

# Digital Video...

## Revisited

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Well it seemed like a good deal to my friend Eldon while shopping at the neighborhood Wal-Mart. You see, some months before Eldon had suffered a heart attack, which ultimately cut short his career as an over-the-road truck driver. They took him to the hospital and one of his trucker friends assured him that his personal belongings in the truck would be taken care of and returned to him later.

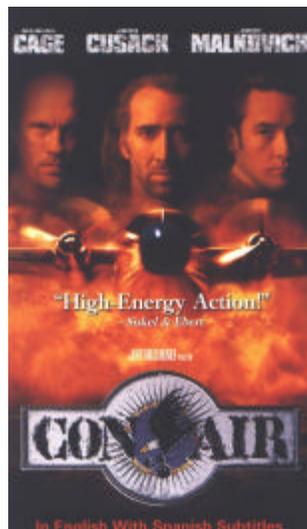
Now Eldon is a big fan of action movies. He had a few dozen in the truck with him at the time. Unfortunately, they all vanished. They were loaned out to other truckers by this 'friend' and quickly disappeared.

So in the checkout at the Wal-Mart he couldn't resist the impulse to purchase a replacement copy of one of his favorites, Con-Air.

You know the movie, Nicolas Cage, an honorably discharged US Army Ranger who ended up in a bar fight and kills a guy who is about to stab him, is a parolee on his way home to his wife and daughter (whom he has never seen) and hopefully a new beginning. While en route the other inmates of

the federal prison system stage a 'jail break' aboard an airplane. Now Cage, being an honorable man and following the Ranger code of never leaving a man behind, feels compelled to do what he can to make the situation right for a diabetic inmate and a female prison guard... and in doing so becomes embroiled in events which ultimately lead to the destruction of a fair portion of the Las Vegas Strip. If you haven't seen the movie it is quite good, and loaded with action.

Well, Eldon brought home his copy and stuck it into the VCR and discovered that it wasn't quite the same as his previous copy... this one was in Spanish. He was disappointed.



One day not too long past these events I happened to be assisting Doris, Eldon's wife, with a problem on her computer and we got to talking about movies and DVD players and such. Eldon was interested how they worked and whether they were actually better than VHS. One of the things he wanted to do was upgrade all of his movies

and replace those that he had lost. He then told me about his recent Wal-Mart purchase.

Well, being the helpful, understanding person that I am (not to mention modest) I offered to dub the copy of Con-Air that we owned onto his original tape. He said "You can do that?" and I said 'Yup'. So I took the tape home and then my interesting journey began...

Macrovision Unmasked...

Now I had been the owner of VHS video equipment for years and had lots of experience with producing video with my VHS video camcorder (which I still have in perfect working order) but I had actually done very little in the way of dubbing commercially produced video tapes. Back in the early 80's and 90's it didn't seem to be much of a problem. But I had just been lucky enough to have never run into Macrovision copy protection. It's actually quite effective.

How it works is quite simple.

The NTSC video standard (the broadcast standard used in North America and Japan) is defined with a 525-line vertical resolution. However, only 480 of those lines are used for transmitting video information.

The extra 45 lines are used to carry control codes (such as interlace information), closed captions, and other similar non-video content. Macrovision copy protection works by adding certain codes to these control lines that are interpreted by an Automatic Gain Control chip in a VCR to scramble the video signal if the video is being recorded.

Videocassettes that are copied from Macrovision-encoded source material will frequently exhibit color loss, image tearing, variable brightness, and picture instability.

Since TVs and video switch boxes do not have Automatic Gain Control circuitry which will interpret these control signals, the Macrovision signals are ignored when the DVD player or VCR is connected directly to the television, or indirectly through an A/V switching receiver or switchbox.

However, for the Macrovision technology to work, the VCR that is used to make an unauthorized copy must contain the Automatic Gain Control circuitry, or no picture distortion will be witnessed. Macrovision estimates that 85% of the VCRs currently in use have automatic gain control circuitry in them, providing copy protection for nearly 550,000,000 videocassettes every year. If you have an older VCR you might want to try making it the destination for your dub and see if it will work. If not then you will have to resort to the process described in the remainder of this article.

Problems with Macrovision

The most glaring problem with Macrovision is that compatibility is not guaranteed. Although the Automatic Gain Control circuitry is only supposed to affect the video signal when a Macrovision-protected video stream is recorded, many VCRs activate their video-scrambling chip when a signal is simply passing through the VCR. Since DVD players rarely include RF output (a single round cable with a single pin in the center - it looks like a cable TV connection), and millions of TVs currently in use lack composite video input (3 cables, 1 yellow for video and 2 (red and white) for audio - all have RCA-style connectors at the ends), or have only one set of composite inputs (which is occupied by a VCR, a Sony Playstation, or any of a variety of popular consumer electronics devices), many people discover that the only way to connect their brand-new DVD player to their television is to run the cables through their VCR.

While there is nothing illegal about this configuration, due to poor design on the part of VCR manufacturers, quite a few people have been innocent victims of distorted pictures, and as DVD technology grows in popularity, this problem will grow

exponentially.

Already popular web sites are receiving questions from worried users, asking whether their new DVD player is broken because they are seeing an image that jumps around their television screen. The troubleshooting section of DVD player owner's manuals rarely mentions this potential problem, incorrectly convincing many people that they own a faulty DVD player.

While early adopters have been generally unaffected (due to the nature of early adopters, most own TVs with multiple S-Video or composite inputs, and thus do not need to connect their DVD players to their VCRs), this demographic is insignificant compared to the number of people who will try to connect their DVD players to their VCRs.

In addition to improperly designed VCRs, some TVs are also incapable of resolving the Macrovision signal.

Some Macrovision signals resemble bad synchronization pulses (the signals that tell the television where the electron guns should be at what time), and some TVs confuse these signals with real synchronization pulses. This problem primarily manifests itself with rental tapes having unstable pictures; however, it may also affect DVD. Alarmingly, this problem isn't restricted to older televisions - in fact, televisions produced after the widespread use of Macrovision copy protection are more likely to suffer from this problem than older TVs.

Additionally, despite all the claims that DVD produces the best quality

image available, it is well known in technical circles that the image quality from DVDs could be even better. Most TVs use a technique called interlacing: rather than drawing each of the 480 visible scan lines every frame, only 240 are drawn in an alternating pattern. Since DVD is a digital format, it is actually possible to output all 480 scan lines at once, and on high-quality TVs (which have Progressive inputs, in addition to composite and S-Video), such images are much more stable than interlaced images.

DVDs implement Macrovision by attaching a small code to the video stream indicating whether or not to enable Macrovision protection. Then, when the DVD player outputs the frame, it adds Macrovision codes to the frame; however, due to technical limitations, it has proven extremely difficult to create a DVD player that can output 480 scan lines per frame in addition to Macrovision control codes. Because this could potentially allow unscrupulous users to connect their DVD players to computer-based recording devices and create perfect copies, the MPAA and DVD Copy Control Association (DVD CCA) stalled the release of progressive-scan DVD players for nearly 18 months.

Enter the DMCA

Historically, problems with Macrovision have been circumvented easily. Because

VCR manufacturers weren't required to include Automatic Gain Control circuitry in their products, several models can be purchased that conveniently ignore the Macrovision signals, and pass an uncorrupted signal to the



television (these also allow unauthorized copying). Additionally, devices that defeat Macrovision protection are available for purchase at gray-market retailers (they are also fairly easy to make). While all of these choices could potentially stifle the copy-protection attempts, they do allow for correct, legitimate playback in cases where the owner's television or VCR is incompatible with Macrovision signals.

Unfortunately, due to the DMCA, such devices are no longer legal. On April 26, 2002, under section 1201k of the Digital Millennium Copyright Act, no analog video recording devices may be manufactured that do not contain Automatic Gain Control circuitry. Additionally, on October 26, 2002, the sale, purchase, or manufacture of any device that disables Macrovision copy protection was made illegal under section 1201a of the Digital Millennium Copyright Act.

All of this legalese has many consumers and consumer advocacy groups up in arms due to the unfair influence the MPAA has had on hardware makers and the apparent contradiction the DMCA creates in the "Fair Use" statues of the United States copyright laws. According to the fair use clause, owners of video tapes, DVDs and other media are allowed to make a backup copy or to use small excerpts in magazine articles, reports, or other publications. If you want to know more about exactly what is defined as 'fair use' go to the excellent web site hosted by the Legal Information Institute of Cornell University<sup>1</sup>. See the link at the end of this article.

Getting your hands dirty  
Now that you have some background information I can tell you how I tackled Eldon's problem.

First, let me tell you that before you try anything with a master copy of a tape that you do it on a blank video tape in order to make sure you can actually perform the duplication. Failure to do so could result in the loss of the original content on the magnetic media. Your only recourse would be to go out and purchase another copy. In some cases this could be exceedingly expensive or even impossible.

The first step involved is to capture the content. In this particular case, I elected to use the video pass-through capabilities of my Sony TRV-340 Digital-8 camcorder. Many of the newer camcorders allow you to take a video signal from a VCR and, without recording it to tape, capture it via an IEEE 1394 FireWire interface.



Some camcorders will also provide a USB connection for this purpose. If you have the choice use the FireWire. Even if you have to go out and purchase a FireWire interface card for your computer. You will thank yourself at the end of the day.

Before you even think about attempting to do a full length 2 hour movie be sure you have about 40 GB of hard disk space available to store the captured video. One hour of DV-AVI formatted content will consume a whopping 13 GB of disk space. You will also need some additional space for doing any editing should the need arise.



If you do not have a DVD burner you will definitely need to do some editing of the video. The software I use and recommend is Pinnacle Studio<sup>2</sup> (see the link at the end of the article). It

is reasonably priced and easy to use.

If your computer has an S-video output jack you may be able to send the edited video back out to a VCR through it, but it is very likely not to work. There is a device from S-Video.com<sup>3</sup> that will reportedly allow you to connect your computer's S-video connection to a VCR, however I do not have one so I could not say for sure that it will work. These devices are used to allow you to record video from your computer to transfer PowerPoint presentations to VHS format.



Performing the video capture is a fairly straightforward process, but be forewarned, it is also a lengthy one. Unfortunately, capturing video is a 'real time' endeavor. For a two hour movie it takes two hours, plus the time it takes for you to do any disk house-keeping necessary to make enough free space and configure your video capture setup and software.

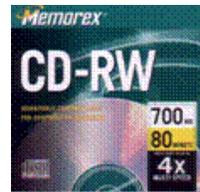
All you do is connect the composite video (yellow) and audio (red and white) jacks on the back of your VCR to your camcorder via the cable that was provided with the camcorder and then connect the FireWire or USB output from the camcorder to your computer. At this point you are at the mercy of the process. You can watch the movie or go do something else. Pinnacle Studio has a really nice feature of allowing you to specify the maximum length of time to capture video so if you now how long your content is, you can have it automatically stop capturing and not fill up your hard disk if you forget you have the process going. Be sure to capture the video into the

DV-AVI format for the best fidelity.

#### The Great Divide

If you do not have a DVD burner you can split your captured video into 2 (or more) parts in order to put them on a VCD or video disc.

The VCD format is a highly compressed format with a pixel size of 352 x 240 using MPEG1 compression and a CBR (constant bit rate) of 1150. This format allows you to get about 70 minutes of video onto a standard formatted CD-RW disc. The picture quality is about the same as that of a VHS tape. **Do not try to use a CD-R disc. It will not work in 99 percent of the stand-**



**alone DVD players on the market.** It will work if you only play your DVDs on your computer. There are only a few DVD players that can handle CD-R discs. Check out [www.vcdhelp.com](http://www.vcdhelp.com) to see what formats your stand alone DVD player can handle, if any.

If you thought the capture process was time consuming, the next step will change your mind.

Using your video editing software create the 'clip' for each disc by designating the start and end time for the segment. Then have your video editing software render the video into the proper format. If you have a DVD burner you can render the file to a DVD format, if you only have a CD-RW drive then you must use VCD. It is possible to use SVCD which has a higher resolution, but it is not compatible with many DVD players.

If your video editing software does not support VCD rendering, then you can use a program called TMPGEnc<sup>4</sup>.

Rather than splitting the movie exactly in half, I would recommend that you leave a little overlap in the sections. For example, if your movie is 120 minutes make the first half from 0 to 61 minutes and make the second half from 60 to 120 minutes. This will give you about a minute of overlap which helps you to maintain the continuity of the movie when viewing after swapping discs (this helps after a trip to the refrigerator while you wait for the DVD player to come back up to speed after inserting the second disc). It will also provide you with some necessary time if you have to output the content of the VCD to your VCR and sync up the scene in the movie when you are recording it back to tape.

Be sure you make note of the time and the last few scenes of the first segment of the movie. You will need to be able to recognize when it is time to change the discs before the end of the first disc so you can press PAUSE on the VCR to temporarily halt the recording process.

Is it soup yet?

One of the places where I made a mistake in working out this process was making the assumption that I could output the edited video through the video pass-through of my camcorder back to the VCR. Unfortunately, the MPAA has already circumvented this idea. My Sony camcorder will capture video this way but will not send it back to the VCR unless you first record it onto a Digital-8 formatted tape. Fortunately, Digital-8 tapes are really nothing more than High-8 tapes recorded in a digital format. Unfortunately, rather than being able to record two hours on a tape, Digital-8 will only record

one hour per tape.

What does this mean?

It means that if you don't burn to a VCD or DVD then you have to record your edited video onto at least 2 separate tapes. Which means double the recording time necessary and also doesn't give you much leeway in terms of creating the overlap you need.

I quickly found the video pass-through didn't work and decided to try encoding a VCD. There was only one fly in the ointment... Would Macrovision get in the way?



I encoded both segments of my video to a VCD MPEG1 format. This gave me 2 files of approximate 550 Mb in size. The next step

requires the use of a good CD burning program.

I use RecordNow Max (which used to be Click N Burn Pro) but you can also use Nero if you have it. RecordNow Max has an option if you go to the 'New' job menu to create a VCD. All you have to do is drag your file into the list and click on the record button. The program will format the VCD with the appropriate folders as expected by the DVD player.

Remember you need to use *CD-RW* blanks to record your VCD discs. And even at that, you sometimes need to use a specific brand to work in your DVD player. I have only found one DVD player that will allow you to use CD-R blanks, the Magnavox MDV450. It was carried by Best Buy and

Blockbuster for a while this year, but there are reports all over VCD Help that the unit is now scarce as hen's teeth.

The reason why most DVD players cannot read CD-R media is the frequency of the laser used in the DVD player has a different reflectivity coefficient than that of a CD-RW drive. Some DVD players have problems with CD-RW blanks that are darker than DVD blanks.

For example, my Panasonic A120 DVD player will read VCDs on Memorex CD-RW 4x media, but will not read ANY 10x media at all. You may be able to increase the voltage to the laser inside your DVD player (there is usually an adjustment for it) if you are really brave and your warranty has expired.

The secret to making the adjustment is to only turn the adjustment control 1/8 of a turn at a time. Try to read the disc. If it doesn't work, make another adjustment.

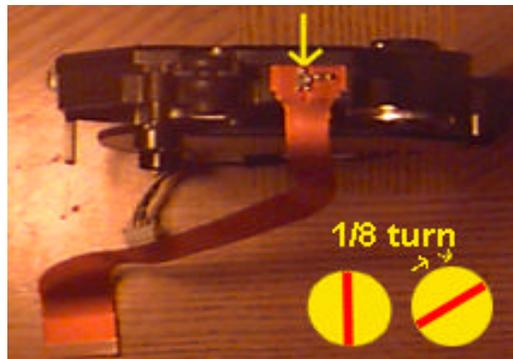
*Never go more than a half a turn total and be sure to remember where the setting was before you start doing ANY adjustments so you can set it back in the event it doesn't work at all.*

*Never set the adjustment lower than it was originally as then you will probably not be able to read any DVDs that were previously readable. You should note that adjusting the voltage higher could possibly shorten the useful life of the laser. I have not heard of any cases of this, but it is a logical con-*

clusion.

Now for the test to determine whether or not all of my efforts on Eldon's behalf were in vain. I put a blank tape into the VCR connected the DVD output to the VCR input jacks, (make sure you have your video input source on the VCR set to 'line in' otherwise you could find yourself with a tape full of Dr. Phil and Oprah. ) I started my VCR recording and then pressed the PAUSE button. Most DVD players will output some kind of text to the screen to display what function is taking place. If you don't want this to happen you may want to configure the settings for your DVD play to not use any on-screen display. I then started the

DVD player and hit PAUSE immediately and waited for the onscreen display to disappear. I then pressed PLAY on the VCR to resume recording and then pressed PLAY to start the DVD player.



When you notice you are approaching the time and the last few scenes of the first segment of the movie be ready to press the PAUSE button on the VCR to temporarily halt the recording of the movie. This will allow you to change the disc in the DVD player and view the overlapped scene. Pay careful attention to the scene that was playing before you paused the VCR. Pausing the recording at a scene change would be the best way to minimize the effects of the disc change. Try not to swap out the disc in the middle of a scene where there is obviously something going on or perhaps some important dialogue.

"Welcome to Con-Air"

As I said, the question was would Macrovi-

sion get in the way. For some reason I have not been able to figure out yet, the process of encoding the VCD seemed to remove the Macrovision signal from the source video. It could have also possibly happened in the original video capture using the video pass-through as apparently the MPAA does not require the use of Macrovision circuitry in 8 mm video equipment. Unless I could analyze the video signal with an oscilloscope it would be difficult to know when the signal was removed. I suppose I could spend the money and buy the S-Video to VCR device and try to record the raw DV-AVI from the S-Video output of my computer, but that would cost about \$90 to find out the answer. Of course I could then record PowerPoint



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presentations and create Programs In The Box for smaller users groups to use!

Eldon now has a copy of his original English version of Con-Air and I learned something interesting that I could pass along to you, the reader.

The key point for you to remember is that it is possible to keep your investment of digital media safe by making backups but please be mindful of the intellectual property issues. Eldon purchased a copy of Con-Air and I own a copy of the movie as well. Had either one of those conditions not existed, I wouldn't have offered the assistance to Eldon to help with his problem. ☺

Links:

Legal Information Institute, Cornell University  
<http://www4.law.cornell.edu/uscode/17/107.html>

Pinnacle Systems

<http://www.pinnaclesys.com>

S-Video Cables

<http://www.svideo.com/svideover1.html>

TMPGEnc

<http://www.vcdhelp.com/tmpgenc.htm>

MPAA

<http://www.mpa.org/about/>