# Macintosh and DV

Bringing powerful video editing
and effects to all professionals

# Contents

# Introduction

Apple Computer is working to reinvent the way digital video is created and used. For the first time, Apple is delivering a complete end-to-end personal video workstation starting at $6,000 including a third-party camcorder. Based on the new Power Macintosh G3 with its built-in FireWire capabilities, the DV video format, QuickTime, and Apple's new Final Cut Pro editing and special effects software, this new solution is combining revolutionary products and technologies to enable professional-level digital video editing for a wide audience of professional and consumer customers. Now anyone in the professional creative space— designers, web authors, multimedia producers, educators, and more—will be able to afford a video system that is high quality, extremely productive, and easy to use.

Apple brings these affordable video systems to market just as the video industry is going through a major revolution. Digital technology is changing the way that video signals are acquired, modified, and delivered: The entire process, from script to screen, has become a digital science. Video creation and use is set to expand beyond entertainment. DVD drives in PCs, streaming video on the Internet, and the worldwide adoption of FireWire are just a few examples of the convergence of media into an easily shared digital environment. This, in turn, will lead to more video being created. These changes will help to make video a common method of communication—for consumers and businesses alike.

"The digital video market is booming. I mean, digital TV is all that everyone talks about. You know, TV is going digital. And that is a radical change in a huge analog industry. It's just as profound as what happened 15 years ago with desktop publishing. Video is going in and out of the computer. It's being scaled. It's being manipulated. It's being moved toward the Net at the same time that it's moving up toward broadcast."

**Dirk Van Dal**
**Principal Consultant**
**Digital Video Showtime Networks**

## A single source for a DV editing workstation

Apple has a unique advantage in delivering a video editing system that is highly productive while also inexpensive. This advantage is due to Apple's commitment to developing, integrating, testing, and delivering every core technology necessary for such a system. These technologies are all part of Apple's comprehensive video components, including DV support, FireWire, and Final Cut Pro, all of which interact through QuickTime (see illustration on page 5). With the exception of Final Cut Pro, each of these technologies is now standard equipment in the new line of Power Macintosh G3 computers, making video a natural extension of the Macintosh, just as desktop publishing has been for more than a decade.

The consumer also benefits from Apple's ownership and development of these core technologies. Competitive solutions typically include a host of products, often not tested together, resulting in incompatibilities, finger pointing, and extensive troubleshooting by the end user. In contrast, the Apple Power Macintosh G3– and Final Cut Pro–based video workstation is completely turnkey. This approach provides the user with a true plug-and-play solution that is tuned for performance and works right out of the box. This in turn leads to higher productivity and the ability to focus on creativity. If the user needs help, technical support is available with a single telephone call. There is no need to call multiple companies.

# QuickTime is the standard for digital video

**QuickTime™**

QuickTime is the hub of Apple's personal video workstation—enabling technology that makes video, audio, music, 3D, and virtual reality a natural extension of both Macintosh and Windows–based computers. It enables the creation, editing, and publishing of digital media. QuickTime includes multiple software components that extend the ability of the operating system to handle dynamic media. Developers use QuickTime to create powerful and dynamic tools and games. For example, QuickTime allows multiple video files to be seamlessly stitched together and played back as a single movie using copy and paste.

First introduced in 1991, QuickTime signaled the beginning of the desktop video revolution. During the past eight years, Apple has successfully made QuickTime a standard for digital video creation and delivery. It has won numerous industry awards, and is gaining widespread acknowledgment for its support of industry-recognized formats including SMPTE Timecode, MIDI, and more than 33 other commonly used media types. Most recently, the International Standards Organization recognized Apple's leadership position and has selected QuickTime as the starting point for the new MPEG-4 multimedia standard, expected to be finalized in 2002.

**QuickTime supports multiple formats, including DV**

QuickTime has plug-in components that support a variety of video formats and compressors, allowing for video to be easily imported to or exported from the computer. Before DV and FireWire, video had to be converted from analog to digital. QuickTime facilitates the conversion by allowing a variety of third-party video capture and output cards to work inside the Macintosh, while presenting a standard set of application hooks and interface to software programs that work with the video. Of course, QuickTime has been extended to support DV and FireWire using the same application hooks and software interface. Consequently, these digital options are presented to the user in the same way as traditional analog options, making them another choice in any easy-to-use environment.

## Macintosh and DV
QuickTime is the standard for
digital video
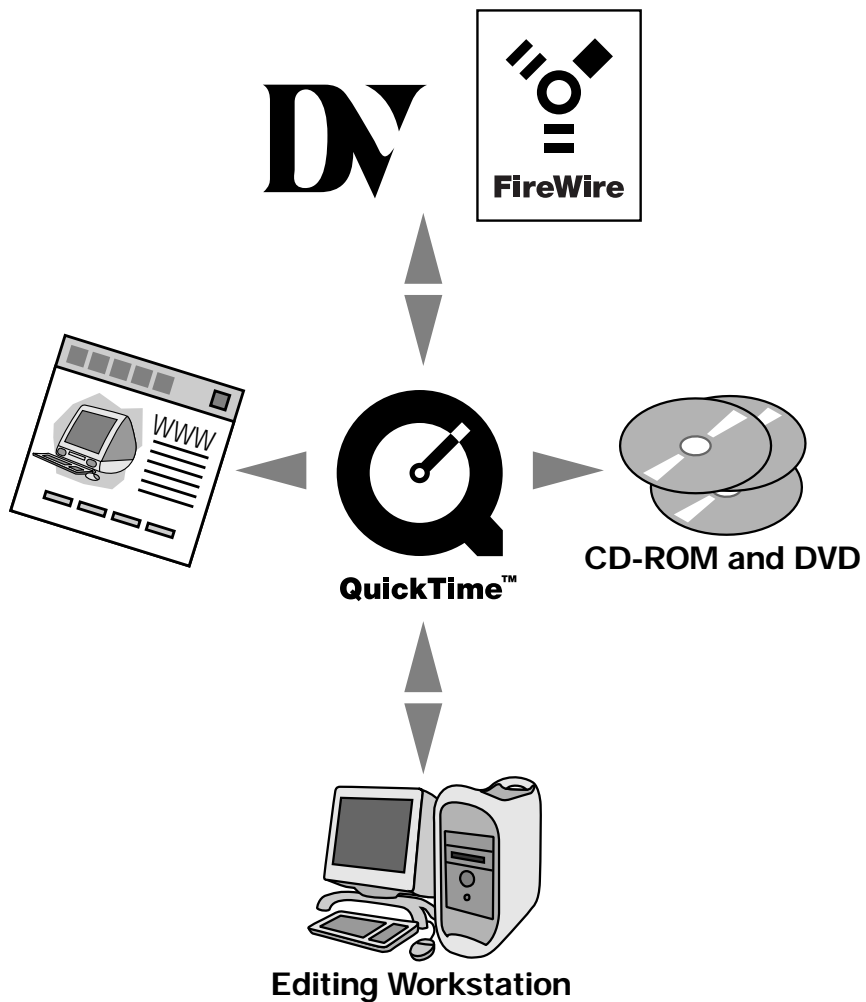
Apple's QuickTime technology seamlessly integrates a wide selection of audio and video
formats making it the ideal environment for DV video production.

QuickTime is the ideal environment which to build a complete video authoring solution,
whether offered by Apple or third-party manufacturers. It integrates seamlessly with a wide
selection of audio and video production tools, easily imports and exports nearly every video
format in use today, and is transparent to the user. QuickTime is also capable of combining
graphics, audio, video, text, and animation into a single file, all while maintaining perfect
audio/video synchronization, support for SMPTE Timecode, and special effects and transitions.
Equally important is the ability of a producer to export a single QuickTime file for broadcast,
CD-ROM, or the World Wide Web. No other media technology offers this range of quality,
performance, and system integration.

**For more information:**
www.apple.com/quicktime
www.QuickTimeFAQ.org

# DV: Changing the face of video production

- DV format digital video offers better quality
- Razor-sharp digital images from start to finish
- Video input and output from camera to the computer using the FireWire standard
- Standard DV cable connection for lossless plug-and-play data transfer
- DV is available from most professional and consumer electronics companies
- Hardware peripherals and products are easily interchangeable using DV

The DV format and its variations (including Sony's new Digital 8) provide broadcast-quality images and audio at remarkably low prices. DV (digital video) offers more than 500 lines of horizontal resolution (higher quality than NTSC television signals) and does so using an innovative compression system. The Discrete Cosine Transform (DCT) system, first used in highly expensive systems, makes it possible to record vast amounts of digital video on a small cassette. DV includes excellent error correction technology, reducing tape dropout errors, while Time Base Correction assists in delivering a high-quality, stable image. DV audio includes two tracks of 12-bit audio (stereo), delivering quality on par with CD or DAT audiotape.

The DV format is available in many cameras with many combinations of lenses, CCDs, and recording mechanisms. Although different manufacturers may use different recording mechanisms or even tape formats (MiniDV, Digital 8, DVCam, DVCPro), the DV compressor technology employed in each camera is the same. Consequently, data from any DV-based camera can be edited on a DV-compatible computer (such as those equipped with FireWire) and output to any DV camera or tape deck.

Until recently, most video recording was done using analog videotape recorders and camcorders. The most common industrial and broadcast formats included Hi8 and Betacam SP, respectively. Although DV tape is smaller than Hi8, the quality and stability are far superior due to its digital environment. Betacam SP, another analog format, produces high-quality imagery and is still highly popular, although too expensive for many independent producers and educational environments. For most applications, DV images appear with the same clarity and overall quality as those shot in the far more expensive Betacam SP environment.

Manufacturers are embracing DV and supporting it with high-speed data transfer and related peripherals. As a result, the video market is on the verge of taking a sudden and rapid step forward. That step is being supported by extremely low entry prices for DV and Digital 8 camcorders—less than $1,000 for not just one model, but a variety. As professionals and consumers alike begin to see the results of DV, the number of users will continue to expand, rapidly creating a new standard (and market) for video production.

**Macintosh and DV**
DV: Changing the face
of video production

**DV is the fastest-growing segment of the camcorder market**

The latest research on new digital video storage technologies by Strategy Analytics (formerly BIS Strategic Decisions) shows that DV is the fastest-growing segment of the camcorder market. DV camcorder sales in Europe, the U.S., and Japan reached 1.4 million units in 1997, worth more than $2.7 billion at the retail level, and are thought to have topped 2.0 million units in 1998, exceeding $3.1 billion in sales. A variety of analysts have projected that by 2002, DV products will outsell analog video equipment, and if current rates continue, virtually all cameras will be digital within the coming decade.

DV camcorders are changing the uses for video in business, training, communications, and entertainment. Because these small DV camcorders capture a high-quality picture, videographers can quickly grab shots when a crew or a short deadline would ordinarily add people, time, and expense to a shoot. It's a snap to grab a sunset, a news story, or an image missing from a video production.

**For more information:**
www.dvcentral.org
www.sel.sony.com/SEL/
consumer/camcorder

# FireWire makes DV a plug-and-play solution

**FireWire**

"There is a tremendous revolution underway as a result of the convergence between digital camcorders and computers. Thanks to FireWire technology, digital camcorders like the Canon Elura are the perfect performance partner for DV-ready computers like the Apple Power Macintosh G3. Consumers and business users alike can quickly and easily capture high-resolution video and audio and transfer it to their computer using little more than a single FireWire cable. By enhancing and editing their video, with all the capabilities of nonlinear software like Apple's Final Cut Pro, anyone can have access to the benefits of a full scale production facility at a fraction of the cost and complexity of industrial gear."

**Michael Zorich**
**Product Marketing Manager**
**Video Division**
**Canon U.S.A., Inc.**

FireWire brings professional-quality video to mainstream computer users for the first time by allowing DV camcorders to be plug-and-play peripherals. FireWire (also called IEEE 1394 and i.Link) is a high-speed data transfer technology that uses a thin cable to support the integration of AV equipment, personal computers, and other peripherals.

FireWire is included with Apple's new Power Macintosh G3 computers. In addition, FireWire connectivity can be installed in older Power Macintosh G3 computers via a PCI card. Apple invented FireWire and then developed it in association with the IEEE Working Group. FireWire delivers high performance, is easy to use, operates in real time, includes cross-platform and industry-standard device interoperability, and sets the stage for integrating the worlds of consumer electronics and personal computers.

Most new DV cameras include a FireWire port for easy transfer of digital video data from camcorder to computer and vice versa. In addition to video, FireWire can move large amounts of data between computers and peripheral devices. Not only can FireWire transfer data from computers to peripherals, it operates in a peer-to-peer mode, enabling computers to talk to other computers, or camcorders and recorders to transfer digital data without using a computer at all.

FireWire features hot-swapping capabilities and fast transfer speeds, currently up to 400 megabits per second with faster speeds on the way. It is possible to add peripherals or video devices (up to 63 total) to a network without rebooting or configuring. FireWire provides higher speed, costs less, and is easier to use than most existing interfaces. In fact, it is possible to add cameras and recorders not only to the FireWire network, but to other computers as well. The audio/video network capability of FireWire lends itself to integration with other digital video devices, including set-top boxes, nonlinear VCRs, and more. The result is a snap-together network ideal for boutique video shops, news organizations, educational labs, independent producers, and the latest home theaters.

## Macintosh and DV
FireWire makes DV a plug-and-play solution
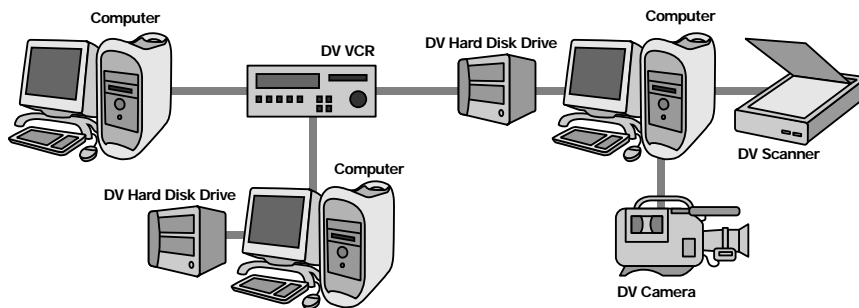
Computer    DV VCR    DV Hard Disk Drive    Computer

DV Scanner

Computer

DV Hard Disk Drive

DV Camera

FireWire operates in a peer-to-peer mode, enabling computers to talk to other computers, or camcorders and recorders to transfer digital data without using a computer at all.

## FireWire supports a wide variety of peripherals

In addition to video, a variety of high-speed peripherals will soon utilize FireWire, including hard disk drives, optical drives, scanners, and music-based Minidisc and multichannel MIDI devices, to name a few. FireWire is already eroding the once dominant market share of existing data/device interfaces such as SCSI. Within the coming 18 months, FireWire will be as commonplace in computers as serial connectors are today.

FireWire is quickly becoming a standard for PCs and AV devices. Compaq Computer Corporation, Matsushita Electric Industrial Co. Ltd. (Panasonic), Royal Philips Electronics, Sony Corporation, Toshiba Corporation, and other manufacturers are beginning to include FireWire in their computer video, and other AV products. FireWire has also been accepted as "the standard digital interface" by the Digital VCR Conference (DVC). The European Digital Video Broadcasters (DVB) have endorsed FireWire as their digital television interface as well. The VESA (Video Experts Standards Association) is considering using FireWire for digital home network media.

# Final Cut Pro:
# The complete solution
# for digital video editing

**Final Cut Pro features:**
- Plug-and-play, state-of-the-art solution for DV
- Professional editing, effects, and compositing
- Unequalled productivity, quality, creativity, and ease of use
- The best QuickTime-based tool for video creators
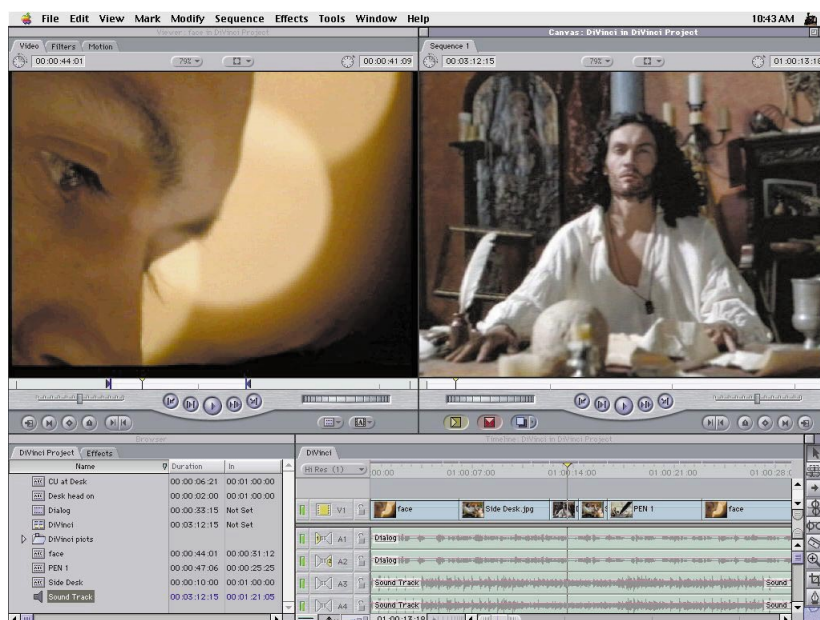


Final Cut Pro provides a combination of familiar editing tools with a powerful, yet easy to use interface. Source and Playback windows provide accurate real-time playback of video and audio content.

Apple's Final Cut Pro software combines the power of QuickTime, DV, and FireWire into a single video editing, special effects, and compositing solution. In many ways, Final Cut Pro provides the human interface to these technologies, allowing users for the first time to take advantage of their power in an environment that is affordable, highly productive, and easy to use. This represents a major breakthrough in digital video editing and effects.

Final Cut Pro is designed from the ground up for the new DV standard. Because it works with the latest release of QuickTime, it offers the most compatible and complete DV editing and effects. Final Cut Pro supports a wide range of video formats, such as SMPTE 259M and component analog from Betacam SP, and third-party hardware, including the TARGA product line from Truevision/Pinnacle. It also breaks down price barriers, offering capabilities and performance consistent with professional turnkey solutions that cost thousands of dollars more.

## Macintosh and DV
Final Cut Pro: The complete solution
for digital video editing
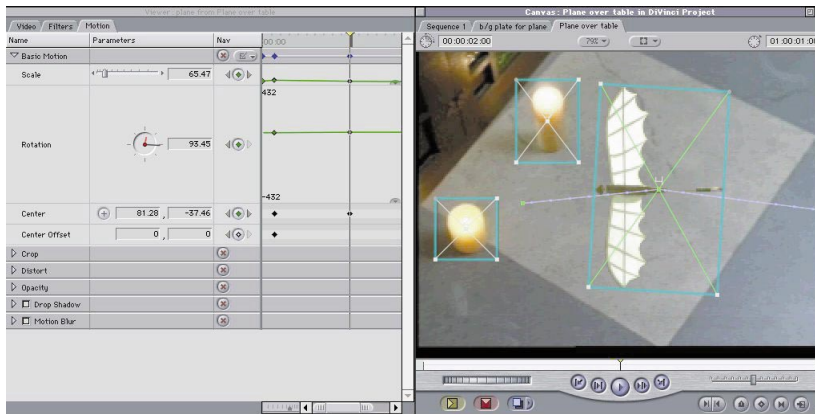
Final Cut Pro delivers compositing tools with direct user-controlled manipulation of the composited elements.

"As an editor, I appreciated the intuitive and streamlined editing functions. With the feel of a much higher-end system, Final Cut Pro will open doors to a lot of people."

**Larry Jordan**
**Professional Television**
**and Film Editor**

### The perfect DV editing solution

Final Cut Pro is the ideal DV editing environment. Users can log, capture, and output footage directly from (and to) their DV cameras or tape decks using Apple's FireWire technology. Final Cut Pro controls the camera and/or deck and allows the user to perform single-clip or batch captures. The DV data stream is not corrupted or converted to analog or other formats, and retains all of its original quality through the editing process.

Final Cut Pro works right out of the box with any FireWire peripheral (such as a DV camera) using the FireWire port on the new Power Macintosh G3. This provides the easiest way to transfer DV video to your hard disk, edit the video and audio source material, and play the results in large, high-quality windows simultaneously on a Macintosh screen and NTSC television monitor via your DV camera or tape deck. It's the first video tool allowing plug-and-play DV as well as support for all QuickTime formats. Final Cut Pro is designed to work with the unique features of DV. For instance, it implements true support for nonsquare pixels and automatic audio/video interleaving.

Final Cut Pro combines a sophisticated editing environment with direct compositing, special effects, and audio mixing—all in one affordable, QuickTime-based application. It is designed for professionals in video or media arts such as ad agencies, graphic designers, multimedia creators, and web authors. Video specialists will love its attention to workflow and productivity, while nonvideo professionals can create a wide range of content, including video news releases and training, marketing, and sales productions with broadcast-quality results.

**Macintosh and DV**
Final Cut Pro: The complete solution
for digital video editing

In many ways, Final Cut Pro delivers the human interface for QuickTime and DV, allowing users for the first time to take advantage of their power in an affordable, easy-to-use environment.

**A new performance standard**

Final Cut Pro sets a new standard for ease of use in professional video editing and effects. It includes a streamlined interface, so users can concentrate on their work and their creativity. Final Cut Pro has been designed to make editors feel "at home" when they edit. This is evident in features such as three-point editing, match frame, automatic synchronization detection and repair, and extensive multitrack trimming. All editing functions can be performed using source/record, in the timeline, with key commands, or the trimming window. These functions all perform as an editor would expect, without additional "computer tricks" to derail the creative thought process. Editors can see exactly how their video will appear in the finished production as they make changes.

Many video productions include at least one composited element these days, from an opening sequence to a unique transition. Final Cut Pro delivers advanced compositing tools with direct, user-controlled manipulation of the composited elements. Final Cut Pro can composite unlimited layers using a pasteboard or numeric interface and a variety of methods, including mattes and mathematical relations. An editor or designer can select and modify a layer directly in the Canvas window. Final Cut Pro makes it easy to manipulate each element—an editor can use Bézier or numeric controls to change the position of keyframes, the curve of the path, and the acceleration of the object along the path.

Final Cut Pro allows an editor/designer to apply key-framed filters and motion to any time range, regardless of clip boundaries, as well as to an entire clip, eliminating arbitrary restrictions that can complicate the creative process. For each range, an editor can apply an unlimited number of effects, reorder their application, synchronize the keyframes, and temporarily deactivate specific filters for absolute control. Editors also have the ability to customize Final Cut Pro with personalized effects and third-party Adobe After Effects–compatible plug-ins.

Final Cut Pro has many time-saving features for applying effects. For instance, it has four quality modes and a sophisticated render cache that saves render files across all quality levels and remembers them during undo commands. This simplifies the production process, giving an editor/designer the ability to work quickly at low resolution, where complex effects can be processed in a short time. Then, as the project evolves, the editor can shift to high resolution and render material at output quality. At any time, the user can change between these various qualities without losing source and render material in any mode. Thus the editor can constantly increase or change the working resolution as he or she sees fit, allowing maximum productivity.

## Macintosh and DV
Final Cut Pro: The complete solution
for digital video editing
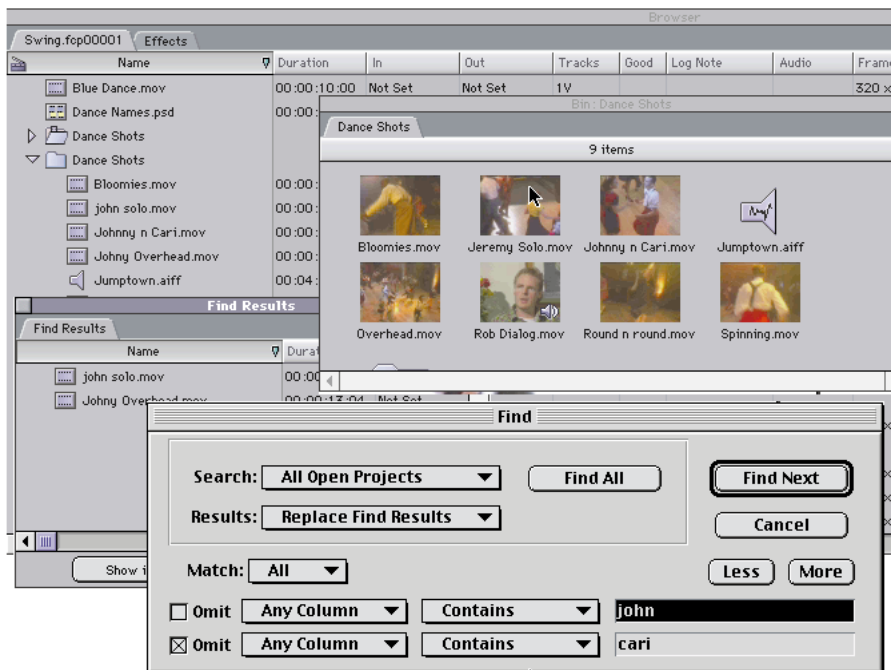
The user interface of Final Cut Pro has been designed to give DV editors a familiar working
environment, while also incorporating all of the advantages of the Mac OS.

### Audio, text, and studio integration

Audio is an integral component of any video editing environment. Most nonproprietary editing
software relies on external applications to manage audio, further complicating the editing
process. Final Cut Pro includes a host of audio mixing capabilities, including the ability to mix
from 8 to 24 or more tracks of audio in real time (computer CPU dependent). Each of the 99
available audio tracks has separate left and right stereo waveforms, individual panning and level
controls, and a host of audio filters that are processed in real time.

Final Cut Pro includes a text generator designed to make titles and lower-third captions fast
and easy to produce. Again, time is of the essence in many editing situations, and keeping
the production workflow moving forward is essential to meeting tight deadlines. The text
generator provides the controls necessary for creating stunning titles including automatic
kerning, tracking, leading, and anti-aliased type using any font at any size. The gradient
generator creates multicolored blends and ramps in a variety of styles. Any text and graphic
elements can be accentuated using the Final Cut Pro layers and keyframe animation features.

Final Cut Pro works well as a stand-alone workstation or can easily be integrated into an
existing studio environment. For working professionals, the ability to plug new equipment into
an existing machine room or edit suite can make all the difference when selecting the type of
product to purchase. Final Cut Pro generates and imports and exports all common EDL
formats, including CMX, Grass Valley, and Sony, allowing an editor to use Final Cut Pro as an
offline editor. It also includes built-in device control for batch capture and frame-accurate
recording to tape; device control uses FireWire for DV, and RS-244 and RS-232 for other
devices.

# The complete and affordable digital video workstation

A complete video workstation based on Final Cut Pro can be purchased for less than $6,000, including a DV video camera and disk storage. Apple's new Power Macintosh G3, combined with FireWire, QuickTime, and Final Cut Pro, provides creative professionals with a turnkey video production workstation unlike anything else available today. Not only is the Apple video solution cost effective in terms of initial investment, it offers substantial cost savings after the purchase as well. All questions related to Final Cut Pro functionality can be answered by a single manufacturer: Apple. All components related to technology, hardware, software and functionality were developed by the same company: Apple. The result is an easy-to-operate, easy-to-upgrade postproduction studio in a box.

## Apple is committed to video and DV

Apple develops and tests all the components that make up the complete solution. DV systems don't work optimally unless each component is specifically designed to work with the others. Windows-based PC systems do not offer the plug-and-play ease of use of Apple's solution. The de facto formats of choice for PC users, Microsoft's AVI and DirectShow, are not able to meet the demands of professional editing. In addition, there are no video editing applications on the PC that were designed for DV without additional hardware. Current DV applications require awkward export rendering and often don't address proper machine control and other issues. During the coming two years, these issues will be resolved as other vendors follow Apple's lead. For now, however, Apple is the only platform to offer a complete, turnkey DV-based production solution.

For creative professionals interested in using video in multiple environments, the Final Cut Pro editing environment offers substantial cost benefits over other solutions. Final Cut Pro supports plug-in enhancements, as does QuickTime. Video can be captured from a DV camera or other video format, edited and combined with graphics, audio, and 3D images, then output directly to a DV recorder or camera for tape distribution. (Other video formats are supported using qualified third-party cards such as the TARGA series from Truevision/Pinnacle.) In addition, using the Cinepak compressor technology contained in QuickTime, the same file can be compressed for playback on CD-ROM. Additional compressors offer a wide variety of options to media publishers. The Sorenson codec delivers crisp, quality video images for web streaming, while QDesign's audio compressor delivers near-CD audio quality in tiny files easily received on 28.8-Kbps modems.

# Conclusion

Apple is the only manufacturer of personal computers with the established leadership position in creative arts, high-performance computers—not to mention the company's inclusion of open standards and cross-platform delivery of digital media. Now the company is moving to extend this leadership into the world of video production. Several factors support Apple's ability to do so, notably its ability to mix and match established standards with Apple-developed technologies, such as DV with QuickTime and FireWire. The introduction of Final Cut Pro provides an unparalleled solution for digital video authoring and distribution—all from a single source.

In combining these technologies and products, Apple is creating a revolutionary new category in video creation—the personal video workstation. The system combines the awesome power of the Power Macintosh G3, Apple's legendary ease of use, and the high quality and convenience of DV and FireWire, as well as support for other video formats and standards. The Apple personal video workstation delivers a highly productive and complete editing and effects solution at breakthrough prices. Now, more people than ever before will be producing professional quality video on their desktops—from script to screen.

**For more information:**

www.apple.com

Apple Computer, Inc.

1 Infinite Loop
Cupertino, CA 95014
(408) 996-1010
www.apple.com