Shooting Stars

A Digital Video Revolution

By Bob Doyle

Sony DSR-130

JVC ENG-1910U

Panasonic AJ-D700

Panasonic AJ-[illegible]

NEWMEDIA LAB

A digital video (DV) camcorder could well be multimedia producers' single most important purchase over the next 12 months. This versatile image-acquisition tool provides high-quality still images that, when properly anti-aliased, rival those produced by digital still cameras. A DV camcorder can stand in as a digital audio tape (DAT) recorder. And it produces full-motion, 720-by-480 video that blows away Hi8 and S-VHS and, in most respects, makes obsolete the industry-standard analog videotape camcorder, Betacam SP. The DV camcorder represents the first step into an all-digital future, in which your program material can be infinitely cloned with virtually no image degradation. Every shot you make instantly becomes a digital media asset.

TEST DRIVE

Several tools—including a few that cost less than $1,000—let you transfer these DV assets into your desktop computer for use in multimedia, CD-ROMs and DVDs, presentations, Web sites and nonlinear editing of videotape productions (see "FireWire Moves Video to Digital Realm," page 30). Even if you're only producing low-resolution video for the Web and CDs, you'll benefit from DV's low noise and excellent picture quality, which improves the efficiency of any compression method.

Here we review eight consumer DV models with list prices from $2,799 ($1,600 street) to $4,295, two semipro camcorders for $6,400 to $8,100, and three professional machines that range in price from $9,995 to $22,900. You will find the principal differences in the cameras themselves, where the quality of the lens and CCD/prism block vary with cost. The recording mechanisms, on the other hand, provide comparable quality because all DV tape has 500 lines of resolution (50 percent more than the 330 lines of resolution of NTSC broadcast television and twice that of VHS tape); a 55dB luminance signal-to-noise ratio (better than Betacam); and digital component recording (separate Y, R-Y and B-Y signals, sampled as 4:1:1, half the color information of the CCIR-601 standard 4:2:2), with no NTSC artifacting like cross-color and dot crawls.

DV audio is also amazing, with two channels of CD- or DAT-quality 16-bit audio, or four channels of 32kHz, 12-bit audio, which in some camcorders allows you to dub additional stereo sound in post-production. However, the camcorders' tiny onboard microphones range from modest to miserable. For quality sound, you should mount or wire up a separate mike.

Despite a raging subformat war (see "New DVCPRO 50 Format Joins DV," April 14), DV provides unprecedented industrywide interoperability.

MiniDV cassettes (used in all consumer and some semipro cameras) are one-tenth the size, one-fifth the weight and half the cost of industry-standard Betacam (30-minute) camcorder tapes, but they have twice the capacity. The standard-size DV cassette (used in Sony's consumer DV tape decks) records 270 minutes of video, compared with the larger Betacam VTR tape's 90 minutes. Panasonic's DVCPRO (18-micron) and Sony's DVCAM (15-micron) models use wider tracks than regular DV tape (10 microns) for more durability in editing, but their digital information and recording quality is identical to that of DV. MiniDV tapes play in every DV, DVCPRO and DVCAM recorder. DVCPRO tape does not play in DV or DVCAM equipment, while DVCAM tape plays in standard DV and DVCPRO recorders. Only DVCPRO tape decks play all three formats. Most important for *NewMedia* readers, all three formats are interoperable when transferred to a nonlinear editing system.

Lower-cost consumer models offer a dazzling array of features, many of which are genuinely valuable innovations, such as image stabilization, slow shutter speeds for still-image work, a 16:9 wide-screen

Sony DSR-200

Sony DCR-VX1000

Panasonic PV-DV1000

Panasonic AG-EZ1U

FireWire connector for digital transfers, and rotating LCD monitor/viewfinders that let you frame yourself in the shot.

Higher-cost semipro and professional models have longer tape formats and recording times, more robust recording formats (like DVCPRO and DVCAM), bigger and better lenses (often interchangeable), high sensitivity with virtually no smear, adjustable video gain, digital signal processing with control of many details, storable setup data, large microphones that are better isolated from camcorder transport noise, XLR inputs and separate-channel audio controls, adjustable viewfinders with large eye cups, and dockable recorders so you can switch to Betacam SP by exchanging the back section. Their front camera sections typically achieve very high resolution, and they have low-noise CCDs with very little vertical smear.

For multimedia producers, perhaps the most distinguishing feature among DV camcorders is IEEE1394 FireWire. Until recently a Sony-only capability, FireWire is crucial for making digital-archive copies of your footage and transferring your media into a computer for editing.

FireWire is currently a 200Mbps serial-data bus that is similar to but less expensive than the 270Mbps SDI interface used in D1 video. In a nonlinear editing environment, this simple four- or six-conductor wire can transmit three YUV component signals in two directions (which requires six cables in the analog world), two stereo channels simultaneously in both directions (another eight cables), plus time code and edit deck control (usually on a 9-pin cable). All in all, this one wire can replace as many as 16 or 17 cables, fantastically simplifying the editing suite. And data is copied virtually bit for bit, so generation loss and cable noise are history.

Ten FireWire-based DV nonlinear editing products are now available, and Panasonic plans to include this feature on all future consumer DV models. At least one of your camcorders must have it, or you'll also need a FireWire-capable VCR—no small expense. FireWire editing systems are coming from DPS (with Adaptec), miro (with Skipstone and Sony), Fast and COMO (with Sony), Matrox and Truevision (with Panasonic) and Radius (on its own).

At the high end, an alternative way to transfer your DV digitally is via SDI. Sony and Panasonic will offer SDI cards for their high-end VCRs. Although these are much more expensive than FireWire, they can transfer data four times as fast as real time.

A second important feature, pioneered by Sharp in its Digital Viewcams, is the ability to use a swing-out LCD monitor as a viewfinder. Being able to hold a camcorder over your head to shoot in a crowded environment is critical for wedding videos and documentaries. And the Viewcams' 4- and 5-inch monitors are good enough for several people to view the playback of an important scene. On the other hand, it is difficult to see on LCD color viewfinders when you drift from sharp focus. Although most of these camcorders offer excellent auto-focus, farsighted people may have to hold a camcorder with LCD monitor at an uncomfortable distance because there is no diopter adjustment.

A third key, but often overlooked, function is the powerful use of the data subcode tracks in the DV format—something that's enormously valuable for managing media in post-production. Every time you start and stop some camcorders, they record in- and out-points in time code, date and time, shutter speed, gain, iris and f-stop. Sony camcorders also grab a frame (a *picture icon*, or *picon*, in nonlinear editing jargon) and store it in the Memory-in-Cassette (MIC) chip. Sony pro camcorders call this function ClipLink, adding OK/NG (OK/no good) markers to each clip, then uploading only the good shots (at quad speed with SDI) to the EditStation. A competitive scheme, called FlexLink, by Panasonic stores clip information temporarily in camcorder memory (in the PCMCIA setup cards of DVCPRO camcorders), then dumps it to the DV tape itself when you remove the cassette. Advanced nonlinear editors will use this clip information to build a storyboard of your clips, saving you hours of logging time.

Testing

To compare camcorder image quality, we built a standard laboratory test scene with strong colors and sharp, high-contrast diagonal lines to expose aliasing. We also recorded rapidly moving colored objects; horizontal- and vertical-resolution charts; variable tungsten lighting (from the 2,000-lux standard down to a few lux); fluorescent lighting; and a candle to show vertical smear.

We captured still images of most of these results, several of which are illustrated here, and the rest on Hyperstand. We also produced a DV tape with our torture-test results (including image stabilization "shake" tests) that includes split-screen performance comparisons of all models. (See Hyperstand for information on how to obtain this tape, which you can

An extended version of this article can be found at www.hyperstand.com/newmedia.

take to your local retailer and play back while checking out the cameras.)

We also measured wide-angle field of view and recorded visible glitches in the transition from analog to digital zoom in some camcorders. (For more details, see "Test Methodology," on Hyperstand.)

At low light levels (critical for event videographers), we found that many auto-focusing systems fail: Some cameras get very grainy with highly visible noise in the picture; colors shift in some; and bright spots of light produce vertical smear lines in others. Manufacturer claims of sensitivity from 3 to 8 lux are hard to compare. See Hyperstand for split-screen comparisons of captured images at the same low light levels (80 lux). Our *NewMedia* DV test tape shows each camcorder in a split screen with the Sony VX1000 as the light slowly falls from 2,000 lux to a few lux. We also compared the semipro and pro cameras directly with each other.

In our testing, we discovered that optical image stabilization is measurably superior; electronic image stabilization (EIS) and digital image stabilization (DIS) often must zoom in, so edge pixels can be used to detect movement, enlarging the picture and reducing resolution. The JVC GR-DV1, with its 570,000-pixel CCD, is an exception. We captured split-screen images of pairs of camcorders being shaken on the same tripod. Not only are EIS/DIS systems less able to remove shaking, they also have a few seconds of lag time after the camera stops, making it difficult to frame up a scene quickly. You can see this for yourself on the DV test tape.

ance and exposure, and so on. The JVC GR-DV1's tiny size belies its full VCR control panel. Many users also miss the microphone input and composite video/stereo audio output hidden under a front plastic panel. Outputs on the cradle include S-video. Like all DV camcorders, there are no video inputs.

While the JVC GR-DV1's electronic image stabilization can't match optical stabilization, it works well without sacrificing resolution like the Sharp and Panasonic products do because the 570,000-pixel CCD uses information around the edges to detect motion. The DV1 has a five-second scene record and a valuable reshoot function, which rewinds to the start of the last scene for a second take. In addition, JVC's Joint Level Interface Protocol (JLIP) lets you control the DV1 from a PC for editing.

The DV1's dozens of special effects (monochrome, sepia, tilt-lock) and transitions (fades, mosaics, wipes) are put to good use in post-production. Even better, when the camera is in its docking station, you can digitally zoom (up to 100X) during playback while panning and tilting inside the video, an effect not available in most online suites. The DV1 is one of only a few DV camcorders that record both 16- and 12-bit sound and let you dub a second pair of 12-bit audio tracks.

On the negative side, the DV1 shows marked vertical smear in low light, and it lacks an accessory shoe and the critically important headphone jack. You must also compensate for its poor microphone (we mounted a wireless third-party microphone with its own headphone jack to the right side of the DV1).

The JVC GR-DV1 is also marketed by RCA/Thomson as the CC900D for $2,099.


Sony DCR-VX700


Sharp VL-D500U


Sharp VL-DC1U


Sony DCR-PC7


JVC GR-DV1

Consumer Camcorders

JVC GR-DV1

The DV1 Digital CyberCam ($2,999) is the smallest, lightest and lowest street-priced ($1,600) DV camcorder in the world, weighing in at 1.1 pounds with battery and tape. And the 10:1 zoom lens (100X digital zoom) and CCD assembly weigh only 1 ounce. *Pictures in normal light are hard to distinguish from the best-of-class Sony VX1000. Its sleek aluminum case easily slides in and out of a jacket breast pocket, and its photo and motor-drive modes are able to take three stills in two seconds. The CyberCam is also a Webmaster's dream image-acquisition tool.*

You can use this well-designed camera with one hand in automatic mode, though you will need both hands to control focus, set white bal-

Panasonic PV-DV1000

The Panasonic Digital Palmcorder PV-DV1000 ($3,999) was the low-light winner among consumer camcorders, and it has good horizontal resolution despite the small number of pixels in its three one-third-inch CCDs. With only 270,000 pixels, the Panasonic CCDs are well below the 720 by 480 (345,600-pixel) resolution required for CCIR-601 digital video. Marketing claims of 500 lines of resolution are not always supported because the cameras—due to limitations of their CCDs and lenses—don't always capture enough detail to take full advantage of the DV format's resolution. We estimated actual horizontal lines for each camcorder using a resolution chart in our tests.

EXECUTIVE SUMMARY

DV CAMCORDERS

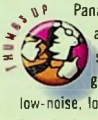
There should be a DV camcorder in every multimedia producer's toolkit. In addition to video, it records top-quality stills and audio, making it an all-purpose digital-media acquisition tool. And the video quality of even the least expensive consumer cameras rivals that of Betacam without the generation loss inherent in analog video. FireWire connectors, so far found only on Sony equipment, fulfill the promise of all-digital nonlinear editing.

The cameras fit into three basic categories: consumer, semipro and professional. In the consumer category, the pocket-sized Sony DCR-PC7 and JVC GR-DV1 both earn Awesomes, while the full-sized Sony DCR-VX1000 camera is our top choice overall. Sony's semipro- and pro-level camcorders also rise above the competition, giving the company a clean sweep. Hopefully, other major camcorder vendors will get into the FireWire act soon and give Sony a run for its money.

The hand-held JVC GR-DV1 generates excellent picture quality despite its tiny size. It has great photo/still modes, audio dubbing and superior electronic image stabilization. The competing Sony DCR-PC7 combines a 2.5-inch LCD monitor with a lower-power color viewfinder. Although the DCR-PC7 is significantly larger and heavier than the JVC-DV1, it offers Super SteadyShot, a headphone jack, built-in S-video and a FireWire connector.

The Sony DCR-VX1000, last year's Hyper Award winner, remains the best overall DV camcorder for multimedia producers. It has top picture quality (among consumer camcorders), optical Super SteadyShot stabilization, FireWire I/O, zebra and time code in the viewfinder, manual audio-level control, interval recording and a Memory-in-Cassette feature for storing shot data. The semipro Sony DSR-200 provides three-hour DVCAM tape length, a shoulder mount with large battery and professional audio features (XLR connectors and manual level control). It takes only the standard-size DVCAM (or DV, in a pinch) cassette, not MiniDV. It has FireWire and LANC connectors.

The professional-level Sony DSR-130, with two-third-inch interchangeable lenses, simply produces the best video available in the DV format. It provides true-to-life color in normal and low light, and it integrates perfectly into editing systems with its advanced ClipLink feature. It works with both DVCAM and MiniDV tape sizes.



Panasonic's closely related PV-DV1000 and AG-EZ1U models (aimed at consumers and corporate or event videographers, respectively) achieve good low-noise, low-light performance. Great features include the sports viewfinder, audio dubbing and excellent search modes, including Top Scan. Pros will miss ND filters, zebra and manual audio-level control. These cameras' vertical resolution is as low as any DV camcorder's.

The less expensive single-chip Sony DCR-VX700 lacks many of the special features of the VX1000. Professional picture controls have been simplified for the consumer, but it still has the FireWire connector.

The semipro Panasonic AJ-D200 has a one-third-inch interchangeable lens, two-hour tape, a pro battery and pro audio connectors, but only automatic audio-level control. It takes only the large (standard) DVCPRO cassette. The FlexLink feature saves NG (no good) and time-code markers for editing. It lacks a filter wheel and neutral density filter.

The pro-level JVC ENG-1910U produced an excellent normal-light picture with its half-inch interchangeable lens, but it smeared badly in low light. It lacks manual audio control. The dockable BR-DV10U MiniDV back is the least expensive way to convert a pro camcorder to DV.

The Panasonic AJ-D700 has a good half-inch interchangeable-lens professional design, but metal-particle DVCPRO tape limits it to a one-hour maximum. It has no FlexLink or edit search, nor does it have zebra or time code in the viewfinder.

Its enormous rotating LCD display puts the consumer-grade Sharp VL-D5000U Digital Viewcam in a class by itself. But it is power-hungry: The large LCD uses much more power than the small viewfinders in other cameras. Picture quality is low (for DV), with the smallest (one-quarter-inch) CCD chips in any camcorder. Digital image stabilization is poor, and the tape counter display is amateurish considering that DV has built-in time code.

The Sharp VL-DC1U, a scaled-down version of the VL-D5000U, proved cumbersome, with rocker-switch access to almost every function. Its quarter-inch CCD has an oddly blurred picture quality, but the relatively small lens has a great wide-angle view.

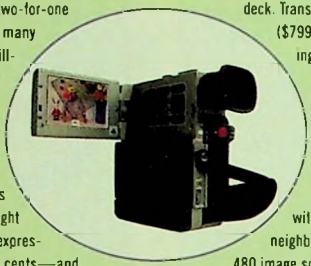
SCORECARD

Camcorder	Overall value	Picture quality/ control	Audio	Ergonomics	Pro or special features	Tape search	Edit support	Price
JVC GR-DV1	●●●●●	●●●●	●●●●	●●●●●	●●●●●	●●●	●●●●	$2,999
JVC ENG-1910U	●●●●	●●●●	●●●●	●●●●	●●●	●●●	●●●●	$9,327
Panasonic PV-DV1000	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	$3,999
Panasonic AG-EZ1U	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	$4,295
Panasonic AJ-D200	●●●●	●●●●	●●●	●●●●	●●●	●●	●●●●	$8,100
Panasonic AJ-D700	●●●●	●●●	●●●●	●●●●	●●●	●●	●●●	$18,725
Sharp VL-DC1U	●●●	●●	●●●	●●●	●●●	●●●●	●●	$2,799
Sharp VL-D5000U	●●●	●●	●●●	●●●●	●●●●	●●●	●●	$3,799
Sony DCR-PC7	●●●●●	●●●●	●●●	●●●●●	●●●●●	●●●	●●●●	$3,199
Sony DCR-VX700	●●●●	●●●●	●●●	●●●●	●●●●	●●●●	●●●●	$2,999
Sony DCR-VX1000	●●●●●	●●●●	●●●●●	●●●●	●●●●●	●●●●	●●●●●	$4,199
Sony DSR-200	●●●●●	●●●●	●●●●●	●●●●	●●●●	●●●●	●●●●●	$6,400
Sony DSR-130	●●●●●	●●●●●	●●●●	●●●●●	●●●●●	●●●●	●●●●●	$22,900

●●●●● = Awesome ●●●● = Thumbs Up ●●● = Does the Job ●● = Needs Work ● = Dorky

DV Camcorders Take Stills Too

Digital still cameras have exploded in popularity, especially for Web publishing. While most photographers will buy a digital camera and a digital camcorder if they need both video and stills, DV camcorder owners get a two-for-one deal. Every frame of digital video is a potential still image, and many of these cameras also have a special higher-resolution still-image mode.



Getting the right picture out of the thousands in the camcorder may seem daunting, but there are many advantages. You are more likely to capture the perfect picture by shooting hundreds within a few seconds—professional photographers use motor drives for good reason. Any of the 108,000 frames on a DV tape may produce a great still image with just the right framing. You can work around blinking eyes and awkward expressions. And the price is right. Each still image costs about .01 cents—and the tape is reusable. Only very expensive digital still cameras have higher resolution than DV (720 by 480).

There are also disadvantages: The pixels are not square; you'll need to adjust images in Adobe Photoshop (once there, you can immensely increase the apparent resolution by following the steps mentioned later); and camcorders do not have a built-in flash, so digital still cameras perform better than camcorders in low light.

When shooting for still use, consider increasing the shutter speed in bright light to get stop-action, less blurry stills (blur is necessary in video to provide a sense of smooth, realistic motion, but undesirable in stills).

The following six steps will set you on track to produce top-quality digital video still-image capture and processing. With a macro program, you can save the Photoshop steps to use over and over.

- Transfer the DV frame digitally (via FireWire) to a hard drive. If you don't have a FireWire-equipped camcorder, you'll need to buy or borrow a FireWire-equipped tape deck. Transfer tools include the Sony DVBK-1000 still-image capture card ($799), the new Radius PhotoDV card ($499) and any of the DV editing cards, like the DPS Spark, miro DV100 and Fast DV Master.
- Open the image in Photoshop; if there is significant motion in the frame, deinterlace it.
- Resize the nonsquare-pixel 720-by-480 image to square pixels (640 by 480). This is a horizontal factor of eight-ninths, or 88.89 percent.
- Enlarge the image size three or four times in Photoshop with interpolation. (Experiment with cubic, bilinear or nearest-neighbor interpolations to see which works best for you.) A 640-by-480 image scales up to 1,920 by 1,040 (HDTV) or 2,560 by 2,080.
- Gaussian blur the image with a subpixel setting of 0.5 or 0.7 pixels.
- Unsharp with a mask of 150 percent, radius 1.5 or 2 pixels, threshold of 8 levels (DV is 8-bit 01 uncompressed, with half the color resolution).

The Sony DVBK-1000 and Radius PhotoDV cards perform some of these steps automatically during transfer, saving a lot of time. And PhotoDV selectively deinterlaces only areas of the picture in motion, preserving original detail for the still portions.

The Sony DVBK-1000 card uses LANC to control the camera (not guaranteed frame-accurate but pretty good) and Radius PhotoDV controls via FireWire. Both can quickly locate frames that were shot in the special photo/still mode that some cameras have. Note that some manufacturers say that photo mode is a lower- not higher-quality picture, though a "photo still" has only a single image, with sound, for six or seven seconds (about 200 frames). —*B.D.*

The DV1000's horizontal resolution (425 lines) came close to the 410,000-pixel Sony VX1000's 450 lines, while its vertical resolution (325 lines) is significantly lower than that of the VX1000 (390 lines). At low light levels, the Sony VX1000 is slightly brighter than the Panasonic DV1000; however, it shows significant unacceptable noise, while the DV1000 picture is still usable.

The DV1000 has some excellent and unusual features, such as Top Scan, which goes to the next scene (or photo) and plays a few seconds, then fast-forwards to the next. Another important feature is audio dubbing. (You must record your initial audio in 12-bit mode if you want to dub later.)

The DV1000's outstanding sports viewfinder (which you can look through from a few inches away) has a large, soft eye cup. It tips up 80 degrees for low-angle shots and folds down 40 degrees for over-the-head work, and the 180,000-pixel color viewfinder is exceptionally clear. The DV1000 has an edit search (which lets you search while in record mode) and a wide range of playback options: slow, frame advance/reverse, fast-forward/rewind search with picture, search by date and Top Scan. Remote edit control is available with a standard Panasonic 5-pin connection.

Important features that are missing include manual audio-level control, an insert edit capability and a neutral density (ND) filter for daylight work. The most significant absence may be FireWire, which Panasonic will ship in two new cameras this summer, the PV-DV700 ($2,000) and the PV-DV710 ($2,500). Both have 10X/100X f/1.4 zoom lenses and EIS. The DV710 adds a 3.8-inch foldout LCD monitor.

Panasonic AG-EZ1U

Marketed through Panasonic Broadcast channels, the AG-EZ1U ($4,295) performs more or less identically to the PV-DV1000. Although it uses the consumer MiniDV tape format, Panasonic has positioned it as an acquisition medium for DVCPRO facilities and offers a cassette adapter that lets MiniDV standard tapes play (but not record) in the AJ-D750 DVCPRO studio recorder. A package with a few extra accessories—a wide-angle lens converter (from 33 to 55 degrees), a filter set, an extra battery and a soft carrier—is available for $4,500.

The large sports viewfinder has a comfortable, soft eye cup, and the manual focus ring will please professionals. The AG-EZ1U's Turbo Zoom quickly pulls back or zooms in, but only when you're not recording (for focusing and framing).

Videographers will also like the handy shutter/iris dial and button with 13 relative iris adjustments from -6 to +6. In more professional auto-exposure lock mode, the wheel sets 16 absolute iris settings from f/1.6 to f/16 and close. The 14 shutter speeds go from 1/60 of a second to a very fast 8 milliseconds. Gain-up, which lets you operate in lower light but adds noise, offers only four steps: 3, 6, 9 and 12dB. A fluorescent preset is valuable, though professionals will miss manual audio level, an ND filter, and a time code and zebra pattern in the viewfinder. Book Mark Search is a convenient end-search function, which fast-forwards or rewinds to the last recorded frame.

On the downside, we didn't like the change in picture size in our electronic image stabilization tests (if you accidentally press the EIS button, your footage is ruined), nor did we like the camera's tendency to keep moving after a pan or tilt motion had stopped.

Sharp VL-D5000U

Sharp's top-of-the-line VL-D5000U DV Digital Viewcam (S3,799) instantly impresses with its huge color LCD viewfinder/monitor—a 5-inch diagonal, 224,640-pixel active-matrix display. A small group can view tape playback on this bright display and listen to sound on the built-in speaker. The fluorescent backlight bulb runs a bit hot, though, so you should carry a spare. The display comes with a removable foldout sun hood, and for its ergonomics alone, this camcorder should be among DV production studios' top choices—especially for over-the-head and low-angle shots. The self-recording feature is great, but you must keep the camera section upright; it's easy to accidentally record yourself upside down.

Professional features include shutter speeds ranging from 1/60 to 1/10,000 of a second, manual f-stops from f/11 to f/1.6 and manual gain-up of 18dB in 3dB steps. It also has manual focus with an auto-focus button. Other notable features include end search for the last recorded frame and the ability to search from the starting points of the adjacent few scenes. However, the VL-D5000U lacks an edit search. You must switch to VCR mode. Quick Zoom enlarges a rectangle in the screen center 2.5 times to fill the monitor, and a zoom microphone is coupled with the zoom lens.

Although every DV tape has time code, the D5000U shows only hours, minutes and seconds on its display. And it only displays the frame number in still mode.

Three menu screens offer a panoply of features. The multifunctional VCR buttons are relabeled by legends in the LCD display. We liked these buttons as well as the separate DIS, Snap and Still/Strobe buttons, which are much more convenient than on the Sharp DC1U, where you must navigate menus to access anything.

On the other hand, some controls are a bit sensitive, especially the zoom rocker and the manual focus wheel, which sticks out on a corner where you can easily bump it. We found it hard to start a slow zoom. DIS expands the image, lowers the resolution, reacts badly to fluorescent lights and consumes extra power.

The f/1.6 lens is small, as are the three quarter-inch CCDs. Picture quality and resolution are fair to good (375 horizontal and 325 vertical lines), though sensitivity is poor. The D5000U was near the bottom in low-light performance. You can turn gain up to 18dB, but it produces very high noise.

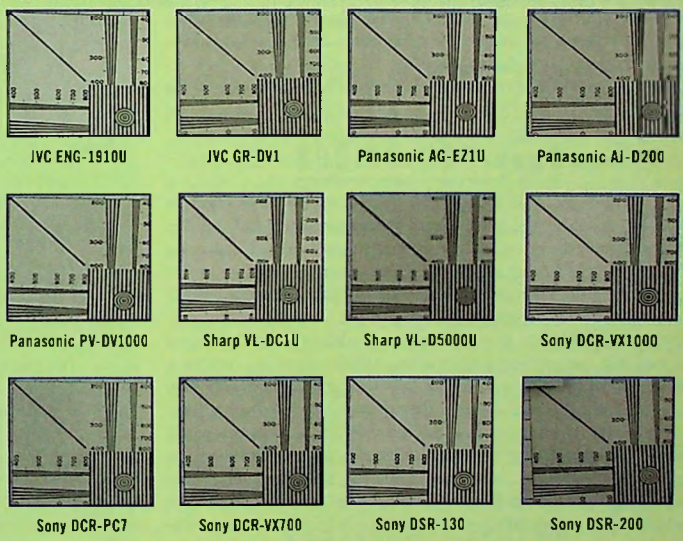
The excellent monitor showed very little overscan, which means that the picture you record will be cut off slightly on a standard TV, though not on a computer monitor. We liked the wide-screen 16:9 mode, which looks letterboxed on the monitor; however, we wished we could lock the swiveling camera when it's mounted on a tripod.

A small side-mounted AV pack provides composite video and stereo. As with the JVC DV1, S-video is available only on the large Viewcamport cradle, which lets you charge two batteries simultaneously.

Sharp VL-DC1U

The Sharp VL-DC1U ($2,799) is a smaller (almost half the weight) and feature-limited version of the D5000U. It has a 4-inch LCD monitor and a single quarter-inch CCD chip, and just three buttons (Menu, Mode Display and Snap) replace 12 buttons, two dials and two switches on the D5000U. Users access everything through a unique four-way rocker switch (like a joystick) and

Sizing Up Resolution



Lower-resolution CCDs or below-average lenses can cause actual resolution on DV cameras to go below 500 lines. To measure the actual image resolution of each camera (vs. the nominal 500 lines of the DV signal format), we shot a standard-resolution chart. The point at which distinct black-and-white vertical lines merge to gray gives us the horizontal resolution. Starting with the best-resolution camera in our study (Sony DSR-130), note the clarity of the numbers that indicate the lines of resolution. The JVC ENG-1910U is second-best. Because of the difficulties in getting digital stills from DVCPRO, there is no resolution chart for the Panasonic AJ-D700, but it would likely place third in our tests. There is very little difference between the cameras in fifth to eighth place. At the bottom, we can't even read the numbers in the quarter-inch CCD cameras from Sharp.

menu choices—which can be a bit daunting. There are four menu screens in camera mode (the fourth has four subpages), and VCR operation adds three more menu screens (one with a subpage). It's confusing at first, but with practice you can control dozens of things from the rocker switch.

Other features the VL-DC1U shares with its big brother are a wide screen, quick return, video search and a built-in speaker. It has gain-up but just a single step increase that is enabled only under the low-light warning. Manual iris reads out as -6 to +6, rather than in f-stops. It has six shutter speeds, down to a fast 1/10,000 of a second. Again, the zoom rocker is too sensitive, and it tilts the lens down when the camera is on a tripod. Quick Zoom can be set to 1.5X, 2.0X and 2.5X. There is no zoom rectangle.

An improvement over the D5000U is an edit-search feature that eliminates the need to switch to VCR mode to locate the next starting point. Also, unlike the D5000U and other camcorders, the familiar REC indicator shuts off after a few seconds, and only an animated loop remains. The DC1U AV pack has S-video output, but its mounting is just as fragile as the D5000U. It can mount an optional TV tuner pack. The DC1U Camcorder also lacks an accessory shoe, single-push auto focus and in-camera battery-charging.

The DC1U had the best wide-angle performance in the study (more than 45 degrees), and the transition from analog zoom to digital zoom was barely noticeable. However, overall picture quality was the lowest achieved in the study. Our tests showed good resolution (400H/350V lines), but irregular blurring makes details like text hard to read (see "Sizing Up Resolution," page 51).

The Sharp VL-DC1U is also marketed by RCA/Thomson as the PROV-2000D.

Sony DCR-VX1000

The Sony DCR-VX1000 ($4,199) was the first DV camcorder to be shipped in the United States a year-and-a-half ago. The basic design put a DV mechanism into the already-successful VX3 Hi8 camcorder, but it added something that has since set the video editing community buzzing: an IEEE1394 FireWire connection (Sony calls it Direct Digital Link).

The Sony VX1000 is loaded with incredibly powerful features: interval and cut recording for making animated movies; data code that stores date, time, f-stop, shutter speed, iris and gain for every shot; a memory chip in each cassette that stores time-code in- and out-points as well as a picture icon for each shot; a two-speed edit search function; a zebra pattern in the viewfinder to warn of overexposure; and manual overrides for all automatic functions, including focus (with single-push auto-focus), white balance, exposure, audio gain and headphone level. When the VX1000 plays back four audio channels, it is the only camcorder that can balance the original and the dubbed stereo tracks.

As measured in our tests, Sony's Super SteadyShot offers the best image stabilization on the market, a combination of Canon optics and Sony semiconductors. Where it falls short, however, is in low light. Here it is outperformed by the Panasonic DV1000, which produces a darker but usable noise-free image. In normal light, however, the VX1000's overall picture quality and resolution (450H/390V lines) were the best of the consumer DV camcorders.

Sony DCR-VX700

The DCR-VX700 ($2,999) is a single-chip version of the VX1000, with several features aimed at consumers rather than experienced videographers. Nevertheless, it makes a great second FireWire camcorder for some producers. With a FireWire cable from the VX1000 to the VX700, you can make clone copies of media assets and put the originals away.

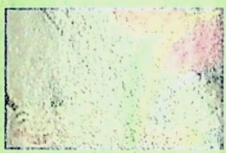
The VX700's automatic-exposure modes are greatly simplified, eliminating manual shutter, iris and gain settings (as well as the ND filter). They are replaced by just four basic modes: portrait, sports, high-speed shutter and twilight. The general-purpose control dial becomes the exposure dial, and the indicator is the same slider as the zoom indicator.

The handle on top that mounts the VX1000 microphone away from camera noise is gone; the VX700 microphone is below the lens; and the accessory shoe is on the right. There are fewer playback search options, but the VX700 still uses Memory-in-Cassette data and has edit search.

Our split-screen testing showed the VX700's low-light performance

Image Is Everything

JVC ENG-1910U



JVC GR-DV1

Panasonic PV-DV1000

Panasonic AJ-D700

Sony DCR-PC7

Sony DCR-VX700

To compare overall image quality, we captured a complex test scene on tape. Using the best picture as a reference (the Sony DSR-130), first look at the very fine stairstep (aliasing) in the black diagonal lines. In comparison, the single-chip Sony VX700 has large stairstepping. To contrast fine details, look at the large number of visible hairs on the doll in the DSR-130 picture as compared with the clumps of hair in the Sharp D5000U image. Another thing to watch for is ghosting (a slight brightening of the background alongside black lines). The Sony DCR-VX1000 and DSR-200 show the least ghosting, compared with the strong white ghosting along-

to be just below that of the VX1000, confirming Sony's specs. We also found comparable resolution.

Sony's DCR-VX700 is a good FireWire DV camcorder, but the relatively small difference in street price between it and its higher-end sibling makes it likely that most buyers will step up to the VX1000.

Sony DCR-PC7

Traditionally, Sony engineers have made the smallest and lightest products in every market in which they compete. The new DCR-PC7 ($3,199) comes close to the ultralight JVC GR-DV1, and considering its multitude of features, many will give it first prize. Perhaps most important, the DCR-PC7 is the smallest FireWire-equipped DV camcorder. Its 2.5-inch foldout swiveling LCD monitor gives you most of the advantages of the Sharp Viewcam designs. And although its small size limits group viewing, it does have a tiny speaker and volume control. Super SteadyShot gives you great image stabilization, critical in a lightweight camcorder. Its new InfoLithium batteries read out their remaining life with great accuracy, and the optional NP-F200 pack offers 16[illegible] minutes of recording time.

The [illegible] has a unique LP mode that records and plays 90 minutes on a 60-minute tape. You can play back LP tapes only on the PC7, but you can transfer critical scenes via FireWire to SP tape, then play them back on standard DV equipment like the new DHR-1000 recorder. You can also transfer LP into DV nonlinear editing systems.

The PC7 has S-video output and audio balance control, and an amazing AV output sends composite video and line-level stereo audio on a special four-conductor miniplug. If you plug in stereo headphones, it drives them too—an audio engineering coup. The camcorder also has a simplified four-mode auto-exposure system, similar to the VX700.

An accessory shoe comes with the PC7, but to use an external mike, it requires a VMC-LM7 adapter (about $60), which also has a LANC jack for computer-controlled editing. The carry strap positions your thumb at the record button and middle finger at the zoom control and quick-infinity focus buttons. Photo mode offers you a preview before you record a still, but we prefer just selecting a single DV frame out of the 108,000 frames on a 60-minute tape (see "Image Is Everything," opposite page).

Picture quality in normal light is excellent, with similar horizontal resolution (400 lines) and superior vertical resolution (375) to the other "tinycam," the JVC DV1. The Sony PC7 is shorter, thicker and heavier than the DV1, and the projecting viewfinder and lens snag on pockets, but its overall technical engineering and video performance are greatly superior. And Sony's new DSR-PD1 is a DCR-PC7 version that records in DVCAM format. Digital zoom is limited to 20X.

Pana[illegible]AG-EZ1U

Panasonic AJ-D200

Sharp VL-D5000U

Sharp VL-DC1U

Sony DSR-130

Sony DSR-200

side the black lines and at intersections in the Panasonic DV1000 and AJ-D200 captures. Finally, check for color fidelity. Observe the strong natural colors in the Sony DSR-130: red lips on the doll and bright, saturated blues and greens. To see even more detail, look at the full-resolution images on Hyperstand or check out the DV test tape.

Sony DCR-VX1000

SEMIPRO CAMCORDERS

Two semipro DV camcorders, the Sony DVCAM DSR-200 and the Panasonic DVCPRO AJ-D200, have taken the event videography and corporate video markets by storm by including many pro features at prices less than one-third those of professional models. And their companion recording decks, the $4,800 Sony DSR-30 and $4,995 Panasonic AJ-D230, also reach new price/performance levels for feeding high-quality digital component video into nonlinear editing systems.

The two companies share a common design philosophy: Take the camera section of the top consumer DV camcorders and add a more professional back end, with a larger cassette mechanism, a pro audio interface, a monochrome viewfinder and a large battery. Panasonic's lens is interchangeable, while Sony sticks with its Super SteadyShot optically stabilized fixed lens. Sony says it could not put optical image stabilization behind an interchangeable lens—something Canon wants to do for its DV camcorders, which are coming soon. The Panasonic is bulkier, but it's only about a pound heavier than the Sony with battery, lens, tape and so on.

Panasonic AJ-D200

The AJ-D200 ($5,995; $8,100 with lens) looks a lot like Panasonic's SuperCam line of S-VHS recorders, using the same three 270,000-pixel CCDs as the PV-DV1000, AG-EZ1U and top SuperCams. Panasonic claims its double-density technology—in which alternating horizontal rows of pixels are staggered by one-half pixel—delivers the same resolution as 410,000-pixel CCDs. We find this claim a bit difficult to believe (since others also use this spatial offset technology), and we could not confirm it. However, the camera

does deliver the same resolution as the 410,000-pixel CCDs in the competing Sony DSR-200, and the slightly larger pixels make the Panasonic more light-sensitive. The f/1.4 lens, faster than the AG-EZ1U, easily outperforms the DSR-200 in low light. The AJ-D200 lens is the first one-third-inch bayonet-type interchangeable lens, a new industry standard.

The large back section holds a DVCPRO large cassette mechanism that is the same size as a standard DV cassette. Standard DV can run as long as 270 minutes; the identical tape in Sony's DVCAM runs 184 minutes; and the thicker metal-particle DVCPRO cassette runs 123 minutes. The AJ-D200 cannot use the M-cassette of the professional-level AJ-D700.

Strangely missing are an ND filter (needed with the bigger f/1.4 lens), 12-bit audio (and its associated dubbing capability) and a filter wheel. At this price, for this market and with pro audio connectors, Panasonic should have included manual audio-level control. The camcorder does, however, come with a pro battery adapter, white balance, 16:9 wide-screen mode and zebra stripes in the viewfinder.

Panasonic's FlexLink is a competitive response to Sony's ClipLink (available in the pro-level DSR-130). FlexLink stores in- and out-points, NG information and two other user-defined marks at the end of the tape. You must manually save your data before ejecting a tape. (But don't expect a reminder: You won't get one.)

The AJ-D200's picture quality and resolution in normal light are much better than the Panasonic consumer units, and they also appear to be better than the Sony in split-screen comparisons.

Sony DSR-200

The Sony DSR-200 ($6,400) is the least expensive shoulder-mounted DV camcorder on the market. It has all of the spectacular features of its market-leading consumer counterpart, the VX1000, and it adds pro audio, a three-hour tape length, a wider-track DVCAM cassette for more robust linear editing and a professional side-mounted monochrome CRT viewfinder.

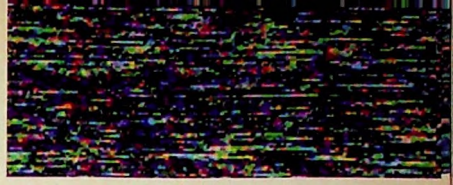
The control panels are impressive, with metal toggle switches for tracking white balance and gain control and auto/manual toggles in the familiar left-hand position. Above these are dial switches for shutter speed (slow, 1/60, 1/100, 1/250, 1/500 and preset, which can be 1/1,000, 1/2,000, 1/4,000, and 1/10,000), gain (-3, 0, 3, 6, 9 and preset to 12dB, 15dB and 18dB) and white balance (3,200K, 5,800K and manual). Slow shutter can be 1/30, 1/15, one-eighth and one-quarter of a second. Below them is an auto/manual iris toggle switch with an iris control wheel. Mounted on the lens (as on the VX1000) are the ND filter switch and the auto/manual focus, with quick-infinity focus position and single-push auto-focus. Below the LCD display panel are switches for audio monitor (stereo, channel 1 or 2), audio mode (32kHz or 49kHz) and separate auto/manual record levels for left and right channels.

With all these manual settings and locking-balance [illegible] this is a very professional audio machine. It is also the [illegible] corder with audio dubbing. The VTR controls include [illegible] and single-frame buttons. There are [illegible] a DF/NDF switch. Digital Zoom [illegible] switches are now up front (much [illegible]

DV Camcorders

Company/product	JVC GR-DV1	JVC ENG-1910U	Panasonic PV-DV1000	Panasonic AG-EZ1U	Panasonic AJ-D200	Panasonic AJ-D700	[illegible]
Phone/URL	(800) 526-5308 www.jvc-america.com		(201) 348-9090 www.panasonic.com	(800) 528-8601			[illegible]
Cassette types	MiniDV	MiniDV	MiniDV	MiniDV	DVCPRO-L	DVCPRO-M	[illegible]
Number, size CCDs	1, 1/3"	3, 1/2"	3, 1/3"	3, 1/3"	3, 1/3"	3, 1/2"	1, 1/4
Pixels per CCD	570,000	410,000	270,000	270,000	270,000	410,000	410,000
Zoom optical/digital	10X or 20X/100X	Depends on lens	10X/20X	10X/20X	12X, 14X, 18X, depending on lens	Depends on lens	12X/30X
Image stabilization	Electronic	⊘	Electronic	Electronic	⊘	⊘	Electronic
Min. illumination (lux)	8	2	5	5	3	2	5
Lens/filter diameter	20/27mm	Depends on lens	27/49mm	27/49mm	Depends on lens	Depends on lens	21/37mm
Max. wide angle (degrees)	42	Depends on lens	33	33	Depends on lens	Depends on lens	46
Video outputs	Comp. (Y/C on cradle)	Comp., Y/C	Comp., Y/C	Comp., Y/C	Comp., Y/C	Comp., Y/C	Comp., Y/C
Digital I/O	⊘	⊘	⊘	⊘	⊘	⊘	⊘
Photo still capacity	5,400	⊘	580	580	⊘	⊘	720
Audio	12-bit, 16-bit	16-bit	12-bit, 16-bit	12-bit, 16-bit	16-bit	16-bit	16-bit
Dub 2nd audio	●	⊘	●	●	●	⊘	⊘
Manual audio-level control/display	⊘/⊘	⊘/●	⊘/⊘	⊘/⊘	⊘/⊘	●/●	⊘/⊘
LCD monitor	⊘	⊘	⊘	⊘	⊘	⊘	●
Accessory shoe	⊘	●	●	●	●	●	⊘
Reshoot/end search	●/⊘	●/⊘	⊘/●	⊘/●	⊘/⊘	⊘/⊘	⊘/●
Edit search	⊘	⊘	●	●	⊘	⊘	●
Edit control	JLIP (on cradle)	JLIP	5-pin Panasonic	5-pin Panasonic	⊘	⊘	⊘
Weight w/battery	1.1 lbs.	13 lbs.	2.4 lbs.	2.4 lbs.	13 lbs.	11.5 lbs.	1.5 lbs.
Price	$2,999	$9,327	$3,999	$4,295	$8,100 ($5,995 w/o lens)	$18,725 ($16,900 w/o lens)	$2,799
	570	570	571	572	572	572	573

● = yes; ⊘ = no or none.



inside the battery compartment, as they are on the VX1000).

Only the edit-search buttons seem poorly placed under the viewfinder. Overall, the DSR-200 has taken most of the VX1000 functions and put them on switches and dials rather than viewfinder menus.

The DSR-200's main shortcoming relative to the Panasonic AJ-D200 is low-light performance. As with the VX1000, we saw noise coming up with light below 80 lux. Although the camera sections appear identical, our measured values for DSR-200 horizontal and vertical resolution were slightly below those of the VX1000.

Professional Camcorders

While pro-level DV camcorders are principally designed for broadcast environments rather than multimedia, it's good to know what you're giving up if you buy a semipro or consumer DV camcorder.

Professional DV camcorders have great interchangeable lenses with more than 1,000 lines of resolution, coaxing the maximum out of their 410,000-pixel CCDs. Sony and Panasonic cameras also come with 2X optical zoom extenders; no gimmicky digital zooms here. However, they do have digital signal processing, with dozens of critical parameters (the usual gain, iris, shutter, etc., plus detail settings for chroma, dark, red, horizontal and vertical sharpness, coring, black stretch and auto-knee) saved in setup cards or read on tape. A skin-detail mode softens facial tones, a sort of electronic cosmetic makeup. DSP and the latest CCDs produce an amazing 62dB to 63dB signal-to-noise ratio, and these cameras show no vertical smear in bright light (the less expensive JVC was an exception). All have wide manual gain adjustments (from -3dB to 30dB by 3dB steps) and filter wheels for preset color temperatures. Using Synchro or Clear Scan, you can record off computer monitors without rolling bars. However, they record only 16-bit, 48kHz audio, so you will not be able to dub additional tracks.

Big, comfortable 1.5-inch monochrome viewfinders have 600 lines of resolution for critical focus work. Professional camera operators will find all the familiar controls on a big camera that balances on their shoulders, with an audio monitor next to their ears (except on the JVC). And the cameras genlock (synchronize) to one another for studio work.

Sharp VL-D5000U	Sony DCR-PC7 (800) 342-5721 www.sel.sony.com	Sony DCR-VX700	Sony DCR-VX1000	Sony DSR-200	Sony DSR-130
MiniDV	MiniDV	MiniDV	MiniDV	DVCAM	DVCAM, MiniDV
3, 1/4"	1, 1/3"	1, 1/3"	3, 1/3"	3, 1/3"	3, 2/3"
410,000	410,000	410,000	410,000	410,000	410,000
12X/30X	10X/120X	10X/20X	10X/20X	10X/20X	Depends on lens
Electronic	Optical	Optical	Optical	Optical	⊘
8	8	3	4	4	1
23/37mm	21/37mm	38/52mm	32/52mm	38/52mm	Depends on lens
41	42.5	39	39	38.5	Depends on lens
Comp. (Y/C on cradle)	Comp., Y/C	Comp., Y/C	Comp., Y/C	Comp., Y/C	Comp., Y/C
⊘	IEEE1394	IEEE1394	IEEE1394	IEEE1394	⊘
720	108,000	540	510	540	⊘
16-bit	12-bit	12-bit	12-bit	12-bit	16-bit
⊘	⊘	⊘	⊘	●	⊘
⊘/⊘	⊘/⊘	●/●	⊘/⊘	●/●	●/●
●	●(also acts as viewfinder)	⊘	⊘	⊘	⊘
⊘	●	●	●	●	●
⊘/●	⊘/●	⊘/⊘	⊘/⊘	⊘/⊘	⊘/⊘
⊘	⊘	●	●	●	●
⊘	LANC/FireWire	LANC/FireWire	LANC/FireWire	LANC/FireWire	⊘
2.7 lbs.	1.3 lbs.	3.3 lbs.	3 lbs.	10.5 lbs.	16 lbs.
$3,799	$3,199	$2,999	$4,199	$6,400	$22,900 ($19,400 w/o lens)
573	574	574	574	574	574

JVC ENG-1910U

The ENG-1910U ($9,327) from JVC Professional combines the new $3,495 MiniDV dockable back with a triple half-inch CCD KY-19U camera head. It lists for half the price of the two other pro models, and the BR-DV10U back is the least expensive way to convert your existing two-piece JVC Pro cameras to DV, though you will be limited to one-hour tape runs.

Like the Sony and Panasonic camera sections, the JVC KY-19U has a lot of exposure intelligence. It turns the automatic gain up as much as 18dB to shoot in 8-lux low-illumination conditions. In daylight, an electronic iris feature stops the shutter down. In addition, a low-lux button combines the light from more than 1 pixel to reduce resolution but increase sensitivity, permitting work at 2-lux illumination at 30dB gain.

The MiniDV BR-DV10U dockable back mounts the XLR inputs and 4-pin power on the right side, along with a +4dB/-60dB switch for line or microphone inputs for each audio channel. It has S-video output, and a standard battery holder at the rear accepts a short JVC NB-G1 or a taller, industry-standard Sony NP-1B. Although the BR-DV10U has no manual audio-level control, a visual display shows the automatic gain level in the KY-19U viewfinder. JVC's JLIP interface allows computer control of the BR-DV10U for editing.

We liked the reshoot function, which rewinds to the start of a shot for retakes. Problems included a door mechanism that tended to stick, and at low light the KY-19U showed significant vertical smear. In normal light, picture quality and resolution were excellent.

Panasonic AJ-D700

Panasonic introduced the AJ-D700 ($16,900 without lens, $18,725 with S14X7.5 lens) as the first DVCPRO camcorder well over a year ago. It records only on the proprietary Medium cassette (up to 63 minutes); it cannot record or play MiniDV, even with the cassette adapter that works in the AJ-D750 studio deck. (An AJ-D800 with two-third-inch CCDs and lenses has joined the line for about $25,000.)

(continued on page 57)

Director 6 Hits All the Right Buttons

BY DAVID K. ANDERSON

With Director 6, Macromedia has managed to address key deficiencies in its industry-leading multimedia authoring program without succumbing to the "featuritis" common among mature product upgrades. A clear focus on productivity, performance and Internet enhancements makes this a must-have upgrade.

Macromedia touts Director as the "author-once, deliver-anywhere" tool, and almost-identical Mac and Windows versions that can each create files playable on the other, as well as on the Internet, make good on that claim.

For the Windows user, one of the best things about the new Director is its dramatically increased playback speed, made possible by Intel's new Pentium MMX processor. The exact improvement will depend on your content, but we saw animations run up to 30 percent faster with the new processor.

For Director mavens, the most obvious change will be the new Score window interface, which makes the program accessible to first-time users as well as multimedia pros. By popular request, the number of sprite channels in the Score has been increased from 48 to 120. And though even 120 channels will be too few for some (we'd like to see maximum channels based simply on available memory), the difference feels like moving from a cramped apartment to a luxury penthouse.

Another Score enhancement is the ability to widen or narrow its frames between 6 and 1,600 percent, which speeds up navigation and makes the interface easier to use on small monitors. Macromedia has also added a toggle button that you can use to hide the portion of the Score that contains the time, transition and sound channels—another aid to the monitor-challenged.

In addition, sprites now act as unified objects that span frames of the Score. A sprite's entire duration on the Stage can be moved around as a single object, which automatically tweens between key frames. (You can also set the Score preferences to revert to a version 5-style Score window if you are so inclined.) Multiple Score windows can be opened simultaneously, each displaying different sprite-channel data. However, this capability aggravates the window proliferation problem. We appreciated the sprite information displayed at the top of each Score window, specifying *x* and *y* locations on the Stage and the values for the left, right, top and bottom of each sprite—data that used to be accessed via the Message window. A new movable window called the Sprite Inspector displays this same information. Also new are the two highlight rectangles that now surround the sprites when they have been selected, making it much easier to select the grabber handles on the sprite bounding box. This makes a world of difference when arranging sprites on the Stage.

The newly enhanced Score window displays sprite tracks as discrete, movable objects. Behaviors can be be dragged directly onto the sprite objects from the Cast window to the Score. Also note the new position-tracking fields at the top.

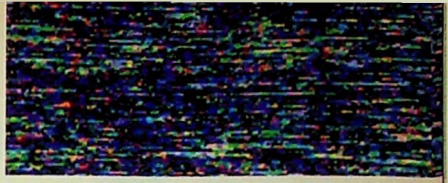
In another major improvement, Macromedia has significantly added to the list of graphics formats Director can import. Both the Windows and Macintosh versions will now import BMP, GIF, JPEG, Photoshop 3, PNG, TIFF and PICT file formats (as well as other, less significant formats). The Windows version will also import Photo CD, PCX, WMF, PostScript and the FLC and FLI animation formats. This curious discrepancy can be attributed to the fact that ImageMark, the third-party software Macromedia uses to handle graphics conversions, is more fully implemented on the PC.

Director 6 can launch any media editor directly, making it much easier to switch between applications. In addition, you can specify different editors for each media type—SoundEdit for AIFF, Photoshop 4 for JPEGs and so on. These editors and formats are listed in a new External Editor Preferences window. Whenever you change media data, Director automatically reimports it. This is in tune with the way most developers work—Director and Photoshop both open at the same time with a dynamic exchange of information between the two. Director still doesn't support alpha channels, but they are available via Xtras.

Net Asset

Shockwave audio is integrated into Director for playback over the Internet or an intranet. This is a tremendous improvement and a boon to those developing for the Internet. A long-desired feature is the inclusion of cue points in digital audio and video files. A cue point could, for example, be set in SoundEdit to trigger graphic sprite changes in Director via Lingo. This means developers finally have a simple and uniform method of lip-synching dialogue to an animated character. It also means that text bullet points can appear at precise points during a digital-video presentation, without the complex timing and list structure procedure previously required.

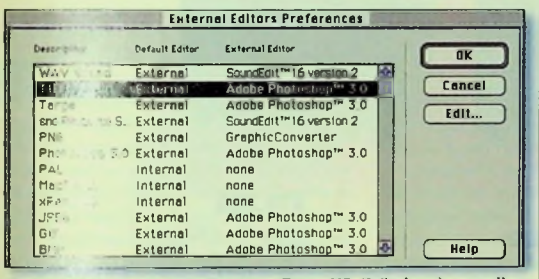
Behavior scripts, Macromedia's answer to mTropolis' behaviors, are also new in Director 6 and provide the ability to add interactivity without starting from scratch in Lingo. Using behavior scripts, you can control the actions and conditions of sprites. If you are an experienced scriptor, the concept may take some getting used to, but it will streamline your authoring.



Several default behaviors ship with Director 6, and it is easy to script your own (which you eventually will want to do). Looking much like other scripts, behaviors are easy to use: You simply drag them onto sprites in the Score, combining several in a single script if you wish. The handy Behavior Inspector (a window through which you can check and set the behavior properties of a sprite) will make you wish for similar access to parent scripts.

Some of the best new features in Director 6 relate to Shockwave. More tightly integrated with authoring in Director. This one feature will do more to speed Shockwave authoring than all the other changes combined. Likewise, you can now link to media anywhere on the Internet just as though you were linking to media on a local hard drive.

Director 6 is packaged with Director Multimedia Studio, a robust set of companion products, for $999; if you are upgrading, Studio costs $499 (compared with $399 for the stand-alone product). Studio adds the SoundEdit 16 audio editing programs (Mac) or Sonic Foundry's Sound Forge XP (Windows), as well as Macromedia's Extreme 3D 2.0 and xRes 3.0 image editor—all of which have earned Thumbs Up or Awesome awards in recent *NewMedia* reviews.



Director supports more media types than previous versions, including JPEG, GIF and Photoshop. External editors can now be assigned for different media types via the new External Editors Preferences dialog.

Netscape Navigator and Microsoft Internet Explorer, version 6 allows Java applets to be played within Director files. In addition, Shockwave now streams graphics during playback over networks—the No. 1 requested upgrade. The animation builds with successive sprite channels in successive frames.

Shockwave Lingo has been incorporated into the Director authoring environment, eliminating the need for the Afterburner Xtra workaround that existed in prior versions. Developers can now test Shockwave productions within Director instead of having to build elaborate Lingo structures to trap Shockwave calls while

With Director 6, Macromedia has taken a strong and mature authoring product and broadened its appeal for novices and pros alike. The emphasis on performance improvements, Internet authoring and behaviors also shows that the company is listening closely to its users. With this latest release, Director's continuing supremacy in the multimedia authoring world seems assured.

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SHOOTING STARS *(continued from page 55)*

At low light, the half-inch CCD FIT Panasonic AJ-D700 was considerably less sensitive than the two-third-inch CCD IT Sony DSR-130 running on full automatic. However, smear was barely noticeable. In normal light, the camera was a full f-stop less sensitive, but on full auto it ran much brighter than the Sony, pushing the IRE 100 level on our waveform monitor. Pictures were excellent when we manually adjusted the iris. However, great horizontal resolution was marred a bit by the low vertical resolution.

The viewfinder does not read out the time code (it's on the side LCD panel), instead showing only F-30, 30-10 and so on (a gas tank-type reading meaning full to 30 minutes left, etc.). If you're planning to edit with a system that moves the tape around a lot, the metal-particle formulation of DVCPRO will hold up better than Sony ME tape.

Sony DVCAM DSR-130

The Sony DVCAM DSR-130 bundles the top-quality DXC-D30 camera section with a DSR-1 DVCAM back and 16:1 zoom lens for $22,900. The camera section has the best signal-to-noise performance in the industry: 63dB. This is much better than the DVCAM (55dB) and Betacam (52dB) tape formats. It outperformed a Betacam BVW-400A in both normal and low light at less than half the price and significantly less weight. The DXC-D30 camera can also dock with a PVV-3 Betacam back for legacy compatibility. It has a dual-VTR interface for new 76-pin dockable backs and older 50-pin backs like the PVV-3. And you can buy just the DSR-1 DVCAM back ($7,400) to get into DV for a relatively small incremental investment.

The DSR-1 is a marvel of engineering, recording and playing MiniDV/DVCAM and standard DV/DVCAM. This is the first camcorder that can work with two cassette sizes: The standard DVCAM cassette gives you up to 184 minutes of recording time, and in a pinch, you can shoot 40 minutes of DVCAM on the widely available 60-minute MiniDV consumer tape. The DSR-1 also has edit search. Controls on the DXC-D30 camera are convenient for the left hand, just above the standard toggle switches, with great tools like EZ Focus, auto-iris and an auto-tracking white button.

We also like the many connections, including S-video, composite/BNC and stereo phono outputs, plus genlock in and time code I/O. A dual-pixel mode doubles low-light performance but sacrifices resolution.

Although it lacks the FireWire connector present in all of the other Sony DV camcorders (digital transfer must be done via a separate tape deck), the DSR-130 has a powerful editing support function called Clip-Link. This function stores shot information, with in- and out-points and tiny picture icons, on the Memory-In-Cassette chip. An NG button lets you mark a shot as "no good," and a take button lets you mark in- and out-points within a shot. Later, when transferring data to the Sony EditStation, only the good shots and material marked as Take get uploaded for nonlinear editing (at 4X speed with the SDI-equipped DSR-85 studio recorder).

In both normal and low light, the DSR-130 also had the best picture quality and resolution in our study.

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