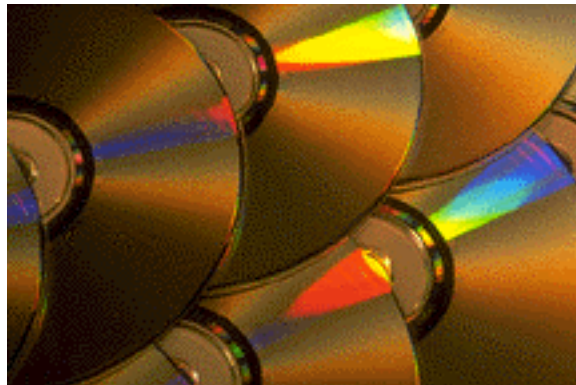


VHS to VCD/DVD Options Analysis



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December 8, 2000

EH 301

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Abstract

The fragility of analog VHS tapes led to the investigation of new technologies for storing video footage. The investigation included two options, Video Compact Disc (VCD) and Digital Versatile Disc (DVD). The evaluation criteria were cost, audio/video quality, use of existing client equipment, and the physical size of the finished product. After brief overviews of the clients' existing multimedia systems and basic VCD and DVD characteristics, an investigation of each option as compared to the given criteria was launched. In the total cost category, VCD was the best choice with a bottom-line cost of \$536.94-\$896.94 (depending on media costs). Cost for the DVD option was \$10,794.50. VCD provided the best video quality for VHS footage because VCD is geared for video with a lower data rate. DVD's higher data rate actually made the footage from VHS tapes look worse. Both options were equal for audio quality. The VCD option used more of the existing client equipment and required the addition of less hardware. The DVD option would entail the addition of complex hardware that could potentially conflict with the system. The DVD option was the best choice in the category of physical space. Its total finished size would be 945.8 cubic inches to 2837.4 cubic inches for VCD. Both options were within the given space constraints. Overall, VCD is the best choice for this project and should be implemented immediately.

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Introduction

Since the introduction of VHS in 1976, “videotaping” has been a common phrase in households worldwide (Moulding 1996). Individuals have used VHS to record everything from their child’s grade school plays to that episode of *Seinfeld* that they just don’t want to miss. Unfortunately, VHS has a poor track record when it comes to longevity, and those looking for a long term storage solution for video footage have been out of luck for nearly two decades. Recent advances in technology are poised to change this bleak outlook. Two relatively new formats, Video Compact Disc (VCD) and Digital Versatile Disc (DVD), have come on to the scene and are offering users greater longevity and unlimited playback without the degradation of quality associated with VHS tapes.

Criteria for Evaluation

The purpose of this report is to outline the characteristics, strengths, and weaknesses of each of these video formats and recommends the media type that is the best candidate for digital storage of footage from approximately 300 VHS tapes. Each of these tapes contains approximately 4 hours of video, so a total of 1200 hours is to be converted.





Each option has been evaluated according to the following criteria, ordered from most important to least important:

1. **Cost:** There is a limited cash flow, and expenses must be kept to a minimum.
2. **Video/Audio Quality:** The audio/video quality of the finished product must be comparable to that found on an analog (standard) VHS tape.
3. **Use of Existing Client Equipment:** An extensive computer and audio/video setup is already in place, and it is advantageous to use as much of the existing equipment as possible when implementing a solution to their problem. Any new hardware or software that is added must be compatible with the clients’ existing systems.
4. **Space Constraints:** There is limited space in which to store the media. Therefore, the final product recommended must take up less space than their existing VHS collection. Also, new hardware must be small, preferably portable or containable within the existing computer system.

The report begins by presenting a brief overview of the clients’ existing systems and the primary characteristics of each format. Next, the report gives a breakdown of the hardware and software needed for each option. Finally, each format is compared to the above criteria to reach a final recommendation.

Summary of Existing Systems

The existing systems for both viewing and editing video are quite extensive, and all of the hardware that would be needed to view videos in either format is already in place. The Sony DVP-S550D DVD player is capable of playing both DVD’s and VCD’s (Sony Electronics 1999). Also, a Compaq Presario 5670 PC is available for editing and writing the discs. The computer is already equipped with several key pieces of hardware that could help support either option. This hardware includes:

-  IEEE 1394 Firewire port
-  Philips 8x6x24 CD-RW drive
-  AGP graphics card port
-  Hauppauge Win TV card

The IEEE 1394 Firewire port is a high-speed interface used to connect external devices to the computer. The CD-RW drive is capable of “burning” compact discs that are then playable in any





device that supports the CD format. The AGP graphics card port allows for fast transfer of video information through the computer and, when coupled with the Hauppauge Win TV card, becomes a powerful tool for capturing and encoding video from a standard VHS tape.

VCD Overview

The Video CD format was first introduced by Philips and Sony in 1993 (Wvong 2000). Using MPEG-1 compression, this media allows 74 minutes of VHS quality video and CD quality audio to be written to a single CD (Pemberton 1993). Video CD's are written using MPEG-1 White book format, which calls for files to be written with 240 lines of video resolution and an audio quality of 16-bit, 44.1 kHz stereo (Pahwa 1995; Baard 1997). The format is successful at compressing a large quantity of data into such a small space for two reasons. First, the video and audio streams of the footage are multiplexed, or integrated, together into a single track (Baard 1997). Second, only the changes between video frames (instead of each separate frame) are recorded, making the overall size of the video component considerably smaller than uncompressed footage (Baard 1997).

Hardware and Software Needed

In order to create VCD's, users need four items:

-  A card to interface with the VCR to capture VHS footage
-  A software or hardware multiplexer to compress the footage as it is captured
-  Mastering software to write the MPEG-1 files in VCD format
-  A CD burner to write the finished CD's

The existing media system already includes a VCR interface card (Hauppauge Win TV card) and a CD burner, but multiplexing equipment and mastering software would have to be added to enable correct capture and writing of the discs. The multiplexer must support MPEG-1 White book format. The CD authoring software can then re-write the video file in a format that the VCD player can read. Table 1 lists the hardware and software needed to fulfill this option, along with the cost of each item.

Table 1
VCD Option Equipment and Pricing

Item	Price	System Req. Met?
ASUS AGP Graphics Card ^a	\$199.99	Yes
CD-R Drive	---	Already In Client System
Adaptec CD Authoring Software ^b	\$ 96.95	Yes
VCR Interface Card	---	Already in Client System

- a) Egghead.com. 2000 Sep 21. AGP-V6800 AGP 4X 256 GPU-32MB DDR RAM 2D/3D. <www.egghead.com/category/inv/00060691/03278090.htm>. Accessed 2000 Sep 27.
- b) Adaptec.com. [undated]. Easy CD Creator 4.0 Deluxe overview. <www.adaptec.com/products/overview/ecdc.html>. Accessed 2000 Oct 24.

DVD Overview

The Digital Versatile Disc video format is popular today as a medium for viewing cinema quality movies in the home. Using MPEG-2 compression, each 5.2 gigabyte disc can hold up to 4.8 hours of video footage (Feuer 1999). MPEG-2 compression calls for video to be recorded at 486 lines of resolution (Baard 1997). No standard is set for DVD sound, and the quality found on commercial DVD's ranges from low bit-rate mono to high-fidelity THX sound.

Hardware and Software Needed

In order to create VCD's, users need four items:

- ✚ A card to interface with the VCR to capture VHS footage
- ✚ An MPEG-2 capable capture card
- ✚ Mastering software to write the MPEG-2 files in DVD format
- ✚ A DVD burner to write the finished DVD's

As stated before, the existing media system already includes a VCR interface card (Hauppauge Win TV card). A DVD burner would have to be added to the computer system. QUE's DVD-RAM drive is the least expensive model currently on the market, and it interfaces with the computer via an IEEE 1394 Firewire port. As with the VCD option, a video capture card and disc authoring software would need to be added to the system. Table 2 lists the hardware and software needed to fulfill this option, along with the cost of each item.

Table 2
DVD Option Equipment and Pricing

Item	Price	System Req. Met?
ASUS AGP Graphics Card ^a	\$199.99	Yes
DVD-RAM Drive ^b	\$599.00	Yes
DVDit! Authoring Software ^c	\$499.00	Yes
VCR Interface Card	---	Already in Client System

- a) Egghead.com. 2000 Sep 21. AGP-V6800 AGP 4X 256 GPU-32MB DDR RAM 2D/3D. <www.egghead.com/category/inv/00060691/03278090.htm>. Accessed 2000 Sep 27.
- b) Beyond.com. 1998-2000. Product information for DVD RAM Firewire EXT drive for PC/MAC. <www.beyond.com/PKIN340037/prod.htm>. Accessed 2000 Sep 27.
- c) Dvdit.com. 1998-2000. Buy DVDit! software. <store.dvdit.com/Category/0,1257,3-16-1009,00.html>. Accessed 2000 Oct 24.

Comparison to Given Criteria

The four criteria provided for choosing an option were (in order from most important to least important) cost, audio/video quality, use of existing client equipment, and the space constraints of the client. The following section of this report compares each option to the given criteria and uses this comparison to choose the best overall option.

Cost

The total cost for each option comes from two different areas. The first area includes the cost of the hardware and software that would need to be purchased for each option. These costs have already been presented in Tables 1 and 2. The total cost of software and equipment for the VCD option is \$296.94, while hardware and software costs for the DVD option amount to \$1297.

The second area of cost includes the discs needed for each option. Table 3, the Media Pricing Comparison chart (on the next page), shows the cost of each disc as well as the cost per hour of video for each option.



**Table 3
Media Pricing Comparison Chart**

Media	Price/Disc	Data Size	Hours of Video	\$/hour of Video
DVD-RAM	\$37.99	5.2 GB	4.8	\$7.91
CD-R	\$0.20-\$0.50*	650 MB	1	\$0.20-\$0.50

* Market prices for CD media fluctuate with such variables as material availability and manufacturing cost. Prices do not vary a significant amount between brands. These estimates are based on normal prices found in circulars for computer stores such as Best Buy and CompUSA over a period of several months.

In order to convert 1200 hours of footage, a total of 1200 CD-R's or 250 DVD-RAM's would need to be purchased. This brings the media cost to between \$240 and \$600 for the VCD option and to \$9497.50 for the DVD option.

Therefore, the bottom line cost including hardware, software, and media for each option is:

-  \$536.94 - \$896.94 for VCD (depending on media costs)
-  \$10,794.50 for DVD

Video CD is the superior choice for the cost criteria.

Video/Audio Quality

The audio and video quality of the finished product must be at least equivalent to the original VHS recordings. VHS tapes have a standard resolution of 240 lines (VHS Video undated). No standard audio bit-rate or fidelity is set for VHS recordings, but they can include both mono and stereo sound. Table 3 presents a comparison between the sound and video qualities of VHS, VCD, and DVD.

**Table 4
Image/Sound Quality Comparison Chart**

Format	Lines of Image Resolution	Sound Quality		
		Sampling	Bit Rate	Fidelity
VHS	240	*	not set	stereo or mono**
DVD	486	*	not set	stereo or mono***
VCD	240	44.1 kHz	16 bits/s	stereo

Adapted from Baard, Mark. 1997 Jun 2. Codecs squeeze into the video market. MacWEEK 11(22): 15-16.

- * no standard set
- ** depends on VCR
- *** depends on the DVD and the player; these can include Dolby Digital and THX standards

While DVD provides an astonishing quality of video resolution and a wide range of audio options, it is geared toward video that has a higher data rate than VHS video footage. DVD's resolution is more than twice that of VHS, and the effect of interpolating two lines of digital resolution for every single line of VHS read in is the same as enlarging a very small photograph into a huge poster (Feuer 1999). The photo may look wonderful at the lower resolution, but the higher resolution will show even the smallest defects in the image quality. The MPEG-1 compression used for VCD's was actually designed for lower data rates and produces better looking pictures at those rates

than MPEG-2 compression (Epstein 1999). Both VCD and DVD are capable of handling VHS quality sound.

Taking these data into account, it is clear that VCD will produce a better visual quality (when recording VHS footage) than DVD. Both formats are equal in terms of sound, but VCD is the overall winner in the quality category.

Use of Existing Client Equipment

Both the VCD and DVD options use some of the client equipment, but the VCD option uses more of the equipment and requires the smallest amount of new hardware and software to be added. Both options require the addition of a video capture card. Fortunately, the ASUS AGP graphics card will support either option, making any future upgrades more feasible. The only other piece of equipment that the VCD option would require is the mastering software required to write the discs, while the DVD option would require both a DVD burner and DVD authoring software to be added to the existing system.

VCD is the best option for this category, as well, because it makes the best use of the existing multimedia systems and requires the addition of the fewest new components.

Space Constraints

Storage space concerns was the least important criteria for evaluation. This is also the only category in which DVD has an advantage over VCD.

VHS tapes consume 30 cubic inches of space, which translates into 9000 cubic inches of space for 300 tapes. DVD's and VCD's have a clear storage advantage over VHS because they can be filed in binder-like storage books. One of these books takes up only 472.9 cubic inches of space (the equivalent of 16 VHS tapes) and can hold 200 DVD's or VCD's (Case Logic 1999). Table 5 outlines the space that would be consumed by each option.

**Table 5
DVD/VCD Size Comparison**

Option	Number of Binders Needed	Total Size (cubic inches)
DVD	2	945.8
VCD	6	2837.4

As Table 5 shows, DVD does have the advantage in this category of criteria, but both options are within the space limit given- that of the original VHS collection.

Conclusions and Recommendations

Video CD, which had the highest ranking for 3 out of the 4 evaluation criteria, is the best option for this project. It will provide the lowest cost, the best quality, and make use of the most existing equipment. Its storage size, while somewhat larger than that of DVD, is still well under the limits set for this project. Table 6 (on the next page) outlines the overall rankings for each of the two options.

Table 6
Overall VCD/DVD Options Comparison Chart

Criteria	VCD	DVD
Lowest Cost	✗	
Best Quality for VHS material	✗	
Uses Mostly Existing Client Equipment	✗	
Smallest Storage Size		✗

I recommend that the best way to implement a long-term storage solution for video footage would be the VCD option. The Stinsons should add the ASUS AGP graphics card and the Adaptec CD authoring software to the existing system and purchase the needed CD-R media so that they can begin transferring footage immediately.

References

- Baard, Mark. 1997 Jun 2. Codecs squeeze into the video market. *MacWEEK* 11(22):15-16.
- Case Logic. 1999. Nylon CD wallet, 200 disc capacity. <http://www.casedirect.com/cgi-bin/sgin0101.exe?UID=2000111609321917&T1=03+CDW+200&GEN0=top_blend_audio.jpg&UREQA=2&FNM=00>. Accessed 2000 Nov 16.
- Epstein, Steve. 1999 Oct. Ask Dr. Digital; producing for the web: MPEG-1 or MPEG-2?. *Broadcast Engineering n.v.(n.i.):n.p.*
- Feuer, Jack. 1999 Jul 12. Disc driven. *Brandweek* 40(28):29.
- Moulding, Helge. 1996 May 8. The decline and fall of Betamax. *AFU White Paper*.
- Pahwa, Ash. 1995 Aug. Video CD architecture, CD-i, and CD writing. *CD-ROM Professional* 8(8): 106-107.
- Pemberton, Heather. 1993 Sep. Hardware manufacturers announce support for MPEG 1 video on CD-ROM. *CD-ROM Professional* 6(5): 4.
- Sony Electronics. 1999. DVP-S550D Product Specifications. <www.sel.sony.com/SEL/consumer/dvd/p5_specs.html>. Accessed 2000 Sep 27.
- VHS Video. [undated]. <www.home-cinema-guide.co.uk/VHS%20Video/vhsvideo.htm>. Accessed 2000 Oct 23.
- Wvong, Russil. [undated]. Video CD FAQ. Updated August 22, 2000. <www.geocities.com/rwvong/vcdfaq.html>. Accessed 2000 Sep 13.

Bibliography

- Adaptec.com. [undated]. Easy CD Creator 4.0 Deluxe overview.
<www.adaptec.com/products/overview/ecdc.html>. Accessed 2000 Oct 24.
- [Anonymous]. 1999 Sep 20. Zapex bringing MPEG-1 back from the dead. *Multimedia Week*. 8(36):n.p.
- Baard, Mark. 1997 Jun 2. Codecs squeeze into the video market. *MacWEEK* 11(22):15-16.
- Beyond.com. 1998-2000. Product information for DVD RAM 5.2 GB media rewritable.
<www.beyond.com/PKIN340016/prod.htm>. Accessed 2000 Sep 27.
- Beyond.com. 1998-2000. Product information for DVD RAM Firewire EXT drive for PC/MAC.
<www.beyond.com/PKIN340037/prod.htm>. Accessed 2000 Sep 27.
- Case Logic. 1999. Nylon CD wallet, 200 disc capacity. <http://www.casedirect.com/cgi-bin/sgin0101.exe?UID=2000111609321917&T1=03+CDW+200&GEN0=top_blend_audio.jpg&UREQA=2&FNM=00>. Accessed 2000 Nov 16.
- Cinax. 1999. About WinVCR. <www.winvcr.com/WinVCR/index.html>. Accessed 2000 Sep 13.
- Cinax. [undated]. WinVCR v1.2.2. <www.cinax.com/Products/winvcr_details.html>. Accessed 2000 Sep 13.
- Dvdit.com. 1998-2000. Buy DVDit! software. <store.dvdit.com/Category/0,1257,3-16-1009,00.html>. Accessed 2000 Oct 24.
- Egghead.com. 2000 Sep 21. AGP-V6800 AGP 4X 256 GPU-32MB DDR RAM 2D/3D.
<www.egghead.com/category/inv/00060691/03278090.htm>. Accessed 2000 Sep 27.
- Epstein, Steve. 1999 Oct. Ask Dr. Digital; producing for the web: MPEG-1 or MPEG-2?. *Broadcast Engineering n.v.(n.i.):n.p.*
- Feuer, Jack. 1999 Jul 12. Disc driven. *Brandweek* 40(28):29.
- Jacobi, John L.; Yegyzarian, Anush. 2000 Sep. Bye-bye VCR—new DVD-RAM format challenges videotape. *PC World* 18(9):66.
- Madison, Cathy; Nathans, Stephen. 1996 Aug. Where is the market for video CD? *CD-ROM Professional* 9(8):85-91.
- Moulding, Helge. 1996 May 8. The decline and fall of Betamax. AFU White Paper.
- Ozer, Jan. 1997 Oct 7. MPEG encoders. *PC Magazine* 16(17):204-207.
- Pahwa, Ash. 1995 Aug. Video CD architecture, CD-i, and CD writing. *CD-ROM Professional* 8(8):106-107.
- Pemberton, Heather. 1993 Sep. Hardware manufacturers announce support for MPEG 1 video on CD-ROM. *CD-ROM Professional* 6(5): 4.
- Sony Electronics. 1999. DVP-S550D Product Specifications.
<www.sel.sony.com/SEL/consumer/dvd/p5_specs.html>. Accessed 2000 Sep 27.

Wvong, Russil. [undated]. Video CD FAQ. Updated August 22, 2000.
<www.geocities.com/rwvong/vcdfaq.html>. Accessed 2000 Sep 13.

VHS Video. [undated]. <www.home-cinema-guide.co.uk/VHS%20Video/vhsvideo.htm>.
Accessed 2000 Oct 23.