individual sounds, and even more advanced systems such as Sonic Solutions allow very complex filtering, editing, and equalization for more challenging projects; some of the results of these systems are truly amazing.

Wheeler: Usually, a barely audible voice can be made clear enough to understand by using filters or digital processing. Both techniques require a person who understands the processing equipment. Sonic Solutions recommends a three-day course for their digital "No Noise" equipment.

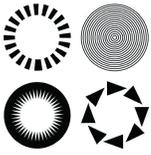
The voices are not really "enhanced." What happens is that the noise is reduced and that makes it easier to understand the voices.

**Question 44: How do I determine the format of an oddball tape in my archive?**

Lindner: Although you would think it easy, sometimes you have to be a bit of a detective to try to figure out exactly which format you have. In some cases the exact same tape was used to record many different formats -- all of which are incompatible. If that were not bad enough, sometimes professional audio formats are recorded on tape that is very similar (or identical) to videotape.

Some basic aspects to examine are: The width of the tape: measure the tape in inches, and in small formats in millimeters. Examine all markings carefully; sometimes knowing the manufacturer, tape type, or batch number can be a good clue. Find out the recording date; certain formats were in common use for a brief period of time. Is the tape on a reel, cassette, or cartridge? Once you have determined the answers to these questions, compare them with a format chart that lists all the video format characteristics. Sometimes, even this is not good enough. The ultimate test is magnetic developing whereby you can actually visually compare the magnetic patterns under a microscope with the patterns of the format standard.

Wheeler: Cut off a few inches of the tape and send it to someone who can "develop" the image of the recorded tape tracks using very fine iron particles. A knowledgeable person can use a microscope to determine how the video and audio tracks were recorded on the tape. This will show what format it is because each format has unique audio and video track dimensions.



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**Question 45: How will the new FCC DTV regulation effect archives?**

Lindner: At this point in time, everyone in the broadcast industry is extremely excited about the possibilities of digital television and high definition television, but no one knows exactly what to be excited about. Unlike other FCC rulings in the past, the digital television rulings are still being discussed and no specific specification about exactly what the new standards will be has been decided. While it is clear that the FCC has allocated spectrum space for broadcasters to phase in digital broadcasts, exactly what these broadcasts will be (and to whom) has yet to be decided. Many broadcasters wish to use the additional spectrum space for additional programming and other service options, and still others wish to broadcast a higher quality signal. No single standard has been set for this so called "high definition" signal, rather it appears that the specification will allow several resolution, scanning types, and aspect ratio signal types.

For now, the impact on archives is small, but in the near future archives may find broadcasters interested in re-transferring program material to the new standard. This will mean a sales opportunity for archives who have material that will be desirable for inclusion in program content. Further along, archives will start receiving tapes that have signals in the new configurations, but do not expect to see them for several years. In many cases the equipment to record them is not generally available.

In summary, the entire broadcasting industry is running fast toward digital television, but exactly where they are running to and how to get there is still very much under discussion.

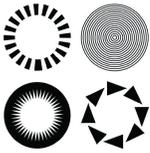
Wheeler: Once Digital TV becomes a reality, the videotape recorder manufacturers will produce tape recorders to the new standard. Presently, the U.S. and Canada use the NTSC standard and Europe has PAL and SECAM. DTV will be another TV Standard. Hopefully, the DTV videotape recorders will be able to play both the DTV and the NTSC standards.

**(from AMIA Newsletter #39, Winter 1998)**

**Question 46: Why is freshness dating on videotape a good idea?**

Lindner: Like other products, videotape that is fresh when first purchased is preferable to tape of unknown age. Currently when production companies buy tape there is no real way for them to know what the age of the media is and how long it may have been in a dealers inventory. In the later years of a tape's life, it is important to know the date of manufacture to help determine its candidacy for remastering and migration. Date of manufacture sometimes helps greatly in later years when trying to identify the format of a given recording. Many different types of format use the same exact tape, and as a result it is often extremely difficult to determine what format the recording is on and one often has to resort to detective work. Some manufacturers do date and batch stamp media, but the codes are proprietary and not easily decoded. When purchasing very large quantities of media it may be possible to require the bidding manufacturers to freshness date the media to be purchased. Eventually I hope that all manufacturers will voluntarily freshness date their media -- but for now consider patronizing a media vendor who thinks that it is important for the user to get fresh product.

Wheeler: When you are purchasing new videotape for archival purposes, you want to be sure that the tape has not been setting in a non-air conditioned warehouse for several years. This would be bad if the tape was exposed to several weeks of high temperature and/or high humidity because that will accelerate the binder degradation.



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**Question 47: How can you tell if the heads on your machine are bad?**

Lindner: Both audio and video play and record heads can and do wear in normal use, and the result will be a poor playback or recording. Video heads in particular can be easily damaged by improper cleaning, damaged media, and will eventually need replacement with even normal use. For professional machines the manuals will give you a pretty good estimate of how long the heads should last. Often the manufacturers warranty will also give you a good idea of how long the manufacturer expects them to last. Professional machines often have a meter or indicator that tells you how long the heads have been running... provided that the counter was reset the last time the heads were changed. Sometimes heads literally break off and it will be obvious that you have a problem because there is literally either no picture or a very, very poor picture. More often, however, head wear is indicated by increased noise in the picture. When the picture appears noisy or "granular" in appearance it is time to bring the equipment to a qualified technician. Head life varies widely by format. Some of the new formats in particular have exceptionally long head life, and others less so. Some formats allow the technician to replace just the damaged head and still others require all of them to be replaced if just one is damaged. Since replacing heads is a major cost, these factors should be considered when looking at the long term cost of ownership.

Wheeler: Either of two things will happen for worn out video play heads.

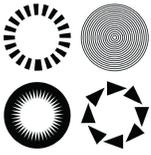
1. High frequency response will deteriorate and this will first be noticed as a loss of fine detail in the picture and/or an increase in dropouts in the picture.
2. The head will become coated with fine particulate matter which causes the picture to tear and eventually become totally video noise. This is commonly called a "clogged head". In the early stages of a head going bad, cleaning the head will make it work again for a few minutes or hours before clogging again.

To be sure that the problem isn't the tape you are using, play a known good tape for about an hour and see if the picture degrades. If the picture does not degrade, then the problem is the tape that you were using.

**Question 48: What are the different types of time code and how can I put time code on a tape that is already recorded without it?**

Lindner: There are two general categories of time code. One type of code (of which SMPTE time code is an example) uses just an encoded audio signal to provide a unique identification code for each video frame. These types of systems are generally less accurate than the other class of code systems (of which VITC or Vertical Interval Time Code is an example) whereby the identification code is recorded in the video signal itself and identifies each frame or each field. While it is fairly straight forward to replace or "jam" the audio type of code without re recording the picture (and thereby losing a generation), VITC type code generally must be inserted when the tape duplicated. Relatively inexpensive time code generators are available that can generate both types of code, and if you have the other equipment it may be possible to do it yourself -- at least to make viewing cassettes. The regeneration of VITC types of code can be a little more tricky. Often both type of codes are recorded on any given tape in production, but one cannot assume that all tapes have consistent or contiguous time code of either type.

Wheeler: The most common time code used for videotape recorders is the SMPTE time code. Depending on the tape format, some videotape recorder models have the capability of recording a time code on a longitudinal track along the edge of the tape.



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Reel-to-reel audio tape recorders do not have the capability of recording a time code track so the usual procedure is to make a copy onto a DAT tape. DAT has a time code track.

Time code is a nice feature for identifying precisely where particular scenes are located on the tape. For instance a river scene may start at 23:09 (23 minutes and nine seconds) and ends at 24:15. So, the catalog when list it as: River: 23:09 - 24:15. (from AMIA Newsletter #40, Spring 1998)

*This is a special edition of "Video Q & A" written on site in Las Vegas after four days at the April National Association of Broadcasters conference. This special edition will concentrate on what Jim and Jim did and did NOT see. It was apparent at NAB that television is changing forever, and Jim and Jim as well as most of the other 104,000 attendees are trying to figure it all out. Needless to say Jim and Jim have many other questions of their own!*

#### **Question 49: What is going to be the High Definition Digital Television Standard?**

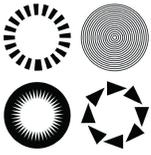
Wheeler: Unfortunately the FCC did not take this opportunity to work toward a world standard. Some of the standards include interlace as well as progressive scanning. Out of all the 18 variations of Digital Television, there is at least one that would be good for High Definition Television -- that is 720 Progressive. Interlace is the result of a political compromise.

Lindner: Although the technology does not appear to be quite ready yet, 1080 Interlace will be broadcast starting in early 1999 by NBC for The Tonight Show, and ABC has announced 720 Progressive as their choice. This means at the beginning that only a few shows will be broadcast in High Definition and the regular broadcasts will be in the digital equivalent of NTSC, which is now called 480i (interlace). For this reason, it appears that single standards as we know them now will not exist in the future. Similar to the way a multi-scan computer monitor will change depending on the resolution, television's future seems to hold a similar scheme whereby different resolutions and interlace or progressive scanning will change in the receiver depending on what is being transmitted. One thing that everyone DOES seem to agree on is the aspect ratio will be 16:9, which is very similar to the aspect ratio of most feature films (though not all).

#### **Question 50: How soon will the transition to digital television occur?**

Wheeler: The FCC wants all terrestrial TV stations in the US to be transmitting Digital Television (DTV) by 2006. Until that time broadcasters will be broadcasting both the current standard and DTV. At major stations in major markets this will be possible, but smaller stations will have a real financial problem paying for all the expensive new equipment. To get the full effect of DTV you need to have a new digital television set, and it is unclear how many people will be willing to spend more than \$2,000 to purchase one.

Lindner: To meet the FCC deadline all that a TV station needs to do is purchase, install, and turn on a digital transmitter. Many stations will rush to comply with this rather simplistic minimal requirement if for no other reason than to be able to promote themselves as being digital. The complete infrastructure necessary to really be a DTV broadcaster is another matter entirely, and it will take a very long time for the industry as a whole -- which includes post production, special effects, news gathering, and many other disciplines -- to convert fully. Remember that a huge proportion of television content, including television commercials as well shows made by commercial production companies and purchased by the networks, will need to be produced digitally. There will be a great deal of publicity around certain shows being broadcast digitally in the same way color TV was



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once promoted, but it will take a very long time before all the content will be fully converted. It is also unclear whether all the content will be High Definition because many of the new standards are digital and NOT high definition. The technologies that we saw at NAB were still largely "demonstration" systems and it will take quite some time to literally replace the broadcasting infrastructure.

**Question 51: Are there any videotape recorders that can record DTV?**

Wheeler: Producing a piece of equipment that can record 18 different standards is a real challenge. What is being used now is largely converters and machines that are compressing some of the higher bandwidth standards in order to record at all. Right now there are only a few machines that can record HDTV in any form and they are extremely expensive.

Lindner: There have been several machines that record HDTV over the years that have been largely for experimental purposes, and these machines cost in the hundreds of thousands of dollars. We saw the D6 format as a machine for the first time at NAB, and it was tucked away in a very small booth with low visibility. D6 as a format that was established a few years ago, but the machine was not available until now. The machine has extremely high density recording and very fast transfer of 1.5 gigabit per second -- a 66 minute tape holds 500 gigabytes, and the machine cost \$300,000. We were told that several have been sold in Japan, and in the US there is only one unit which is located in the Advanced Television testing center. There will certainly be a new generation of videotape recorders that will have to be cost effective (compared to these at least).

**(from AMIA Newsletter #41/42, Summer/Fall 1998)**

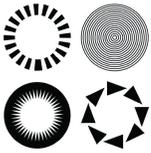
**Question 52: What kind of shelving can I use for storing of magnetic tape materials?**

Lindner: Steel shelving is excellent and cost effective. Do not worry about magnetic fields with steel shelving unless magnets have been used on or near the shelving (some rare book bookends use magnets). Remember that tapes can get extremely heavy, so make sure that the load is distributed, and that the load does not exceed the manufacturers recommendations. Also ensure that the shelves are put together with ALL the hardware and bracing that the manufacturer recommends. Shelving should usually be properly anchored to the walls and or floors and braced so that it cannot fall on other shelving and cause a "domino" effect -- consult your local building code for details. Make sure that tapes are stored on their end (like books) and are not stored laying down. If you have a space problem compact shelving is a good solution and there are many options with this type of shelving. Make sure the vendor understands the load that will be on the shelving, and if the motors are placed below the lowest shelf -- do not store tapes directly over the motors.

Wheeler: Steel shelves are recommended because they do not absorb moisture (like unsealed wood does) and will not burn if a fire is started. Steel is also good because of its strength and durability. An overhead sprinkler system is used, design the shelves so that sprinkler water will not contact any of the tapes. Shelving should provide for air circulation around the tapes. Circulating air and low humidity prevents mildew.

**Question 53: Is DVD a good option for archival storage?**

Lindner: There are several unresolved issues with DVD that currently make archival usage a big question mark. DVD can have a very high density storage capability which offers many options -- and this is very appealing on the surface. After all, one does not NECESSARILY have to compress video to store it on a DVD -- although on a practical basis this is the normal procedure.



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Because high lossy compression is not desirable for archival storage -- no matter what media it is recorded onto, the idea of using DVD with lossless compression is appealing even if it will be for relatively short time durations. This, however, is very different from the DVDs that are pre-recorded for mass market distribution and will require an entirely different approach using a DVD as a data disk and NOT as the video disk the way it is sold.

DVD is a laminated media -- and determining the longevity of laminated media is a complicated issue. Adhesives are used that can fail or change over time, as well as concerns about the substrate and other layered elements of the media. The cost of making a DVD is currently very high, and only cost effective for large volumes. DVD-R (recordable DVD -- similar to CD-R) recorders are currently \$16,000 US, although the media cost is not too bad. DIVX is throwing a bit of confusion into the marketplace, and DVD-RAM is too. Standards are still a big issue with lots of issues still not settled. The December 1998 issue of Red Herring magazine reported research by Polk Verity which said that 64% of the consumers polled who did not own either a DVD or DIVX player are postponing their decision to buy one with the other 36% equally split as to which format to buy -- this is not a good trend.

Wheeler: DVD is not a good archival medium at this time. For video, DVD requires high compression and that means some information is deleted. That is not acceptable for archival purposes. DVD is great for viewing and the quality is comparable to laser discs.

There is no audio DVD standard at this time. DVD has the potential of storing high-quality audio without compression and being superior to CDs. It will probably be called DVD-A.

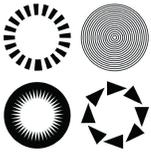
Another issue with DVD is the long-term stability of recordable DVDs. I am not aware of any tests of long-term stability of DVD-R. DVD-R is what most archivists would use. At this time, DVD-Rs are also having interchangeability problems. A friend of mine recently recorded a DVD and discovered that it would not play on two of the three playback machines he used.

**Question 54: Our company has stock footage viewing cassettes on 3/4-inch Umatic. These are not the masters, but are used to make screening cassettes for our potential clients. It is apparent that we must finally move from 3/4-inch -- but what should we move to?**

Lindner: Since your masters are NOT on these tapes, this is not a preservation issue but an access issue. It is probably a bit early, but considering server based access systems for your application is important. While the implementation costs are steep, this is one application where using the new technologies available may actually make the company money by being able to readily access more material quickly for a potential customer to purchase. Fast access may mean that you can meet a customer's tight deadline, and less staff time will be spent on searching for reels and more time will be spent in finding the best clips for the customer. Server based solutions may not be cost effective for large collections with limited need for accessing the entire collection. On the other hand specific applications which are well defined and can generate profit and reduce internal time constraints may be good candidates for using a server system with visual catalog and database systems.

Wheeler: There are several possible videotape formats that are good for non-archival work. The cheapest and most common format is VHS. You can buy a good-quality professional VHS machine for about \$2,000. For a little more money, you can buy a digital DVCAM.

For detailed information about DV, DVCAM and DVC-PRO digital videotape formats, go to <[www.adamwilt.com](http://www.adamwilt.com)>. My friend Adam has a 33 page report about these three formats.



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**(from AMIA Newsletter #43, Winter 1999)**

*Jim Wheeler was on vacation for this issue, so Jim Lindner chose to answer in greater depth than usual two questions that are frequently asked.*

**Question 55: I accidentally erased a tape -- can you get it to play for me?**

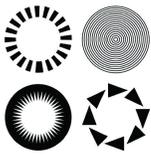
Lindner: This is one of those questions that comes up once or twice a week. I think that the answer will surprise you. Erasing a tape -- either by recording something new over the same location on the tape or recording "nothing" on the tape is a common problem. Depending on whether the tape is audio or video and depending on the format -- it is SOMETIMES possible to play back portions of a tape that has been erased. Sometimes the success in trying to recover such a tape is based on whether the machines that did the initial recording and erasure were in proper or similar alignment -- if you are very lucky they weren't. With audio recordings in particular it is sometimes possible to retrieve portions of a lost recording by taking the playback machine and changing the alignment of the heads so that the head is positioned to hear portions of the guard band (the space between tracks). When doing this it is sometimes possible to hear both the old and the new recording. If the new recording was silence -- then it will sometimes be possible to listen to the old recording. Similar techniques can be used if the new recording is another sound.

Video is much trickier. Modern video recording uses a technique for erasure called a "flying erase head." A flying erase head is mounted on the rotating head drum like the other heads -- but it's function is to erase the preexisting recording exactly over the existing track. Of course not all video formats use this technique, and there are times when the recorder itself malfunctions allowing a tape to be played back with varying levels of success.

In general, the answer to whether a tape that has been erased can be played back is no. The recording systems in audio and video recorders are designed to erase the previous recording so that the new recording is all that is left. The process of TRYING to play back a previously erased recording is very time consuming and therefore very expensive and requires painstaking work, as well as the ability to put the equipment out of normal alignment to try to play back the remnant (if there is one). The results can vary widely. The moral of the story? If you are working with master recordings use a machine that is not used for the playback of "use" copies, and, if you can, disable the record function entirely by removing the electronics that do the recording. Always use the record lock mechanism on cassettes, and make sure master recordings are very clearly labeled -- DO NOT ERASE!!

**Question 56: There have been relatively few new video formats introduced in the past few years. Is this a trend and is the market finally consolidating on a few formats?**

Lindner: Unfortunately the answer is NO. Recently Digital 8 was added as a new format from Sony. This format is Digital and uses Video8 and Hi-8 tape. This format is geared for consumer camcorder use. I expect there to be MANY new formats added within the next few years. There are some very significant factors that signal the imminent introduction of these new formats. One major obvious factor is the introduction of Digital Television. Digital Television and HDTV signals will require new formats to record on. Different formats will be necessary for different market segments as well -- and I suspect that the manufacturers will respond with different product lines for different markets and market segments. For instance there will be different product for newsgathering as well as for high-end production, and of course different offerings for the prosumer as well as consumer markets.



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While some of these formats will be "traditional" from a media perspective, and use magnetic tape of one sort or another -- expect new formats to use all sorts of other media. DVD-R may eventually make its debut despite a very delayed introduction, and DVD-RAM will certainly have a role as well -- but the biggest change may be that the next generations of "tape recorders" will probably be much more like a computer and much less like a videotape recorder. Several offerings will have disks inside that can be used for short term storage for people who use machines for these applications. Network tapeless machines will use remote servers that may be in very distant locations to store a/v data. Indeed, the network itself may become the recorder of the future.

While the things that images and sound are recorded on will change -- another change will effect the information that is being recorded. In the next few years you can expect machines that will record metadata as well as the a/v information. While these machines will be more computer and data recorder than a traditional video recorder -- a very important element will be the way that the metadata is captured for different applications.

From a market perspective, expect that formats will start appearing from new companies as well as the traditional consumer electronics powerhouses. This is because as the components that allow video to be recorded become more data oriented -- features will start to change based more on software than hardware. Indeed if the personal computer becomes your home VCR, then many opportunities open up for new product from entirely new players in the market. Expect things to become much more confusing in the next few years as the single function VCR makes way for multifunctional equipment that records a/v as well as other data.

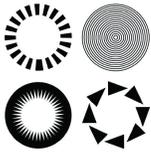
What will this mean for archives? Well unfortunately you need to expect that the more frequent introduction of product will mean more formats will eventually show up at the archive. This will mean supporting more media types. The growth of new suppliers will unfortunately mean that some of the new product that will reach the market will not be successful and go out of the market in very short time periods -- this will make some recordings very, very difficult to play back in just a few years. On the positive side, diversity will provide competition with new features at better prices. Competition and market segmentation will mean that there may be new interest in important niche market segments like archives.... perhaps some of the issues in a/v archiving will be addressed by new products that designed specifically for archival applications.

**(from AMIA Newsletter #44, Spring 1999)**

**Question 57: What environment do you recommend for storing old tape recorders and electronic equipment?**

Lindner: I am going to talk less about storage than the issue of the equipment itself. Some of our equipment at VidiPax is very old -- as in pre-electronic. We have literally hundreds of machines and they vary dramatically in size and complexity, from the huge Ampex ACR 25, which is about 10 feet long by 7 feet high by 3 feet deep and weighs over 1,000 lbs., to tiny portable "spy" tape recorders. The care of these machines is really quite different depending on the technology.

In some cases we try to keep the equipment in operating condition so that we can demonstrate the technology. The machines that we do this with are generally the machines that are less rare, as they are easier to find, and therefore to maintain by virtue of having a few "parts machines" in the back room that we cannibalize when necessary. That is clearly not the case with prototype machines or extremely rare machines -- of which we also have many. In most cases we make no attempt with this category of machine to keep them workable, the primary reason for this being our concern about damaging the authenticity of the artifact by putting in non-period parts, or literally burning them up. (We always have a halon fire extinguisher around when



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we power up an old machine for the first time.)

There are different categories of component failure. Some parts, like those fabricated out of rubber, fail due to simple age. Mechanical assemblies fall into this category -- with metal parts that oxidize and fail or wear and usually require the services of a machine shop. Wire insulation also falls into this category. Some insulation is woven cloth, others are rubber, and plastics including some PVC. You can still get cloth insulated wire -- but some of the earlier plastics are now impossible to obtain (they are made of banned material). When insulation fails, you often get a short when two or more wires make contact. This happens even with machines that are used in production, because heat will cause some insulation to dry and literally flake off the wire. In high voltage circuit areas it is easy to get an arc as the insulation starts to fail.

Other components also fail, such as capacitors (particularly electrolytic ones) or resistors, which can easily burn up. Usually failures of these types in old equipment are multiple -- meaning that when a capacitor fails it usually takes out other components in the circuit -- and some of them may be located in other boards or locations. Thus finding equivalent components can be a bit of a treasure hunt. However, basic "building block" components are still readily available -- even if they are not accurate historically. This will not be the case when the current technology becomes old, because more modern equipment have custom multi-function IC's which will be impossible to source and replace.

The issue of safety and technical knowledge is important to discuss. Even if you have the parts -- can you find someone who is skilled in debugging 50-year-old machines -- some made before they were born? This is not a widely available skill set. Older machines were not as safe as current technology -- interlocks and other safety devices did not exist -- so you really have to be careful.

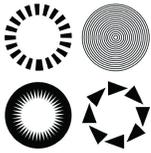
Finally there is the issue of documentation. Many of the machines that we have are without technical documentation. This may be because it was lost or was never owned by the original owner. Other than their value as ephemera, user manuals are pretty useless. We need the service manuals, and for some machines -- such as ones where the company went out of business -- they are virtually impossible to get. For these cases you need an electronic technician who has a good enough knowledge of older style electronics to figure out what is going on. While this is fairly straightforward with a small audio or wire recorder, it becomes quite another matter with a complex machine like a VR-1000 (the first videotape recorder). On the positive side, the machines were really a great deal simpler than those available now, so the circuit design is more straightforward.

Wheeler: Cool and dry works for all organic things. Below 70 F is considered cool enough for most purposes, but not freezing. Below 50% RH is considered dry enough for most purposes but 10% RH is probably too dry.

Some of the rubber-like materials will not survive in any environment, so some type of replacement will have to be developed by a company that specializes in that type of work. Capstans and belts are the most common "rubber-like" items in tape recorders.

**Question 58: I have a large collection of posters to which I would like to have more immediate access. Should I capture them with a digital camera (I have access to a Sony Mavica) or store them as single frames on a videotape? How should I do this -- laser video disc, CD, DVD, computer disk? What about storage space?**

Lindner: I would definitely go with a digital camera -- not particularly a Mavica, but rather a camera that has far higher resolution and color depth. There are many digital cameras on the market right now -- so a little work will have to be done com-



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paring the advantages of each. The reason not to go with video is the resolution of NTSC video. I personally have been involved with several laser disc projects that used the still frame capability. It did work, but it was expensive and not particularly intuitive. If you were starting this project in a few years from now DTV might be an option, but now is way too early. For now I would definitely tie the records with a database manager, so that I could properly catalog the materials. I would not worry too much about space -- with 25 gigabyte drives available wholesale at \$400 you can have plenty of storage space for little money. CD-R are also very cheap means of distribution.

The next question becomes which file format to use. Depending on the database manager and operating system some file formats may be easier than others to deal with, but I would also keep source files separate from the database manager just so that you can maintain and use them separately for migration and other purposes in the future. I recommend many different file formats stored in many different places. You should mix some of the more "generic" file types like JPEG, GIF, or TIFF with some proprietary types like Quicktime, BMP and Kodak PhotoCD. On the issue of which database software to use, there are many options that would work easily. Even FileMaker, which handles picture files, would work nicely for a modest size database and simple application like this one.

It is important not to confuse the issues of applications software obsolescence with file format obsolescence. The JPEG file format is likely to remain standard for a long time. However, if the JPEG file is stored on an obsolescent media type -- you are stuck. There is no indication that technology today is becoming more compatible and universal. While there is some interest in universal formats in standards groups, and in the user community to some extent, there has been little progress in that direction on a practical basis. Unfortunately the needs of consumers (particularly archives) and manufacturers are not the same. This is true in both the video and computer markets. Many applications have very limited abilities to export to other applications. The reason for this is that manufacturers are eager for you to use their software (and upgrades) and are not particularly interested in you leaving and finding another competitive product. Further, R&D resources are spent largely on new features -- and exporting to another competitive application is not high on the development list.

In sum: Spread the risk of both file and media issues by having multiple copies of each -- and store them CORRECTLY in DIFFERENT PLACES.

Wheeler: Even with expensive digital cameras, the resolution is not as good as using 35mm with a 35mm scanner. A Minolta system costs \$600 and \$150 extra for a programmable adapter for APS and other film formats. It will handle negatives or positives. It is 2800 dpi and requires about 25 megabytes per picture. Minolta provides software for interfacing with your computer but it is recommended to use PhotoShop or Photo Lab. You can pay about \$2,000 for a system that does multiple scans for a higher resolution but the \$750 system is adequate for most uses.

Regarding the option of copying your posters to videotape one frame at a time: As the inventor of that technology, I say no. Instant replay works great for sports but not for frame-by-frame storage. If you use a professional videotape format you can still-frame on one frame for several hours with no degradation of the image, but that is not necessarily true for the non-professional formats. You should use a disc system and make two of each.