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New VHS Releases at the NEF Research Library

And so it begins! After about six months (!) of studying and gearing up, I've finally started releasing (and more importantly, preserving) the collection of 300 VHS tapes housed at the NEF Research Library.

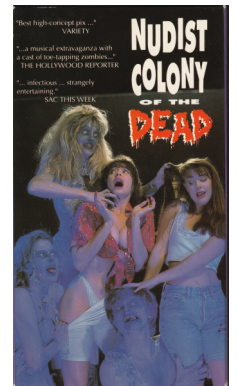
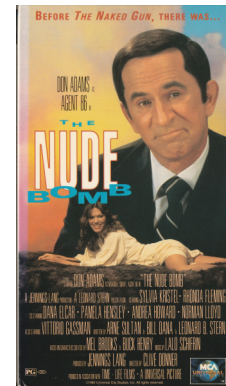
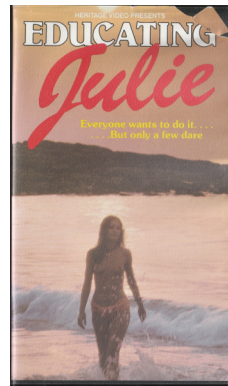
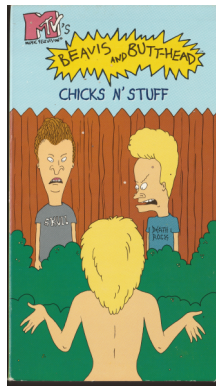
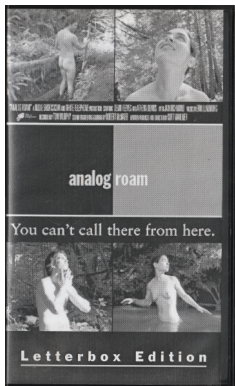
This page announces the first batch of Fiction videos. Patrons of the NEFRL can begin requesting and watching these films. It's free to become a patron, and free to request materials. However, monetary donations are highly appreciated and are instrumental in encouraging this continued effort. Donations of VHS tapes the library doesn't have are helpful in preserving naturist history.

My extensive writeup that follows is two-fold. First, I'd like library patrons

to get a taste of what's going on behind the scenes, and why releases are fairly slow to arrive. Second, while my focus is NEFRL's collection, I'm open to helping the other naturist libraries with similar efforts, or perhaps processing videos they have that NEFRL doesn't.



Last Name	First Name	Video Title	Year	Asset Tag
Wahlner	Kurt	Analog Roam	2002	video201
Kaplan	Yvette	Beavis and Butthead: Chicks n' Stuff	1995	video208
Thomas	Gerald	Carry on Camping	(1969) 1996	video212
Hardman	Gail	Educating Julie	1984	video219
Baldra	Hugh	Gone With the Sun [revised]	(1957) 2002	video234
Baldra	Hugh	The Magic Glasses [revised]	(1953) 2002	video248
Donner	Clive	The Nude Bomb	(1980) 1991	video266
Pirro	Mark	Nudist Colony of the Dead	1991	video275
Carvana	Hugo	O Homen Nu	(1997)	video279
Eide	Clay	"Peter's Day in the Sun" Fly Filmmaking 2000	2000	video282



VHS Preservation: Way Beyond Conversion

How the NEF Research Library is Implementing "The Final Standard" of VHS Preservation

By Doug Hickok

From the start, I wanted to "do it right" instead of "do it quick". The NEF Research Library has over 300 VHS tapes. Not only are many of these rare and irreplaceable, but they document naturist history from the 1930s to the 2000s.

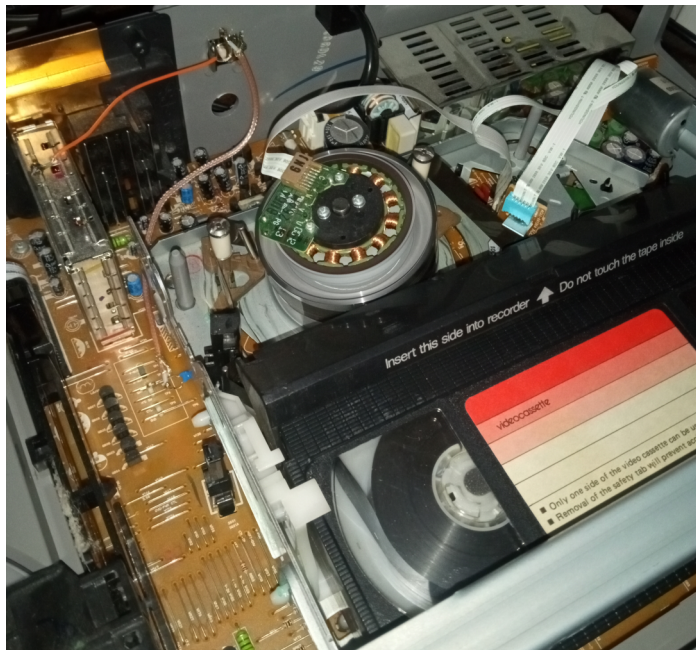
I've evaluated the options. Conversion services are expensive and do things the quick way -- press record on one device and press play on the other. With thousands of dollars of equipment, the results look better, but still aren't nearly a perfect replica. Doing this at home with equipment under \$1,000 produces some very low-quality results.

Then I found a fringe group of preservation enthusiasts. Originally, the focus was on extracing and preserving laserdiscs. (Remember those?) Not too many years ago, other enthusiasts expanded the project to VHS tapes, and "vhs-decode" was born.

Trust me, there aren't a lot of people preserving VHS tapes this way! But, they have good reason to call this the "final standard for tape archival".

The philosophy is to "Capture today, decode tomorrow!" and also to "bypass all non-essential hardware, and process it all in software directly." Capturing and saving the raw signal today (before the tapes get worse) allows us to re-process that data in the future as vhs-decode improves. Being only 5 years old, the vhs-decode algorithms are pretty good for most VHS tapes, but there's a lot that can be done to auto-correct dropouts, clean up noisy frames, and address color bleed.

Good VHS preservation isn't easy! (But at least it's inexpensive!) This short guide will show you what is involved.



The High-Level Summary:

- ▶ VHS tapes were made from about 1975-2005, making them already 20-50 years old. The magnetic tape decays over time, resulting in weak signal and color bleed. Many tapes in NEFRL's collection are showing these signs.
- ▶ Celluloid film (1930s - 1980s) also decays over time. NEFRL has numerous VHS tapes that were sourced from celluloid. Except for high-budget films, these looked in rough shape already by the time they were converted to VHS. I hope they have been well-preserved since then.
- ▶ VCRs are no longer being manufactured. They are full of fragile and complicated machinery that will likely break within the next couple decades.
- ▶ In 50 more years, both VHS and celluloid will be far worse than it already is. VHS tapes may be unreadable, even if you can find a VCR to play it.
- ▶ NEFRL is reading the raw radio frequency (RF) signal directly from the VHS tape. This is the highest fidelity copy that is possible to make and is closest to the source as we can get.
- ▶ NEFRL is converting the raw signal to a FFV1 digital archival video format using the "vhs-decode" project. These are full-frame lossless videos that can be played on a standard computer.
- ▶ NEFRL is down-sampling the FFV1 to a copy used by the library for Digital Lending.
- ▶ All of the above digital files are stored on an optical disc (quad-layer Blu-ray) and a magnetic disk (standard hard drive) with parity recovery information to detect issues early and fix them. These should last 50+ years and can be perfectly replicated as needed in the future.
- ▶ NEFRL believes in Preserving Naturist History for the long-haul, not just converting it to the currently-playable format using the easiest method.



? hours

[Throughout this article, I'll identify the compute time using these info boxes. The times are for a 2-hour VHS movie.]

Samples From The Effort:

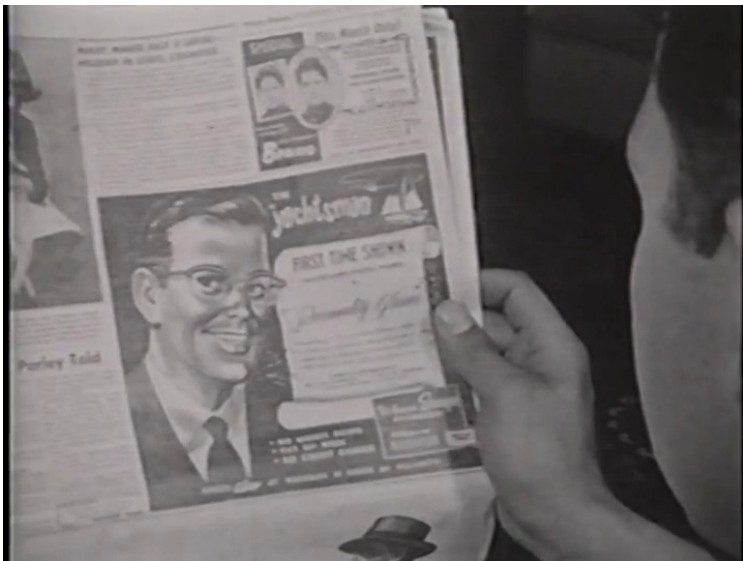
The Magic Glasses (1953 film, 2002 VHS)



[A NEF Board member, several years ago, used specialized equipment at a Chicago-area library to convert the VHS to DVD. This screenshot is directly from the DVD.]



[The new method using "vhs-decode" on the exact same VHS tape. Notice the extra detail in the wallpaper, hair, couch, and clothing.]



[Same movie, same VHS-to-DVD copy.]



[Same frame from the new method. The quality isn't good enough to read the paragraphs, but you can at least see that they are words instead of blurry lines. Also notice some detail in the dark background.]

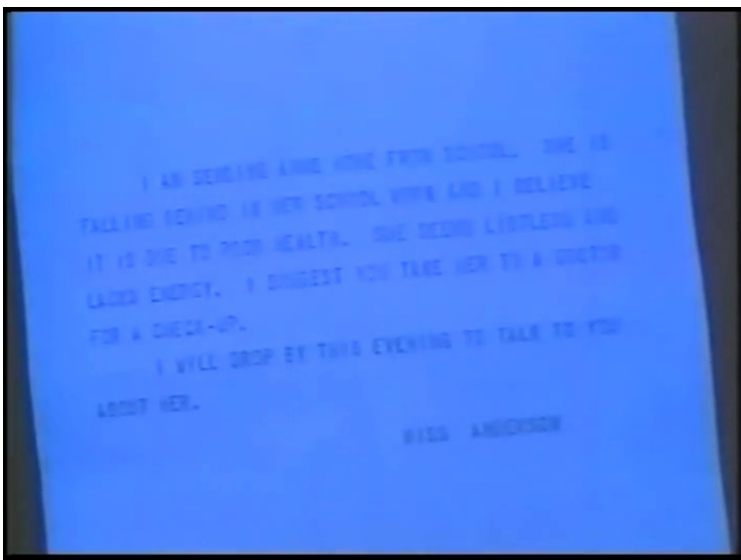
Gone With The Sun (1957 film, 2002 VHS)



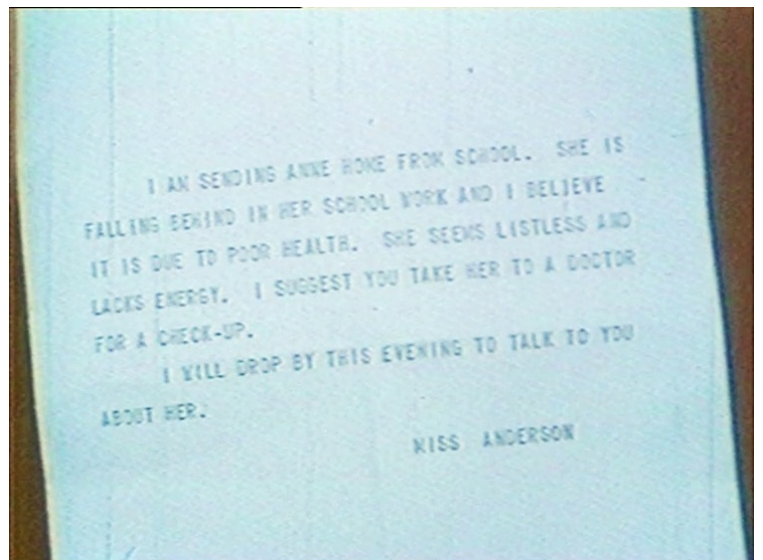
[Same as The Magic Glasses, the NEF Board member converted this VHS to DVD also. I'm not sure why the process produced such a strong color cast throughout the film. Either the VCR or the capture equipment thought this was the right thing to do.]



[The new method. Notice the extra detail in the trees and signs. We can identify the plants on the bottom left as ferns, can see detail in the car's hubcaps, and can identify where the driver's hand is on the steering wheel.]



[Perhaps magic glasses would be able to read this? It is important to the plot of the film, but is almost completely lost in the conversion process. These DVDs are NOT the way to preserve this film!]



[Perfectly legible, now that "vhs-decode" is extracting the full quality available on the VHS tape.]

Educating Julie (1984 VHS)



[Above: This film was digitized by the Western Nudist Research Library (WNRL). Because of how old the film is (mid-1980s), the tapes have degraded to being somewhat noisy. Whatever equipment WNRL was using, it had a strong denoising filter applied. Also, observe how the black lines on both sides are curved. This indicates there was no time base correction (TBC) done between the VCR and the capturing equipment. Some high-end (\$700+) VCRs have basic TBC. Otherwise, it's a \$4,000 piece of stand-alone equipment for broadcast-quality TBC.]

[Top-Right: NEFRL's FFV1 archival copy, full frame. The "vhs-decode" project automatically does TBC.]

[Right: Cropped, and mildly denoised, for NEFRL use.]



[WNRL's digital copy.]

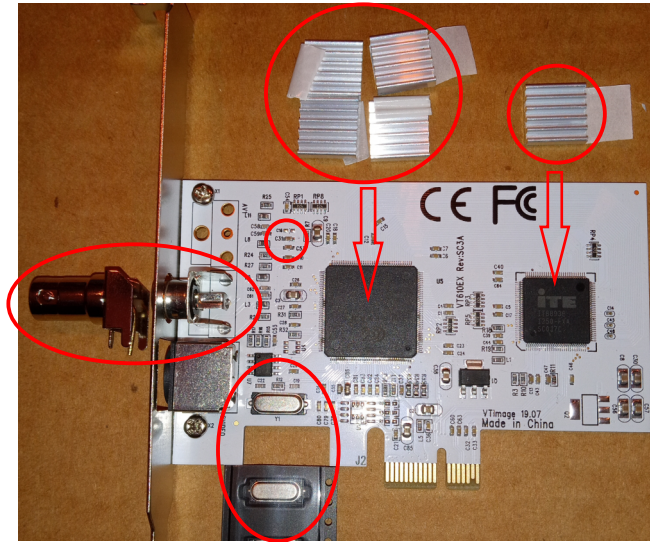


[NEFRL's digital copy (after processing for library use)]

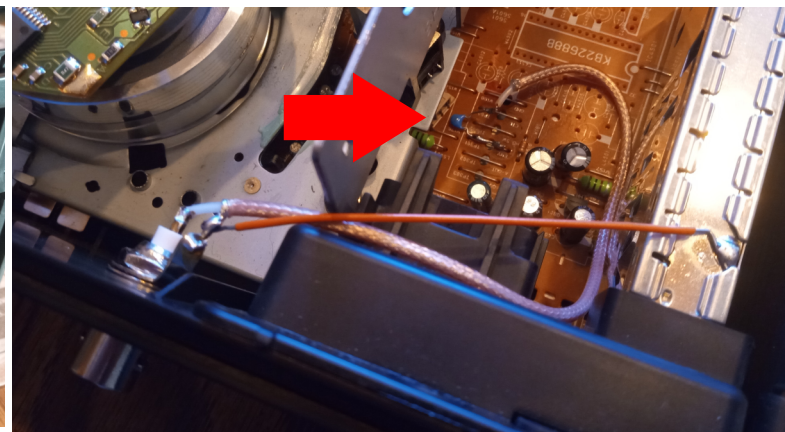
Main Equipment:



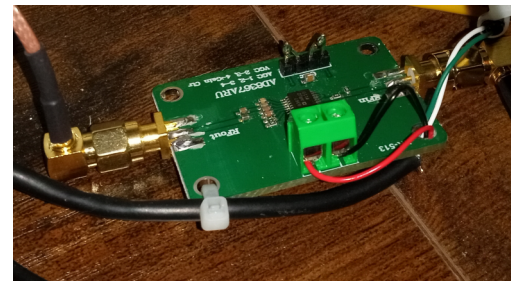
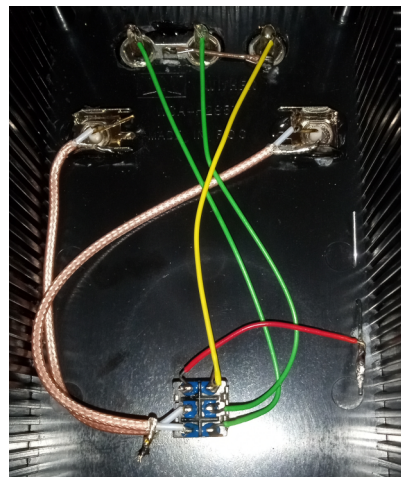
[Clean working VCRs. Sony is highly recommended due to strong RF signal. Cost was between \$10 and \$75 each.]



[This \$30 CXADC card is a horrible video capture device when stock. With another \$10 in parts, it becomes awesome and absolutely critical in capturing the raw RF signal! Replace the RCA connector with BNC and remove component C31 (reduces noise). Upgrade the 28 MHz clock with a 40 MHz clock. Now that it's overclocked, add some heat sinks and make sure a fan is on it when installed. This must go into a Linux PC, because you'll need to compile and install a customized driver to make it work.]



[VCRs need to have a RF tap. This "improved" VCR has a BNC connector added to the back which connects to the RF test point. The VCR drum reads data off the tape using the two heads on the drum, combines the signal from those two heads, amplifies it slightly, and makes it available on the RF test point. The small blue capacitor smooths out the signal.]



[The AD8367 chip acts as a RF amplifier, if the VCR RF signal needs extra amplification. This is a \$15 test board with RF connectors and a power terminal.]



[An external volume control is handy. I found that loud segments could easily clip the line input of my sound card.]

[You'll need a way to synchronize the sound to the video. I built this box around a two-pole switch. At the same instant, the RF signal is turned on and the sound goes from the Standby test tone to the VCR audio. This is critical to easily put the sound and video in sync at the beginning.]

Capturing:



3 hours

- ▶ Check for a clean tape, and reasonably clean VCR.
 - ▶ I cue the video to the end, reset the counter, and rewind it, so the VCR displays a countdown timer.
 - ▶ Check sound levels and check that everything else is ready.
 - ▶ Start the recording script.
 - ▶ Flip the Sync Box from "Standby" to "Active".
 - ▶ End the recording script at the end of the video.
-
- ▶ Audio is recorded via the sound card as 16-bit samples at 48,000 Hz, stereo, resulting in a 1.3 gigabyte wav file for a 2 hour video.
 - ▶ Video RF is recorded via the CXADC card as 8-bit samples at 40,000,000 Hz (40 megabytes per second) resulting in a 288 gigabyte file for a 2 hour video.

Compressing:



96 hours

- ▶ Audio is compressed with a 320kbps MP3 codec. (MP3 is lossy, but the sound quality is still on par with VHS.) A 2-hour wav file compresses down to a 270 megabyte MP3 and only takes a couple minutes.
- ▶ Videos that are shorter than 1hr30min can be losslessly FLAC compressed during the capture. The 2-hour video that was 288 gigabytes compresses down to a 93 gigabyte FLAC file.
- ▶ Videos that are longer than 1hr30min must use better compression if it's going to fit on a Blu-ray disc. For this, I use 7-zip at the highest compression, which takes about 4 days of compute time and results in a 80 gigabyte file for a 2-hour video.

Clean Your VCR!

Crud inside your VCR absolutely WILL impact playback and could even damage the tapes.

Playing 40 year old tapes WILL leave crud in your VCR. The chunks on the leftmost Qtip below are flakes from a VHS tape.

Starting with a clean VCR, this is what came off the rollers after playing **only 10 tapes!**

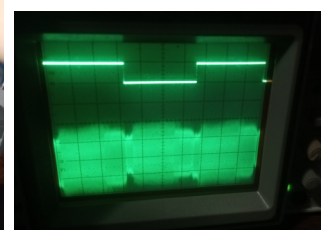


Problematic Tapes

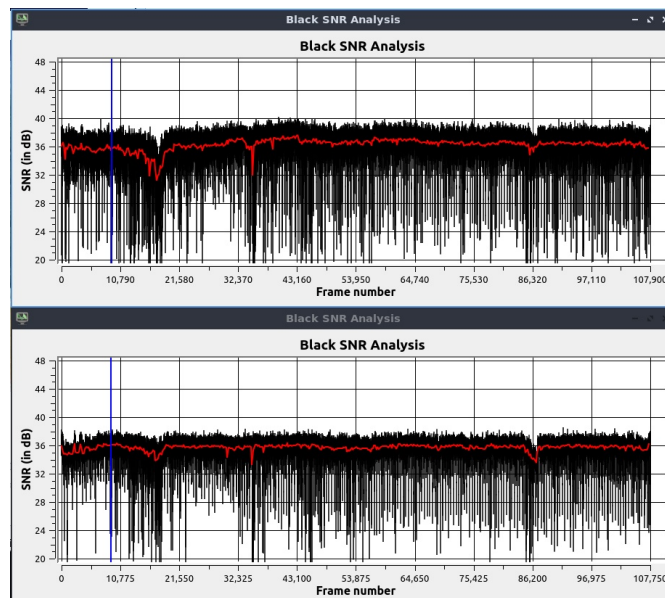
One of the VHS tapes was recorded in the mid-1990s, but recorded on a VHS cassette that looked from the early 1980s. My primary VCR had trouble with tracking throughout the film.

Suspecting that the recording was done on an out-of-calibration home VCR, I "de-calibrated" my test VCR to match that specific tape, and got better results.

The oscilloscope is used to fine-tune VCRs. The line at the top indicates the head switch position. The signal at the bottom is the RF "scan-line" being read from the tape as the active head passes by.



[Calibrating the VCR to match the tape. The oscilloscope image on the right shows 3 scan-lines on the tape and a nice balanced RF signal.]



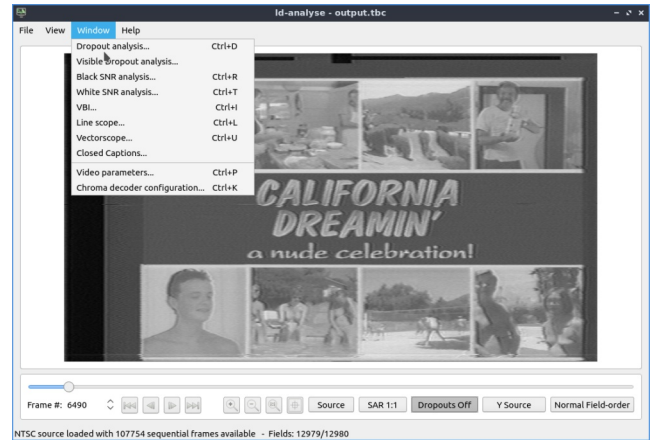
[Signal analysis of the problematic tape as played on the primary VCR (top) and the calibrated-to-match VCR (bottom). The signal looks better and there are less dropouts on the bottom chart, but the signal is still bad no matter what. Hopefully NEFRL can find a better source tape in the near future. I've pulled everything I can get from this one.]

Video RF to TBC:



34 hours

- ▶ Run "vhs-decode" on the Video RF file to generate the "TBC-luma" and "TBC-chroma" files. These are the decoded video frames separated by the luminance channel and the chrominance channel.
- ▶ Each TBC file is about 200 gigabytes. For that 2-hour video, the RF file and both TBC files are totalling 688 gigabytes. Make sure you have the space to process these.
- ▶ Analyze the output -- there's a few adjustments that can be made for setting the black point, white point, aspect ratio if letterbox format, color, and a few other things I've never needed to touch.
- ▶ Run the tool to extract Closed Caption information, and run another tool to convert it to modern formats. Not many VHS tapes in NEFRL have Closed Captions, but any that do, make sure to preserve them.
- ▶ Run the script to convert the TBC files into the FFV1 video format. This is a "draft" file without sound.



[Luminance]



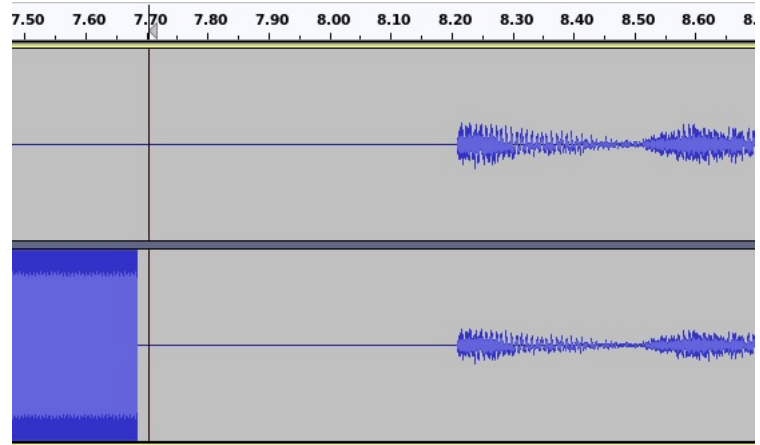
[Chrominance]



[Combined]

Audio Prep:

- ▶ Find the audio start point by finding the end of the synchronization tone, and adding 20 milliseconds. This synchronizes the audio start to within 1 video frame. (It takes about 5 milliseconds for the switch to flip. Each video frame is about 30 milliseconds, and we don't know exactly when the frame starts, so you'll be up to 15 milliseconds off which is imperceptible.) Trim off the audio up to the start point.
- ▶ The audio end point is already synchronized by the capture script. Both the video capture and audio capture are stopped within a couple milliseconds.
- ▶ You'll need to stretch the audio to match the video. VCRs aim to play at (NTSC) 29.97 frames per second. The "vhs-decode" output will be exactly 29.97 frames per second. As an analog medium, it is unsurprising that the VCR skews a little bit during playback. From my observations so far, a regular-length movie will be off by a couple hundred milliseconds by the end. Without stretching the audio, the sound will be noticeably out of sync by the end.
- ▶ All these manual steps, and saving the file, take less than 10 minutes.



[The vertical line is the start point as indicated by the VHS Sync Box.]

TBC+Audio to FFV1:

- ▶ With the audio and video synchronized, make the FFV1 archival video.
- ▶ This FFV1 video is a MKV file with lossless video compression, and is about 40 gigabytes in size.



3 hours



For NEF Research Library Use:



9 hours

The FFV1 video is WAY too big to be practical, so I created a script to convert the FFV1 to a clean Library copy. The script relies on "ffmpeg" to process the video in the following ways:

- ▶ Deinterlace to progressive frames.
- ▶ Clip the start and end of the video to remove any dead space.
- ▶ Crop the black borders off.
- ▶ Scale to 480p (which is native to VHS anyway).
- ▶ Set the aspect ratio.
- ▶ Convert the colorspace to bt709.
- ▶ Denoise if needed, using a very good (and slow) algorithm.
- ▶ Stretch contrast if needed (for films with really dark and bright scenes).
- ▶ Color boost if needed.
- ▶ General brighten if needed using a curve (for dark films).
- ▶ Remove extra streams embedded in the video file.
- ▶ Transcode audio to the NEF library standard (currently MP3).
- ▶ Transcode video to the NEF library standard (currently H264 MP4).
- ▶ In the rare case of Closed Captions, do the whole encode a second time with hard subtitles in the video.

Name	Size
capture_notes.txt	538 bytes
carryoncamping.wav.mp3	193.4 MiB
carryoncamping_adjusted.mp3	193.1 MiB
CarryOnCamping_FFV1.mkv	37.4 GiB
carryoncamping-40msps-8bit-cx-card.flac	62.4 GiB
video212_art1.jpg	5.2 MiB
video212_art2.jpg	7.2 MiB
video212_Carry_On_Camping.mp4	2.3 GiB
video212_tape.jpg	3.9 MiB

There's more to creating the Library Use copy, like scanning the sleeve, updating the catalogs, and moving it to the archive. That's all out of scope for this article.

Archiving:

Just because there's a version for library use doesn't mean the job is done. The following files are preserved for the long-term:

- ▶ The compressed raw VHS RF capture.
- ▶ The FFV1 video.
- ▶ The original audio capture.
- ▶ The processed audio.
- ▶ The library use video.
- ▶ Scans of the cover artwork and cassette.
- ▶ Any Closed Captions.
- ▶ An information file about the capture.

All of the files above aim to be around 120 gigs at the most. The remaining space on the 128 gigabyte Blu-ray disc is consumed by parity recovery files. At any time, these can be used to verify the disc contents and recover large amounts of corrupted data.

- ▶ Generate the parity recovery files by using the "par2" tool.



3 hours

- ▶ Burn the Blu-ray disc (2x, verify).



6 hours

- ▶ Duplicate the Blu-ray disc contents on a designated large storage hard drive.



2 hours

Name	Size
video212_Carry_On_Camping	
a_backup_recovery.par2	41.6 KiB
recovery.par2	41.6 KiB
recovery.vol000+01.par2	52.7 MiB
recovery.vol001+02.par2	105.3 MiB
recovery.vol003+04.par2	210.6 MiB
recovery.vol007+08.par2	421.2 MiB
recovery.vol015+16.par2	842.2 MiB
recovery.vol031+32.par2	1.6 GiB
recovery.vol063+64.par2	3.3 GiB
recovery.vol127+67.par2	3.4 GiB
z_backup_recovery.par2	41.6 KiB

Finally, it's done! Time to move on to the next one? Not really... I'm doing the captures and the processing steps on multiple USB 3.0 solid state (fast!) drives that I can move between multiple computers. Steps may take days of processing time, but usually I can do multiple in parallel. I'm still getting into a more efficient groove in getting these done.



One More Little Update

I've updated the Audio and Video catalogs with a new format! All three now include preview images of the primary artwork associated with the item. (Typically these are covers, but in some cases might be record labels or CD images if there isn't a cover.)

For videos, and with the help of another volunteer, I'll be filling in short summaries for each one.

Best of all, for me anyway, is that it's all semi-automated now. The text is all generated from a spreadsheet into relatively simple HTML. Updating the preview images for new items is just running a script.

Hopefully everyone is happy with the new format, and hopefully it helps patrons select the items to check out.



	Adam and Six Eves (The 3-D Nudie Cuties Collection) , (1962) 2019, Blu-Ray 3D John Wallis, 3-D Film Archive Comments: Must specify the format! Summary: Soon!
	All of Me , 1963, DVD Joel Holt, Something Weird Video Summary: Soon!
	American Nudist , 2011, DVD Clinton H. Wallace, CineRidge Comments: Includes DVD extras. Summary: Soon!
	Analog Room , 2002, VHS Kurt Wahlner, White Telephone Summary: Soon!
	Anarchy TV: The Movie , 2002, DVD Jonathon Blank, IndieDVD Comments: Includes most DVD extras. Request "video202dc" for the Director Commentary track. Summary: Soon!
Soon!	As Nature Intended (aka Naked as Nature Intended) , (1961) n.d., VHS Harrison Marks, Mondo Movies Summary: Soon!
Soon!	As Nature Intended (aka Naked as Nature Intended) , (1963) 1996, VHS Harrison Marks, Something Weird Video Summary: Soon!
	Babes in the Woods , 1962, DVD Achem Krovek, Aurora Productions Summary: Soon!
	

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