



## Technofile: digital video cameras

With analogue camcorders being slowly ousted by inexpensive digital video cameras, it's not only the professional moviemaker that can create high-quality, impressive footage. Jason Whittaker explains the jargon as well as outlining essential specs you should look for

Until the 1980s, creating movies on a small scale was a complex task. While there was something of a boom in 8mm moviemaking during the 1970s, anything more complicated than inserting a spool into a camera and turning the handle was expensive and required considerable expertise.

The advent of video soon brought with it another popular invention: the camcorder. Video cassettes were smaller and easier to handle than film, but still bulky when moved from a VCR to a camera. The result was that a number of formats soon appeared, the majority of them using smaller tapes than the VHS standard. We'll run through these shortly.

Betacam, mainly used by professionals or keen amateurs, concentrated on image quality while other formats such as Hi-8 and S-VHS-C were used by those looking for portability. Early formats were analogue and, with the exception of Betacam, low

quality. Even the relatively sophisticated Betacam was used mainly for television rather than high-quality film. Copying from tape to tape – an essential process for editing your footage – meant that quality deteriorated even further.

With the introduction of DV (digital video), movie information could be stored on tape as bits, ones and zeroes. This meant that footage did not automatically deteriorate when transferred between the camera and editing suite.

### DV and its Mini-Me

In recent years an increasing number of film studios have turned to DV to create their blockbusters – for instance, the new *Star Wars* episodes – while the digital format MiniDV has become a popular choice for the average user. Part of the reason for this is due to tumbling prices.

Until the end of the 1990s you could have expected to pay £1,000 or more for

an entry-level camera. Nowadays prices start at £500, while between two and four times that amount buys you a device, such as the Canon XL1S, capable of capturing broadcast-quality footage.

As a quick trip to Argos will demonstrate, there are still plenty of analogue camcorders available at bargain prices. However, unless you intend to capture your movies in a single take then you will need to transfer your footage to a PC for editing – and this is where a DV camera comes in.

While most MiniDV cameras (and an increasing number of PCs) have FireWire ports, to capture analogue video you will need a dedicated card which itself will absorb the price difference between a DV and analogue camera. Transferring analogue video is also more cumbersome and typically results in a loss of quality. What, then, are the storage formats available for camcorders?

## Is your PC up to the job?

**U**ntil very recently, video editing with a typical PC was a frustrating task. Hardware struggled to cope with the huge amounts of data that's shifted around when cutting together scenes and adding effects.

But with the latest processors, hard drives and fast, cheap memory, even the average computer is more than capable of handling digital video. Below is a checklist of requirements for a suitable video-editing machine.



- **Processor** Any processor above 1GHz will be able to handle most tasks. If you're going to be working with a lot of transitions and effects that you wish to handle in real time, you'll need to look at the latest Pentium processors. Not only can these chips run at speeds of 3GHz, they also include SSE2 (streaming Simd extensions), a special batch of instructions designed to boost multimedia applications and produce high-quality rendered images.

- **Memory** For most tasks 256MB to 512MB is adequate, but some programs that preview effects in memory – for example, Adobe After Effects – will benefit from higher amounts.
- **Hard drive** You can never have enough hard disk space. To edit an hour's worth of video at DV (digital video) quality, you will need about 40GB. This is when the value of the latest 200GB drives suddenly becomes clear.

The hard drive is also the main bottleneck when editing. Fast IDE drives

are acceptable, but if you are considering video editing professionally then look for the latest (and more expensive) SCSI drives.

- **Video card** Again, most modern video cards are sufficient for occasional work, but dedicated graphics cards such as the Matrox RT.X100 will speed up real-time video editing.

- **Connectivity** Some cameras are appearing with USB 2.0, but for ease of use make sure you install a FireWire port.

- **Betacam/DigiBeta/Betacam SX** Betacam was developed by Sony and still remains the format of choice for many professionals. It can record luminance (brightness information) and chrominance (colour information) as separate tracks and offers better quality than S-VHS. Digital Betacam, or DigiBeta, captures video using a 2:1 compression rate and Betacam SX employs Mpeg-2 compression (the same type used by DVDs) to compress video at a rate of 10:1. As such, Betacam SX still forms the benchmark against which other standards are compared.

- **Hi-8** Another video format from Sony, Hi-8 uses 8mm analogue tape to provide a cheap alternative to S-VHS-C. The quality of Hi-8 is comparable to S-VHS, though nowhere near that of Betacam.

- **S-VHS/S-VHS-C** Although not a digital format, Super-VHS (along with its compact version S-VHS-C) forms the basis for high-quality camcorders. It was essentially designed as an alternative for the 8mm tapes that were common when VHS was devised. S-VHS-C cameras allow footage to be transferred to higher quality formats, but PC editing still has to translate video from analogue to digital with potential loss of quality.

- **Digital-8** This consumer format, again developed by Sony as an improvement on Hi-8, stores digital video and audio on 8mm tape. Digital-8 camcorders were fairly common a few years ago, providing the cheapest way to capture digital video, but as their quality is inferior to MiniDV they have become much less popular.

- **DV** As an abbreviation of digital video, DV covers a wide range of formats (including MiniDV, Sony's DVCAM and Panasonic's DVCPRO or PRO50), although all share the same

compression rate of 5:1. Until recently, the higher compression rates of DVD have proved too difficult to achieve in real time, so DV has become a de facto standard for broadcast-quality footage and even film.

- **MiniDV** This format was introduced as the standard for single users or small firms that wanted broadcast-quality video. However, the price of MiniDV cameras has dropped so much that it is fast becoming the first choice for consumers. Unless you purchase very expensive cameras to produce HDTV (high-definition TV), even moderately expensive mid-range camcorders tend to use MiniDV.



Some cameras, such as the DZ-MV200E from Hitachi, are now using rewritable DVD for storage

## Codecs: the lowdown

**W**hile uncompressed video offers the best quality, even uncompressed DV (digital video) tape uses a codec – a hardware or software compressor/decompressor which, as the name suggests, squashes down your audio-video files and then decompresses them when they are played.

Popular codecs include Cinepak, Divx and Mpeg. Codecs work differently: some compress every frame in a video, while others discard information that does not change between certain key frames. Depending on the data in your footage – whether it is fast moving or static, uses certain colours and so on – different codecs will produce better footage and you will need to experiment.

Some codecs have been standardised as certain file formats such as Mpeg, the Real format and the new Windows Media Video. Again, these offer different trade-offs between quality and file size. You will need to experiment to find which one works best depending on how you plan to distribute your files.



- **DVD-RAM/DVD-R** In recent months manufacturers such as Sony and Hitachi have begun to provide cameras that record directly to rewritable DVDs. The main advantage of such devices is the ease of use in transferring video to the PC for editing, but at the moment the media for such cameras remains more expensive than MiniDV tape. Samsung has also announced a camcorder, the ITCam-7, that stores video directly on to a hard drive.

### Optical aid

Important as it is for capturing high-quality video, cameras are not only distinguished by their storage formats. One of the

reasons why a camera such as the Canon XL1S costs nearly four times as much as the Panasonic NV-DS29B is because of its optics, which in a digital camera includes the lens and the CCD (charge-coupled device) that converts light into a digital signal.

As with still image cameras, lens quality can vary enormously from model to model with the most trusted names, including the Carl Zeiss lenses employed by Sony, Leica (used on some Panasonic models) and Canon.

Something else to watch for when buying a camera is how much manual control it offers: full control over the

lens can be overwhelming for the novice user, who will appreciate the point-and-click functionality of a fully automatic model. Nonetheless, for many visual effects (such as depth of field) you need to be able to adjust the focus manually.

Most, if not all, modern camcorders offer image stabilisation, removing the shakes from your footage. Budget cameras, however, rely on electronic image stabilisation to adjust the picture after it has been converted into a digital signal, while the more expensive models provide optical stabilisation built into the lens. Not even the best stabilisation, however, can compensate for a good tripod.

### Get closer

It is also worth bearing in mind the difference between optical and electronic zooming when buying a camera. Even the cheapest camera tends to provide a 10x lens capable of zooming in closer to a subject, though the more expensive mid-range cameras rarely go above 20x. This may appear surprising at first, but the reason is that no single lens is capable of capturing detail at all focal lengths. As such, a professional user will expect to change lenses for undertaking different tasks.

With regard to digital zooms, it is not uncommon to see cameras advertised with 200x, 300x or even 500x zooming capacity – nearly all of it worthless. Digital zooming effectively works by cropping your image then expanding what is left to fill the frame – this is something best done during editing.

## Features comparison: software

	Program	Supplier telephone	Website	Price (ex VAT)	Timeline editing	DVD authoring	Plug-in effects	Titling editor	Output formats
entry-level	Pinnacle Studio DV 8.0	01895 424 210	www.pinnaclesys.com	£60	yes	yes	no	yes	DV, Mpeg-1/2, RM, WMV, AVI
	Roxio VideoWave 5.0	0870 429 3100	www.roxio.co.uk	£65	no	yes	no	yes	DV, Mpeg-1/2, RM, WMV, AVI
	Ulead VideoStudio 7.0	01327 844 880	www.ulead.co.uk	£42	yes	yes	no	yes	DV, Mpeg-1/2, RM, WMV, AVI, QuickTime
pro & mid-range	Adobe Premier 6.5	020 8606 4001	www.adobe.co.uk	£445	yes	yes	yes	yes	DV, Mpeg-1/2, RM, AVI, QuickTime
	Pinnacle Edition DV	01895 424 210	www.pinnaclesys.com	£424	yes	yes	yes	yes	DV, Mpeg-2, RM, WMV, AVI, QuickTime
	Ulead MediaStudio Pro 6.5	01327 844 880	www.ulead.co.uk	£300	yes	yes	yes	yes	DV, Mpeg-1/2, RM, AVI, QuickTime





← High-end DV cameras, such as Canon's XL1S, are now used to produce broadcast-quality footage

As well as the lens, a camera's optical capability is affected by its CCDs – both in terms of their size and number. One of the main differences between entry-level and professional cameras is that the former typically have one CCD, while the latter include three to capture red, green and blue light separately.

In terms of size, as beginner and high-end camcorders typically capture video at 720x576 resolutions (the resolution for PAL video), they do not need particularly large CCDs. As such, even the most expensive camcorders will not include CCDs larger than 1.5Mp (megapixels) with the majority coming in at around 0.8Mp.

The physical size of the CCD – typically between a sixth and a third of an inch – can, however, affect image quality. The best CCDs also use progressive scanning,

so rather than displaying alternate lines (as on a television screen), they display an image line by line in order to produce a more stable picture. Only expensive professional cameras offer progressive scanning for anything other than stills.

## Be connected

As we have mentioned already, unless you wish to capture your movies in one take you will need to transfer footage to a PC for editing. At present FireWire, or IEEE 1394 is best for this, although alternatives are beginning to appear over the horizon.

FireWire was a standard developed by Apple to allow electronic devices to communicate with each other. As well as offering a speedy transfer rate of up to 400Mbps (megabits per second),

FireWire also keeps track of any video frames that are dropped during transfer so you can recapture lost footage.

If you have bought a computer in the past year then you may very well have a FireWire port (particularly if your PC came with an Audigy sound card), while digital video cameras tend to include them as standard.

One thing to look out for, however, is whether a particular model has DV-in as well as DV-out. If the former is the case then you can transfer your edited movie back to tape for storage.

Alternatives to FireWire include different forms of rewritable DVD and, increasingly, USB 2.0. As well as being slightly faster than the current incarnation of FireWire, USB 2.0 is likely to be fitted as standard on all new PCs.

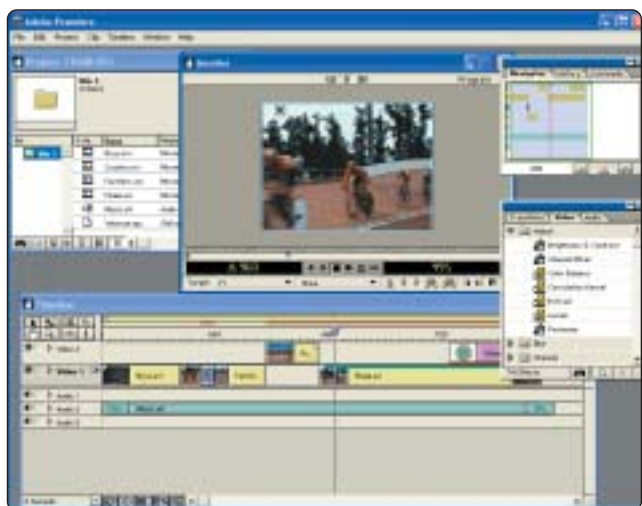
You will also want to view your footage as you capture it. All camcorders include a viewfinder, but those at the very bottom of the range may economise by leaving out an LCD panel. If you have the chance to view before buying, check the panel for brightness, particularly in broad daylight. Also test the dimensions – a 2.5in screen represents the best compromise between size and cost.

Some cameras offer extras such as flash memory support with SmartMedia and (in Sony's case) Memory Stick being the most popular formats. These allow you to transfer still images, but if you can connect via FireWire or USB you really won't need to use flash memory.

It's more important to check what cables are provided. You will almost certainly have to invest in a FireWire cable, but also check whether you will need cables for USB or a Scart adapter – useful if you wish to transfer your movie to VHS for distribution.

One of the best things about camcorders is their portability, so you'll need to get a decent case to transport yours around from shoot to shoot. And if you're planning to be on the move a lot, then be prepared and buy extra batteries.

Finally, using a tripod can make a real difference in turning an amateur video into a more professional effort. Even the built-in stabilisation features found in more expensive models cannot compensate. The tripod is probably the most important camera accessory you will buy.



← Adobe Premiere is an advanced and highly accurate editing package for dedicated users

## Take control

Many camcorders come with basic video-editing software, while Windows XP and Me include a good introduction in the form of Movie Maker. There are, however, several applications available that will help you get far more from your movies.

At the low end of the market, expect to pay somewhere between £50 and £100. Beginner applications, such as Roxio VideoWave 5.0 (formerly MGI VideoWave) and Ulead VideoStudio 7.0, provide plenty of help and tend to take a storyboard approach. Such programs generally break the editing process down into three clear steps: video capture, editing and creating your final output.

If your needs are basic and infrequent then VideoWave or VideoStudio will do a good job of creating a movie quickly and easily. At this level, however, Pinnacle Studio DV 8.0 is a much better piece of software. Like its competitors it offers a simple storyboard approach to video editing, but can also toggle between this and a more complex timeline view that offers more control.

At the mid-range end of the market there are three applications we recommend. Adobe Premiere, now available in version 6.5, is the market leader – and justifiably so. Although Premiere lagged behind the competition in offering DVD-authoring, it offers precise control over every part of editing. Ulead's MediaStudio Pro 6.5 is better value than

➤ The difference between a professional and entry-level DV camera is not only the number of extra features included, but whether the camera uses one or three CCDs



Premiere, but it is in need of an update – particularly for Windows XP users.

Finally, there's Pinnacle Edition DV. This also provides a large number of useful tools at a reasonable price (it comes bundled with a FireWire card), but the interface is harder to work with and less customisable than either Premiere or MediaStudio Pro.

## The right decision

While cheaper analogue equipment is still available, buying a Hi-8 or S-VHS-C camcorder is a false economy. Not only does DV (and even MiniDV) offer higher quality video, but it's also easier to use. Connecting an analogue camera to a PC is

more a case of plug and pray. And even when it works you may discover frames are dropped because your hardware cannot cope with digitising video. FireWire, in particular, offers a convenient and troublefree way to link to a digital camera and control it from your PC.

Future developments, such as rewritable DVD and cameras equipped with onboard hard drives, may simplify the process even further. However, a MiniDV camera with FireWire connectivity offers the best compromise in terms of price, ease of use and performance. ■



Unsure of a technical term? Find out exactly what it means in our searchable Glossary which is on the cover disc

## Features comparison: hardware

	Model	Supplier telephone	Website	Price (ex VAT)	Format	CCDs/size	Optical/digital zoom	FireWire in/out	Max aperture	Focal distance
entry-level	Hitachi DZ-MV200E	01628 643 000	www.hitachi-consumer-eu.com	£680	8cm DVD-RAM	1 x 1/4in	12x/240x	n/a	2.7	4.1-49.2mm
	JVC GR-DVL767EK	0870 330 5000	www.jvc.co.uk	£680	Mini DV	1 x 1/3.8in	10x/500x	yes/yes	1.8	3.8-38mm
	Panasonic NV-DS29B	08705 357 357	www.panasonic.co.uk	£499	Mini DV	1 x 1/4in	10x/500x	no/yes	1.8	3.6-36mm
	Samsung VP-D77i	0800 521 652	www.samsungelectronics.com	£495	Mini DV	1 x 1/4in	22x/500x	yes/yes	1.6	3.6-79.2mm
	Sony DCR-TRV18E	08705 111 999	www.sony.co.uk	£454	Mini DV	1 x 1/4in	10x/120x	no/yes	1.7	3.3-33mm
pro & mid-range	Canon XL1S	08705 143 723	www.canon.co.uk	£2,000	Mini DV	3 x 1/3in	16x/32x	yes/yes	2.6	5.5-88mm
	Canon XM2	08705 143 723	www.canon.co.uk	£1,878	Mini DV	3 x 1/4in	20x/100x	yes/yes	2.9	4.2-84mm
	Panasonic NV-MX500	08705 357 357	www.panasonic.co.uk	£1,106	Mini DV	3 x 1/6in	10x/100x	yes/yes	1.6	2.85-28.5mm
	Sony DCR-TRV950E	08705 111 999	www.sony.co.uk	£1,276	Mini DV	3 x 1/4.7in	12x/150x	yes/yes	1.6	3.6-43.2mm