

On film degradation

Since combustible nitrate stock was never used for 16mm film, and polyester stock (introduced in the mid-50s) has proven to be remarkably stable, we're mostly concerned with the tri-acetate film used primarily in educational settings until the mid-1980s (polyester can be distinguished by the greater amount of light passed through when viewing an entire reel held flat between you and the light source). The two most common forms of tri-acetate deterioration are a color shift toward the red spectrum, and the "vinegar" syndrome. This section addresses vinegar syndrome and storage issues. For information on color shift, see Film Stock Basics, below in section 4.

"Vinegar" Syndrome

In unfavorable storage --- i.e., high temperature-high humidity settings --- film will often take on the smell of vinegar as acetic acid begins to eat away at the film base. Eventually, the film will eat itself, its reel, and its can, by which time it has "traveled" to adjacent films as well. Probably the film genre with the largest percentage of vinegar is WWII training film, conveyed and stored in unfavorable war conditions. The good news is that vinegar, while not curable, can be stabilized so that little, if any further degradation takes place. The key is in identifying then isolating these films, then treating them with a product called "molecular sieve".

Identification

The cheap way is to use your nose. Walk around your collection, sniff for vinegar, and look particularly for rusted cans (always throw these away), and be particular about war-era films. The expensive way is to send away for "A-D Strips" (IPI 716-475-5199), put them in all of your cans, then look for color changes on the strips which indicate presence of acetic acid.

Isolation

You're going to have to move these away from the rest of your collection, and cool them down if possible. Think about using an old refrigerator or freezer. If you're interested in the scientific aspects of film, heat, and humidity, IPI will sell you a kit for about \$25 that will tell you everything you need to know. Call them at (716) 475-5199 and ask about their Storage Guide for Acetate Film.

Treatment

Re-can them in a vented polypropylene container, and then return it to refrigeration /isolation.

Film Storage and Preservation

Flawless film storage can be a beautiful thing for organizations fortunate enough to have exceptional funding resources. Barring that, all entities concerned with preserving their films can take basic measures, and can accelerate efforts as better resources become available. I have constructed a taxonomy of four levels of preservation, from the most basic to the most effective. Because my philosophy leans toward public showings on a regular basis, I view storage on plastic cores as an unnecessary measure, useful primarily for archives having little or no educational interest in increasing the public's knowledge and appreciation of film:

Level I Storage

All films stored in cans, stored indoors, under "best local" conditions, in terms of temperature and humidity. This will differ for each archive, relative to each locality's weather conditions. An important and inexpensive tool is an indoor humidity/temperature station. Christy at NorthEast Creations, 603-964-6840, sells one for \$23.95. Combine that with Image Permanence Institute's Storage Guide for Acetate Film, which is a wheel that predicts the onset of vinegar syndrome based on temp/humidity, and you've got basic tools that will tell you where you stand in terms of the future physical health of your archive.

Level 2 Storage

As above, with "vinegar" films removed, leading film edge rendered immovable within can with temporary "paper tape" (masking tape and cellophane tapes hurt both films and projectors)

Level 3 Storage

As above, with temperature and humidity automatically controlled. ANSI Standard IT 9.11-1993 recommends a relative humidity of 20-30%, at a temperature of 70 degrees Fahrenheit. Evidence points to even lower temperatures for optimal film life.

Level 4 Storage

As above, with a Halon, or similar fire retardant environment. In 1993, as a result of a disastrous fire at Hendersons Film Laboratories outside of London, many irreplaceable negatives of the films of Satyajit Ray were badly damaged. Water is extremely damaging to film as well, which means that the better your cans are sealed, the less damage your overhead sprinklers will do. Some preservationists feel that the more a film "breathes", the less chance internal toxins will have to damage a print, and advocate breathable plastic cans with overlapping lids. Theoretically, these are stored in horizontal stacks, which, again, is less-than-optimal for easy retrieval for public showings. There may be an argument for a "Level Five" preservation category, but here we delve into differing, and sometimes unproved

philosophies. If your archive has reached level four conditions, your challenges are nice ones to have!

Some of the challenges we've addressed above were also noted by Penelope Houston in her book *Keepers of the Frame* (1994, British Film Institute):

"Archive costs... have the potential to go on rising almost indefinitely, as more material involves more complex, elaborate and expensive processes. And this at a time when all the pressure has been to cut back, and archivists are inclined to remind you of what it costs them to carry out such an elementary operation as replacing rusty film cans with new ones. All film preservation seems to become a matter of juggling a range of options and compromises, and there are many areas in which it is recognized that the difficulties are not of a kind which could easily surrender to more money. If the older archives know what they should be doing, but struggle to afford it, many of the newer ones are handicapped by a shortage of expert technical knowledge and of laboratories equipped to carry out highly specialized work. There are many places around the world where it is all too likely that films are rotting on the shelves, and will continue to do so."

More information: The Library of Congress has published a document that, while providing few answers, details some of the challenges and scope of the problem of film storage and preservation: <http://lcweb.loc.gov/film/storage.html>

Digital Preservation

We field a large number of questions on digitally preserving film, and the issues, as discussed by the archival community, seem to revolve around costs (expensive) and the longevity of digital playback devices. We advise you to read Jeff Rothenberg's fine article in *Scientific American* (1995, Vol. 272, Number 1, pp. 42-47), 'Ensuing the Longevity of Digital Information', which addresses important preservation issues, including obsolescence of playback devices: <http://www.clir.org/pubs/archives/ensuring.pdf>.

A special note on CD-Ws

While our interest is in preservation of 16mm safety film, we recently began copying our library of morlam music VCDs onto CDs. We read with interest the potentially negative effect of felt-tip marking pens on the recorded data, as reported by Dr. Jerry Hartke of Media Science: <http://www.mscience.com/faq508.html>. Not to deviate too much from our focus on 16mm film, but Tape Archival & Restoration Services' Jim Wheeler notes that some CDs and DVDs have a problem with "laser rot", where moisture gets through the "protective" layer and reacts with the reflective surface. Low humidity storage is advised (gold DVDs and CDs do not have this problem). To make matters worse, ozone and reactive oxygen cause the aluminum layer on CD's to breakdown. When aluminum in a thin film oxidizes, it becomes clear and unable to reflect the laser pulse attempting to read the CD. One solution is Corrosion Intercept®, a product that replaces the black hubs in jewel cases. For more on this, visit: <http://www.conservation-by-design.co.uk/sundries/corincep1.html>. There also seems to be some degree of evidence that Mitsui's gold CDs will last decades, and it appears that they are priced at roughly \$1.50 each. Visit their website at: <http://www.mitsuicdr.com> for more information.

On Film Repair

To secure the end of the leader to the film, use only the "paper tape" you buy from film supply houses. Never use any other kind of tape when securing your leader: this includes cellophane "scotch" tape, masking tape, or strapping tape. All of these will either destroy the frames to which they're adhered, or gum up the transfer path in your projector. Do not tape the end of your film to the core or reel, a practice which will tear sprockets when the last bit of film snaps off the reel. When repairing torn film, use only the proper slicing tape, again bought from film supply houses. More films have been damaged by violating these rules than I can guess, and spending the money for the right supplies will be your best long-term investment. No splicer? Look on the the open market for a used one (I like the double bladed "Special" made by Construzione Incollatrici Rapide). I've been asked about "hot" splicing", and have found that these splices tend to separate under stress, after several years.

Film stock basics

The most common film stock complaint among 16mm film enthusiasts surrounds the fact that most of the print film sold by Eastman in the 50s - mid 1970s has a tendency to lose blues and greens, thereby shifting toward the red end of the spectrum, a problem that has occurred in 35mm as well as 16mm prints. There are unsubstantiated rumors --- we've heard them from at least two independent sources --- which Eastman was aware of this tendency and yet continued to sell the stock anyway. Cynics might suggest that a possible reason for this might be that it would force customers to continually buy new prints to replace degraded footage. We further understand that a threatened lawsuit by Martin Scorsese forced Eastman to eventually discontinue the practice, but meanwhile, a significant portion of our film legacy has been degraded. There is no cure for "red" film, but we at ciné16 suggest you keep red prints of good films until you ---- in piecemeal fashion --- can replace them with other stock, if available. Also, film dyes are more stable at low temperatures, therefore temperatures of 50 degrees Fahrenheit have been recommended for long-term storage (films are not harmed by thawing and re-freezing, but allow at least a one-hour thaw at room temperature before showing).

Since various stock terms are confusing, a quick glossary is included below the Eastman Date Code Chart. What's the chart about? Eastman listed date of manufacture on every film, right between the sprocket holes, but you've got to have a magnifying glass to see it. It's helpful to look up the code, because if you have a decent color print from the problem years, it won't be that way forever. Below the chart above (which also includes Fuji and Dupont film data), please reference the glossary below to assist you with film types.

Glossary of film stock types

Agfa & 3M Color: Generally stable; Agfa may occasionally be listed as AG, S1, or S2 between sprocket holes.

Eastman 4b: Made from the early 1970s to the late 1980s, generally stable.

Eastman Ektachrome: Also referred to as CRI Tech (color reversal internegative) this was the print film of choice for most companies selling 16mm film from approximately 1950 - 1975. Extremely prone to magenta-shift.

Eastman LPP: Produced in the beginning of the 1980s, stable, nice color, but occasionally leaning somewhat to green.

Eastman Reversal and Kodachrome: The camera film of choice for shooting the original picture, reversal has beautiful colors which do not fade, but most prints were, unfortunately, made on Ektachrome.

Eastman SP: Eastman's first response to magenta shifts, and made from the mid-to-late 1970s. Still unstable, now turning orange or yellow, in addition to magenta.

Estar: Refers to a non-acetate base, rather than an emulsion. More durable than acetate, less durable than polyester base.

Fuji Color: Stable, but slightly shifts toward blue. Made from the 1970s, its dates are coded between sprockets by year, not Eastman symbol.

I.B. Technicolor: Imbibes yellow, cyan, and magenta dyes onto a latent black and white image. Will not fade, and is the most stable of all color processes.

Degradation characteristics of various films stocks

Richard W. Haines author of *Technicolor Movies* contributed the following information:

Fujicolor has the tendency to degrade into 'Fuji rot' which are colored dots that appear all over the emulsion. Cause is unknown but it might be both bad processing and storage or an inherent flaw with the stock itself since the same phenomenon is rare on Eastmancolor stock.

Cinecolor has the tendency to shift to green over the years but there's usually enough left of the two color spectrum to make them viewable. These copies tend to be grainy and difficult to focus due to the double emulsion.

SuperCinecolor does not fade but was only used briefly in the early fifties for 12 features (i.e. "Invaders from Mars" and "Jack and the Beanstalk"). It somewhat resembles a Technicolor print but was grainier and hard to focus due to the double emulsion.

Kodachrome doesn't fade but is very contrasty when you make a reversal print from a Kodachrome original. Too dark and not enough detail but rich and vivid reds and blacks.

Anso color in 16mm was a kodachrome type process that didn't fade. They also made color print film in 35mm via the dye coupler process, similar to Eastmancolor. These prints did not shift to red like Eastmancolor but tended to lose their overall contrast. Surviving 35mm Ancocolor prints look de-saturated and washed out the color still there.

The cyan soundtracks of 16mm blue track Technicolor prints have the tendency to fade a bit making the sound hissy although the images don't fade.

All films with magnetic soundtrack are subject to deterioration since the iron binding accelerates the potential of tri-acetate hydrolysis ('vinegar syndrome') and Eastmancolor fading. That's why original 70mm prints fade quicker than standard Eastmancolor prints. 70mm was razor sharp and sounded great but it was not an archival process.

The best process was dye transfer printing. It was the only system that generated mass produced first generation sharpness combined with superior color, resolution and image stability. It was abandoned in 1974 in favor of Eastmancolor (release prints are two or three generations removed from the negative and have inferior color, contrast and resolution). It was revived by Technicolor briefly from 1997-2001 with recent re-issues of "Rear Window" and "Apocalypse Redux" but most contemporary Hollywood cinematographers and directors are not interested in improved the quality of general release prints nor does the aesthetics of modern photography (de-saturated, bland or muted color and under-exposed negatives) really conducive to the 'Glorious Technicolor' look associated with dye transfer printing. The line was shut down and is now in storage.

Acquiring film

Paradoxically, your least expensive means of getting the films themselves is also the most expensive. We encourage you, as preservers of the art of film, to contact your own local school districts and ask them when they plan to sell off their film libraries. Typically, you'll get a hazy response about some time in the future. This is your best time to cultivate a friendship with the film librarian by letting him or her know about your repertory cinema, and why you should be considered the first resource when films go up for sale. We started ciné16 by buying individual titles for between \$10 and \$20, but later realized that we should have made an offer for the whole shooting' match. How much should you pay? It varies, but buying a whole collection for fifty cents to one dollar a title is about right. Negotiate the rights to the film racks as well, as you'll need them. You'll undoubtedly get duplicate prints, which allows you to choose the best prints for archival purposes, and also will give you something to trade with other film institutions as you begin growing your library in specific directions. Needless to say, this whole process might cost you \$5 - \$10,000. Am I suggesting taking out a loan? You bet. Films are incredibly inexpensive right now, and it may not stay that way for long. In the ensuing years, you'll be congratulating yourself on a wise and no-longer-affordable financial decision.

Projectors

You'll need two so you can make quick switches between reels, and you'll want a third as a backup. Choose one type of projector, such as Bell & Howell 552 (tube) or 2592 (solid state). We use 2592s here, as we've found that they're overall less buggy than 552s. These, however, are "autoloaders", which can chew film mercilessly when out of adjustment, or use by an

unskilled operator. A slot load projector, such as the Bell & Howell 2580, is more forgiving. Do find a local repair person who is reasonable and familiar with your type of projector --- you'll become good friends in the ensuing months. It may not be such a bad idea to identify this person before buying a projector (call your local school district & ask who does/did their repairs), get his or her recommendations which unit to buy. Pay no more than \$100 for a used projector in running condition.

Buying on the internet? Think again. I recently had the sad experience of buying a couple of projectors from somebody who operates a 16mm listserv on the internet (sounds trustworthy, doesn't it?). He guaranteed they would work perfectly, swore he'd run them first, as I had asked, and when they arrived, neither was in operating condition. When I questioned his honesty, he refused to accept responsibility. The fact that neither would advance film, and one had a broken \$85 lamp was not a concern for him. He "graciously" sent me a \$25 refund, for \$300 worth of has-been projectors. To sum up: there are so many nuts, kooks, crooks, and inept people on the 'net, I wouldn't buy anything in the way of projectors without seeing them myself, and running a film through them.

15 minute projector test check: before buying a projector, run a 400 foot (10 minute) film on it first, to make sure the picture isn't jumpy, and sound is OK. Run it all the way through. Then rewind it, to ensure that rewind mechanism works.

Venue and admission charges

We like bars and coffee shops, because seating is already there, there is usually a blank white wall you can use as your screen, and owners of these establishments love having events that will draw people. Some owners will request that you charge a small fee. Explain that you can't, as detailed under #3, below. Indoors or outdoors? Outdoor showings are terrific, but if you'll be showing in areas abundant in ambient light, you'll need a projector with a carbon-arc light source, roughly \$2500. 16mm film comes with the cachet that each print may be shown in an educational environment without remuneration to the distributor provided that no admission fee is charged. Once you charge admission, you're fighting two battles: a) fees may be more than you can recoup at the door, & b) you've got to find the distributor/copyright owner, which can be extremely challenging.

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Unless you can deal with the expense of postage and printing, consider making weekly email postings your modus operandi. An extra benefit is that you can change programs on the fly without having to re-mail (you will find dozens of people who don't yet have email, so encourage them to go to a public library that offers computer access to patrons, and ask them to open free email accounts through Hotmail or Yahoo. You will also find at least one local film or entertainment critic that will think your idea is terrific, so get in touch and ask that your schedule be mentioned every week, free. And contact all local professors of film/media history, and ask if you can make a ten-minute presentation to their classes every quarter/semester. Free cinema is loved students on academic budgets.