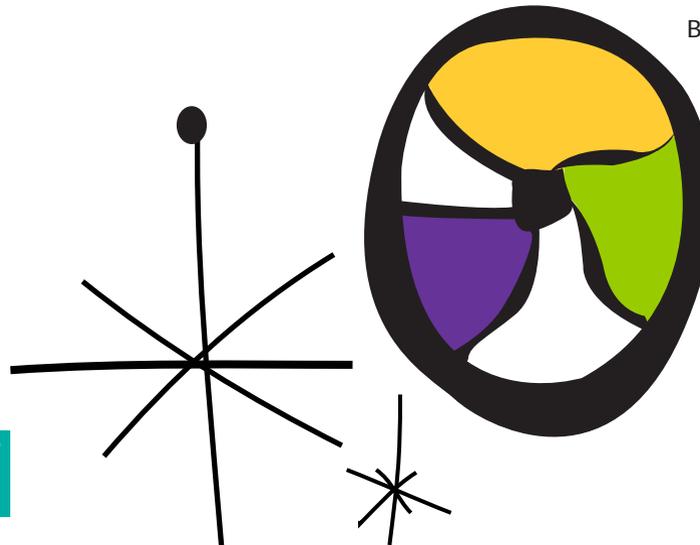
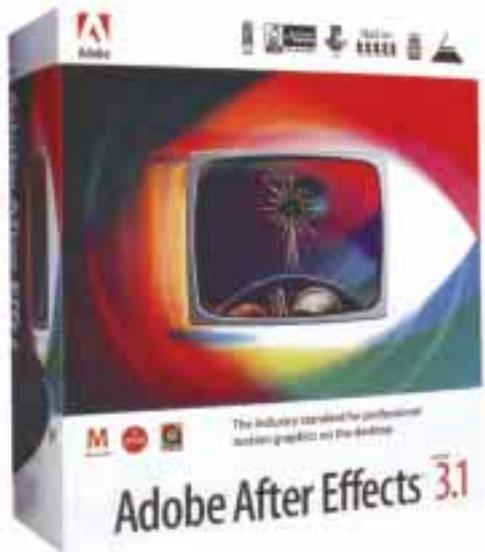


By Art Walker 1999



This article discusses the new  
DV (Digital Video) format  
and outlines  
how it can be used to  
make music videos  
for broadcast, multimedia  
and the web, at home.

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After FX. Adobe's video compositing program for animating still images and manipulating video.

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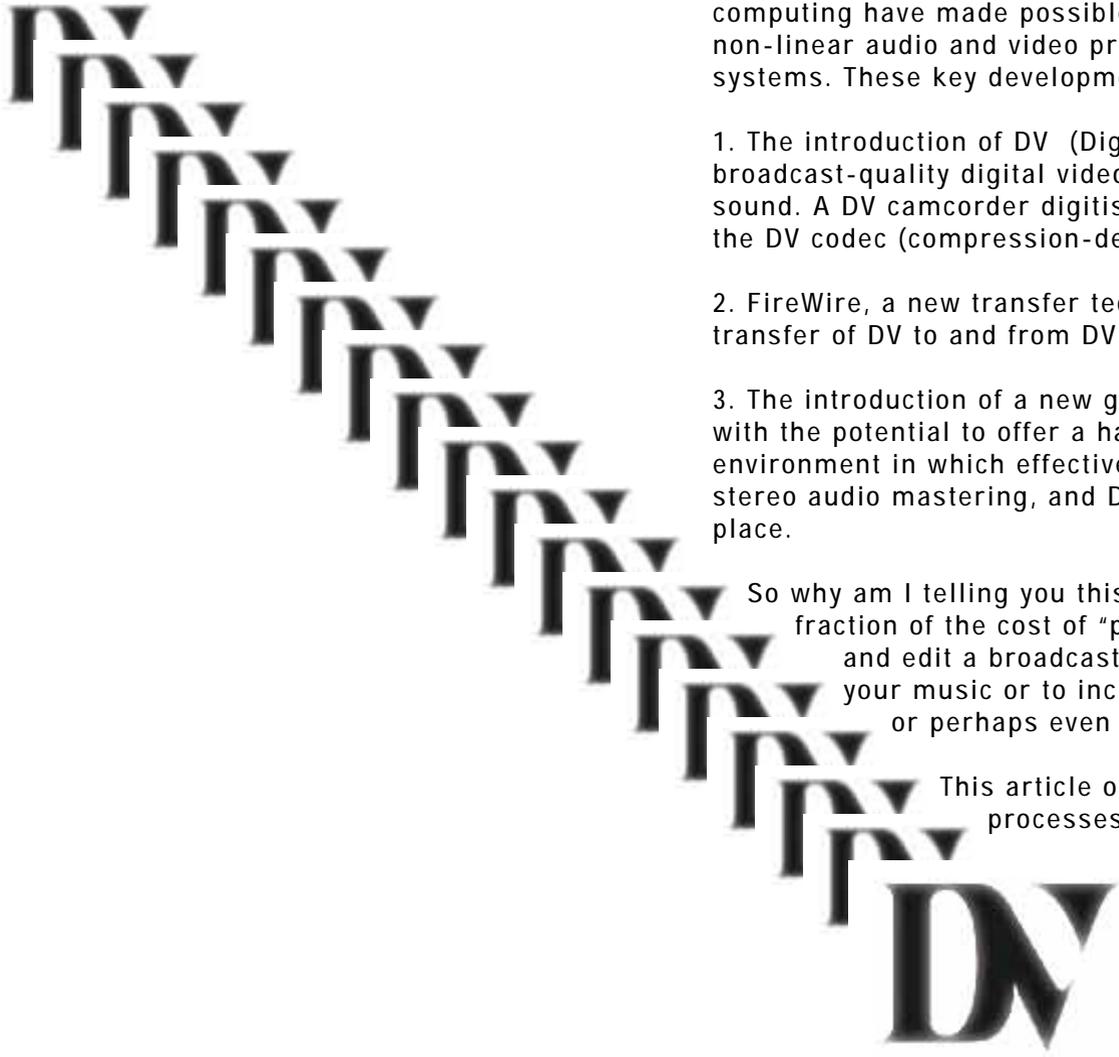
**Introduction** Before digital systems became widely available, broadcast-quality music-video production was carried out by professionals using hugely expensive analogue sound and picture technologies. These technologies employed high quality components designed to minimise the side effects of analogue signal processing, such as degradation and distortion of the signals passing through them.

Digital systems offer four principle advantages;

1. Providing the original analogue recorded sound and filmed pictures can be converted into digital data streams successfully, signal integrity can be ensured throughout the production process.
2. Sound and picture non-linear editing and effects applications provide better and more flexible creative tools than their analogue counterparts.
3. Increased speed of production.
4. Lower overall cost.

Initially, the cost of bespoke digital hardware and software based systems was beyond the reach of the home user. However, in recent years technological developments in





computing have made possible affordable broadcast-quality non-linear audio and video production using domestic systems. These key developments are:

1. The introduction of DV (Digital Video), a domestic broadcast-quality digital video technology with CD quality sound. A DV camcorder digitises the video in-camera using the DV codec (compression-decompression software).
2. FireWire, a new transfer technology allowing trouble-free transfer of DV to and from DV and computer hardware.
3. The introduction of a new generation of home computers with the potential to offer a hardware and software environment in which effective multitrack audio recording, stereo audio mastering, and DV post production can take place.

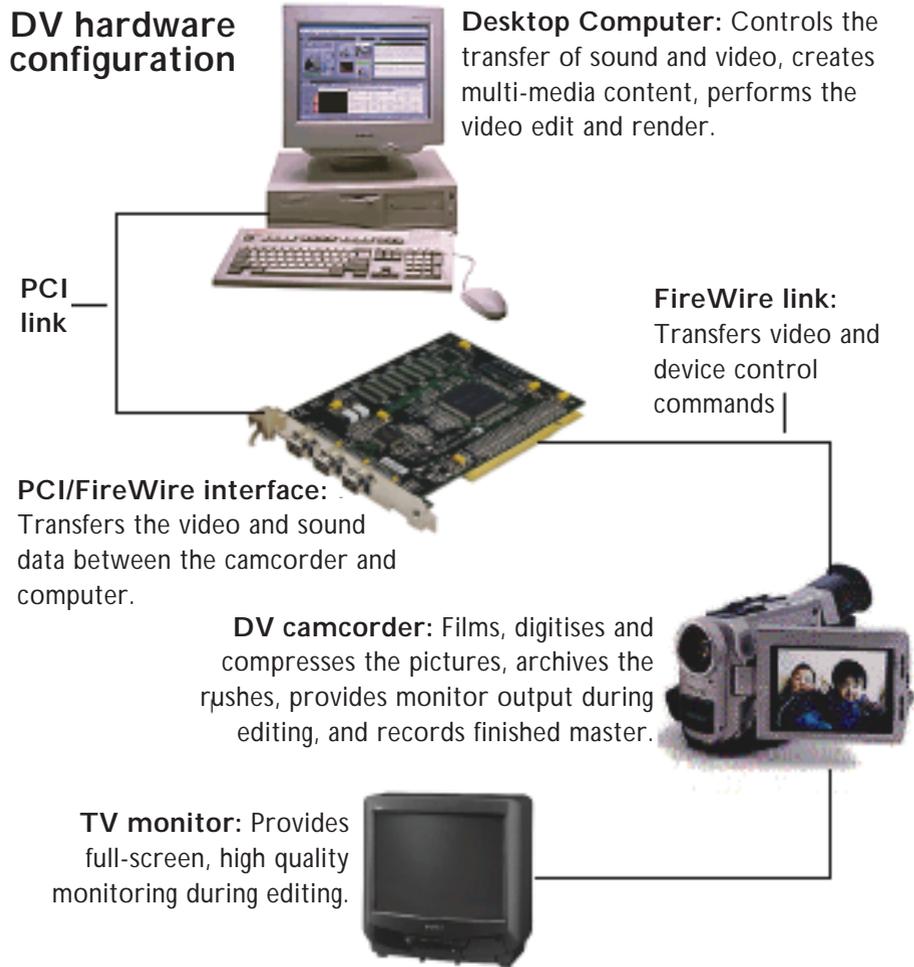
So why am I telling you this? Well, it means that for a fraction of the cost of "professional" gear you can film and edit a broadcast quality music video to promote your music or to include in a multimedia production or perhaps even on your web site.

This article outlines all the hardware and the processes necessary to make a music video at home.

## An Overview of the process

Here is an overview of the DV music-video production process.

### DV hardware configuration



1. Prepare the finished stereo music mix (16-bit, 44.1kHz) of the track you are going to use and store it on your hard drive.
2. Make some animation or other multimedia content to include in the video.
3. Film yourself jumping about, or cavorting with deeply attractive members of the opposite sex how normally wouldn't give you the time of day, or whatever, using a DV camcorder.
4. With a FireWire interface card installed in your computer, connect your camcorder, and using a suitable DV application, control the camcorder from the desktop to select and then transfer the clips you want to use to the computers hard drive.
5. Using video editing software, import the music track, multimedia content and the DV clips and edit them together adding FX and transitions etc.
6. Render the finished video to your hard drive.
7. Transfer the finished video back to your Camcorder for archiving or duplication.
8. Create other versions suitable for a CD-ROM or your web site.

**DV format & camcorders** Clearly a broadcast-quality video depends primarily on the quality of the filmed images. DV picture quality is superb. Like its analogue counterparts, a DV camcorder records its pictures onto a magnetic tape. The recording process involves digitising the pictures and then compressing the data using the DV codec. However, unlike its analogue counterparts once encoded the quality of the pictures remains unaltered throughout the various production processes.



Pictures can be transferred, processed and edited entirely within the digital domain by a wide range of hardware and software components and then output in a number of different formats suitable for broadcast, DC-ROM and the web. Here are some DV facts:

Frame size of 720 x 480 pixels.

Frame rate of 30fps.

A single minute of DV requires 222MB of disk storage.

DV boasts 16-bit 44.1kHz CD quality audio.

DV requires a transfer rate of 3.6MBps.

A 30 minute  
Mini DV tape



A DV camcorder can perform five principal tasks during production.

1. Film and digitise the video pictures and compress them in-camera using the DV codec.
2. Record sound.
3. Archive the rushes.
4. Provide full-screen high quality monitoring. During the edit DV data can be sent back to the camcorder which utilises its own circuitry to output an analogue signal to a TV monitor.
5. Record the finished video master.

There are several camcorder formats each using a different cassette tape type and offering different in-camera features but picture quality is consistent between them.

1. Mini DV uses cassettes smaller than DATs of between 30 and 60 minutes costing around £20. Mini DV camcorders start at around £700.
2. DV "standard" uses cassettes slightly larger than Hi8 with running times up to 270 minutes. A 2 hour tape may cost around £50. These camcorders cost between £1200 and £2500.
3. DV Pro uses a more robust 8mm type tape format.

For in-depth information on tape formats visit <http://www.adaptec.com/technology/standards/1394formats.html>

Before you shout hurrah! and rush out to buy a camcorder bear in mind the following issues and check before you buy.

1. nEUtered DV camcorders: For political reasons some DV

camcorders have been FireWire-in disabled effectively preventing them receiving and recording a finished video master during outputting. With FireWire-in disabled you will be forced to output to a DV deck or via a professional quality analogue capture card, the addition of which will add substantially to the cost of a system.

2. Head life issues: There has recently arisen speculation regarding the head life of DV camcorders.

## FireWire

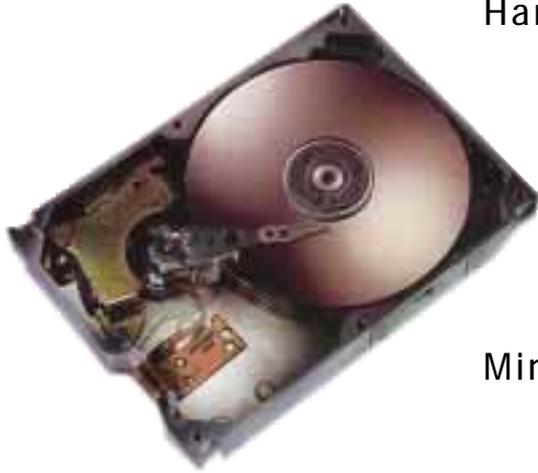
Because DV is digitised and compressed in-camera it need only be "transferred" to a computer hard drive. No conventional analogue capture processes, with its attendant problems of dropped-frames and signal quality loss, is necessary.

Radius's MotoDV PCI FireWire interface card.



Designed by Apple, FireWire (also known as IEEE 1394) is a high speed transfer interface which has been adopted by the makers of DV hardware. DV camcorders have a FireWire socket. A DV connection uses a single cable and can transfer data both ways. DV requires a transfer rate of 3.6MBps, well within FireWire's current 12MBps and projected eventual 800MBps.

Although Apple have recently announced plans to include the FireWire interface as standard on future G3 Macs, at present you will need to buy a separate PCI card for both Macs and PCs. The leading card for DV applications seems to be Radius's MotoDV (£399, [www.radius.com](http://www.radius.com)) which includes utilities for controlling a camcorder from the desktop (called Device Control) in order to automate the selection of clips and transfer video to and from a camcorder. There are others, try Adaptec ([www.adaptec.com](http://www.adaptec.com)) and Pinnacle ([www.pinnaclesys.com](http://www.pinnaclesys.com)).



**Hard drives** One minute of DV will require 222MB of disk space so depending on how long your video is going to be, and the number of clips you need to experiment with, you will require a hard drive of between 4 and 9GB. It should revolve at no less than 10,100rpm and have an access time no greater than 10ms, 7.5ms preferred.

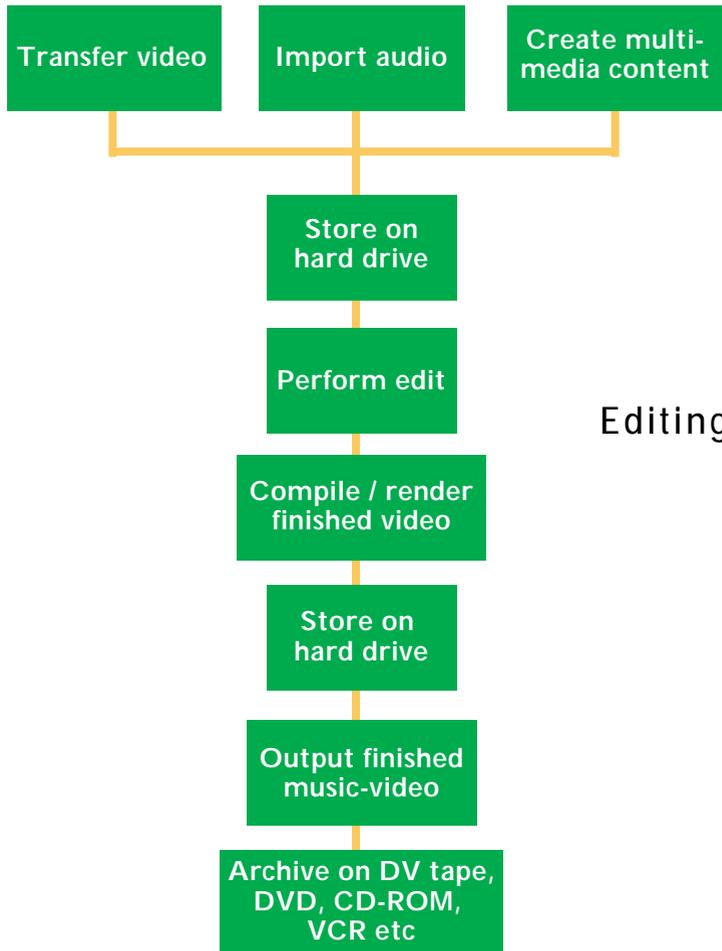
Until recently only expensive AV/SCSI drives were capable of the performance necessary for DV work. But today it may be possible to use the cheaper E-IDE or DMA type drives.

**Minimum system requirements** If everything so far sounds easy it's worth remembering that processing video data will impose huge demands on a desktop computer system. Once your DV clips are successfully transferred editing them will push your system to its limits.

You will need a powerful system if you want a smooth editing experience. For Mac users this means a fast G3, for PC users a fast Pentium II. You will also need an up to date system optimised for video work, plenty of RAM and some decent editing applications.

**Rendering** Your systems performance will become most apparent when rendering. During editing you will need to view and listen to the results of editing decisions. Computers take a finite amount of time to process data. When editing a word processing document these processes seem to occur instantaneously or in real-time. Applying special effect and transition processes to raw digital video signals, however, requires enormous computational power and necessitates a period of processing or "rendering".

## Overview of video editing process



"If you have a two second transition, that's 50 frames where there isn't just straight video - the computer has to work out what each frame looks like ..." Alistair Banks

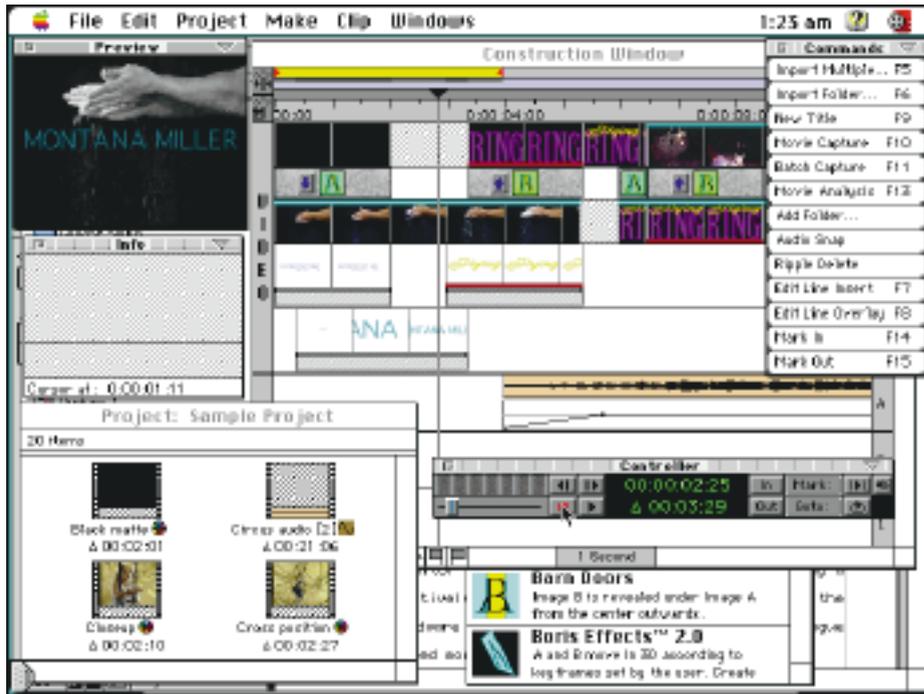
The faster your system the shorter the wait. In practise editing applications reduce the waiting time during editing by offering low resolution "preview" renders and don't execute the full quality "compile" render until the edit is complete.

The important thing to know is that just because a preview is smaller and of lower quality, and rendering and compiling routines take longer, it doesn't necessarily mean a system with a less powerful CPU can't edit DV, you'll just have to wait longer.

**Editing the video** Although often referred to as the 'video edit' this is actually the process of assembling the video, audio (including music, FX and dialogue), and multimedia elements into the finished music-video.

Most editing applications allow a user to place sound and picture elements on a time-line and then apply transitions and effects to them. During compiling the data is copied and the effects and transitions are rendered as a new file on the hard drive.

Space precludes an in-depth discussion of the post production process but suffice to say that current home computers are able to accomplish all the essential tasks to broadcast-quality standards by employing new and "affordable" applications. These applications can be used to create a variety of visual content which may be intergrated



Adobe Premiere video editing software screenshot

with the video pictures and music. Video editing applications now offer sophisticated effects and manipulation of this content. They include:

- Adobe Premiere (video editing).
- Final Effects (Plug in video editing effects).
- Adobe After Effects (video effects including motion tracking, transitions, filters, and animation).
- Adobe Photoshop (still photograph manipulation).
- Infini-D (3D animation).
- Freehand (illustration).
- QuickTime.

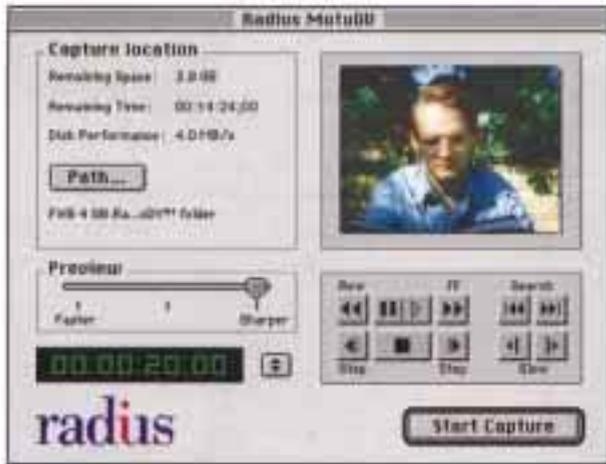
Whatever editing application you choose ensure it is able to output your finished edit in a variety of compressed and uncompressed formats suitable for the three principal delivery environments, broadcast, CD-ROM, and the web.

**In conclusion** The time is coming when music lovers will no longer be satisfied with simple audio CDs. As music makers we will be expected to deliver a high quality audio-visual experience. This means integrating graphical, animation and video content with our music. Elsewhere at planetoftunes.com you will find articles that address some of these issues. The LINKS & DOWNLOADS page lists useful links if you wish to take your investigation of DV further. You might also consider buying Computer Video magazine, it has been an invaluable source for my research.

As the cost/quality gulf between home and professional technologies narrows, professionals will find they are paying an ever increasing cost premium for an ever decreasing technological advantage. For the majority of home music-video makers this is good news. Our creative efforts will be judged not by our technological but by our creative qualities.

Have fun!

## GLOSSARY



Radius's MotoDV device control utility.

**AIFF** Audio Interchange File Format, the Mac OS audio file format.

**ActiveMovie** Microsoft's video and audio synchronisation and file format system resource.

**Artifacts** Distortion of the signal usually caused by high compression settings during capture.

**AVI** Audio Video Interleaved. PC DV 'wrapped' file format.

**AV Hard Drive** Audio Visual Hard Drive. A storage device that does not perform automatic thermal recalibration routines during read/write actions therefore not interrupting data transfer. Important for non-linear audio and video systems. See also Hard Disk.

**Capture Card** Interface board that connects a computer and a VTR or camcorder and digitises incoming video to allow desktop editing.

**Chrominance** The video signals colour component.

**Codec** Video data Compressor/Decompressor process. May be software and/or hardware implemented.

**Compiling** The process whereby the finished music-video is automatically assembled by the editing application according to the EDL.

**Component video** Highest quality video signal in which luminance and chrominance are divided into three separate signals for transfer and processing.

**Composite Video** Lower quality video signal in which luminance and chrominance components are combined together in one cable.

**Compression** Process whereby data quantity is reduced.

**CPU** Central Processing Unit. Main computer chip where most of the computer processing takes place (eg Motorola PowerPC, Intel Pentium). May also refer to the computer hardware box in which it is housed along with the disk drives, interfaces and power supply.

**DAC** Digital to analogue converter.

**Data Rate** Speed of data transfer.

**Device control** DV camcorder remote transport control protocol.

**Digital BetaCam** Sony broadcast quality digital video format.

**Digital-S** JVC broadcast quality digital video format.

**DSP** Digital Signal Processor. Co-processor designed to take some of the workload from the CPU. Often dedicated to audio and image manipulation.

**DTR** Digital Tape (video) Recorders also know as decks.

**DV** Digital video. Consumer digital video format.

**DVC** Digital video (camera). Now known as DV.

**DVCpro** Panasonic broadcast quality digital video format.

**DVD** Digital Versatile Disc. The next generation optical disc format.

**DV Deck** Digital video VCR.

**DVE** Digital video effects.

**EDL** Edit Decision List. Computer created record of video edit points and transitions.

**FireWire** Apple's cross platform digital interconnect

technology employed by DV devices.

**Full-duplex** The ability of a computers audio interface to monitor audio through the system as it's being recorded.

**GUI** Graphical User Interface.

**Hard Disk** A high capacity digital storage device which may be internal or external to a computer system, and be fixed or use removable cartridges.

**Latency** The audible delay introduced by a PCI audio cards inability to process digital audio quickly enough during record monitoring.

**Lossy** Data compression system in which some data is discarded.

**M-JPEG** Motion Joint Photographic Expert Group video compression standard used in home and semi-professional video systems. Has a data rate of 4-5Mb per second Is saved as either AVI or QuickTime files.

**MPEG** The Motion Picture Expert Groups video compression standard commonly used by professional broadcast systems. Records critical frames and the differences that occur between them.

**NTSC** National Television Standards Committee TV system used in Japan and USA.

**OS** Operating system. The software which organises and controls the running of applications and the user interface. eg Mac OS, Windows.

**PCI** Personal Computer Interface. Low cost interfacing protocol.

**Plug-ins** Software programs which integrate with an audio or video application to offer additional processing tools.

**QuickTime** Apple's video and audio synchronisation and file format system resource.

**Rendering** The process whereby a video clip has effects and transitions etc applied to it or a preview made form it.

**SCSI** Small Computer Systems Interface. High performance computer interconnect protocol.

**SDII** Sound Designer II audio file format.

**SPDIF** Sony Phillips Digital Interface.

**S-VHS** High quality version of VHS.

**VCR** Video Cassette Recorder. Generic term for consumer decks.

**VHS** Video Home System. Consumer analogue video format.

**VTR** Video Tape Recorder. Generic term for professional decks.

**WAV** PC audio file format.