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PRODUCTION, POST PRODUCTION
SERVING THE BROADCAST,

TV TECHNOLOGY

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IN THIS ISSUE

Servers Follow Divergent Paths

by Andrew von Gamm

DIERSCHEID, Germany

One day, every viewer will have a server in his living room. That, at least, is the view of DEC's director of interactive multimedia, Phil Corman, and Microsoft chairman Bill Gates. And that, say critics supporting SMP (Symmetric MultiProcessing) and MPP (Massive Parallel Processors) is an impossible dream.

The current server market seems to have split into two camps: MMP and SMP. Compared to the amount of information needed by the Internet or any other network, video delivery needs massive capacity indeed.

CHOOSE YOUR SERVER

"There is no one server technology that has all the right answers for all markets," said Scott Wattawa, spokesman for video server technology at CableLabs, which leads research and development for the U.S. cable industry.

But does he see the earlier gains being made in SMP systems?

"They are within budget and some of them are ready to go," he said.

He points out that PC-based CD video disks can be used for added storage, and the bigger networks needing massive economies of scale may migrate to MPP.

CableLabs sees the market falling into three classes: PCs providing six streams per system for locally based near video-on-demand (NVOD); RISC-based UNIX systems using SMP and providing some 150 streams for such projects as local video-on-demand; and lastly, the MPP system providing up to 100,000 streams for true video-on-demand for the mass-market consumer.

PRICE CONSCIOUS

As in all things, success will be a question of price. Current wisdom sets the goal at about one stream of video for about five subscribers and the target cost for a stream at US$500. That is an investment of US$100 per subscriber.

By taking another look at the market and placing major products such as news and films on near video-on-demand, there can be 10 viewers per stream, some say even more.

Current thinking in Europe is placing the time delay for hit movies much further apart than was originally envisaged. Voices from within major media companies like Kirch and CLT are talking of NVOD time separations at half an hour or even longer, meaning current broadcast servers or even tape could be used.

By projecting a price of US$300 per stream, Intel is threatening to increase the goals of future VOD disk-based servers. Intel is basing its system around the P6 and P7 chips. By 1996, says Christina Blackwell, Intel's multimedia marketing manager, they will be shipping systems containing up to 256 P6s handling

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Brian Flowers explores the basics of electricity.
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Disk Technology Takes to the Air

Hewlett-Packard's Broadcast Video Server (BVS) helps stations evolve to a tapeless environment.

See Page 22

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Circle 10 On Reader Service Card

NEWS

NETWORKS

LEADING FIRMS FORM LATIN AMERICAN SATELLITE SERVICE

RIO DE JANEIRO, BRAZIL

Add two powerful names to the list of companies backing a Murdoch/TV Globo satellite direct-to-home venture for Latin America: Mexico's Grupo Televisa and the U.S.'s Tele-Communications Inc. (TCI)

The addition of these two media giants brings a wealth of programming options for the service, which is expected to launch later this year.

The service is likely to compete directly with a DTH system from Hughes Communications, operator of the DirecTV venture in the U.S. The Hughes Latin American service is supported by Venezuela's Cisneros Group, Brazil's Televisão Abril and Mexico's MVS Multivision.

The addition of Grupo Televisa to the Murdoch team leaves in doubt an earlier plan by Televisa to launch the Galavision satellite service aboard PanAmSat, of which Televisa owns more than 40 percent. Murdoch and TV Globo have already lined up 11 transponders aboard the Intelsat VII-A bird.

Still the partnership will bring a vast array of programming to the service. Grupo Televisa will supply its numerous Spanish-language soap operas and variety shows, while News Corp. has the extensive lineup from its Fox network in the U.S., BSkyB in Europe and Star TV in Asia. Meanwhile, TCI can offer up programming from more than a dozen cable channels in the U.S.

NEWS GATHERING

ONE-MAN CREWS GAIN STATURE

BERLIN

The days of three- and four-man news crews are over as new digital OB formats make it easier for individuals to provide the same service.

Such was the message of Michael Rosenblum, president of NYT Video News International, at the recent News World 95 conference here in November.

"The new small (US)$3,000 systems like the Panasonic DVC Pro can be used by a new breed of news-gatherer: the video journalist, or VJ," Rosenblum told an audience of leading news executives from across Europe.

Rosenblum blasted the established news organizations for the way they work.

"It is like having the print journalist come along with one guy holding the paper and another holding the pencil and third guy doing the interview," he said. "If I have five people out there, then each one should have a camera. To do it any other way is a huge waste of resources."

The very portability of the DVC Pro system proved to be its downfall during the show when the only one there was stolen off the Panasonic stand during the first day.

At an earlier session, Jeff Meadows of Quantel and Steve Owen of Panasonic agreed that the number of formats will increase dramatically.

"This is just the beginning," Meadows said. "Get ready for the biggest format war you have ever seen."

As an exhibition, News World 95 with just 35 stands, is still rather small, but most of the market leaders were there and every major broadcast news organization was represented. Altogether 550 delegates attended this first attempt by Media Ventures International (MVI) Ltd. of London to hold an annual fair for the news gathering market.

REGULATION

DENMARK STEPS UP DEREGULATION PROCESS

COPENHAGEN

The Danish Parliament has reached an agreement in which Tele Danmark, the Danish telecommunications group, will give up its exclusive right to radio and TV network transmission but will be allowed to enter the programming business.

The deal, which also encompasses a host of telephone- and network-related measures, is the second in a series of recent agreements aimed at liberalizing the Danish telecommunications sector.

The radio and TV portions of the agreement are slated to take effect July 1, 1996, with full deregulation of the industry expected by January, 1997.

Tele Danmark was privatized in April, 1994, with the intention that it would take part in telecom deregulation.

TELECOM

ATM DEAL REACHED

OTTAWA, CANADA

Telecommunications equipment manufacturer Northern Telecom (Nortel) and software developer Microware Systems Corporation of Des Moines, Iowa, have struck a deal that could hasten the introduction of interactive video signals over ATM (Asynchronous Transfer Mode) telephone lines.

The two companies plan to enhance Microware's 'DAVID' (Digital Audio/Video Interactive Decoder) set-top software by making it capable of handling ATM data transfers. DAVID has become a de facto standard for set-top manufacturers such as General Instrument, NEC, Philips and Zenith.

If successful, the combined ATM/DAVID architecture would allow telecoms to significantly reduce the cost of delivering a mix of digital pay-per-view programming, video telephony and a host of educational and commercial services over their broadband networks. By doing so, Canada's New Brunswick Telephone (NB Tel) — which is planning to deploy the ATM/DAVID technology — will have positioned itself to compete effectively with cable TV.

Separately, both technologies seem well-suited for their upcoming marriage.

On the one hand, ATM's ability to digitally expand or contract the bandwidth of its transmission channels — limited only by the overall carrying capacity of fiber or coaxial transmission lines — means that it has the capacity to carry and manage two-way video services on a telephone-style network.

"We believe that ATM end-to-end in the network is the right avenue," said Steve Naor, Nortel's business manager of broadband software products. "We can enable software operating systems (such as DAVID) in the home that can manage ATM service.

"The first application for this will be interactive services that involve video delivery," he added.

On the other hand, DAVID technology has already won wide acceptance among cable companies and telecoms as a possible platform for interactive television (ITV). For instance, Bell Atlantic, Telecom Italia, Hong Kong Telecom and Telecom Australia are already testing interactive DAVID ITV networks over fixed-capacity ADSL lines. Meanwhile, NYNEX is testing it over a fiber/coax system, and Cox Cable over an analog network.

According to Naor, NB Tel intends to rollout the ATM/DAVID boxes in the Canadian province of New Brunswick next year.

"NB Tel does not look at this deployment as an experiment," he said. "The view is that this is a pilot" that will eventually lead to the provision of ATM/DAVID services across New Brunswick.

"This actual customer is even looking, on a trial basis, at taking fiber to the home," added Arthur Orduna, Microware's strategic marketing manager. "So we are talking major bandwidth here."

COMPRESSION

ROMANIAN BROADCASTERS LAUNCH COMPRESSED SERVICES

BUCHAREST

Two of Romania's leading broadcasters are planning to initiate digital compressed services as a way of expanding programming offerings without tying up additional transponder space.

Antena 1, the country's first private network, and Central European Media Enterprises (CME) partnered with Media Pro International (MPI), have both selected Scientific-Atlanta's PowerVu system.

Antena 1 will uplink the service using a 4.5-meter earth station to the Eutelsat II F4 satellite. The service will be available in 10 Romanian cities in which Antena 1 holds broadcast rights.

In addition to more programming, the MPEG 2-based PowerVu system will allow Antena 1 to provide additional teletext services, a separate stereo audio channel and high-speed data transmission.

CME and MPI also plan to uplink their PRO TV service from a 4.5-meter dish in Bucharest. The service will be downlinked from Eutelsat II F1 at more than 100 receive stations across the country.

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Gaining on Electronic Cinema

by Jim Mendrala

GUEST COMMENTARY

Electronic Cinema is a technology that is the subject of intense research by a number of leading companies around the world. In the near future, theater-goers will see bright, high resolution images of at least 35mm quality, projected onto a wide screen. This idea of converting movies into high-resolution, digital bit streams (or packets of data) for delivery to theaters with quality as good as the film itself has the major motion picture studios turning an eye toward the economic realities of electronic distribution.

Electronic Cinema can bring a number of important advantages to the evolution of the film industry. First is the amount of time and money saved, an especially important consideration to the producer and/or distributor. Second, Electronic Cinema can equal or better the very best cinema of today with its 35mm or 70mm quality images. Technically, with today's technology, there is no reason why film images (limited only by the film itself) cannot be projected electronically onto the big screen.

FUTURE VISION

Some people believe that HDTV is the cinema of the future. But HDTV has some inherent problems, as we shall see. Its resolution, though high, is only capable of super-16mm quality. The incompatible frame rate, inadequate bandwidth, inadequate number of scan lines, interlaced fields and bandwidth-limited color all combine to stymie efforts at real qualitative improvements in image quality for the wide-screen cinema. The broadcast-imposed standards of the television industry have tended to thwart the application of a time- and money-saving video technology to Electronic Cinema.

Today, movie prints are sent via land, sea and air to the various theater chains. Even though security is tight, piracy of the print does happen. Prints for a typical movie are expensive. They can average as much as US$2,700 per print copy. Prints also show wear and tear. They get scratched and cinched, or they break and have to be spliced back together while the audience sits and waits. Sometimes print reels inadvertently get shown out of sequence. Also, when switching from one reel to another, the film might be projected out of focus, sometimes for only a short time, sometimes for the length of the whole reel.

In the near future, a whole new way of delivering movies will evolve. Films today, with existing HDTV technology, can be transformed into a digital signal using either the NHK 1125/60 HDTV system or the European 1250/50 HDTV system. With the 1125/60 HDTV system, the frame rate is 30 frames per second (fps). This is not desirable, particularly in the U.S. where film is shot and projected at 24 fps.

The 1125/60 HDTV telecine must convert the 24 fps to 30 fps using the 3:2 pulldown technique, which is not a very good idea. Various digital compression schemes, such as MPEG, have ways to look only at the actual 24 fps, thus freeing up some of the time that would be wasted on compressing a video frame made up of one field of the previous film frame and one field of the next film frame. Sometimes the 3:2 pulldown detectors get fooled. This is another reason why Electronic Cinema in the U.S. cannot be led by conventional HDTV television technology.

FILM RATES

The American Society of Cinematographers (ASC) has insisted upon a 24 fps rate. With the European 1250/50 HDTV system, the frame rate is 25 fps. This is closer to the 24 frame rate used in the U.S. and the one the (ASC) is insisting on. Film in European and other 50 Hz countries is projected at 25 frames per second. The difference between 24 and 25 is 4 percent. With Electronic Cinema, films can be shown at their original frame rates, be it 24 fps or 25 fps.

Both of the above HDTV systems use a 2:1 interlace, yet the film is scanned progressively and converted to interlaced scan. The main reason for using the 2:1 interlace was primarily to reduce flicker. Electronic Cinema progressively scans the film. One major service bureau presently scans the film progressively and generates a digital file for every frame, with a resolution equal to or better than the film itself. We have seen the results on the wide-screen in such films as "Forest Gump," "Apollo 13" and others. Those digital bit streams were put back on film with no apparent loss of resolution even though they were manipulated through various types of computers.

As you can see, capturing a film digitally with quality as high as the film itself is being done today.

Let's look at a typical film projector. The projector has either a two- or three-blade shutter that allows each frame to be displayed two or three times per frame. Thus, what is seen on the screen is either 48 or 72 pictures per second at a 24 fps rate. Because of the light loss with a three-blade shutter most theaters use a two-blade shutter. This gives a perceptible flicker that gets worse as the amount of light is increased. Flicker tends to disappear when the display rate approaches 60 fps. With today's digital technology, to display a picture two or three times between frames is not a problem. 24 fps can be displayed at 72 (3 x 24) pictures per second and 25 fps can be displayed at 75 pictures per second, well above where flicker tends to be perceptible. MPEG compression, in a way, does this now when the 24-frame image is decompressed and its output displayed at 30 fps.

Most compression schemes are upwardly scalable. This means that if MPEG, as an example, is used, it could be scaled to do wide-screen, Electronic Cinema including scope-type films with their 2.35:1 aspect ratio and beyond.

Today, when a producer or film studio transfers a film to video, the process is very lengthy. A colorist does a scene-by-scene color correction on the film. The film from the film lab, as good as it is, is not as color correct as is required in an HDTV viewing situation. After the scenes are color corrected, the film is transferred into a digital signal and recorded. Electronic Cinema would be no exception. A colorist would be required here also. As a matter of fact, the only difference is that the film would be observed on a large screen, not a small CRT-type of monitor. Because of the phosphors, CRTs cannot display as much color as the film image contains. New projectors can display as much color as the film has. HDTV has reduced resolution in the color. Equal resolution color is absolutely necessary for big wide-screens, something HDTV cannot deliver.

Some people believe that HDTV is the cinema of the future. But HDTV has some inherent problems...

COMPRESSION PRO

Lately, a new person has been added to the list. A compressionist. Sometimes the colorist does both functions and is known as a Compression/Colorist. This person not only optimizes the color but also the compression. The main reason for the need of the compressionist is that today's films are destined for bandwidth-limited systems. A CD-ROM, for example, cannot support the high data rates necessary for wide-screen, high-resolution pictures. Even the new Digital Video Disk (DVD) is only up to standard broadcast quality. The so-called "Sweet Spot" in MPEG encoding for professional broadcast quality is around 6 MHz. For HDTV and wide-screen Electronic Cinema, the data rates are much higher. Today, it is not only possible to record that high amount of data with existing technology, but it is possible to distribute that data by fiber optics or, more economically, by satellite.

Today's satellites are designed for the traditional data, communication and television type of signals. Even with today's satellites though, the much better Electronic Cinema type of pictures are possible. In the near future, satellites dedicated to Electronic Cinema movie distribution will be in place to replace the current system of distribution.

Since the signal is digital, no loss of quality would be visible to the movie-goer. And because it is digital, various encryption schemes could be employed to protect the feature from unauthorized exhibition or piracy.

Once the digital bit stream reaches the theater, either via fiber optics or satellite, it finally needs to be displayed. Projection systems today fall into three main categories: emissive, transmissive light valve, and reflected light valve. Emissive displays

(continued on page 11)

NEWS

SHOW LISTINGS

6-8 February — Australian Cable & Satellite Television
Sydney. The convention center at Darling Harbour will host this examination of the Australian Pay-TV and other interactive developments. For information, contact AIC Conferences, GPO Box 3924, Sydney, NSW, 2001, Australia; telephone: +612-210-5777; FAX: +612-221-7773.

13-16 February — Wireless Technologies Mexico
Mexico City. The World Trade Center will be the site of this examination of the wireless technology industry. For information, contact organizers at E.J. Krause de Mexico, Rio Marnel No. 6, Col. Cuauhtemoc, 06500 Mexico, telephone: +525-592-3257; FAX: +525-592-6613.

22-25 February — Middle East Broadcast
Bahrain. The Bahrain International Exhibition Centre will house this even highlighting modern video and film transmission and production. For information, contact Philip McKean at Overseas Exhibitions Ltd., 11 Manchester Square, London, W1M 5AB, UK, telephone: +44-171-486-1951; FAX: +44-171-935-8625.

27 February-1 March — Comdex Mexico
Mexico City. The Interface Group brings its highly successful computer technology to The Sports Palace for an exhibition of everything from networking technology to mobile radio. For information, contact organizers at 300 First Avenue, Needham, MA, 02194-2722, USA; telephone: +1-617-449-6600; FAX: +1-617-449-3434.

4-7 April — Broadcast Thailand '96
Bangkok. The Queen Sirikit National Convention Center will play host to this gathering of audio and video specialists. For information, contact organizers at Reed Trudex House, 323 Bond Street, Office Villa, Muang Thong Thani, Cheangwattana, Nonthaburi 11120, Thailand, telephone: +662-503-2199; FAX: +662-503-4100-1.

15-18 April — NAB
Las Vegas. The National Association of Broadcasters will host U.S.'s premiere broadcast and production technology exhibition, set to draw record crowds again this year. For information, contact the association at 1771 N Street NW, Washington DC, 20036-2891, USA; telephone: +1-202-429-5350; FAX: +1-202-429-5406.

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Compression Offers a Post Solution

by Chris Dickinson

LONDON

Digital formats are being used in the transmission and storage of television and video more and more, which inevitably involves the increasing use of compression.

In what is perhaps a rare moment of consensus across the industry — widely put down to the charms and persistence of the MPEG governing committee — MPEG-1 and now, more commonly, MPEG-2 are accepted as standard tools for initiating compression, albeit with the proviso that one person's MPEG-2 may differ from the next.

COMMON GOAL

There are a number of projects working on creating MPEG-2-based studio systems. The goal of all of them, though, is finding the most efficient ways of compressing an image so it uses the least amount of storage space while the pictures still remain "watchable" for the viewer. With MPEG-2, a scaleable set of compression ratios allows the user more freedom to choose how much compression and so how much picture quality to trade off for additional storage space.

Of course, as network bandwidths increase and storage costs come down, the need for compression will itself be reduced, but that, as they say, is another story.

Leading the rush of compression systems for production equipment are a number of groupings, two of the most prominent of which are Tektronix, with the MPEG-2 system it uses in its Profile disk storage system, and Sony, which has SX and the Serial Digital Data Interface (SDDI) standard.

Tektronix is collaborating with Texas Instruments (TI) on the definition of a codec architecture supporting the MPEG-2 4:2:2 profile. Tektronix claims the MPEG-2 4:2:2 profile standard delivers "unparalleled flexibility" through the ability to make tradeoffs between levels of compression and bit rate while maintaining video quality. In addition it provides better color resolution and the capability to encode all active lines of video.

Rex Ferbrache, Tektronix vice president for strategic planning, says he wants to involve other companies beside TI in developing the MPEG-2 system.

"We are enthusiastic about working with TI, a world class leader in digital signal processing, to help further the development of open systems through MPEG-2 4:2:2 profile codes," Ferbrache said. "Tektronix is committed to open systems and we will engage in similar relationships with other companies who share our commitment."

Sony has its SX system, which is used in its newsroom systems and forms the basis of the compressed news format Betacam SX. According to Sony, the 4:2:2 studio profile compression system is a "highly efficient interframe compression method."

In essence, standard compression techniques found in MPEG-2 are applied, while maintaining the 4:2:2 color structure and the full number of lines in each frame.

SX, like MPEG-2, uses a video signal compression algorithm based on Discrete Cosine Transform (DCT) technology. SX is the compression system in the equipment. SDDI, which is an extension of the current Serial Digital Interface (SDI) standard, handles the moving of data around a studio complex or newsroom.

The DVC Pro line from Panasonic could potentially provide various amounts of compression.

Meanwhile, Panasonic has chosen to focus on the internationally agreed upon DVCPro system, the basis of a range of equipment being launched by the company. DVCPro has the potential to offer variable amounts of compression, can potentially handle HDTV pictures and has the benefit of being accepted by a number of rival companies.

Other work on compression systems includes some in-depth analysis of how to improve on the methods of sampling data. At IBC, for instance, a number of research groups gave the results of experiments on compression techniques using MPEG-2 and its derivatives.

The BBC, as part of the European Commission's COUGAR project, is looking at high quality motion estimation methods to provide vectors and other control information for the MPEG-2 coder. The end goal, say BBC researchers, is to produce "true" motion vectors, leading to higher quality pictures.

"The approach is driven by the observation that it is possible to perform high-quality motion-compensated temporal interpolation (for example, in standards converters and advanced slow motion generators) and obtain excellent results without the use of any prediction error signal to correct errors in the interpolation," the BBC says. "Such interpolation is based on the use of 'true motion vectors' and the use of fallback modes designed to produce visually acceptable pictures. There may, therefore, be an advantage in the use of such a philosophy when forming predictions for P and B pictures in an MPEG coder."

The BBC says the results of tests so far have been encouraging, though there is still a lot of work to be done.

MIND OVER MATTER

The Bolton Institute in the U.K. has approached compression systems from a different angle, having done work on neural network technology. Neural networks are based on the learning mechanism of the human brain. The structure of a neural network consists of a number of small computation units or processing elements to imitate neurons and couplings among them.

The Bolton Institute argues that by modifying the function of the processing elements, various learning algorithms can be designed to take advantage of the parallel processing in neural networks. This could, in theory, give a huge increase in the capacity of a compression system.

MPEG-1 and now, more commonly, MPEG-2 are accepted as standard tools for initiating compression.

ERA Technology of the U.K. has also looked beyond MPEG-2 to the next level of compression. It believes image-warping, in which an image is wrapped around a tube as is commonly seen in visual effects, can also be used in compression systems.

ERA executives say that the motion of objects and their apparent deformation in shape can be estimated and characterized by a number of descriptive parameters, which can then be transmitted. At the receiving end, a reconstruction of the moving object can be obtained from the object in a previous frame by using the parameters to define the necessary motion and deformation. This approach, ERA concludes, allows for a more natural movement of the object than purely translational models.

Across the industry, the fascination with compression and MPEG-2 in particular looks set to continue for some time. The rush is clearly on to develop the most cost-effective and efficient systems that allow video professionals in all fields to do more with less. ■

Satellite Firms Unite Behind MPEG-2 Delivery

by Chris Dickinson

LONDON

There are a number of practical, satellite distribution systems on the market that use MPEG-2 compression. These vary from professional signal distribution to Direct-to-Home transmission systems.

The leading vendors include General Instrument (GI), Scientific Atlanta and Digi-Media Vision (the former advanced products division of NTL now owned by News International).

GI originally did not support MPEG-2 but moved toward the standard as its acceptance grew. The company has its DigiCipher I system for encoding and decoding video for satellite relays. Up to 24 digital or 16 analog channels can be sent over a single transponder.

The company also has DigiCipher II. According to GI, DigiCipher compression is optimized for television, with MPEG-2 compression for video at lower bit rates. One of the main GI products incorporating DigiCipher II is the DSR-3200 integrated receiver/decoder for use with private network digital television. GI officials say key features of the compression system are its moderate memory requirements, its access speed and its ability to work with the company's Jerrold access control products.

The latest version of DigiCipher II is dual mode with MPEG-2 that enables mixed format video, audio and data services on a common multiplex system.

GI also has its new DigiCable system, which uses DigiCipher II and MPEG-2. DigiCable works by compressing up to 10 channels into a standard 6 MHz (for NTSC) or 8 MHz (for PAL) of cable channel spectrum.

Scientific Atlanta has a number of products using MPEG-2 compression and has been a supporter of the standard since its early days. The company introduced what it claims was the first MPEG-2 digital set-top box for the Time Warner and USWest trials in the U.S. It has also introduced head-end products like the Connection Management Controller and the Broadband Integrated Gateway, with two-way real-time QPSK signalling and 64/256 QAM downstream modulation.

The Model 8603 and Model 8603X are Scientific Atlanta's mass set-top box systems, both using MPEG-2.

Digi-Media Vision (DMV) has the NTL-developed MPEG-2 and DVB-compliant System 3000 distribution system for relaying compressed television signals to cable headends. There is also a new MPEG-2 satellite newsgathering system that allows broadcasters to send digital signals from the field back to the studio.

The codec in the system multiplexes the coded signals and then adds digital scrambling to provide secure program transmission. The digital stream is then forward-error-corrected and modulated onto a single 70 MHz (or 140 MHz) IF carrier.

With huge cost savings at stake from the ability to squeeze multiple programs through valuable transponder space, it appears that the satellite industry will be one of the driving forces behind compression technology for some time to come. ■

NEWS

Plasma Screens Come Into Focus

by Charles White

LAS VEGAS

Plasma video displays came a step closer to commercial roll-out recently as the thin screens made their debut at the Comdex Fall show in Las Vegas.

The displays can be manufactured larger than any conventional picture tube yet developed and will soon provide large, space-saving color screens, first for television applications and later for computers.

DUELING SCREENS

Two competing technologies were shown at Comdex. Sony's Plasmatron is a modification of traditional plasma technology that delivers a brighter, sharper picture. Following close behind was Fujitsu with a true plasma display, and although the picture quality did not quite equal Sony's, it sported a 42-inch screen versus Sony's 25 inch.

Since the displays will be first introduced in the Japanese market in 1996, all were using the NTSC wide aspect ratio (16:9) that is prevalent in Japan today. Fujitsu predicted it would be first to sell a plasma display, citing late 1996 as its rollout date. Sony was a bit more conservative, hoping to deliver its screens sometime in 1997.

Fujitsu's screen, a mere 1.38 inches thick,

The displays can be manufactured larger than any conventional picture tube yet developed . . .

▲ ▲ ▲

is a true plasma display that works with two transparent electrodes on its front glass plate with a corresponding electrode on the rear glass plate. In between the two sets of electrodes is a discharge cell filled with a plasma mixture of neon and xenon gas. When voltage is applied between the electrodes, a surface discharge generates ultraviolet radiation, which then excites red, green and blue phosphor dots. The full-color picture is displayed by controlling the luminance of each individual color phosphor.

"The structure is very compact," explained Stuart Hough Fujitsu's marketing manager for the U.S. "It is very simple to produce. There are only five major steps in the manufacturing process."

The primary advantage of this type of display is that it can be viewed from a wider angle. In Fujitsu's demonstration, this was dramatically obvious when viewing the screen from the side.

When viewing Sony's screen from that same angle, the picture quickly deteriorated, looking like a negative image of itself. Sony officials were quick to point out that this off-axis deterioration problem would be fixed before the units were brought to market.

PLASMA LIGHT

Sony's Plasmatron display, slightly thicker than Fujitsu's but still picture-frame thin, works more like active matrix liquid crystal displays in use on smaller laptop computer screens today. Instead of using the plasma discharge as a light-emitting source, the Sony technique, called Plasma Addressed Liquid Crystal (PALC), uses the plasma discharge phenomenon as an electrical on/off switch. The screen's brightness is supplied by a backlight that Sony says is a distinct advantage because the screens will last much longer than a true plasma display.

Sony has taken a more complicated chemical etching manufacturing process used by co-developer Tektronix and simplified it for mass production by using a manufacturing method that is much like a printing process. To further simplify manufacturing, the Plasmatron monitors do not need a separate driver for each pixel of the liquid crystal.

According to James Dalton, director of corporate development at Tektronix, "There are no fancy microelectronics involved. This device is just empty space: some grids, glass and metal. There is nothing else in it."

True plasma displays have been criticized for the limited length of service compared to the PALC type of plasma displays. However, of all the true plasma displays, Fujitsu believes its entry will have the longest life.

"The surface discharge electrode structure is unique to Fujitsu and developed by us," Hough said. "It is superior to the opposed electrode structure which other vendors are using. Our screen delivers higher luminance and longer life of the product."

The screens made quite a dazzling impression at Comdex. Fujitsu hung its model flat against a wall, while Sony presented an elegantly designed thin panel supported by small legs. The designs are quite mature, but not enough to lower the price. Compared to a conventional large-size television, which today costs about US$100 per inch of screen size, a plasma screen is now about US$400 per inch. Both Sony and Fujitsu expect that price to be substantially lower when the screens hit the mass market.

Fujitsu expects its production line to start making about 1,000 units per month by next October, increasing output to 10,000 per month by 1998. Sony, while less specific about its manufacturing timetable, did say it wanted to be able to sell its screens at prices similar to those of today's comparably-sized TVs. ■

NEWS

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Circle 2 On Reader Service Card

Pushing the Compression Edge

by James Careless

TORONTO

In its current configuration, digital video compression (DVC) has worked wonders in squeezing four digital channels in the same bandwidth required for one uncompressed analog feed. However, bigger and better things lie ahead, as TV Technology discovered in discussion with two leading-edge DVC companies, Compression Labs, Inc. (CLI) and Iterated Systems Inc.

Based in San Jose, California, CLI has arguably been the pivotal player in the research that led to the development of MPEG-2 compression. A measure of CLI's impact is the fact that its "Magnitude" MPEG-2 encoders/decoders are currently being used by both DirecTV and USSB (United States Satellite Broadcasting) to provide more than 200 channels of digital video and audio to their DBS customers.

AND FURTHER STILL

However, CLI still wants to take DVC even further. That is why it has developed "Statistical Multiplexing," or "StatMux," a recently patented technology that allows users to pack five or even six channels — rather than four — into a single analog channel. It has recently been incorporated into Magnitude equipment.

StatMux can do this because it has the real-time ability to reallocate bandwidth from channels that do not need it — channels showing relatively fixed scenes — to channels that do. This is possible because current fixed DVC channel allocations each have extra bandwidth allocated to them to handle signal-load "peaks," such as fast-moving camera pans during sporting events.

In most cases this bandwidth is not being used during transmission. That is why a multiplexer like StatMux, which is capable of monitoring multiple signal requirements in real time, is able to reallocate this bandwidth from relatively stable channels to channels that need the extra data space, in much the same way that ATM (Asynchronous Transfer Mode) equipment allocates bandwidth on a needed, rather than a fixed, basis.

"The key here is that demand is created within the encoder itself by looking ahead and determining on a frame-by-frame basis the degree of difficulty of encoding materials coming into the encoder in real time," said Jim Lakin, CLI's vice president marketing and development. "We are able to allocate bandwidth virtually on the fly.

"What that does is it actually allows you to increase the number of channels within a multiplexer," he added. "... you can not only improve picture quality with this technique, but we actually make available additional bandwidth for additional channels, which of course translates into additional revenues for broadcasters."

Lakin says CLI is also working to squeeze more signals into bandwidth by improving the transfer of film to video. This is particularly important to NTSC countries. Because film only requires 24 frames a second, NTSC broadcasters currently send out six redundant frames per second (fps) to bring it in line with the format's 30 fps rate.

CLI's Magnitude line features the latest in statistical multiplexing technology.

Obviously, these six frames could be eliminated and the bandwidth freed up for other uses, if equipment were developed that could compare the frames to each other in real time, deleting those that are redundant.

EVEN MATCH

Lakin says such "detelecining" equipment already exists, but that it is only currently capable of reducing the frame rate to 29 per second, due to the challenge of doing such complicated analysis in real time. However, he says that CLI's latest research has resulted in equipment that can drive this rate down to 25 frames/second, which exactly matches the PAL rate and frees up more bandwidth in NTSC countries for other uses.

"What this means for Near Video-on-Demand is that rather than transmitting one movie four times (within the same bandwidth), I may be able to transmit the same movie five or six times," Lakin said, "or I may be able to transmit two different movies in the same transport."

Other DVC applications being developed at CLI include a DS-3 multiplexer interface capable of transmitting a package of digital channels at 45 megabits/second (Mbps).

"That means that we can use a standard telco interface to transmit very large numbers of channels," Lakin said.

Meanwhile, Iterated Systems Corp. of Atlanta is taking an entirely different approach to DVC.

Since 1987 Iterated has been using the mathematical phenomenon of "fractals" — equations that create images in which the parts are similar in shape to that of the whole — to devise data-reducing ways to store still images on digital form. In essence, the "fractal transform" method searches for self-similarities within a bit-mapped image and expresses these relationships in mathematical terms.

This is possible because fractal images themselves are created through the translation of fractal formulae into computer images. Computer-generated graphics created using fractal geometry can be made to resemble naturally occurring shapes, such as a snowflake, a mountain range or a fern, says Brian Meek, Iterated's director of product marketing.

"So it occurred to Dr. Michael Barnsley (founder of Iterated) that he should be able to go the other direction and create a computer program that could take a digitized photograph and deduce the fractal codes that could best describe and recreate that image," Meek said. "This idea ultimately led to the discovery of the Fractal Transform method of image compressions, the founding of Iterated Systems and the release of software and developers libraries that utilize this technology."

FRACTAL FORMULA

Iterated's success in developing software capable of doing this — defining an image into a fractal formula that contains much less data than the original and requires far less bandwidth for transmission — has allowed the company to break into the CD-ROM still image market, and to make progress using fractal DVC for non-real-time store-and-forward video storage applications.

"We had set out to prove to the world that video could be done using fractal technology," Meek explained. That is why MCI and Iterated formed an alliance in 1994 to further develop image compression technology to telecommunications.

At present, fractal DVC has yet to reach the stage where it can deliver broadcast-quality video in real time. Still, there is the undeniable lure of fractal technology's amazing ability to squeeze a lot of information into a relatively small mathematical formula.

"I definitely believe that VHS quality and better will eventually be achieved at ISDN rates," Meeks said. "That is something I feel pretty comfortable with."

What is obvious from this outlook is that DVC still has room to grow. Whether it is simply a better utilization of existing models, as demonstrated by CLI, or an entirely new approach being researched by companies like Iterated Systems, it is clear that we will see more — and better — forms of the digital video compression in the years ahead. ■

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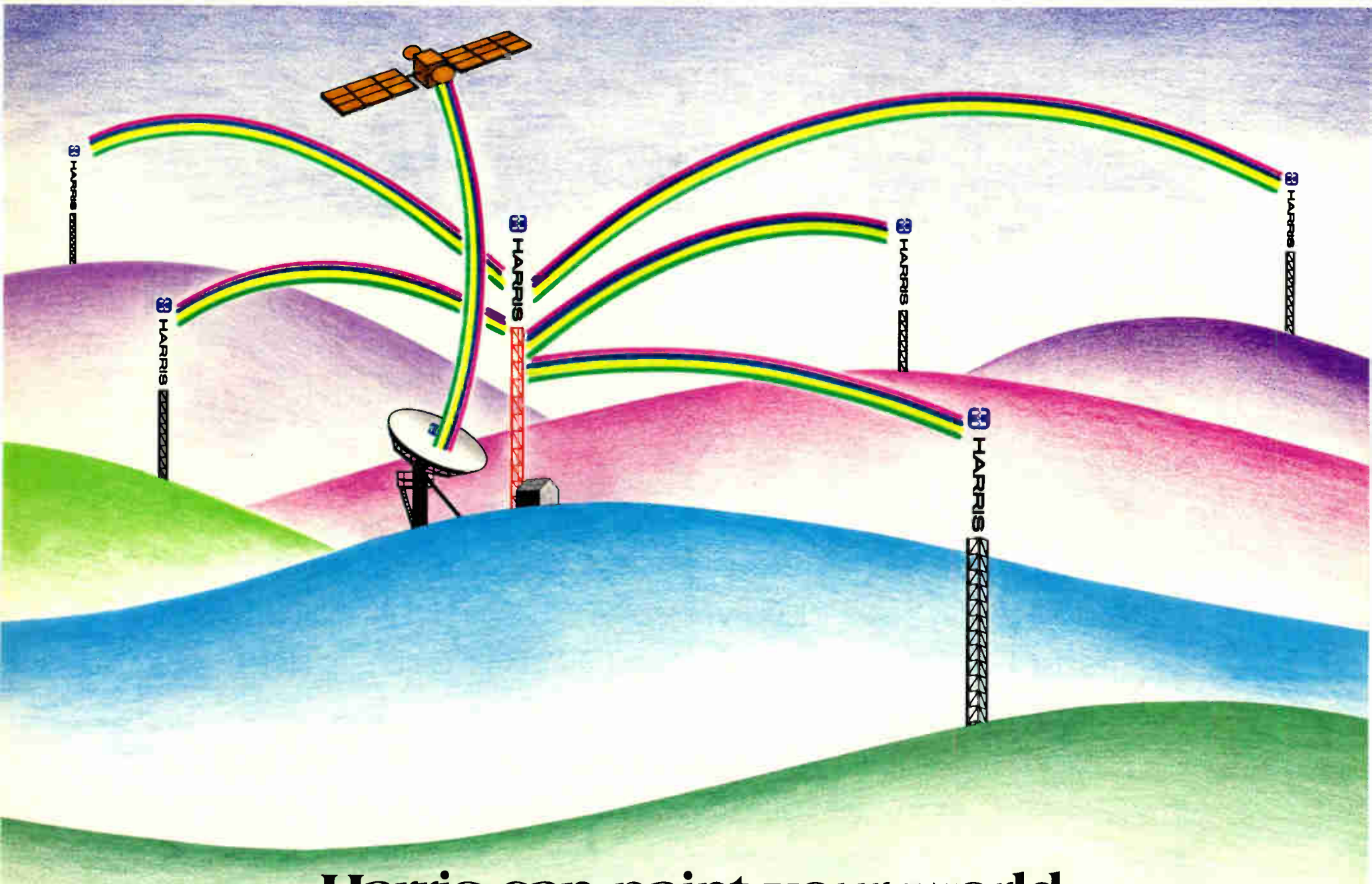

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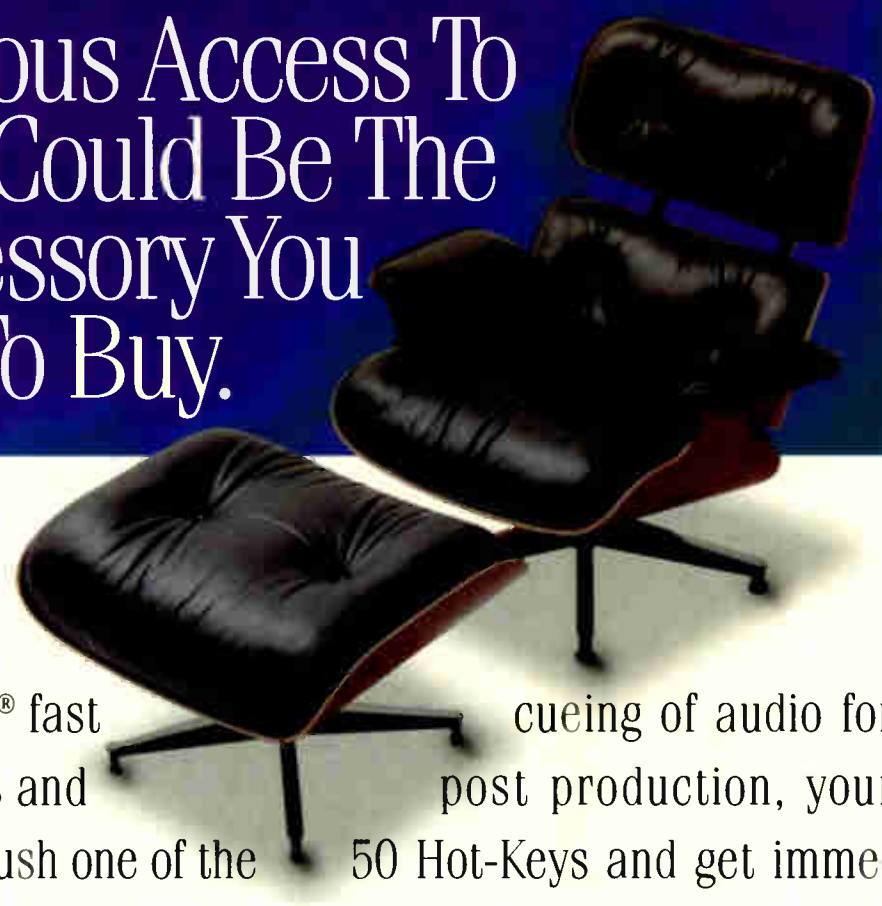

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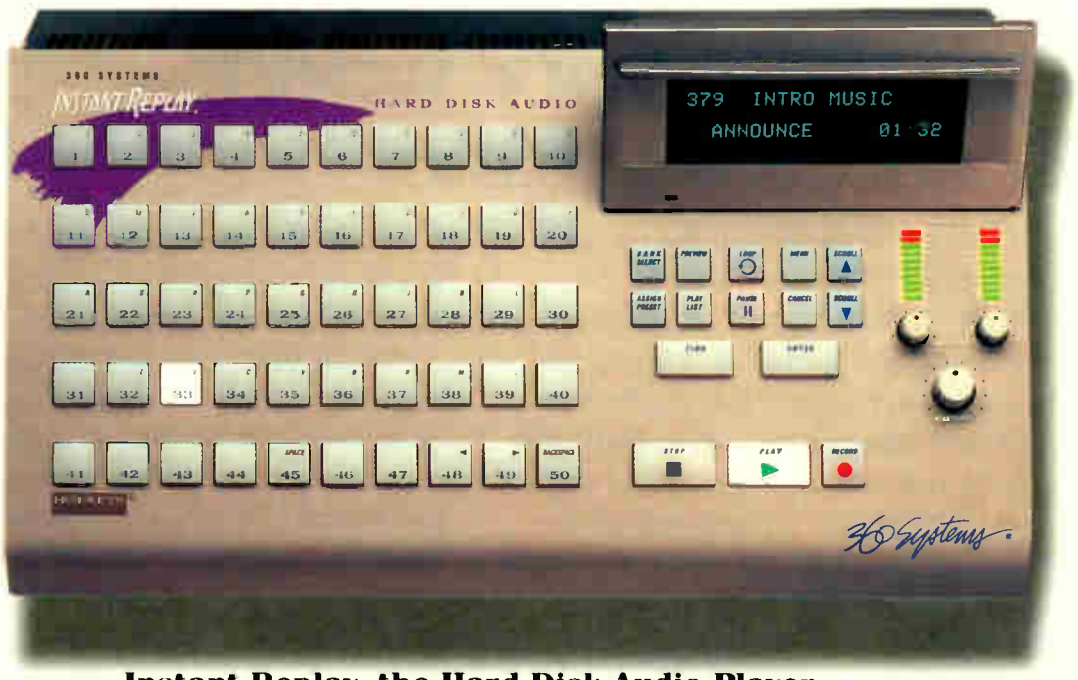

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CONTINUED FROM PAGE 1

Keeping Tabs on Video Servers

38,400 streams and costing about US$10 million.

A prototype system has been developed using 16 plug-in Pentium-based nodes each capable of delivering up to 1,000 MPEG streams that could be interconnected to create even larger systems. This system is being developed for a variety of communications applications and seems to target the SGI Challenge XL on economics.

The Challenge can hold up to 36 R4400MC processors with a bus speed of 1.2 GBps and enough bandwidth to put out more than 3,000 video streams.

According to CableLab's Wattawa, a solution to the demand for entry level local-based near video-on-demand could be CD video and the coming super density (SD) video disk. Prices for a CD video system could be as low as the Intel system within a couple of years and they could be docked onto a network, just one stream at a time.

A very different approach is being taken by suppliers to the broadcast market, but the two segments are moving ever closer. The Phillips/BTS Media Pool provides the broadcaster complete random access and off-line editing and has the ability to provide enough output streams for NVOD. This could provide broadcasters with access to the VOD market and an in-house system at the same time.

SERVER SUCCESS

The largely unsung success story of the hard disk server is Tektronix Profile, of which some 250 units have been shipped since its introduction in 1994. According to European sales manager George Boath, this has been almost exclusively to broadcasters, though he was able to announce a sale to a German medical research facility for the stereoscopic (3D) recording of operations, including brain surgery.

The Profile uses so-called intelligent M-JPEG compression that varies the amount of compression according to the content of the picture. Typically, for high quality broadcast applications the 4:1 to 8:1 range is used, giving quality superior to Betacam SP. The video files are managed by a single Intel 960 chip and can be in two- or four-channel configuration. The hard disk array ranges from 16 to 100 GB, giving 40 minutes to 9 hours of playing time at the high quality setting. All four channels are fully bi-directional (i.e. record or playback) regardless of what the others are doing.

Like the Profile, Quantel's new Clipbox is able to register considerable interest from the new breed of multiple-channel broadcasters who wish to put dozens of digital channels out over satellite and cable. The first major sale for the Clipbox was to CLT, which acquired 300 hours worth of storage with an unspecified number of editing systems. The system is to be combined with the IBIS LandScape automation system and linked to NewsBox and EditBox editing systems, while a Hal Express is to cover graphics. Because all the systems will draw material from the ClipBox, results of production and post production work will be immediately available for transmission.

...the traditional gateway function of the broadcaster may be replaced by multimedia and telephone companies.

This instant availability is an important point: any future VOD market may not need broadcasters. Producers and TV journalists will be able to access data banks directly, and the traditional gateway function of the broadcaster may be replaced by multimedia and telephone companies. Systems like the Clipbox and Profile provide the ability to put multiple NVOD signals on digital cable and satellite today, rather than wait for the solutions of tomorrow.

One of the tools being used to trigger the multimedia market is what DEC calls the "Content Creation Centre," which is a fancy expression for an office that helps the customer create interactive, multimedia software packages using still and moving video and hypertext. The first such office was opened in December 1994 in New York, and DEC hopes to have similar facilities throughout the world, each employing about 20 people.

Hewlett-Packard claims to be taking a different path with what it calls "an upgradeable, loosely coupled architecture" called the Video Transfer Engine. However, at first inspection, it seems to fulfill very much the same role as an SMP system. It is a UNIX-based system that should be able to handle 5,000 to 10,000 video streams.

Sony has unveiled a server system to provide multimedia and VOD using what Sony claims is a unique software platform. Sony announced the new system in the hope that it will boost the VOD market that has fallen "short of expectations." Called the Interactive Video Communications System (IVS), it is the link between the server and the set-top box. According to Claude Barraud, director of Sony Telecoms Europe, the IVS is to begin shipping by the end of 1996.

BOXED IN

In the meantime, Oracle and Hitachi have developed an interactive television system for on-line shopping, news and VOD. Hitachi is to continue to develop its set-top boxes and Oracle its Media Server, and the new system is designed to link the two.

Sony is now in talks with Oracle and Hitachi with a view to combining their system with the IVS architecture, although Barraud said that his company did not expect VOD to take off within the next three years.

Sun has launched a new series of servers for the provision of video across networks for corporate users. Called the MediaCenter, the server is designed for financial services, training applications and retail outlets. Sun is developing a series of VOD products and software to be packaged with the MediaCenter. Systems start at 33 streams and 8 hours of storage, and a top-of-the-line outfit will provide 65 hours of video and support 270 streams. The server is to integrate with Oracle and Sybase software and was to have begun shipping in December.

However, Sun may not have the market all to itself as Microsoft gets ready to roll out its new server software package based on the Windows NT operating system. Hewlett-Packard and DEC are also getting ready to launch competing systems, and Netscape Chairman Jim Clark announced at Geneva that his company had "completed talks with telecommunications providers for the Netscape commerce provider."

Many voices in Europe regard the idea of video servers becoming a commodity and discount these developments as being too absurd to even take seriously. Michael Salmony, of IBM's interactive TV department in Stuttgart, told the Imagina conference that building a number-cruncher is one thing, installing a network and building customer acceptance is quite another. He places the costs of VOD at well over US$1,000 a stream and the network installation costs at US$700 per customer.

He also points out that the present video rental customer pays just US$2.25 a film.

"It would take 14 years just to make return on investment," he said.

Ranged against that view are such figures as those from DEC's director of interactive multimedia, Phil Corman, who said "Let's face it, video servers are doomed to become a commodity." ■

CONTINUED FROM PAGE 5

Research Closes In On The Electronic Cinema

are based upon cathode ray tubes (CRT) or laser technology. CRT projectors today are relatively dim and limited to approximately 1 Kw power input. The best CRT projectors give a maximum light output of approximately 1,000 lumens at peak white. CRT projectors can suffer poor resolution in the corners, spot growth at high beam currents, or visible line structure at low beam currents.

COLD BLUE

Laser CRT projectors offer potentially higher power and more efficient operation but depend on very low operating temperatures, and the efficiency of the blue lazing material is low. Laser projectors in general require mechanical scanning and high power demands and potentially high costs. Image speckle has been an obstacle in laser projectors even though techniques can minimize this problem.

Until the Liquid Crystal Display (LCD) projector, large screen projectors were based on electron beam-addressed oil films to produce high brightness projected images. These projectors require continuous adjustment during their operating life. However, LCD Projectors based upon transmissive active matrix light valves have efficiency losses due to polarization and partial blocking of the light path by the active matrix. They also deliver pixelized images with low resolution, which is inherent in their design. Image lag is also a problem on some displays.

Reflective LCD light valves deliver a very bright, pixel-free image with more than 400 percent more contrast and much higher resolution. The reflective LCD is addressed with a low level infrared, high resolution CRT imaged onto a layer of liquid crystal (one for each of the tri-stimulus colors, RGB).

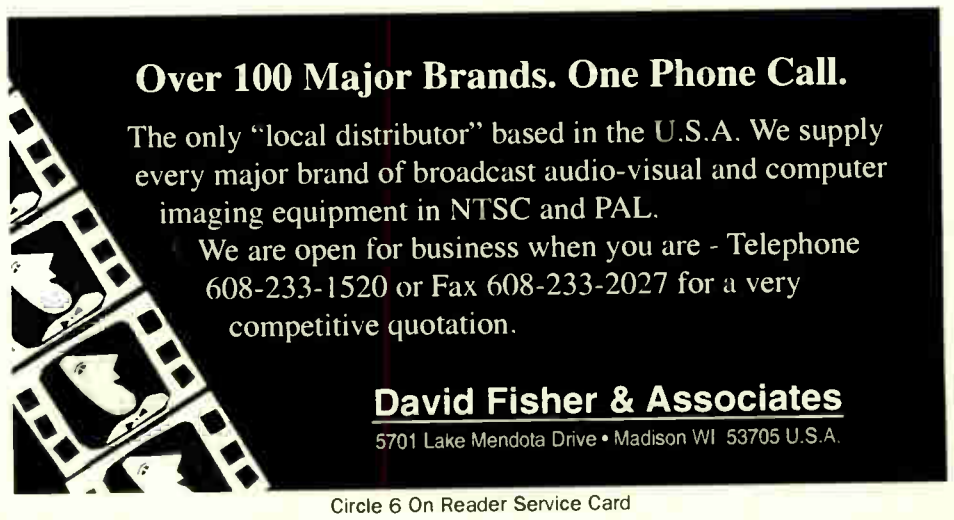
Digital Micromirror Device (DMD) projectors are reflective also. But unlike CRTs or reflective LCDs, they use tiny micro-size mirrors to reflect the light through a lens to the screen. Pulse width modulation modulates the intensity of the light as seen on the screen by the eye. This produces a linear modulation or unity gamma (i.e., gamma = 1.0). A DMD device for each of the primary colors (RGB) is used, and being solid state, like a CCD color camera, it requires only a simple one-time registration.

However, interlaced pictures are not suited to DMD devices, as only half the maximum possible picture brightness would result. By using progressive scan, the vertical spatial bandwidth is increased by about 60 percent. DMDs are inherently low-flicker devices with no lag. The DMD-type of projector produces a picture that is similar to projected film. The technology is scaleable and compatible to all known aspect ratios, such as 2.35:1, 2.2:1, 1.85:1, 1.78:1 (HDTV format), 1.66:1, and 1.33:1.

Electronic Cinema will evolve into a more efficient way of delivering a bright, sharp, focused film with excellent color, high resolution, digital clarity and digital CD quality multitrack surround sound audio.

The loss of prints en route to the theater will be eliminated, as will film breaks and scratched or cinched prints. Encryption of the digital data will make piracy extremely difficult. Satellite delivery will make distribution costs plummet. All solid state DMD type of projectors will make digital displays possible and relatively maintenance-free, a real advantage to the cineplex theaters of tomorrow. ■

James Mendrala is an electronic media/HDTV/video/film consultant. He pioneered early developments in electronic cinematography for the wide screen and HDTV industries.



Circle 6 On Reader Service Card

Electricity in its Most Basic Form

by Brian Flowers

ENGINEERING CORNER

NEWS

American humorist James Thurber used to tell about his grandmother who would go around the house making sure that all the light bulbs were screwed in tight to ensure that electricity did not leak out of the sockets. While this may have had a calming effect on the poor woman's psyche, it is clearly not based on any scientific fact.

Of course, this is excusable because her daily life did not revolve around an understanding of the nature of electricity. And yet it is surprising how many people whose lives do require such understanding — such as television engineers, both veterans and novices — are clearly lacking.

Any elementary discussion of electricity requires some basic physics. We should start with the basic units of classical physics, namely length, mass and time, using the MKS system (meter-kilogram-second).

PLATINUM DEFINITION

A length of one meter used to be defined as the distance between two lines on a bar of platinum kept at a constant temperature in Paris. But this has been superseded by 1,650,763.73 wavelengths in a vacuum of a specific radiation from krypton-86.

A mass of one kilogram is the mass of a well-preserved block of platinum at the International Bureau of Weights and Measures at Sèvres, France. But it is also the mass of one liter (0.001 cubic meter) of pure water at a certain temperature.

One second used to be derived from the time between the meridian (when the sun reaches its highest point as seen from a given place on the earth's surface) on two consecutive days, this being equal to 24 x 60 x 60 = 86,400 seconds.

Since the rotation of the earth is not absolutely steady, a more precise definition of a second has now been adopted, namely the time interval corresponding to 9,192,631,770 oscillations of caesium-133. Using this definition, it is sometimes necessary to add an extra second to the last day of the year to bring Greenwich Mean Time in line with Astronomical Time.

Incidentally, do not make the mistake of thinking that the Earth revolves once every 24 hours. In fact, since the Earth orbits the sun once a year, it actually revolves about 361 degrees in 24 hours. Hence it revolves 360° in 24 x 360/361 ≈ 23 hours 56 minutes.

The bridge from the above classical physical units to electrical units is provided by the definition of the ampere, namely the current that produces a force (due to the interaction of the two resultant magnetic fields) of 2 x 10^{-7} newtons per meter between two infinitely long wires of negligible cross section, which are one meter apart in a vacuum. For calibration purposes, the two wires are made into two parallel flat coils, one being fixed and the other one being attached to a sensitive balance.

NEWTONIAN PHYSICS

The newton is defined as the force that will accelerate one kilogram one meter per second per second (force = mass x acceleration). Hence we have now defined the unit of electric current, the ampere (or amp), in terms of MKS parameters, but it remains a basic unit. The dimensions of the newton (mass x acceleration) are $M.L.T^{-2}$.

The use of length, mass and time as basic dimensions is valid only for the familiar world of classical Newtonian physics.

An electric current corresponds to the flow of electrons through a conductor, or through a vacuum in the case of a cathode-ray tube. The unit of electrical potential that makes the electrons move is the volt. Some substances allow the flow of electrons more easily than others, metals being generally good conductors. This is because the metal atoms easily pass electrons from one to another, whereas the atoms or molecules of most other substances do not.

Gases conduct when their atoms or molecules are ionized, as in a neon sign. Ions are also produced when substances dissolve in water, so brine is a good conductor, whereas pure water is not. Dissolved molecules dissociate into two parts, with one having too many electrons and one having too few. The two parts, or ions, thereby acquire a negative and a positive charge respectively.

We should now introduce Ohm's law, namely I = V/R, where:

I = current in amps,

V = potential difference in volts,

R = resistance in ohms.

When one volt produces a current of one amp through a resistance of one ohm, one watt of power is produced. This heats the resistance, though not enough to make toast or to boil a kettle of water. For this you need a few hundred watts.

A power of one watt produces energy at the rate of one joule per second, and one joule is the work done when a force of one newton moves its point of application one meter in the direction of the force. Think of pushing your car when the engine refuses to start and you will immediately understand that this involves quite a bit of work. One horsepower is 746 watts, so one manpower is about 100 watts, although some athletes can produce several hundred watts for a few seconds.

So 1 joule/second = 1 watt = 1 volt x 1 amp, or in general terms: W = V x I.

Combining this equation with Ohm's law also gives us $W = V^2/R$ and $W = I^2 \times R$.

The dimensions of work are $M.L^2.T^{-2}$ (force x distance), so the dimensions of power are $M.L^2.T^{-3}$ (work per unit time).

Hence, the amp is defined in terms of MKS units, and the watt is derived from MKS units. The volt is derived from the watt and the amp, and the ohm is derived from the volt and the amp.

However, the use of length, mass and time as basic dimensions is valid only for the familiar world of classical Newtonian physics. For a more comprehensive description of the universe, we must include relativity and quantum theory.

The three universal constants are actually the speed of light (c), the gravitational constant (G), and Plank's constant (h). The latter relates energy quanta and electromagnetic radiation frequency by the equation: E = h x f, where

E = the smallest quantum of energy that can be emitted at a given frequency,

h = Plank's constant,

f = frequency of the emission.

Hence, Plank's constant is (h) = E/f, so it has units of energy x time. Its actual value in MKS units is about 6.6256 x 10^{-34} joule/seconds. Like the speed of light (c) and the gravitational constant (G), Plank's constant (h) has the same value for any observer anywhere in the universe.

In contrast the mass of a moving object varies according to the formula:

$$M = \frac{M_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

where:

M = mass,

M_0 = rest mass,

v = velocity,

c = speed of light.

From this equation it follows that an object moving at the speed of light would have infinite mass, which explains why only entities with zero mass, such as photons, can travel at the speed of light.

Similarly, the moving object's length in the direction of motion becomes shorter as it goes faster, and its time slows down, as seen by a "stationary" observer. In fact (length x time) is a constant, so the moving object's seconds become longer in inverse proportion to its reduction in length.

This leads to the "twins paradox," whereby one twin sets off on a very fast space flight and comes back to Earth five years later in his time, to find that his brother has aged 20 years.

This time-slowing effect has a practical effect on the business of television transmission. For instance, it reduces communication satellite oscillator frequences by a few Hz in 10 GHz. Of course, the effect is completely swamped by other variations, such as Doppler effect and oscillator instability. In fact, to complete the analysis, we should also realize that for objects on Earth, the effect of gravity slows their time very slightly compared to objects in free fall, such as satellites. However, for satellites the speed effect far outweighs the gravity effect.

LIGHT SPEED

The fact that the speed of light is a universal constant also means that we are not really entitled to define length and time separately, since as soon as one is defined, the value of the other one follows automatically from the value of c.

Hence length, mass and time, are not really basic units at all, but they can usually be regarded as such in our everyday world. This is just as well, because most people are so used to the classical concepts that they have great difficulty in accepting the implications of relativity and quantum theory.

Even Einstein had problems with the implications of quantum theory, leading to his remark that, "God does not play dice." But experiments carried out since Einstein show that God not only plays dice but is also not averse to a game of poker. ■

An engineer at the European Broadcasting Union for 33 years, Brian Flowers is the former head of service and project manager for the EBU's Eurovision Control Center in Geneva. He was recently transferred to the Transmission Technology sector at the EBU. He studied engineering at the University of Southhampton and served for two years in the Royal Air Force before joining the BBC. He is a member of the Royal Television Society and was recently accepted as a member of the IEEE.

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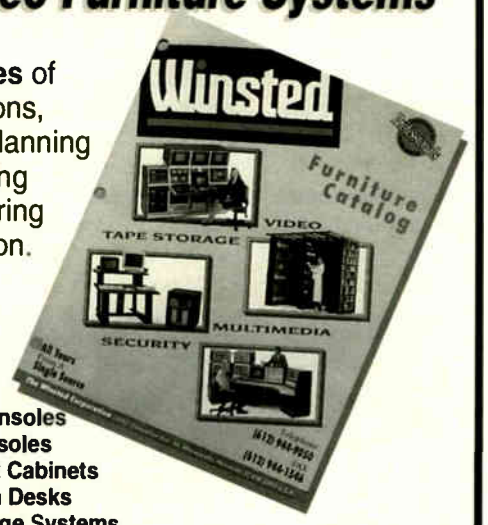

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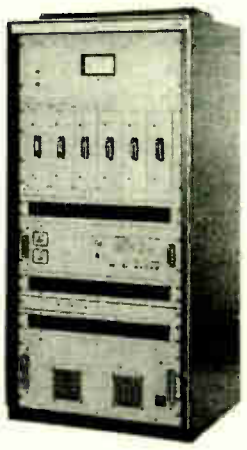

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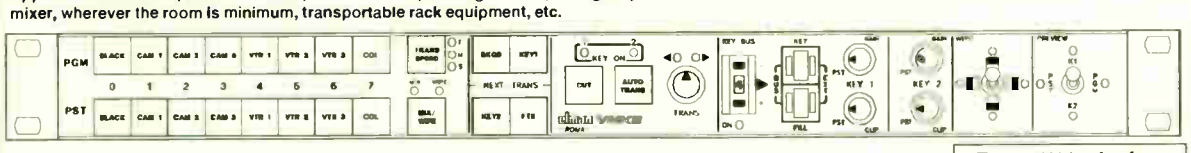

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Disk Technology Through the Ages

by John Watkinson

VIDEO WATCH

With hard disks taking a greater share of the audio and video storage market, it is important to know how they work. I first studied disk drive technology 20 years ago, and although today's drives are more sophisticated, the basics are still the same.

The disk drive occupies a unique niche in the data storage market. Data storage devices are primarily rated by cost per bit and access time. It is a fact of life that these two goals features mutually exclusive. The fastest access is obtained from RAM (random access memory), but it costs far too much for universal use. Likewise, tape is cheap but slow.

Today's disk drives are descendants of magnetically coated drums.

IN BETWEEN

The disk drive lives in the area between RAM and tape. It is faster than tape and cheaper than RAM. In the right application, like editing, disks give a better price/performance compromise than other storage techniques. However, do not forget that the disk is a niche technology. In the wrong application, it can fail. For example, if the need for rapid access is absent, such as in archiving, using a disk drive just increases the cost.

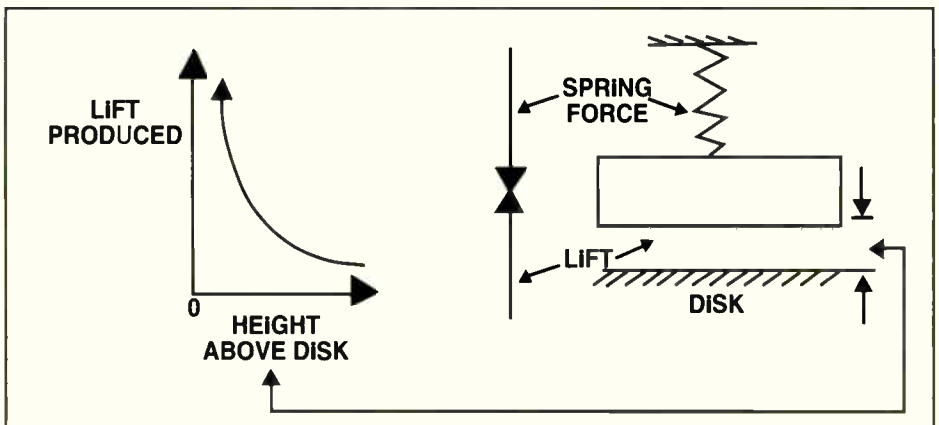

Figure 1
Flying height of head reaches balance when lift equals spring force.

Today's disk drives are descendants of magnetically coated drums. These were large cylinders coated with the same oxide as was used on tape. Fixed heads, similar to tape heads, accessed signals recorded on circular tracks. The time taken to access any data was no more than one revolution and usually averaged half a revolution. This is called rotational latency.

Clearly, faster access would require higher rotational speed. But with conventional magnetic recording, the contact between the head and drum would cause frictional heating and wear. The first breakthrough was to lift the head off the drum surface by feeding compressed air to the interface area. This eliminated friction and allowed a dramatic increase in speed. Soon, it was discovered that a suitably shaped head would produce its own lift and would fly automatically.

Air is viscous, and a fast spinning drum carries around with it a thin layer of air turning at the same speed. Upon leaving the drum's surface, the air speed falls off. Figure 1 shows that as aerodynamic lift goes as the square of speed, lift will fall as the head goes too high and rise as it goes too low. It is only necessary to apply a downthrust from a spring and the head will reach an equilibrium spacing.

Figure 2 shows the evolution of the disk drive. Greater storage requires greater surface area, and switching from drum to disk allowed a huge increase in area because several disks could be stacked on a common spindle. The large number of tracks now available made it uneconomical to provide a fixed head for every track. The first practical multiplatter disk drive, the IBM RAMAC, had only a single pair of heads. These were mechanically driven from one disk platter to another along a vertical axis, and then driven radially to the selected track. The two heads could access tracks on both sides of the platter.

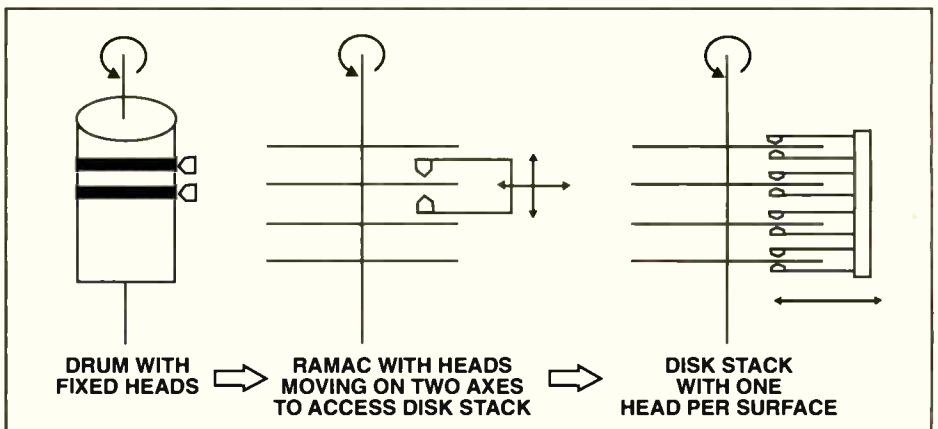

Figure 2
Evolution of today's moving head disk drive from drum store.

TWO HEADS

This soon gave way to a better compromise in which each platter had its own pair of heads. All of the head pairs were mounted on a common positioner that only moved radially. With mechanical positioning like this, the rotational latency has to be added to the positioning latency. It is important to be able to move the heads from one track to another at high speed. Early drives used hydraulics to move the heavy head assemblies. The development of the power transistor allowed the moving coil positioner to take over and this has remained the dominant technology, except in slow, low-cost applications were stepping motors are used.

It is well known that when dirt separates the tape from the heads on an analog audio recorder, the high notes get muffled. This is exactly what happens in a disk drive because of the air film between the heads and the disk. Without the air film, the heads burn up. The loss of high frequencies restricts the recording density in comparison to a system having heads in contact. As I said earlier, rapid access and cost per bit are mutually exclusive.

Disk drive development is driven by intense competition between manufacturers. The drive with the fastest access will capture certain markets; the drive with the lowest cost will capture others. Driving down the cost per bit requires the recording density to rise, and there are several areas that affect recording density. Advances in media and heads allow the same electrical energy to be induced from a smaller area of the disk. Improvements in precision and cleanliness allow the head closer to the disk without crashing. Improved modulation schemes allow a higher bit rate without increasing the signal bandwidth. More powerful error correction allows the data to be extracted with the same reliability from a noisier signal. More accurate positioning mechanisms keep the heads more closely registered with the tracks.

As all of these effects multiply, it will be clear that a 10 percent improvement in every one has a dramatic effect on the overall performance. Consequently, the speed and capacity of drives has advanced dramatically, with the density typically doubling every few years.

Although the evolution of the disk drive has generally been incremental, there have been two quantum leaps in development that have allowed performance to rise even faster

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than usual. The first of these was the development of the servo surface. The positioning accuracy of the drive limits the density. Prior to the servo surface, temperature changes would cause the data tracks to expand and contract, resulting in tracking errors. The tracks had to be made wide so that they could be read over a reasonable temperature range, With servo surface technology, one surface of the disk pack is dedicated to the alignment patterns, which are read by a servo head. This servo surface expands and

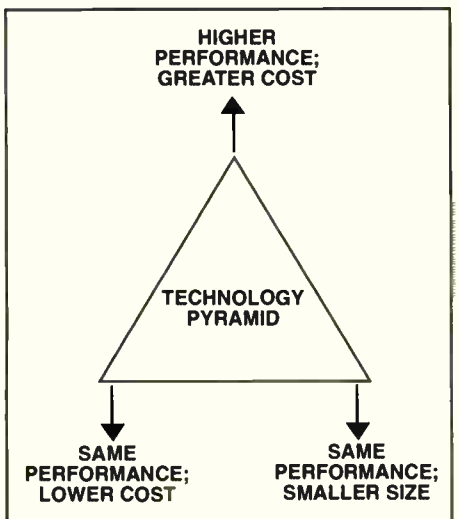

Figure 3
Developments in disk technology result in progress in several directions.

contracts in step with the other surfaces, canceling out errors due to temperature changes. The loss of one surface is wiped out by the increase in storage capacity allowed by narrower tracks that can now be reliably accessed.

ON TARGET

The second quantum leap was Winchester technology. The name came about because the project number at IBM was the same as the model number of the famous rifle. The Winchester disk drive departed from tradition by fixing the disk pack in the drive so it

...there have been two quantum leaps in development that have allowed performance to rise even faster than usual.

could not be exchanged. This lead to a number of advantages. The entire assembly could be sealed against dirt, so the flying height of the heads could come down, reducing spacing loss and driving up the along-track density and the data transfer rate. With no need for interchange, the tracks could be made narrower and put closer together. The drive would only have to read tracks it had written itself, so no head adjustment was needed.

While the Winchester drive was a giant breakthrough in disk technology, it brought about a requirement for high speed tape drives to back up the data because the disk packs could no longer be removed. Unlike exchangeable pack drives, failure of a Winchester drive usually led to loss of the stored data. So much for the myth that disk and tape compete.

Figure 3 shows how disk technology developments take several directions. At the leading edge, applications that were impossible become feasible. At the trailing edge, existing applications may become cheaper, or they may become smaller. There are many good reasons for making disk drives smaller. A small disk requires a shorter positioner travel and smaller, lighter head arms. The entire positioner can be driven much faster with benefit to the access time. Today, very small drives are available that are no larger than a postage stamp. These plug into chip sockets and compete with RAM where the fastest access time is unnecessary.

For a given storage requirement, it will be faster to use several small drives rather than one large one. As the greatest volume market for disk drives is in personal computers, small drives may well be cheaper as they are made in greater quantities. A further advantage of using a series of small drives is that error correction techniques can be used to protect against the loss of a drive. In RAID (redundant array of inexpensive drives) technology, data to be recorded is assembled as code words that include a certain amount of redundancy. The code words are not recorded on a single drive, but are uniformly distributed across several drives. The redundancy in the codewords is such that the data lost by the failure of any one drive can be fully restored by the error correction systems. The failed drive is replaced and the system recreates the data it held. ■

John Watkinson is an independent consultant on digital audio, video and data technology and is the author of seven books on the subject, including the Art of Digital Audio and the Art of Digital Video. He is a fellow of the Audio Engineering Society, a member of the British Computer Society and is listed in Who's Who in the World. Based in England, he regularly presents papers at conventions of learned societies and has presented training courses for studios, broadcasters and facilities around the world.

He is currently working on a video fundamentals book. John can be reached at +44-1734-834-285, or read his web pages at http:/www.pro-bel.com/ guests/john/

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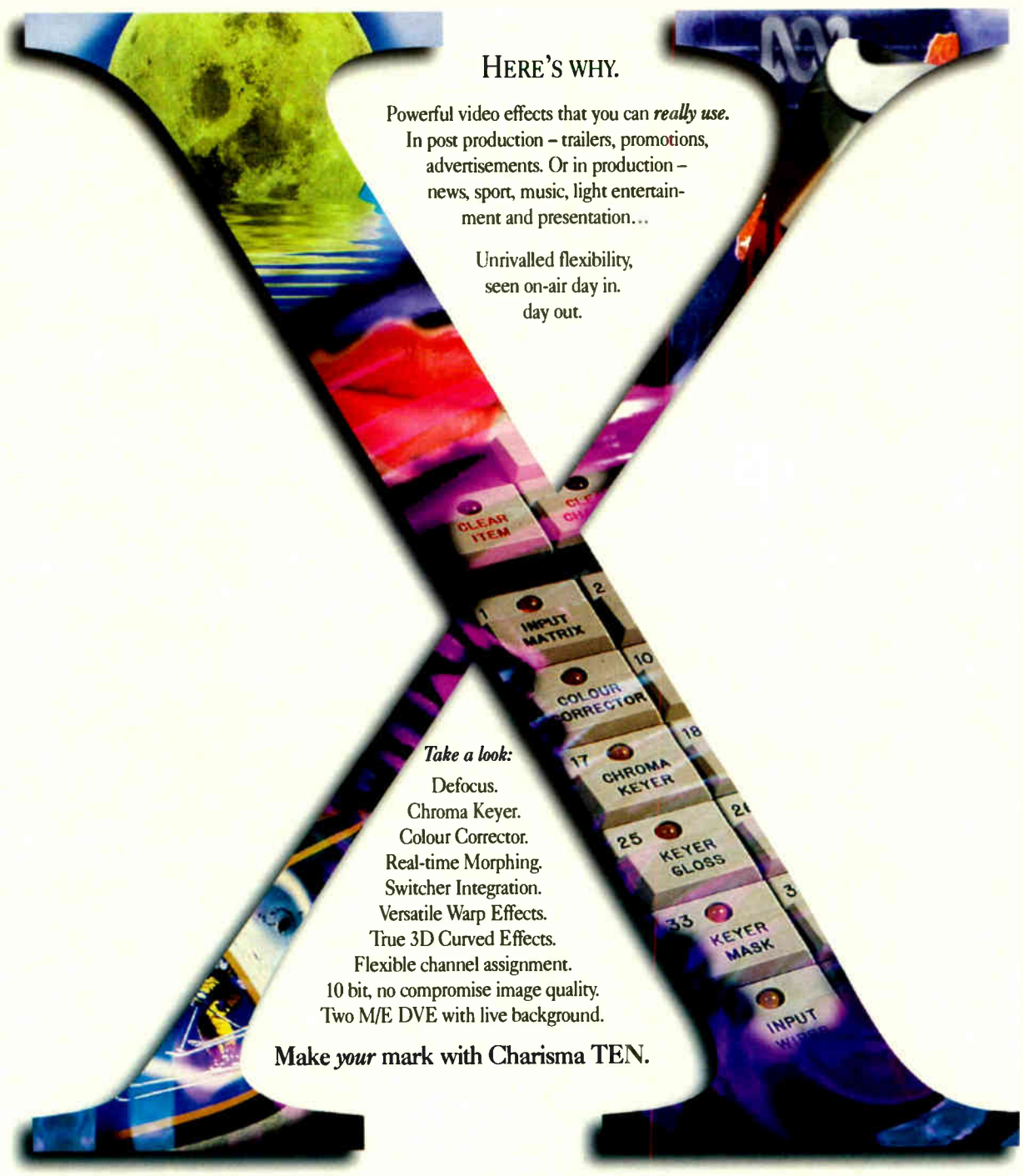

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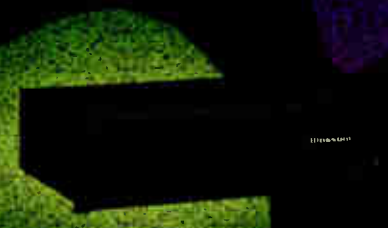

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Searching for Useful Gadgets

by Craig Johnston

PRODUCTION MANAGER

For most of our lifetimes, computers have "been there to help us." Until the introduction of the personal computer, the "us" that got help were mostly large institutions that could afford large mainframe systems.

FOCUS ON GADGETS

I do not plan to write about dedicated computer applications. TV Technology has writers who live and breathe these machines and who make their livings operating them. Software and peripherals that run on PCs or Macs but which perform the same function as dedicated machines will also be outside my scope.

As you will see below, I am looking for, well, gadgets.

The first gadget program I remember falling in love with was called LOG-IT 100, distributed by Comprehensive Video Products. The software was on a ROM chip that plugged into a Radio Shack Model 100 laptop, and there was a cable that plugged into the modem or cassette port on one end and the timecode output of a video tape machine on the other. While playing a tape at regular speed, pushing the F2 key on the laptop read the tape's timecode into RAM, and connected that to whatever description you wanted to type about the current scene. The completed logs were printed on an inexpensive nine-pin dot matrix printer.

This was the most popular piece of equipment I have ever bought. It removed the drudgery of logging videotape. Even though they were not usually the ones who logged the tapes, the video tape editors loved it too; the logs were legible and the timecodes were accurate. And because logging could be done in real time (the logger did not have to stop the machine each scene to write down the timecode), the logging process did not get put off or ignored. To the people who used it, the LOG-IT 100 became indispensable.

SELECTIVE GADGETS

I will give you another example of a gadget program that has been very useful. Called Select-A-Lens v. 1.1 from Fujinon, it is a Windows program that lets me put in three lens parameters, and solve for the fourth. For instance, I know my center field camera is 400 feet away from home plate, and I want to be able to frame a six-foot tall batter head to toe. By inputting those two parameters (plus my 2/3-inch imager size) the program tells me I need a 440mm lens. Of course, the next screen tells me which Fujinon lenses to use, but that is why the software is free.

I used Select-A-Lens just the other day. We were moving our news department into a new space and we needed to decide where to locate the newsroom update camera. One of the questions we needed to answer was how much of the background wall we would see. I could have carried the camera up to the new space, or I could have looked the numbers up on a lens table, but instead I answered my question using a gadget program.

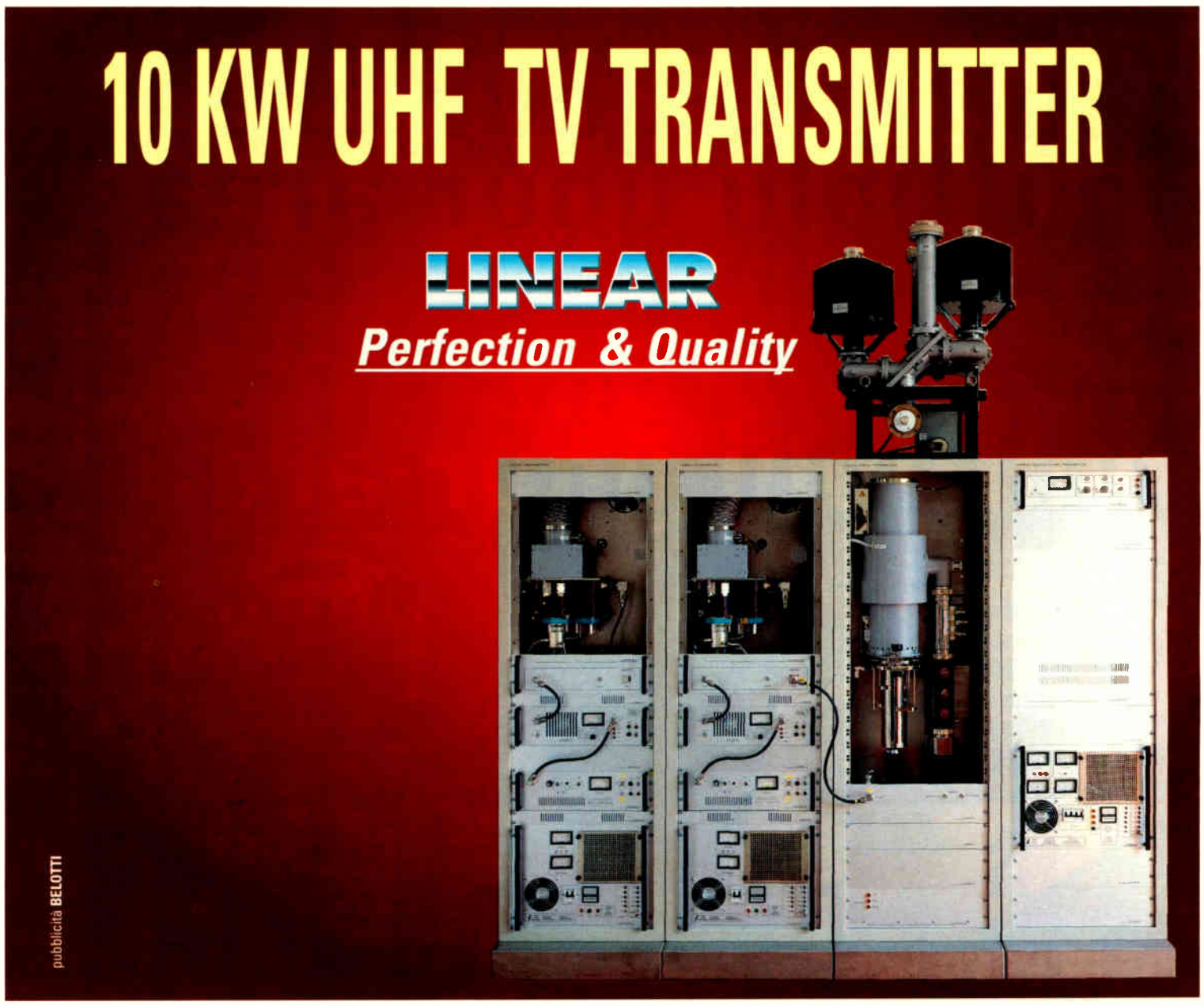
Here is a look at one final gadget, called Scriber, which is sold by a company I used to work for, Pacific Lotus Technology. Scriber decodes closed captions and writes them to text files. It comes in either a DOS or Mac version, and uses a small piece of peripheral hardware (which comes bundled with the software) called a Telescriber that plugs into a PC serial port or a Mac modem port.

This technology was developed in Japan for use in teaching English as a second language, but I think it has numerous application in broadcasting. A news director could monitor his competition with it and not only know the order of their stories, but read their scripts as well. It could be used to monitor and transcribe weekend news coverage, making it easier for producers to choose sound bites.

MUSIC ON TAP

A final goal for this column is a wish list section. I would like a generic music library catalog on computer. Although I have never worked with one, I understand certain music libraries offer a computer database of their selections with

(continued on page 18)



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Surround Sound Monitoring Tips

by Terry Nelson

In last month's column, we made a cursory tour of modern trends in audio for video production and started to take a closer look at the development of stereo sound through to surround sound production.

This month's column will look at several monitoring solutions currently available to facility executives wishing to move seriously into surround sound mixing but who do not have the space or budget to consider large film-style mixing theaters or dubbing stages.

Multichannel sound formats tend to use LCR (left-center-right) screen channels and either mono or stereo surround channels. The Dolby stereo cinema format uses four channels, LCRS (left-center-right-surround), that are matrixed down into stereo compatible tracks (Lt and Rt) when decoding is not available. A subwoofer channel is often derived from the left and right channels for subwoofer information.

LCR RULES

To keep viewers firmly engaged, a basic mixing rule is to put the main effects and music tracks into the left and right channels and dialog into the center channel. The surround channels should be used for ambiance and diffuse sound effects to put the viewer inside the action without attracting attention away from the screen by using discrete sound cues.

The moment attention is pulled away from the screen, the magic is broken and the viewer is back in the living room and no longer in the film, sporting event or whatever is being watched and listened to.

The importance of the sound cues gives rise to different requirements for the screen loudspeakers and the surrounds. The LCR loudspeakers are required to give a broad stereo image across the entire audience and not just on one "sweet spot," as is often the case with music systems. Research has shown that the front speakers should have a tightly controlled vertical pattern — as little as 15 degrees — and a wide horizontal pattern for the viewing area. The narrow vertical pattern puts the sound pretty much into the plane of the viewer's ears and diminishes the risk of interference through unwanted room reflections.

Surround monitoring for small environments is more than just a few extra loudspeakers. The diffuse soundfield of a good cinema is achieved by an array of surround speakers around the rear half of the auditorium. In a small space, a large number of speakers becomes impractical, and reducing the array to one or two

CONTINUED FROM PAGE 17

Gadget Search

.WAV files (or their Macintosh equivalent) allowing users to actually audition a few seconds of each cut on the same multimedia computer that runs the database. An ideal system would allow users to ask for a list of, for example, medium-slow tempo, romantic, steel guitar, 30 second music beds. In a few seconds, a list of perhaps five selections would appear on the screen. By highlighting a selection and pressing the mouse button, users would hear five seconds of that selection.

That is much more advanced than the database that came with one of my music libraries. But I have a couple of music libraries, and I do not want a separate database for each one. I would like a gadget program that would allow me to import the databases offered by several different music libraries, manually add information from another library that may not offer its catalog in database form, and easily capture a representative portion of each cut off the library's CD collection as a .WAV file.

Am I a dreamer?

If any readers have a favorite gadget program they would like others to know about, send me a note through TV Technology. And if there is a program you would like to see, put it down on paper and send it in. You never know, you could spark an enterprising program developer into action. ■

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units per side gives rise to problems of directionality.

The best solution is to use dipole loudspeakers, from which no direct sound is aimed at the listening area and the surround information remains diffuse. So what is a dipole speaker? The simplest way to describe it is to compare its polar response pattern with that of a figure of 8 microphone: it diffuses sound at either side with nothing in the middle. Placed on or near a wall, the speaker will throw sound along the walls and/or (if it is tilted) up into the ceiling but not directly into the room at the listening position.

HOW LOW?

Low frequencies tend to add excitement to the viewing and listening experience. However, it is worth mentioning that for many people, what they call bass is more like low mids. Real subwoofers should ideally not be coming into play above around 100 MHz and should extend down to at least 30 Hz, if not further.

I mentioned monitoring solutions, so what are they? For studios wishing to apply a monitoring standard similar to that used in film mixing, a look at the Lucasfilm THX program is worthy of consideration.

Although the program was designed for dubbing stages and cinemas, there is a system for small film and video mix rooms: the Apogee MPTS-1 system. Literally a scaled-down theater system, the THX-designed MPTS-1 features three-way LCR components, dipole surrounds, separate subwoofers (either 2 x 15 or 2 x 18 inches) and a controller/crossover unit with switchable film and television frequency response characteristics.

Because the Apogee system falls into the THX program, you will have to get your room certified by THX to benefit from the use of the name and logo, and this will mean that certain electro-acoustic standards will have to be met. The front monitors will also have to be mounted into a vertical baffle wall or the THX-approved "Bafflette" assemblies.

STEP DOWN

Although this is worthy of consideration, the expense may deter smaller operations. But do not despair, there is another solution: the home THX system.

The rapid rise of the home theater prompted Lucasfilm to develop the Home THX program to provide optimum playback facilities for video and television entertainment. Incorporating the essential features of a cinema system, Home THX components feature front speakers with correction directionality, dipole surrounds and real subwoofers. THX-approved Dolby ProLogic decoders are fitted with THX circuitry for proper frequency response in a domestic environment, and approved power amplifiers provide the power and response necessary for film and television soundtracks.

Though expert advice is recommended for installation, a Home THX system does not require room certification, but it does provide a very cost-effective solution to the problem of a reliable monitor setup for surround sound mixing and previewing.

There is now a wide selection of Home THX-approved equipment, and although some of them are rather pricey, there are others that will make your company's accountant happy while at the same time provide you with what you want: a compatible surround monitoring system you can trust. ■

Terry Nelson is co-principal of Studio Equipment in Yverdon-les-Bains, Switzerland. He began his professional audio career in 1967 and has worked in the areas of sound reinforcement, recording studio design and mobile operations and has more recently become involved in turnkey studio projects for music, film and television.

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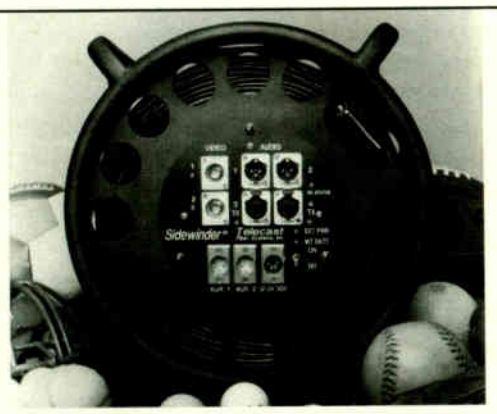

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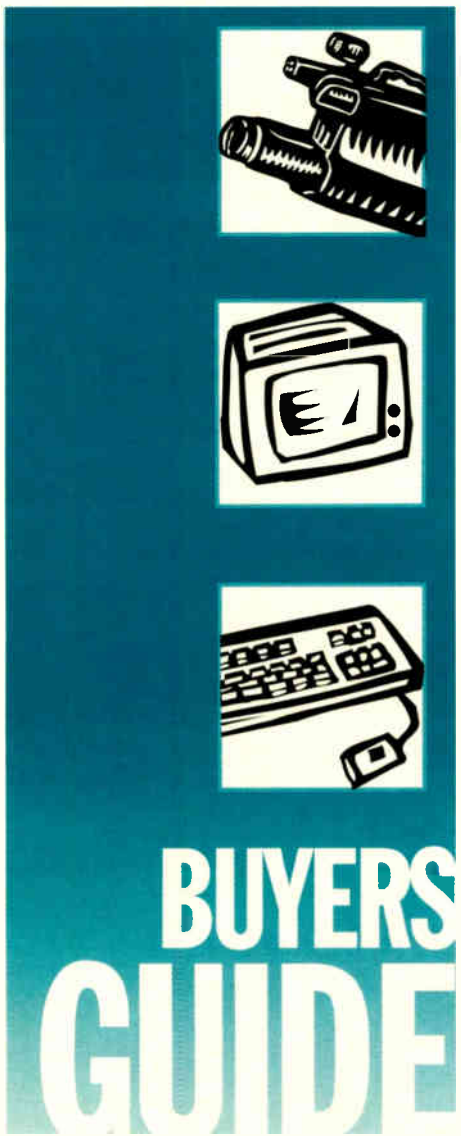

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BUYERS GUIDE

USER REPORT

Scitex Takes TJFX to 10 Bits

by Dave Levy
Director
TJFX Limited

LONDON

The Mill is one of the major facilities houses in the Soho district of London, a region of the city where most of the top post houses in the country can be found.

The facility has 12 edit bays using two Discreet Logic Flames, two Flints, two Quantel Henrys and three A84s. The balance is taken up with two Avid suites and a Quantel Harry. Telecine is sourced from two Ursa Golds on the ground floor. TJFX provides the 3D graphics with six Softimage Extreme seats running on Indigo2 platforms.

COMMERCIAL WORK

The core business for the Mill is commercials, with many award-winning high profile campaigns to its credit. The D-1 SDI (serial digital interface) infrastructure at the Mill gives a standards-independent environment allowing regular TV work in either 625 or 525 digital.

All of the commercials work destined for television leaves the building on D-1 tape, which is also used for archiving and "in progress" storage. For us in 3D, this means that we need a bridge from the RGB Softimage elements residing on our IRIX network disks to a full resolution, uncompressed D-1 signal that can be piped to the rest of the building for compositing. For this we need a machine that can sit on the graphics network and be capable of real-time playout.

In the graphics department we have access to six digital disk recorders (DDRs). We have three A60s, one A66, a DPS PVR for tests and the Diskus from Abekas (now Scitex Digital Video). All of these reside on the Ethernet and the Diskus also is directly connected to one of the SGI Indigo2 systems via SCSI. All of the DDRs, with the exception of the analog PVR, output serial D-1 streams to the 128 x 128 router.

Like all animation houses, we have been waiting for a method of transferring our 24-bit RGB graphics to a system that will give us the required dynamic range of at least 10-bit uncompressed YUV, data integrity (error correction at last), simple multi-user networking (TCP/IP with no faking) and rapid transfer of data between machines and color spaces (fast SCSI with real-time RGB-YUV-RGB conversions). The Diskus does all of these things and is a considerable improvement over the previous two generations of Abekas disk products.

Since the Diskus is the first Abekas DDR that is quiet and small, we decided to put it in the actual work area with the operators. This allows us to use SCSI for a transfer rate of several frames a second. The Ethernet is also much improved, with transfer rates of under a second per frame.

Having the machine in the production area has led to clients operating the Diskus with the GUI and mouse. This can be a useful distraction during long renders. But seriously, the interface is so simple that users can instantly jog and step through material to indicate points of interest to the 3D operator.

It might be of interest to note that we do not use either the hard or soft control panels available with the machine, as the GUI provides all the functionality required. However on a networked machine it is possible to use the AVCP provided. The edit control functionality, either as a source or target machine, would be of use to a user with a smaller setup, allowing accurate laying off of material to tape. We do not actually use that here, as a quick blast into Henry is usually sufficient.

The 10-bit D-1 I/O means that when we are sourcing a 10-bit device such as the Flame, we can get what approaches the true dynamic range of the 3D signal. In addition, the price per byte has dropped considerably since the A60 was introduced. And while it still does not approach the PC-based compressed DDRs at a quarter of the original price of the A60, you can get into real-time D-1 I/O for around the cost of a mid-range workstation.

IN FAVOR

We have had our Diskus for about a year. It has stabilized well after the beta release and is the most sought-after DDR on the network. Since its introduction, SGI has brought the Impact Indigo2 range onto market with the SDI straight from the computer chassis.

But I think that SGI may have missed the point slightly. D-1 component is not the most advantageous format, especially in the color channels, although the demo on ultra-SCSI running a Ciprico raid at Siggraph was impressive.

However, as with all these intracomputer solutions, you have to ask yourself if it is worth having an internal solution which effectively freezes out the use of the SGI during the viewing phase. At least with the Diskus you can have your client happily jogging up and down his/her work or transferring clips while you get the next scene ready. Just how do you explain to the animator and client currently sitting at an Impacted SGI that you need their graphics output just for a few minutes while you get that material out from last night's render?

In the future, the workstation solution will probably be more fashionable, not because it is more sensible, but because people want more power. However I am sure that where the drive goes is a matter of design, and DPS has shown that an internal (external) solution is probably the least messy way. I presume Abekas is ready. ■

The 10-bit I/O on the Diskus gives the Mill expanded 3-D capabilities.

Editor's note: Abekas has recently been acqired by Scitex Corp. of Israel. The company has merged the operations of Abekas and ImMIX into a single unit, Scitex Digital Video.

After graduating with a BSc in Electronic Engineering from The City University, London, Dave Levy spent three years working as an R&D Engineer with Sony Broadcast in the D-1 development group. He joined TJFX in 1994 providing full-time software development.

The opinions expressed above are the author's alone. For further information, contact Scitex Digital Video in the U.K. (telephone: +44-1734-585-421; FAX: +44-1734-597-267), or circle ***Reader Service 55.***

BUYERS BRIEF

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For more information, circle ***Reader Service 117.***

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USER REPORT

NOB Expands with Digital Beta

by Rob ten Siethoff
Director of Engineering
NOB

HILVERSUM, The Netherlands

NOB (Nederland Omroepproduktie Bedijf) is Europe's largest commercial broadcast facility. The Hilversum-based company, with more than 1,700 employees, is the broadcasting heart of The Netherlands.

We can satisfy a very wide demand. From a rigid, formal organization, we have developed into a flexible company that is customer-oriented rather than hardware-oriented. This transition has been ongoing since 1988. The previous structure was replaced by 14 business units hosting a wide range of activities, including NOB Post Production, NOB Interactive and NOB Audio.

In addition to branches in The Netherlands, NOB has a five-studio facility near Cologne. Our greatest strength is efficient production and an excellent price/performance ratio. In Germany, our high level of flexibility is key to our success.

HIGH QUALITY

My main preoccupation is ensuring that NOB maintains its reputation for technical excellence while meeting the demands of the new, cost-conscious commercial broadcasters. To achieve this, we are committed to NOB's introduction of digital technology. We are a full-service company with a lot of conventional production tools — OB vehicles, studios, edit suites, etc. — but at the same time we are always exploring new avenues. We design and build complex digital studio facilities, edit suites, etc., and we make sure that all operational and technical requirements are strictly complied with.

These days, instead of waiting for market trends, we aim to set them. For instance, we have done a great deal in the area of virtual studios, and NOB Interactive is building Internet sites for its customers. Such activities are a long way from our broadcasting origins.

Until two years ago, NOB's facilities were based on Betacam SP, and 200 one-inch B-format machines that dated back to 1976. The heart of the system was PAL-oriented. On the post production side, we used analog component and composite edit suites.

When we decided to transfer to digital, we discussed the various formats at length. We definitely wanted to work with component technology, which was needed for future broadcasting in PAL Plus and future digital transmission standards. From our installed base of Betacam SP, we opted for Digital Betacam mainly because the format can play back analog Betacam SP tapes. We have tens of thousands of these tapes, and we can make excellent use of them with the help of the Sony DVW-A500P machines.

On the recording side, we wanted Digital Betacam as quickly as possible to create masters in the new digital format. The trick is that if we produce with Digital Betacam exclusively, the demand develops to transmit in the same format, completing the circle. Eventually, we will record, process and broadcast in a totally digital environment.

Within a year, NOB installed 300 Digital Betacam machines, more than half with analog playback capability. It was a very easy transition for us, because all we had to do was remove the analog machines from the racks and replace them with their digital counterparts. Now, we use Sony DVW-A510P players and DVW-A500P machines for a variety of different applications, such as transmission, editing and recording in studios and OB-vans.

Eventually we will only use fully digital machines. The advantages of Digital Betacam are obvious. There are no more dropouts, and the four audio channels that are fully editable are extremely useful — a major advantage in The Netherlands where everything is produced in stereo. Also, the user-friendliness of Digital Betacam is an important factor. Everybody is used to working with Betacam SP, and the operation of the digital machines is practically the same.

ONWARD AND UPWARD

NOB is now building a digital infrastructure, a massive project due for completion in October 1996. We are changing the present facilities from analog PAL to component digital. Production satellites are connected through a central routing system, and all equipment is linked via SDI (Serial Digital Interface) with embedded audio. Eventually

We opted for Digital Betacam mainly because the format can play back analog Betacam SP tapes.

there will be digital uniformity to work in and outside NOB in a completely transparent manner. We also buy our cameras to be ready for a completely digital chain in 4:3 or 16:9 from acquisition to transmission.

In the long term, the reliance on Digital Betacam is more a matter of cost of ownership than replacement costs. Analog equipment always required extensive tuning, and these costs will mainly disappear.

We have to work fast because that is what our customers expect from us. We will keep investing in new technologies. Widescreen is one example, and news gathering is another. News is still gathered with analog equipment, but we are heading toward server and compression technology with determination.

Editor's note: During his long career in the industry, Rob ten Siethoff has worked for companies such as Sony and Tektronix. In 1985, he and two partners started the high-end post production house, AVP, which produces top-end TV commercials. AVP developed into a subsidiary of NOB and in early 1995 ten Siethoff moved to his present position.

The opinions expressed above are the author's alone. For further information, contact Sony in the U.K. (telephone: +44-1256-550-011; FAX: +44-1256-474-585), or circle ***Reader Service 54.***

USER REPORT

KOLD Serves Up Video With Hewlett-Packard

by Rod Dombrowski
Master Control Tape Operator
KOLD-TV

TUCSON, Arizona

KOLD-TV Channel 13 is a CBS affiliate ranked in the 81st market. At our state-of-the-art, 25,000 square-foot facility, we offer sales and commercial production services as well as news and community service support.

In the fall of 1994, KOLD updated its spot-playback system. We installed a Hewlett-Packard Broadcast Video Server (BVS), which was quite a jump for our station. However, we felt that passing up an LMS system was the correct way to go because we wanted to move toward a tapeless environment.

Some of the criteria that we used in choosing a server were reliability, video quality, functionality and cost savings. We purchased the BVS system because HP met our criteria and offered us features that were not available in any other system. At the time of the purchase, KOLD became a Beta test site for the server. While working closely with HP over the past year, we have built a relationship that has been truly rewarding.

THE SET-UP

Our current Broadcast Video Server (BVS) set-up consists of a single (main) BVS with one channel in and two channels out. The BVS is controlled remotely by Louth Automation's HP Ad Management System. The AMS is a client/server-based PC system that communicates with the BVS and external VTRs via RS-422. The AMS computers are connected through a LAN that distributes traffic, master control and production functions among various workstations. We use the BVS/AMS system to edit and transmit the daily log (playlist), dub spots from tape to BVS, preview spots and create and run compiled tape backups.

Our BVS contains six disk drives with a RAID level 5 configuration. Encoding at a 10 Mb-per-second compression rate gives us approximately 10 hours of storage time. We now hold about 1,300 spots in the system, including all commercial material, promos, PSAs and news spots. The BVS and AMS are now fully integrated into our station.

Each day the Traffic Department downloads the next day's playlist. Then the master control operator calls up the list on the master control Playout Manager PC. When the list is loaded, the operator creates a mismatch list that pinpoints spots with discrepancies between the traffic log and information in the AMS database. With the help of the Traffic Department, the operator uses the mismatch list to make corrections to the playlist, which helps us avoid on-air problems.

SWITCHER LINK

In the Master Control Department, we use a Grass-Valley Master 21 switcher. The AMS is connected to the preroll transition switch via GPI. The playlist is activated and spot playout begins when the operator presses the preroll transition. Currently, we use one of the two BVS channels for air playout. We use the second output channel for spot preview and compiling. However, when necessary we can easily switch the second channel to air the playlist.

Checking in commercial material is simple. Each day we download a dub (spot) list from the traffic workstation to the media preparation station. Operators call up the spot information from the downloaded traffic spot list. This eliminates errors that might occur if the operator loaded information manually.

Once operators are ready to dub a spot to the BVS, they press a single function key. The spot is copied to the BVS and the AMS database is updated. Once the dub is completed, the operator can review it for quality instantly. The database, which contains information on all spots in inventory, can be printed and made readily available to the Traffic, Sales and Master Control departments. This is an efficient way to manage disk space in the BVS.

In addition to spot playback, our news operation uses the BVS to air news opens, bumpers and related news items. We look forward to future non-linear news editing systems that will directly feed the BVS and be controlled by a separate playlist. This will give our news department a huge advantage in the marketplace.

FAVORITE FEATURES

There are many features of the Hewlett-Packard Broadcast Video Server that we truly appreciate. Among these are:

— Reliability. During the year that the BVS has been on the air at KOLD, it has been extremely reliable, especially when compared to our previous spot playback system. With the BVS system's redundancy, we rarely miss spots. That adds up to cost savings because we have fewer errors and fewer make-goods.

Since September 1994, we have experienced only one drive failure that, because of RAID protection, did not take us off air. Reconstruction of the drive was simple; it occurred without affecting the on-air product.

— Maintenance. Because the only moving parts of the BVS system are within the disk drives, there is no maintenance, which is another major cost saving.

— Support and service. Without a doubt, HP has lived up to its reputation in service and support. Having been a beta test site for the product, service was a major factor in our original decision to purchase and it continues to be an advantage.

HP provides support in real time via a modem connected to the BVS 2E. Using the modem, the support engineers can diagnose problems and — in many cases — instantly correct them. No problems are too small for HP to work on, and the company always finds a solution. The support staff is well-organized, knowledgeable and quick to respond. And they do so with a smile.

(continued on page 28)

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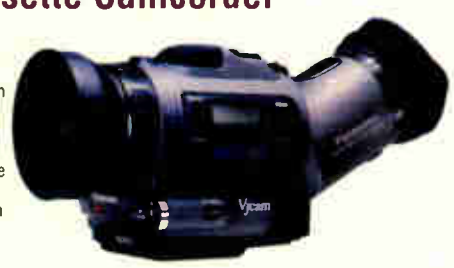
Panasonic
Broadcast & Television Systems

AG-DP800 SUPERCAM
S-VHS 3-CCD Digital Signal Processing Camcorder

- Three high-density 380,000 pixel CCDs with half-pitch pixel offset achieves over 700 lines of horizontal resolution, a S/N ratio of 60dB and remarkable sensitivity of f8 at 2000 lux. Additionally the Frame Interline Transfer (FIT) CCDs minimize vertical smear, so you maintain impressive picture quality even in very bright illumination.
- Some of the DSP (Digital Signal Processing) circuits and their functions:
  - CHROMA DETAIL - This function compensates for poor resolution in the high chroma areas of the picture.
  - DARK DETAIL - Determines optimum degree of contour enhancement in dark areas to deliver crisp, natural-looking images
  - HIGHLIGHT COMPRESSION - Expands the dynamic range of the highlighted areas and prevents halation. The highlight compression circuit allows a wide dynamic range producing detailed images even against bright backlight or daylight.
  - FLARE CORRECTION CIRCUIT - Compensates for unsteady black caused by light or by a subject's movements.
- In addition to regular AGC (Automatic Gain Control), Supercam has a Super High Gain mode. At F1.4 this enables shooting under illumination as low as 2 lux while retaining detail and color balance.
- Synchro Scan function allows flicker-free shooting of computer monitors. Electronic shutter increments can be set variably from 1/61 seconds to 1/253 of a second.
- Built-in internal time code generator lets you record with SMPTE LTC/VITC (Longitudinal/Vertical Interval) time code
- Two hi-fi stereo audio channels with a dynamic range of 80 dB, as well as two linear audio channels with Dolby NR. Normal/Hi-Fi recording is selectable. Uses XLR connectors to further ensure high-quality sound.
- Phantom power can be supplied to an optional microphone. Power can be switched off to prevent battery drain when not in use.

NEW! AG-EZ1
3-CCD Digital Videocassette Camcorder

Heralding a new era in video, the AG-EZ1 is the world's first camcorder to incorporate 6mm DVC (Digital Video Cassette) technology. The biggest leap in video since S-VHS and Hi8 were introduced six years ago, DVC is a revolutionary video format that delivers such high quality —it literally rivals broadcast cameras. Utilizing DVC the AG-EZ1 records an extraordinary 500 lines of horizontal resolution—nearly 25 percent more than S-VHS, Hi8 or laserdisk, and 50 percent better than a live television broadcast. And because it's digital, picture quality is not only sharper but unbelievably clean. Audio is also recorded digitally, resulting in quality equal to that of CDs. In addition to it's digital capabilities, the AG-EZ1 also features a 3-CCD pickup system,180,000 pixel color viewfinder, 10:1 power and 20:1 digital zoom, full automatic and manual controls and a large LCD panel.



- Three CCDs with 270,000 pixels each are horizontally staggered for optimum resolution.
- Digital recording system delivers incredible 500 lines of horizontal resolution and virtually no noise. The signal -to-noise ratio is 54dB, an improvement of 6-9 dB over conventional analog systems. This actually represents a S/N ratio 2-3 times better than existing camcorders.
- Audio is also recorded digitally using PCM (Pulse Code Modulation) for quality that rivals CDs.You can choose between two-channel 16-bit recording or two sets of 12-bit stereo, with the second set reserved for uses such as narration.
- Includes a huge 1.5" 180,000 pixel color viewfinder. More pixels than any other camcorder to date, the viewfinder provides a remarkably clear, accurate image with 400 lines of resolution and displays all automatic and manual features on demand. The viewfinder also tilts 120 degrees vertically for shooting subjects from high or low angles, & its professional size means you don't have to press it against your eye to see the picture.
- Variable high speed shutter goes from 1/60—1/8000 of a second in 14 increments.
- Built-in Digital Electronic Image Stabilizer (DEIS) compensates for jittery video and is particularly effective when the digital zoom is employed.
- Equipped with 10:1 power and 20:1 digital zoom lens .Both zooms are adjustable in four speeds (3.5 seconds—15 seconds) based on how hard or soft the zoom toggle is pressed. To set up a shot quickly, a Turbo Zoom function moves from tight to wide angle, or vice versa, in under two seconds. For extreme close-ups the lens can focus up to 1/4" from the subject.
- 3 features for finding previously recorded scenes easily:
  - —TopScan plays back the first few seconds of each segment, providing a handy way to review an entire tape.
  - —Record/Review rewinds the camcorder and plays the last 10 seconds of the last recorded scene, ideal for making sure you got that important shot.
  - —Indexing function encodes the first scene shot on a given day, so you can quickly find the starting point of each day's shooting.
- Digital Photo-Shot let's you record a still-frame for about six seconds, while audio continues as normal. This feature is great for creating video photo albums or insurance tapes, as 290 still pictures can be recorded on a single 30-minute tape and 580 shots on a 60-minute tape. Using the TopScan feature any shot can be found easily.
- Large LCD panel on the side of the camera displays camcorder status and operating modes.

Vinten
Vision SD 12 and SD 22
Pan and Tilt Heads with Serial Drag

The Vision SD 12 and SD 22 are the first heads with the "Serial Drag" pan and tilt system. The system consists of a unique, permanently-sealed fluid drag and an advanced lubricated friction drag. Now you can achieve the smoothest pans and tilts regardless of speed, drag setting and ambient temperature.

- Patented spring-assisted counter-balance system permits perfect "hands-off" camera balance over full 180° of tilt.
- Instant drag system breakaway and recovery overcome inertia and friction for excellent "whip pans".
- Consistent drag levels in both pan and tilt axis.
- Flick on, flick off pan and tilt caliper disc brakes.
- Greater control, precision, flexibility and "touch"
- Touch activated, time delayed illuminated level bubble.
- Working conditions from as low as -40° up to +60°C.
- SD 12 weighs 6.6 lbs and supports up to 35 lbs.
- SD 22 weighs 12.7 lbs and supports up to 55 lbs.

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

The ultimate in lightweight and innovative tripods, they are available with durable tubular alloy (Model #3513) or the stronger and lighter, axially and spirally wound carbon fiber construction (Model #3523). They incorporate torque safe clamps to provide fast, safe and self-adjusting leg clamps.

- "Torque Safe" requires no adjustment. Its unique design adjusts itself when required, eliminating manual adjustment and maintenance and making for a much more reliable clamping system.
- New hip joint eliminates play and adds rigidity.
- They both feature 100mm levelling bowl, fold down to a compact 28", and support 45 lbs.
- #3513 weighs 6.5 lbs - #3523 CF (Carbon Fibre) weighs 5.2 lbs.

Vision 12 Systems

All Vision 12 systems include #33643 SD 12 dual fluid and lubricated friction drag pan/tilt head, single telescoping pan bar and clamp with 100mm ball base.

SD-12A System
- 3364-3 SD-12 Pan and tilt head
- 3518-3 Single stage ENG tripod with 100mm bowl
- 3363-3 Lightweight calibrated floor spreader.

SD-12D System
- 3364-3 SD-12 Pan and tilt head
- 3513-3 Two-stage ENG tripod with 100mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

Vision 22 Systems

All Vision 22 systems include #3386-3 SD-22 dual fluid and lubricated friction drag pan and tilt head, single telescoping pan and clamp with dual 100mm/150mm ball base.

SD-22E System
- 3386-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3516-3 Two-stage EFP tripod with 150mm bowl.
- 3314-3 Heavy-duty calibrated floor spreader

Quick-Draw Professional
FOR CAMCORDERS OR STAND ALONE CAMERAS

porta brace

- Designed for working from the back of a van or the trunk of your car. The top loading case has a wide open fold back top that stays neatly out of the way. It's lighter and more compact than shipping cases, thus saving valuable storage space. With other equipment crowded around it the sturdy built-in frame provides added protection.
- Heavy duty shoulder strap & comfortable leather hand grip.
- Carry it in crowds – crush proof aluminum guard protects viewfinder.
- Fits into back seat and fastens securely with seat belt.
- Holds camera with on-board battery attached.
- Lid closes with Velcro for quick-opening or secure with full-length zippers.
- Two trim exterior pockets and clip board pocket.
- Dual purpose rear pouch is an expandable battery chamber or all-purpose pocket.

JVC GY-X2B
3-CCD S-VHS CAMCORDER

- Newly designed three 1/2" CCD image sensors deliver 750 lines of horizontal resolution and superb signal-to-noise ratio of 62dB
- New micro-lens technology provides exceptional sensitivity of F8.0 at 2000 lux and LOLUX mode lets you shoot with almost no light! Shoot superb footage with excellent color balance at a mere 1.5 lux
- Variable Scan View allows flicker-free shooting of a computer monitor.
- Quick Record Mode - when turned on the camera is set to the auto iris even if lens is set at manual. Also activated is (ALC) Automatic Level Control and EEI Extended Electronic Iris which provides both variable gain and variable shutter. Now you can shoot continuously from dark room to bright outdoors without having to adjust gain, iris or ND filter.
- Full Time Auto White circuit lets you move from incandescent to fluorescent to outdoor lighting without changing white balance or the filter wheel.
- Genlock input allow synchronization with other cameras.
- Dual output system allows camera output to be connected directly to an external recorder

KY-27C
3-CCD Color Video Camera

- New ⅓" broadcast-quality 380,000 pixel CCDs with advanced electronics deliver resolution of 800 horizontal lines and reduced smear.
- High sensitivity of F9.0 at 2000 lux allows a truly usable minimum illumination of 1 lux with JVC's exclusive LoLux dual pixel readout sampling technique.
- LoLux mode allows shooting scenes that were previously impossible due to insufficient lighting. CCDs are maximized for low light sensitivity equivalent to an electronic gain of 24dB, then the dual pixel readout system is added which provides an additional 6dB. Together they provide +30dB without the noise and picture degradation normally associated with this much gain.
- Signal-to-Noise ratio of 63dB assures virtually "noise free" images.
- Auto Shooting Mode where you only have to zoom, focus and record. All other parameters are controlled automatically.
- Enhanced ALC (Automatic Level Control) mode for continuous shooting in all light levels. This allows continuous automatic shooting from dark interiors to bright outdoors. Also features an aperture priority mode, manually set the iris for desired depth of focus and the ALC circuit automatically achieves correct video level.
- The Multi-Zone Iris Weighting system gives preference to objects in the center and lower portions of the picture. The Automatic Peak/Average Detection (APB) provides intelligence to ignore unusual objects such as bright lights.
- Auto knee circuitry extends a scene's light to dark dynamic range reproduction by up to five times without overexposure.
- Has large 1.5-inch viewfinder with 600 lines of resolution and SMPTE color bars. Status system provides audio levels, accumulated or remaining recording time, VTR operation, battery voltage and camera setup. Zebra pattern indication and safety zones with a center marker are also provided.
- Equipped with Variable Scan function. This allows flicker-free shooting of computer screens. Variable scan enables a precise shutter speed from 1/60.2 to 1/196.7 of a second in 256 increments to be set, matching a computers scan rate. Almost any computer display can be clearly recorded.
- Star filter creates dramatic 4-point star effects. Users can also select from a wide range of optional filters.
- Advanced Memory System (AMS) stores customizable settings for various shooting conditions.
- Camera head allows direct input of genlock signal and timing adjustment. A wide range optional remote controls, RS-232 interface, multicore and triax CCU's are available.
- Docks directly to the JVC BR-S422U, BR-S411UB and BR-S420CU professional S-VHS recorders. Optonal adapters for docking to Hi-8 and Betacam SP are also available.

JVC SPECIAL!

Buy a KY-27C in any configuration and you can also get a Betacam docking adaptor for only **$100** ($1290 list price). You have a choice of three adapters: KA-P20U (PVV-1A/Hi8) or KA-P20BU (PVV-3) or KA-B27U (BVV-5). Expires 3-31-96

MILLER Fluid Heads & Tripods

The silky, smooth action of each Miller Fluid Head is the product of the finest quality cast and machined parts functioning together in a fluid environment. They are engineering masterpieces, built to operate under extreme conditions. They're engineered to exceptionally fine tolerances and their mechanisms are protected effectively against ambient moisture and dust.

Miller 20 - Series II Fluid Head

- Continuously adjustable fluid drag control
- Sliding/Quick Release camera platform
- Weighs only 4 lbs. will handle cameras up to 22 lbs.
- Counterbalance system designed to compensate for nose heavy or tail heavy camera configurations, and permits fingertip control of the camera throughout the tilt range.
- Includes independent pan and tilt locks, bubble level, dual pan handle carriers and integrated 75mm ball levelling.

#601-Lightweight Tripod

- Weighs only 4.5 lbs., supports up to 30 lbs.
- Minimum height down to 24", maximum height to 57".
- Extremely portable, folds down to 33"
- Engineered from thermoplastic moldings, diecast alloy & hard anodized tubular alloy.
- Fast one turn, captive leg locks
- Includes 75mm (3") ball levelling bowl

#649-2-Stage Tripod

- Two extension sections on each leg. Operates at low levels as well as normal heights without the use of mini legs.
- High torsional rigidity, no pan backlash
- Weighs 6.6lbs., supports 50 lbs.
- Very portable, folds to 27"
- Includes 75mm (3") ball levelling bowl

System 20 Catalog #338
- Miller 20 II fluid head • 601 tripod
- 410 on-ground tripod spreader **1549.00**

System 20 Catalog #520
- Miller 20 II fluid head • 601 tripod
- 510 above ground tripod spread **1549.00**

System 20 ENG Cat. #339
- Miller 20 II fluid head •649 2-stage tripod
- 410 on-ground tripod spreader **1895.00**

System 20 ENG Cat. #522
- Miller 20 II fluid head •649 2-stage tripod
- 512 above ground tripod spread **1895.00**

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TRUEVISION

TARGA 2000 PCI for Macintosh

An integrated digtial video production engine, the TARGA 2000 PCI is the premier open systems (QuickTime 2.1 Native) video capture/playback and effects acceleration board on the market today. It provides a flexible off the shelf "plug-and-play" solution for video authoring, 3D animation and multimedia applications. With the Macintosh OS and TARGA 2000's open architecture you can work on an animation or 3D effects project in the morning with software like Strata Studio Pro, Specular Infini-D or Electric Image and switch to video or CD-ROM authoring in the afternoon with applications like Adobe Premiere or Strata Media Paint, and then spend the next day working on a desktop publishing project with Quark Express, Photoshop or Aldus Freehand to name a few. The TARGA 2000 is the complete solution for those tired of being locked into expensive closed architectures, tired of paying for upgrades that never come and tired at the lack of creative flexibility.

- Real-time JPEG Compression/Decompression with built-in encoder. Allows record and display and/or print-to-tape video at 60 fields per second 720 x 486 (maximum) resolution (CCIR601) NTSC and 50 fields 768 x 576 PAL straight from the hard disk.
- Outputs composite and S-Video. Premium model PCI Pro provides RGB and component capture and playback as well.
- 16-bit CD-DAT-quality stereo audio (up to 44 and 48kHz) captured and synchronized to video, ensures lip sync is always perfect.
- Video capture plug-in for Adobe Photoshop.
- Quicktime 2.1 compatible, can be used directly out of the box with many applications.
- Supports both RGB (1152 x 870 24-bit) monitor and NTSC video monitor simultaneously.
- Quantization feature (Q-factor) can be adjusted on the fly to create the highest quality video compression on a frame-by-frame basis.
- Resizable, movable video-out-a-window lets you define part of the display to be recorded, while viewing the complete picture on the RGB monitor
- Accelerates commonly used transitions such as cross-dissolves and wipes by 700%.

Complete TARGA 2000/Macintosh Turnkey Systems

TARGA 2000 PCI/Power Macintosh 8500
- TARGA 2000 PCI videographics card for Macintosh
- Power Macintosh 8500/120 MHz with 16MB of RAM, 1GB system hard drive.and built-in 4x CD-ROM player
- ATTO *ExpressPCI* SCSI-3 Accelerator for Macintosh
- Seagate Barracuda 4.1GB Ultra Wide SCSI hard drive
- Adobe Premiere 4.0 for Macintosh
- AppleVision 1710AV self-calibrating 17" multiscan monitor with integrated front mounted speakers

TARGA 2000 PCI Pro/Power Macintosh 9500
- TARGA 2000 PCI Pro videographics card for Macintosh
- Power Macintosh 9500/120 MHz with 16MB of RAM, 1GB system hard drive.and built-in 4x CD-ROM player
- ATTO *ExpressPCI* SCSI-3 Accelerator for Macintosh
- Seagate Elite 9.1GB Ultra Wide SCSI hard drive with external case and cable
- Adobe Premiere 4.0 for Macintosh
- Apple Multiple Scan 20 20-inch multiscan monitor

TARGA 2000 PCI
PC-based Digital Video Capture Board

Designed for high performance IBM compatibles, Truevision's TARGA 2000 PRO PCI brings tremendous power to the desktop video editing market. With the proliferation of PC-based video (and audio) programs, there has been a demand for high performance hardware that won't tie up the computer's resources. The TARGA 2000 PRO PCI meets that demand with a board that performs all its own signal processing. Realtime CODEC (COmpression/DECompression) processing of audio and video, 24-bit video windowing and full motion/full screen print-to-tape are just a few of its many capabilities.

- Allows recording and playback of video directly to/from hard drive at full motion, full frame rates (50 fields/sec - PAL, 60 fields/sec-NTSC). Video is stored and played back at the highest resolution for each format (768 x 576 x 24 bit - PAL, 640 x 480 x 24 bit - NTSC). Compression can be adjusted on the fly to optimize for image quality and/or minimum storage space.
- Equipped with composite, S-video and component (Betacam) inputs and outputs.
- Accelerated Windows 3.1 and Windows NT drivers offer integrated, true-color (24-bit), non-interlaced desktop up to 1152 x 870 pixels
- Genlock using separate sync input for working in professional video suites
- Provides a large work area for displaying video, as well as editing application controls. Any part of the display (or even the whole image) can be recorded to tape (video-out-of-a-window).
- The audio is digitized at 16-bit resolution (at 44.1KHz or 48KHz sampling rates), yielding professional quality stereo sound. Since all audio and video processing is done by on-board DSPs, you are assured of perfectly synchronized sound and images.
- View your desktop and video-in-a-window on your non-interlaced high resolution desktop display while the processed video is output at NTSC or PAL resolutions to a video monitor and/or a VCR.
- All Windows, VFW (Video For Windows) and ADI compatible software run perfectly. You have a choice of hundreds of applications, with more to come (see Real Impact below).

Complete Truevision TARGA 2000/Avid Real Impact Non-Linear Turnkey System:
• TARGA 2000 PCI digital video capture board • Avid Real Impact software • 220-watt, 6-bay midtower case • PCI motherboard with 256K synchronous cache • Pentium 133 Mhz processor • Diamond Stealth64 Video VGA display card • 32MB of EDO (Extended Data Out) RAM • Quantum 1.28GB IDE system drive • Seagate (Barracuda) 4.2GB SCSI-2 Wide hard drive • Adaptec AHA-2940W Fast Wide SCSI II controller card • 3.5" floppy drive • Plextor 4.5x SCSI internal CD-ROM drive • Altec-Lansing 300.1 three-piece speaker system • MAG Innovision MXG-17F 17" multiscan monitor • Focus 2001A keyboard, Microsoft MS mouse, Windows NT 3.51 software. **$12,250**

Enhancement Options Available:
• Additional 32MB of RAM • Additional 256K cache memory • Seagate (Elite) 9.1GB SCSI Wide hard drive • Mag 21" multiscan monitor • 8x CD-ROM drive • Adobe Premier 4.0a for Windows

NEW!

Real Impact
Video Editing Software for TARGA 2000

With the introduction of Real Impact, Avid provides Windows users with the same professional image quality, intuitive cut/copy/paste editing, and instant random access capabilities that have won 2 Emmy awards—for thousands of dollars less than outsourcing an average video. Designed exclusively for Truevision's TARGA 2000, Real Impact lets you create professional-quality video with audio, graphics, animations, special effects and titles—with the speed, flexibility and creative freedom you need. Create sales, training and product videos right on your PC quickly and easily—without compromising quality. Produce video in 24-bit color, with CD-quality sound and perfect lip sync.

Video Features:
- Real-time JPEG compression, decompression and playback at 60 fields per second.
- Supports Sony serial and VLAN deck control protocols, supports SMPTE time code.
- Edit two tracks of video for layered effects.

Audio Features:
- Edit up to four tracks of 44.1 KHz, 16-bit CD-quality audio.
- Real-time pan and volume adjustments, digital audio scrub.
- Audio waveform for precise audio editing.

Digital Editing:
- Instant random access to footage. Cut, copy, paste editing with 32 levels of undo and redo.
- Instant trim editing mode, plays back all edits instantly.

Import/Export:
- AVI video files, WAV audio files, FLC animation files.
- OMF Interchange files.
- BMP, JPEG, PCX, TGA and TIFF graphics files.

Special Effects:
- Filter effects with previews and adjustable parameters.
- Transition effects include wipes, dissolves, zooms, pushes and squeezes.
- Layered effects include picture-in-picture, luminance and chroma key.
- Support for Avid TransJammer effects Vol. 2 or later (Vol. 1 requires a free update through Avid Technical Support).

Integrated Title Generator:
- Fully anti-aliased titles.
- 32-bit processing (24-bit color and 8-bit alpha channel).
- Support for TrueType fonts and international character sets.
- Drop shadows, transparency and color blends.
- NTSC and PAL-safe color palettes.

Media Management:
- Media library for organizing digital media clips.
- Database with search capabilities.
- Customized views for easy clip access and retrieval.

LEADER

5850C Vectorscope

An ideal companion for the 5860C Waveform Monitor, the 5850C adds simultaneous side-by-side waveform and vector monitoring. Featured is an electronically-generated vector scale that precludes the need for fussy centering adjustments and eases phase adjustments from relatively long viewing distances. Provision is made for selecting the phase reference from either (A or B) inputs or a separate external timing reference.

5860C Waveform Monitor

A two-input waveform monitor, the 5860C features 1H, 1V, 2H, 2V, 1 µs/div and 2V MAG time bases as well as vertical amplifier response choices of flat, IRE (low pass), chroma and DIFSTEP. The latter facilitates easy checks of luminance linearity using the staircase signal. A PIX MON output jack feeds observed (A or B) signals to a picture monitor, and the unit accepts an external sync reference. Built-in calibrator and on-off control of the DC restorer is also provided.

5864A Waveform Monitor

A fully portable waveform monitor for field use, the Model 5864A is a two-channel unit that provides 2H and 2V sweeps with MAG, FLAT and IRE response, and normal and X4 gain.

5854 Vectorscope

2-channel portable vectorscope is ideal for field use and features A and B phase reference, fixed and variable gain. Both units shown w/optional battery holder and NP-1 type battery.

SONY
COLOR MONITORS

PVM-1350
13˝ Presentation Monitor

- Employs a P-22 phosphor fine pitch CRT to deliver stunning horizontal resolution of 450 horizontal lines.
- Equipped with beam current feedback circuit which eliminates white balance drift for long term stability of color balance.
- Has analog RGB, S-video and two composite video (BNC) inputs as well as 4 audio inputs.
- Automatic Chroma/Phase setup mode facilitates the complex, delicate procedure of monitor adjustment. Using broadcast standard color bars as a reference, this function automatically calibrates chroma and phase.
- Chroma/Phase adjustments can also be easily performed with the monochrome Blue Only display. In Blue Only mode video noise can be precisely evaluated.
- Factory set to broadcast standard 6500K color temperature
- Provides an on-screen menu to facilitate adjustment/operation on the monitor. The on-screen display can be selected in English, French, German, Spanish or Italian.
- On power up, automatic degaussing is performed. Also has a manual degauss switch to demagnetize the screen.
- Sub control mode allows fine adjustments to be made on the knob control for contrast, brightness, chroma and phase. The desired level can be set to the click position at the center allowing for multiple monitors to all be controlled at the same reference level.

PVM-1351Q
13˝ Production Monitor

Has all the features of the PVM-1350 *PLUS* -
- Is also a multisystem monitor. It accepts NTSC, PAL and NTSC video signals. NTSC 4.43 can also be reproduced.
- Equipped with a SMPTE 259M Serial Digital Interface. By inserting the optional serial digital interface kit BKM-101C for video and the BKM-102 for audio the PVM-1351Q can accept SMPTE 259M component serial digital signals.
- Equipped with RS-422 serial interface. With optional BKM-103 serial remote control kit all of the monitor's functions can be remotely controlled with greater confidence and precision.
- Equipped with input terminals such as component (Y/R-Y/B-Y), analog RGB, S-video, 2 composite video (BNC) and 4 audio terminals for complete flexibility.
- Aspect ratio is switchable between 4:3 and 16:9 simply by pressing a button.
- Underscan and H/V delay capability. With underscan, entire active picture area is displayed. Allows you to view entire image and check the picture edges. H/V delay allows viewing of the blanking area and sync/burst timing by displaying the horizontal and vertical intervals in the center of the screen.
- Color temperature switchable between 6500K/9300K/User preset. 6500K is factory preset. 9300K is for a more pleas-

PVM-1354Q/PVM-1954Q
13˝ and 19˝ Production Monitors

All the features of the PVM-1351Q *PLUS*:
- SMPTE C standard phosphor CRT is incorporated in the PVM-1354Q/1954Q. SMPTE C phosphors permit the most critical evaluation of any color subject. Provides over 600 lines of horizontal resolution.
- The PVM-1354Q mounts into a 19-inch EIA standard rack with the optional MB-502B rack mount bracket and SLR-102 slide rail kit same as PVM-1351Q. The PVM-1954Q mounts into a 19-inch EIA rack with the optional SLR-103 slide rail kit.

Panasonic
AG-DS840/AG-DS850
S-VHS DIGITAL Slow-Motion Editing System

- They provide clear, noise-free, high quality slow playback. Playback speed, including Digital Still is selectable in 10 steps (-¼, -⅓, -½, -⅔, -¾, +¼, +⅓, +½, +¾, +1).
- 3-dimensional digital TBC with a correction range of one field. With the VCRs continuously retaining one field in memory, the data is used for 3-D type processing thereby providing excellent dropout compensation.
- Digital Signal Processing for improved picture quality, and for maintaining uniform picture quality during editing. A Chrome Aperture Compensation (CAC) circuit eliminates color blurring and expands chroma bandwidth. Other digital processing circuits include:
  - Dig. Noise Reduct. (DNR): Processes Y & C signals separately to boost S/N Ratio by minimizing noise during playback.
  - Digital Comb Filter: Advanced 3-dimensional system for total Y/C separation providing reduced color and luminance blurring.
  - Switching Noise Mask Circuit: Eliminates noise caused by head switching during slo-mo playback.
- Employs amorphous video heads that have a higher magnetic coercivity than conventional ferrite heads. Expanded frequency response from the amorphous heads enhances picture quality by minimizing color blurring.
- Built-in LTC/VITC (Longitudinal/Vertical Interval) time code reader/generators for absolute frame accurate editing.
- Equipped with component outputs allowing easy connection to other component video equipment. This allows high quality transfer of S-VHS source material to Betacam or MII.
- IQ (Intelligent Quest) mechanism delivers precise, high-speed operation. The dual-loading system achieves high-speed response while protecting tapes and heads. The tape transport mechanism uses five direct drive motors, including two reel drive motors.
- Capstan Control System with large capstan spindle allows high-speed search at 32x normal speed (with color picture).
- 4 channel audio – 2 hi-fi stereo channels with dynamic range of 90dB as well as 2 linear channels with Dolby NR. Each audio channel has its own input (AG-DS850 only) and output with individual channel-level setting capability and uses XLR connectors.
- Provide 16:9 wide aspect compatibility, so they are fully equipped for the next generation of televisions.
- 3 rack units high, they are unbelievably compact for easy space saving installation. 19˝ rack-mountable with optional AG-M730.

NEW!

AG-DS540/AG-DS550
S-VHS Source Player/ S-VHS Edit Recorder

The new AG-DS540 and AG-DS550 are *identical* to the AG-DS840 and AG-DS850 in every respect except they have no Digital Slow-Motion capability and no component output. Otherwise they are exactly the same! They are built for the budget conscience and for those who have no need for slow-motion playback. Or at the very least, for those who require slow-motion playback but certainly not on the record side. They can now purchase just a recorder without paying for capabilities not needed (eg. AG-DS840 & AG-DS550).

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- **PRO PAC 14 NICAD BATTERY** (14.4v 60 Watt Hours)
- **PRO PAC 13 NICAD BATTERY** (13.2 v 55 Watt Hours)
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MAGNI

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FEATURES:
- Converts waveform or vector display information into a standard video signal which can be displayed on a video monitor or routed around a video facility. no need for additional expensive monitors. Switch between pictures and waveforms at the push of a button.
- Incorporates an advanced SC/H phase and color frame indicator that is a must for editing and post production. At a glance it tells you if a signal's subcarrier-to- horizontal phase is properly adjusted and if the signal's color frame matches the house black burst connected to the MM-400 external reference input.
- Works anywhere and with any analog video format—NTSC, PAL, Component or S-Video. It has automatic detection between NTSC and PAL formats.
- Three loop-through inputs can accept three composite signals or one component, or RGB signal
- No complex displays or special test signals are required for component video monitoring
- Interchannel timing and amplitude display make component analog monitoring easy. has color bar limit markings for Betacam, M-II and SMPTE formats.
- Waveform and vectorscope controls, including channel, sweep speed, position control, phase rotation are on easy-to-see dedicated pushbuttons.
- Besides instant toggling between picture and waveform, a mix mode combines waveform and picture displays for simultaneous viewing.
- The MM-400 can be readily used by even novice operators. It has easy-to- understand set-up menus for display color, Interchannel timing, SC/H phase alarm.
- Usable in any video facility of any size for displaying signals. its low cost makes it affordable by the smallest studio, while its features and performance make it ideal for monitoring in high-end facilities as well.

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USER REPORT

EVS Lets Editec Take it Slow

by Steve Cotterill
Managing Director
Editec Ltd.

ATHERSTON, U.K.

Editec Ltd. was formed about four years ago with the aim of providing quality equipment and crewing for sports slow-motion operations. The company can also supply a complete OB consultancy, systems engineering and editing service.

Editec has made the EVS LSM system an integral part of its OB operation.

Our clients include BBC, BSkyB, Sportsworld, ITV Sport, Granada and various OB facilities companies worldwide. Editec is currently the only U.K. company hiring out LSM (Live Slow-Motion) systems, and also runs advanced operational courses on LSM operation.

Two years ago, Editec decided to investigate "state-of-the-art" slow-motion systems with fast access replay. Several manufacturers were approached, and sales information and specifications were obtained from a wide range of companies. Available products were either RAM-based with capacities between 30 seconds and five minutes or disc-based with various duration and compression options.

Of all the systems considered, the EVS system appeared to offer the best in quality and facilities, and was available for demonstration on a live OB of my choice. This was more than could be said for the other manufacturers. My impression was that competitors' systems were mainly on paper or at very best, prototypes.

In preparation for the demonstration, I was invited to visit the EVS factory in Liege, Belgium. I spent the day being trained on a three-minute EVS LSM RAM recorder. EVS explained that this product was near the end of its life, and that a new disk-based system would soon be available. One very interesting point was that existing customers could have their RAM-based machines upgraded to disk. Apparently this has always been, and still is, the EVS policy — a standard mainframe for all products, upgradable when required.

I was very impressed by the LSM. Primarily a slow-motion machine, it had a built-in target tracking system, paint package, split-screen analysis system and digital mixer, with clip and playlist management. The main selling point of the system was its ability to stay in record mode at all times, even when replaying a clip.

Another superb facility was the ease and speed with which a slow-motion compilation for a program closing could be made. Within a few days, Yves Rolus, the EVS Sales Manager, bought a system into the U.K., and I had arranged three live OB demonstrations with BSkyB. These went very well, and immediate requests for the system to be used on future programs were received.

As a result of the high level of interest, I purchased the first system in the U.K. — a three-minute RAM recorder — and planned to upgrade to disk when available. Now, Editec owns two LSM disk recorders. The systems, now widely used on sports OBs, will usually be supplied as a package, with a trained operator.

In its basic form, the LSM can be a direct replacement for a standard Beta SP machine, although the mainframe is 1RU higher. By its nature, the LSM offers instant re-cue of slow-motion replays. In fact the dual access enables the material to be available before the action is finished. Try doing that on tape.

During quiet periods or at half-time, filling material or pieces for analysis that have been previously stored are available for instant replay. There is no more waiting for the goal that is 70 minutes back on a 90-minute tape.

If required, several pieces can be "bolted" together very quickly in a playlist, with a dissolve between each. This feature is used by BSkyB to lead into commercial breaks and for program closing montages. At full speed, a highlights package can be played with audio crossfades between clips.

The "icing on the cake" with the LSM is the available software options. Briefly, there is a built-in telestrating system, a tracking split-screen system and a target-track package that allows an operator to follow a player with a circle, highlight or x4 zoom lens. These can be controlled from a graphics tablet or remote touch screen.

... the dual access enables the material to be available before the action is finished. Try doing that on tape.

A version of LSM called Super LSM is now available. This system is a direct disk replacement for the Sony supermotion tape recorder. Future products include a two-camera version and a system with dedicated editing facilities.

Panasonic and EVS will be involved in a joint venture at the Atlanta Olympics. EVS will supply the recording medium for the new Panasonic high speed camera, and NBC is looking into using LSM units to enhance its Olympic coverage.

As you can probably guess, I am a fan of the EVS system. For the basic slomo operation, the system makes the operator's job much easier. It is truly wonderful to have the ability to check something without the risk of missing important action. The technology enables operators to become more inventive and adventurous, and the program most certainly gains from this. In fact, I have found that operators actually look forward to working with the system. ■

Editor's note: Steve Cotterill spent 10 years at Central TV, and two years as VTR supervisor at OB company 021 TV. His videotape experience started with two-inch Quadruplex ACR 25 cart machines through one-inch HB U-matic, Beta SP and Digi.

The opinions expressed above are the author's alone. For further information, contact EVS in Belgium (telephone: +44-1827-717-354; FAX: +44-1827-717-474), or circle ***Reader Service 114.***

BUYERS GUIDE

USER REPORT

BSkyB Cuts a Strong Profile

by David Sparks
Chief Engineer
British Sky Broadcasting

LONDON

Before Tektronix launched its Profile professional disk recorder (PDR) in Europe, I had a sneak preview — well, a detailed one, in fact — of the system at Odetics in Los Angeles. My reaction was such that we "designed in" the Profile as part of our long-term plans as long ago as October of 1994.

Why the interest? As chief engineer at British Sky Broadcasting (BSkyB), I was looking to find a more efficient system to replace our seven-year-old tape-based system. Running 10 channels meant that we had to copy every promo and commercial 10 times. That adds up to a lot of tape, heavy maintenance costs and a considerable amount of operator time.

FORWARD THINKING

At the same time, with a clear long-term strategy to produce a CCIR-601-quality network infrastructure across our broadcast operations, any new system would have to be fit and robust. Setting all the hype aside, I have encountered only two video servers that actually work as they are intended — the Profile being one.

So what is the Profile exactly? It is a four-channel digital disk recorder delivering first-generation Betacam picture quality and CD-quality audio. In effect, it has the functionality of four conventional VTRs.

At BSkyB, we now have eight Profile systems with three hours of storage on each, which we use principally for commercials and promos. A master copy is retained on an LMS1000, played down to the Profile system and then played out as required.

For me, and I suspect for most broadcast engineers, one of the system's main attractions is that it not only acts like a VTR and configures like one in an overall system, it even looks a bit like one. Something that looked and acted more like a computer would undoubtedly meet with more resistance, regardless of its capabilities.

The Profile is very practical. With a single large video server, any station would be at risk. Conversely, with a cluster of Profile systems, that risk is minimized and I always have a reserve running in duplex for each of the four units.

Of course, as with any new system, there were a few bugs at the outset, and at first it did not have its own protocol. However, these issues are solved now, and overall control is very good.

The VTR emulation protocol is now a standard feature and implements a large portion of the Sony BVW 75 Betacam VTR command set. This enables the Profile to mimic the ballistics of a mechanical tape transport and, as a result, it may be substituted anywhere a BVW 75 is in use.

AUDIO, TOO

Embedded audio has also been added since the product was launched. This greatly simplifies planning and signal routing by multiplexing four channels of digital audio into the serial digital video stream.

The systems sit inside a new multichannel complex here at BSkyB. Housed in one room, this is designed for future expansion, such as the new joint venture channels with Granada anticipated later this year. It is very cost-effective as it allows two operators to manage up to 12 channels, as opposed to one per channel previously.

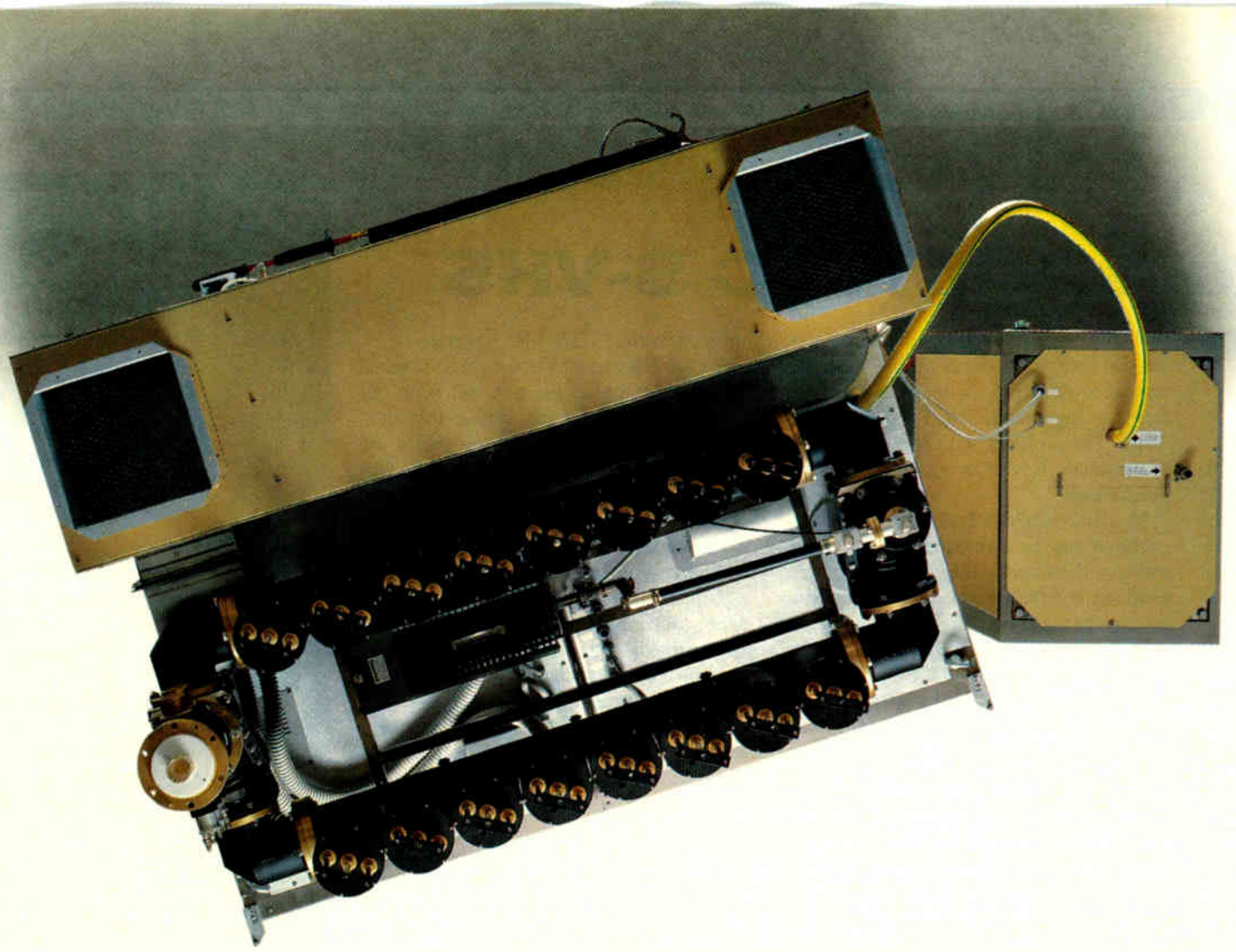
When fully operational this month, the new set-up, which was supplied by Drake on a turnkey basis, will still retain program material in a traditional Betacam tape format with the entire system controlled by a Drake D-MAS automation system.

In the immediate future, we are also looking at expanding the use of the Profile systems into news and sports. Longer term, our goal is to network the Profiles, delivering all the benefits of a large server, and roll them up into a fully digital operation that could perhaps be transmitting on the MPEG-2 standard.

However, that is for tomorrow. Today, any chief engineer would find it well worth the time the take a look at the Profile system.

Editor's note: David Sparks leads a team of 12 engineers at Sky, based in Osterly, West London. He is responsible for the broadcast side of the network, including its five studios transmitting 10 channels.

The opinions expressed above are the author's alone. For further information, contact Tektronix (telephone: +1-503-627-7111; FAX: +1-503-627-2465), or circle ***Reader Service 97.***



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USER REPORT

Dorset Rolls with JVC S-VHS

by Les Roworth
Owner
Dorset Television

LONDON

Dorset Television was set up in 1989 to provide a specialized video transfer service for overseas program sales. At the time, the two main customers, namely a large London-based ITV contractor and an international program sales operation, required high-quality VHS cassettes for audition purposes.

These would be sent to prospective overseas customers before they purchased the programs for transmission. Because both companies were selling worldwide, Dorset Television had to be able to handle both 525 NTSC and 625 PAL standards.

INCHING ALONG

The operation started with three two-inch Quad VTR machines, two one-inch C format machines, two high/low band U-Matic machines, two multistandard U-Matic machines and six multistandard VHS machines. There was a central routing system that could route any VTR machine to any other machine. There was also the facility for "burning-in" various customer identifications into the video to stop pirating.

In 1991 the facilities were increased with an editing system complete with a JVC KM-D600E Y/C digital effect generator/vision mixer and an audio mixer. The desk contained an Ampex edit controller, a Sony U-Matic edit controller and high band edit and low band edit U-Matic machines.

The edit system was to provide simple editing of promotion cassettes, and the one-inch editing was for the removal of commercial breaks, etc. VHS editing was either machine-side editing or material was transferred to high band, edited and returned to VHS. The problem with this system was the resultant loss of quality over the extra generations.

In 1992 more VHS machines were required and an investigation was carried out on those available. There was a requirement for limited S-VHS facilities and in the end, two JVC S-VHS top-end source players were purchased. As JVC was the originator of the S-VHS format and maintains a strong presence in London, we decided that the company filled our requirements as well as those of our customers. In 1993 several more machines were purchased, including a 525 NTSC 3.58 S-VHS. In 1994 a broadcast standards converter and several more JVC S-VHS machines were purchased.

BIGGER AND BETTER

In 1995 we moved to our new premises and the edit facilities have been expanded to handle S-VHS cassettes. Two more JVC S-VHS SR-S368E recorder/players and an RM-G800E edit controller have been added to the edit desk. The routing system allows the two S-VHS machines to feed into the KM-D600 vision mixer and the U-Matic and one-inch machines.

The S-VHS edit operation provides good quality pictures without having to change format. Original material on VHS, or preferably on S-VHS or Sony Hi8, can be edited directly without any of the generation quality loss that we experienced before we took on the JVC S-VHS systems.

The S-VHS standard is not yet a universal standard for broadcast use, but from our experience some of the smaller transmission organizations around the world are changing from U-Matic to S-VHS. Our new set-up will handle both PAL and NTSC 3.58 and 4.43. The two NTSC standards are used because 4.43 is required for audition purposes but 3.58 is used for transmission. This means that not only are two types of U-Matic and VHS machines required, but also the standards converter must be able to handle all systems.

The future requirements are for more 525 3.58 NTSC U-Matic machines, but these seem to be in short supply. The manufacturers have forgotten the small stations in the U.S. and Pacific Rim that still transmit from U-Matic and who have not moved to Beta SP or M-II. We are investigating Beta SP, but the cost is rather high and the cheaper machines do not have access to the two FM channels that are often used for M/E tracks. These are frequently required for overseas cassettes where English is not the dominant language.

SAFE AND SURE

As our business has developed, we have found the S-VHS format and the JVC machines to be reliable, and they have enabled us to maintain our high standards while saving us considerable time and cost. As the older VHS-only machines become expensive to maintain they will be replaced by S-VHS machines that can handle both S-VHS and VHS.

In our operation, there will always be a need for U-Matic machines. We hold a library of 6,000 U-Matic cassettes, but because of the cost, ordinary VHS will be the standard for audition cassettes for a very long period. The standard is quite suitable for review purposes and we will only need higher quality S-VHS for transmission purposes.

At Dorset Television we now have two one-inch machines, 10 U-Matics, five S-VHS and 12 VHS decks. A new area we are examining is to provide a service for the non-professional market both in the edit and transfer area. Here we are beginning to use S-VHS both for camera acquisition work and final productions.

The problem we are all facing is the number of formats that are now available. When I started in broadcasting the only recording system was 35mm telerecording. We then had two-inch, followed by one-inch, U-Matic and VHS. Now there are two U-Matic formats, the various VHS formats, Beta SP, the digital formats, Sony Hi-8 and its variations and the disc formats. Where will it all end? ■

Editor's note: Les Roworth joined Associated Redifusion in 1955 as senior vision controller, moving to Tyne Tees Television in 1958 where he was assistant chief engineer. In 1969 he joined LWT as controller of production engineering and left the company in 1989 to start Dorset Television.

The opinions expressed above are the author's alone. For further information, contact JVC in the U.K. (telephone: +44-181-896-6000; FAX: +44-181-896-6060), in Japan (telephone: +81-426-60-7560; FAX: +81-426-60-7569), or circle ***Reader Service 24.***

CONTINUED FROM PAGE 22

HP Served KOLD

— Functionality. The HP BVS system is well-designed, a fact that our testing process proved. It occupies a small amount of space. And because the BVS and AMS are well-integrated into our station, the system provides flexibility and ease of use for the Operations, Sales and Traffic departments.

— Picture quality and on-air look. Another reason we went with the HP is that the quality of MPEG-1 is very good. Of course, we in the industry can sometimes recognize compressed video, but the viewer at home rarely can.

With MPEG-2 now available, the quality will improve without the errors and spot loss associated with videotape. At KOLD, our on-air look has improved measurably.

— Training. One of area of concern for any station in moving from a tape-based to a disk-based system is the new base of knowledge required of its operators. To help the operators at KOLD adapt to this new technology, HP provided a training program that benefitted even those operators with no prior computer background.

— Cost savings. With this system, KOLD has seen savings in power costs, in storage space inventory and in tape costs. We have also been able to make more productive use of station personnel.

We believe the HP BVS has changed our operation for the better. It has given us a new level of flexibility and the ability to make split-second changes to our schedule. The BVS gives other departments such as Sales and Traffic an edge as well. It has provided a cleaner, quieter, safer environment for operators. Its integration into our station has simplified the operational environment, which gives our staff more time to perform other functions.

Moving to the HP BVS has helped us take a necessary step toward the latest stage of technology and gives us a great advantage in our marketplace. The road has not been without its bumps and rattles, but at every crossroads HP has been there with solutions for the next mile. We feel that the HP BVS was the right decision for us. ■

Editor's note: Rod Dombrowski has more than eight years of experience in television, ranging from operations to management. He has a bachelor's degree in television production and business from the University of Arizona in Tucson.

The opinions expressed above are the author's alone. For further information contact Hewlett-Packard in the U.S. (telephone: +1-408-553-3945; FAX: +1-408-553-3905), in Europe (telephone: +31-20-547-9809; FAX: +31-20-547-7799) or circle ***Reader Service 89.***

BUYERS GUIDE

BUYERS BRIEFS

The LDR-100 disk recorder from **FOR-A** is a non-linear, random access, compression-based recorder that is NTSC, PAL, PAL-M and PAL-N compatible. The system has a digital serial component, YPBPR, analog composite and Y/C input/output.

The system has selectable JPEG compression rates, RS-422A and RS-232C input/output and comes with two audio channels that can be expanded to four. The system allows for up to 83 minutes of record capacity and the DOS-based, PC-controlled software has menu select operational settings and an overview main menu.

The LDR-100 can be used as a standalone or as a control system operated by the Symphony desktop production system or CLASP automated management systems.

For more information, circle ***Reader Service 19.***

The CLIPBOX video server from **Quantel** is a random access, simultaneous multi-user server that provides up to 40 hours of on-line random access storage.

The unit is an intelligent server with multiple inputs and outputs and built-in database management. Its discretionary compression allows noncompressed component digital video to be stored alongside grid-compressed material on a clip-by-clip basis.

Any stored material is simultaneously available at any of the multiple outputs without copying. CLIPBOX contains a built-in TCP/IP interface, allowing it to be easily networked to all of Quantel's products.

For more information, circle ***Reader Service 135.***

The VideoStore disk-based digital ad insertion system by **Sony** now includes a wide area networking (WAN) capability and an increase in the number of channels to which a VideoStore system can play out.

Other enhancements include the ability to play out commercials at two resolution levels and an expansion board to help augment horizontal and vertical motion estimation/compensation.

In addition, the VideoStore has an embedded clip identification for traffic and billing verification, a dedicated RS-232C port for remote diagnostics and a vertical interval closed caption board.

For more information, circle ***Reader Service 68.***

EQUIPMENT EXCHANGE

TV Technology's Equipment Exchange provides a FREE listing service for all broadcast and pro-video end users. Brokers, dealers, manufacturers and other organizations who sell used equipment on an occasional basis can participate in the Equipment Exchange on a PAID basis. All free listings run at the discretion of the publisher.
Call 1-703-998-7600 for details.
Submit your free listings on your letterhead and state the make, model number, a brief description, sale price and complete contact information and mail it to:
TV Technology, PO Box 1214, Falls Church VA 22041

CAMERAS

Want to Sell

Canon L1, low hrs, excellent shape, 15x lens, batteries, case, AC adapter, $1800. Rick, 503-484-2711.

Philips LDK-25 studio camera, B/O; RCA TK76B (2) ENG cameras, $300/$500; RCA TK44 studio camera, B/O. Mark, 1-800-236-4000.

JVC Porta-Pack system, JVC KY-1900 3-tube camera, nice picture, no burns, low hours, power supply/charger & hard case, JVC 4400 portable 3/4" R/P, power supply/charger, 4 batteries, cables & manuals, excellent condition, $725. Dave, 616-776-1633.

Olympus VXS405 SVHS camcorder, same as Panasonic AG400/PV350, new heads, $675. Richard, 914-769-0676.

JVC GYX2, 3 CCD camcorder w/12x Canon lens, batts, charger, less than 20 hrs use, $6200 or B/O. Peter, 303-733-3679.

UVW-100 Betacam SP, used only few hrs, factory warranty, $7800; Fuji 16x2x Berm lens, $5250 or both for $12,900. Jim, 619-436-2308.

Canon LX100 Hi 8 camcorder, professional version of L1, with 15x & 8x zoom lenses, light & batteries with rechargers, like new, paid $3300, asking $1580. Erkki Kanto, 805-584-9749.

Panasonic AGDP800 Supercam package incl Fuji 14x lens, hardshell travel case, tripod plate, Porta Brace soft travel case, 2 Anton Bauer digital trimpac, 14 batts w/charger, original boxes, 1 year new w/warranty, approx 75 hrs use, $6700. Sundad Productions, 808-737-1060.

Panasonic AG-DP800XL Supercam, complete package, with 4 year warranty, $6850. Hanna, 714-554-1252.

Hitachi Z-31P plumbicon camera in excellent shape, component & composite boards w/both cables, power supply, batt, extender board, manual, tripod plate & Canon J15x9.5 KRS lens, $2300. Nick, 718-981-0120.

Sony DXS-M7 with VCL915BYA zoom lens, hard case, Porta Brace cover, with VO880 SP recorder, BKU-706 timecode, Porta Brace, Sony BC1WA charger & 8 batteries, all manuals, low hours, mint condition, $11,000; Panasonic AG450 SVHS camcorder, hard case, charger, mint, $850. 808-823-6130.

Canon L2 Hi 8 camera, mint condition, charger w/4 batts, remote, low hrs, $2200. Mike, 307-733-7871.

Panasonic SuperCam, 3 chip SVHS camcorder, 14x lens, less than 20 hrs, w/warranty, $6300. Kelly, 318-234-1422.

Canon J8x6B4 IRS lens, 2x extender, exc condtion, $11,500. Ed, 507-663-1048.

Panasonic AG-450 (3) w/accessories & cases, $825 ea; AG-455 w/accessories & case, $1250; WV-3260 plus genlock, extra cable, studio power supply & protective bag, $775; Bogen 3254 folding auto-dolly, black finish, quick wheel release, like new, $100; 3137 folding dolly, like new, $100, all prices negotiable. Ron, 718-966-0470.

Sony DXC-M3A, excellent condition, Canon J15x9.5B4 KRS zoom lens, plate, extra tubes/prism, extra viewfinder, batt pack, hard case, 10 ft Sony cable, manuals, $1600 or B/O. Adam, 904-874-0740.

Ikegami HC200, 3 CCD video camera, $2195. R MacDonald, 407-452-4326.

Sony BVW1A dockable record deck w/537/637 adapter, low hrs, good condition, $2800 or B/O. J Boyer, 208-746-8335.

Ikegami ITC-730A, 3 tube camera, very good condition, with Fujinon 9.5mm to 152mm lens, camera plate, multi-pin cable, AC power, hard travel case, Porta Brace quick draw case, rain cover, manuals, $2100. David, 617-547-2073.

Sony BVP30 camera head, fair condition, no shoulder pad, tubes in great shape, low hrs, $750 or B/O. 505-888-7616.

Sony BVW-507, Fujinon 14x8.5 lens, hard case, manuals, good condition, $18,500. Larry, 805-522-8417.

JVC GYX2U, soft carry case, 13x1 Canon lens, NRG AC power source, used 80 hrs, excellent condition, $5400; Panasonic WJMX-12 AV mixer, $850, price incl shipping. Joseph, 216-273-9194.

Sony Hi 8 EVW300 camcorder, 3-chip, 13:1 Canon lens, hard case, AC supply, batt, $5800 or B/O. Terry, 800-748-4982.

Sony M3A camera, 12-1 Fuji zoom, A/C adapter & case, new tubes, 40 hrs, $1500 or Best Offer. Gary, 818-996-5812.

Sony-Thompson 601 color video camera & recorder, new plumbicons, Fujinon A14x9.5 lens, wide angle adapter, CCU, 100 meter cable, Peter Lisand tripod, O'Connor 50 head, zoom & focus controls, BVU150SP 3/4" SP recorder, 8" Sony color monitor, excellent condition, $12,500. Bill, 301-585-1118.

Sony/Ampex BVP-30/BVV-1A, Fujinon 14x9 Pegasus II lens with 2x extender, original owner, less than 300 hrs, beautiful condition, manuals, extender board, tripod plate, $5000 or B/O. Grant, 415-558-8339.

Lipstick cameras (3), CCU & switcher, unique Elmo/Toshiba MN401E system with one CCU & mini custom-made switcher & extras, 400+ lines resolution with Y/C (SVHS) output, used for POV cockpit series, very light & compact, excellent condition, 3 years old, Hi 8 deck also available, $8000 new, Best Offer. Eye in the Sky TV, 908-832-2050.

CAMERA ACCESSORIES

Want to Sell

Sony BC-1WD battery charger, like new, less than 50 hrs use, $500 or B/O. Jim, 414-547-2231.

Porta Brace CC-505PW quick draw camera case for Betacam, etc, like new, only used once, $200. Bill, 502-426-6278.

Porta Brace carry-on camera cases for DXC325/9000, $150; Betacam cameras, new condition, $200; BC1WA battery charger, $350; Panasonic NVB51 power supply, $200; CSI fluid head, three section tripod, $1200; Precision Optics 2x extender for Sony 1/2" lenses, $550. Jim, 619-436-2308.

ITC tripod, heavy duty, $200. R MacDonald, 407-452-4326.

Tripods, all types; 44x1, 45x1, 50x1, 55x1 field lenses, Sony B4 mount; 26-pin CCU cable, any length, with ends or bulk; Sony CCUM7 & DXF50. AVPS, 703-527-1200.

Bogen 3046 tripod w/3063 mini fluid head, $170. 808-823-6130.

Hitachi SK91 CCU cables (3), 50 meters, good condition, $100 ea. Adam, 904-874-0740.

ITE P4 studio pedestal, with counterweights, $2500 or B/O; PVT studio pedestal, air counterweight, excellent dolly, $2500 or B/O. Terry, 800-748-4982.

Sony RMP3 remote paintbox, excellent condition, with long & short cables, $700. Grant, 415-558-8339.

Fujinon A8.5x5.5 lens, wide zoom with /internal focus, excellent condition, $9500 new, Best Offer; Canon J15x9.5 lens with 2x adapter, excellent condition, $4500 new, Best Offer. Paul, Eye in the Sky TV, 908-832-2050.

COMPUTERS

Want to Sell

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DIGITAL EFFECTS

Want to Sell

Ampex ADO100 single chan, 3 axis, Digi-Matte, 3.5" disk drive, manuals, VGC, $10,500 or B/O. Dave, 216-696-1122.

Ampex ADO100, $3000. AVPS, 703-527-1200.

Truevision Classic 32 bit board w/Rio software for IBM, $600. D Smoot, 205-539-5003.

DSC Eclipse DVE, page turn, curve, shadow keyer, $5500. Michael, 612-227-9520.

EDITING EQUIPMENT

Want to Sell

Hahnel Super 8mm film editor w/Wurker splicer, exc condition, $150. David, 617-547-2073.

Convergence Editor ECS1000lmk, 4 machine control, monitor menu, EDL list, $1100. Terry, 800-748-4982.

JVC CR8250 3/4" editor, $1600; JVC CR6650 3/4" recorder, $950; JVC CR8200 3/4" editor, $1200; JVC CR5500 3/4" player, $800; JVC BRS810 SVHS editor, $2100; JVC BRS610 SVHS recorder, $1100; Paltex Abner A/B controller w/cables, $1375; Videomedia Mickey A/B V-Lan controller, $975. Richard, 914-769-0676.

Laird 1500 CG system, extended keyboard, extras, $1350. Michael, 612-227-9520.

Sony VO5800, $1650; (2) Sony VO5850s, $2000 ea; (2) Sony RM-440, $675 ea; Sony BVE-800 w/3 serial interfaces, $1350; Sony BVU-800 w/TC-13, $2600; Crown D-150A audio amp, $400; Nakamichi MR-1 cassette deck w/XLR in & out, $775; Ampex ACE-25 internal audio mixer board, $1400; Ampex TBC 80/40 video out board, $600; Garner 270 belt degauser, like new, $1200; (3) Tektronix 528 wfms, $600 ea; Ultimatte Newsmatte, $1100; Ampex ADO-1000 w/Digimatte & perspective 7.1 software, $8000. Eric, 203-357-8488.

Avid/Micropolis 2 GB HD's for MSP, 3 units avail, hardly used, can be used for any Avid so generic HDs can be used downstream, cost $4000 ea new, will take B/O. Paul, Eye in the Sky TV, 908-832-2050.

CMX 330A, A/B/C roll, GPI, GVG-100 interface, GISMO, manuals, VGC, $4100 or B/O. Dave, 216-696-1122.

Sony BVW60, $13,900; Sony BVW75, $27,900; Abekas A-53 single chan DVE, $13,900; Sony BVH2000 w/BKH2011 Type I control panel, BKH2100 TBC, BK2006 TBC remote, BKH2014 side panel kit, & BKH2015A TC board, $10,900; Sony BVE900 w/BVE910 upgrade, CPD121, RMM507, BKE901/912/915/916, (2) BKE904, $4900; Sony BVM1310 broadcast monitor w/auto set-up & probe, $2900; Sony BVX10 color corrector w/BVR58 remote, $2700; Chyron ACG CG, $2900; Grass Valley 100-N switcher w/serial interface, $4900. John, 201-934-1250.

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Sony RM440 editor, excellent condition, $500. D Smoot, 205-539-5003.

Panasonic WV5203 triple 5" monitor, needs work, $195; Matthey delay line 10-165 NS, B/O; off-line package, Panasonic WJ4600B switcher, needs work, Microtime T100 TBC, Panasonic BT-S1300N monitor, Comprehensive Edit Master w/keyboard, IBM compatible XT, Sony VO5850, loading problem, $2900; all manuals, extender boards & most original cartons available, will consider all reasonable offers. John, 201-934-1250.

JVC CR8250U 3/4" recorder/editor, excellent condition, new heads, $1350; JVC RM86U edit controller, cables & service manual, $600; JVC BR7700U VHS HiFi recorder/feeder, needs loading mechanism adjustment, $500. Rob, 414-384-7083.

Convergence ECS-103B parallel editor with 2 cards for MDA-100, NV-8500, AU-300, CTL or TC capable, cables for AU-300, excellent condition, $400; CMX Edge editors with interfaces for Ampex VPR-1, Sony 5850, Sony BVU-800, timecode included. Adam, 904-874-0740.

Cipher Digital Phantom II emulator, synchronizer, paralled 422, any tape transport, audio-video w/manuals, excellent condition, $1000. Gene, 619-749-7662.

Sony BVE-500A U-matic editing control unit w/cables, 300 hrs of use, operation maintenance manual, $600 or B/O. Jim, 716-264-0335.

Sony BVE900, 910 upgrade, audio board for Sony mixers, can run 4 machines & GPI, $5000. Jaime, 810-694-0996.

TAO Editizer, PC based A/B roll edit controller, TAO shuttle knob, software & cables, $1200. Kelly, 318-234-1422.

MOVIE PRODUCTION EQUIPMENT

Want to Sell

Moviola 35mm, 4 gang synchronizer w/2 mag mounts, $150; Moviola 4 gang, 16/35 combo sync w/2 mag mounts, $100; 16mm Zeiss Moviescope, $150; Movieola long sem rewinds w/brakes & tight wind attachment, $125; Ediquip/QTS 35mm tape splicers, straight, $125; diagonal, $75; Rivas 35mm straight cut/razor, $150; sync mag heads, $30; 35mm 1100' split reels, $15. Charley, 718-263-6300.

Beaulieu R-16 with 12-120 Angenieux, 2 batteries, charger, 200' magazine, hard case, sun shade/filter holder, 7 filters, sync generator, zoom stick, Nikon F to C mount lens adapter, manual, $1150 or Best Offer. Charley, 718-263-6300.

SIGNAL PROCESSING

Want to Sell

Fortel Turbo-2 TBC, infinite window correction, manuals, VGC, $1250 or B/O; Evertz 3600D timecode gen & reader, drop & non-drop frame, manual, VGC, $300 or B/O; BVS SA101 safe area gen, remote control, VGC, $400 or B/O; Ultimatte Newsmatte 1, RGB input, manual, VGC, $950 or B/O; Lenco PRM-600/PPS-602, card rack & power supply, PAA-650 audio DA, manuals, VGC, $200 or B/O. Dave, 216-696-1122.

Adda AC20A dual TBC w/effects, remotes, $1600; Alta Group Cygnus TBC w/effects, excellent condition, $1000; (2) Quantel DPE5000 DVE's, fully programmable, $2500. Gene, 702-727-0498.

Fortel 2H2 TBC w/enhancement, $275. Richard, 914-769-0676.

Sony VPR-722, (2) remote controllers for video projectors, good condition, $25 ea. Adam, 904-874-0740.

Hotronic AH91 dual channel TBC w/digital effects, composite & S-video, $1500. Kelly, 318-234-1422.

Nova 920SP TBC inputs, 2 composite, 2 SVHS, outputs 2 composite, 2 SVHS, 1 Betacam, freeze, fade strobe, posterize & mosaic, color bars, proc amp, Y/C timing, digital drop-out compensator, 100% up to spec, manual, original box, $1950 or Best Offer. Charley, 718-263-6300.

SWITCHERS

Want to Sell

Lenco PSW-468, 12x1 router, VGC, $400 or Best Offer. Dave, 216-696-1122.

Crosspoint Latch 6109 switcher, $500 or B/O; JVC KM-1200U switcher, $700 or B/O. Mark, 1-800-236-4000.

Grass Valley 1600, 7k production switcher, 24 inputs, 3 ME, DSK & more, $6500. Terry, 800-748-4982.

Sony SEG1210 video switcher, SEG; Panasonic WJ5500A switcher, B/O for each. JL Video Productions, 607-797-0545.

Panasonic WJ5500B, recently serviced, manual, $1000 or Best Offer or trade for VO5850. Steve, 215-245-7733.

Panasonic MX50 switcher, WJ-KB50 CG, excellent condition, all manuals, 2 yrs old, $3995 or B/O plus shipping. Rick, 410-296-2612.

Grass Valley 110, serial & chroma key options, $6500. Michael, 612-227-9520.

Crosspoint Latch 6119 w/chroma key, bars & tone, $975; JVC KM1200 switcher, $850; Showtime 4 input switcher, $499; Vidicraft, $225. Richard, 914-769-0676.

Grass Valley 100N switcher w/digital borderline & serial interface, exc condition, $6000 or B/O. D Smoot, 205-539-5003.

3M model 101 vertical switcher, 10 in, 1 out, audio follow video, $185. Nigel, 702-386-2844.

Krammer S-video 4x4 matrix switcher, $325. Charlie, 718-851-8229.

Grass Valley 200-2N, linear borderline key, chroma key, DSK with options, $27,500; Abekas A53D, 1 key channel, warp board, page turn curl, circle, burst, many other options, single channel, $28,000. Jamie, 810-694-0996.

Grass Valley 1600-7K SWR, 24 in, 3 M/E, E-mem, all cables, manuals & ext cards, $6000 or trade towards DVE; other equipment available. John, 617-396-6093.

TRANSMITTERS/ EXCITERS

Want to Sell

TTC 100W UHF transmitter, tube final, rebuilt upconv & modulator, on ch 61, $6000 or BO. Steve, 402-438-4989.

TV Transmitters - 1 watt to 60 kilo, VHF, UHF, Harris, RCA, others. Solid state also. Miami, English, Español, Portugues, Frances. 305-757-9207.

TV FILM EQUIPMENT

Want to Sell

RCA Telecine TK29B with new Machusta tubes, FR35B, PM86, TP66, TP7 & TP55 multiplexer, with many spare parts & all manuals, $15,000 or Best Offer. Dick Rex, 770-458-1168.

TV FILM EQUIPMENT...WTS

Kiron VPR-RGB photo recorder, 15 kHz interlaced analog RGB or composite to film, 2 Polaroid backs & lenses, exc for Targa board output, incl Targa cable, $400; Agfa/Matrix 6500 film recorder w/16mm Ariflex animation camera, holds 100 ft reels, ultra high bandwidth analog scan, RS-232 interface, 1500 lines hor resolution, incl all docs, exc condition, $1500. Adam, 904-874-0740.

VIDEO PRODUCTION EQUIPMENT

Want to Sell

Matrox A/B/C roll editing system, 2 A fully upgraded, EDL, edit contoller, 4 chan audio, 2 DVE, inscriber CG, 486 DX2, much more, $9500 or B/O; Avid MSP3.11, in Quadra 950 w/30 MB RAM, 250 int HD, 18 Gb of Avid storage. EDL, component in & out, 1 yr support, 4-8 Gb data DAT backup, all cables, upgradable to Composer 1000, $26,500 or B/O. J Boyer, 208-746-8335.

Videonics Video Titlemaker TM-1, Y/C video, very little use, $345. S Slocomb, 406-363-6196.

For-A VTW-222S video typewriter, SVHS & composite, cut, roll & crawl modes, 500 colors, 32 page memory, manual & orig box, $375 or B/O. Charley, 718-263-6300.

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Chyron 4100 EXB graphics gen, 2 chan, 2 keyboards, paint tablet, dual disk drives, hard drive, fully loaded, $9000; DSC Illusion DVE, rotation & perspective, 2 chan switch, $3900 or B/O. Terry, 800-748-4982.

Hamlet 301 videoscope complete waveform/vectorscope w/3 BNC connectors, never used, $1600; Sony VO8800 portable 3/4" SP VTR w/Porta Brace case, $1690; Sony M3A Mark II 3-tube video camera w/Porta Brace case, $890; Hitachi CA-Z1 camera back adapter back, $350; C201TD U-matic (14 to 26 pin) camera cable, $100; Sony Zepplin Blimp windscreen $150; LTM Pepper Pot 3 way power supply dimmer, $250. Kirk, 606-885-9613.

VCRs/VTRs/RECORDING MEDIA

Want to Sell

Sony VO4800 3/4" portable, Porta Brace case, $850; JVC CR4400 3/4" portable, $475; Panasonic AG6400 VHS, Porta Brace case, $475. Richard, 914-769-0676.

BVW-25 Betacam portable R/P, exc condition, w/carry case & batt, $3000. Nick, 718-981-0120.

Panasonic AU300A, (2) 1 exc condition, 1 parts, M-format component analog, uses good grade VHS tape, exc pictures w/3.8 MHz bandwidth, extender board, manuals, $1200/both or B/O. Adam, 904-874-0740.

Panasonic AG6400 VHS HiFi portable, $350; Panasonic NV8420 VHS portable deck w/AC power supply, $125; Panasonic WV3250/8AF color video cameras w/5 MHz Newvicon tubes & standard 10-pin connectors, $75 ea; Auratone 5C monitor speakers, $75 pair. Rob, 414-384-7083.

JVC BRS622U edit source & record, mint condition, very low hrs, $2995; JVC TBC for 622, $300, timecode for BRS622, $250. Chris, 707-571-8888.

UVW-1400A Betacam SP deck, new condition, orig packaging, only few hrs on head, factory warranty, $5500. Jim, 619-436-2308.

Ampex AVR-1 2" quad recorder, $2500 or B/O or trade; JVC CR-600U U-matic recorder, $2000 or B/O; JVC 4900U port U-matic recorder, $700 or B/O; RCA TR-600B 2" quad recorder, $1500 or B/O; RCA TR-50 2" quad recorder, B/O; RCA TR-3 2" quad recorder, B/O; Sony VP-5020 U-matic player, $1000 or B/O; Sony VO5800 U-matic recorder, $1500; Sony VP5000 U-matic player, $750. Mark, 1-800-236-4000.

Sony EVO-9800 Hi 8 VCR, just checked by Sony, new heads & guides, works great, $2600. Rick, 503-484-2711.

Sony 2850 (2), Sony VO1600, RCA TV monitors (3), very good condition, all for $195. Leonard. 716-535-7251.

BCS Broadcast Store — *Buy Consign Sell Service Trade*

Sony BVU-950-8,000
Sony BVE-9000-12,500
Grass Valley 200-48,500
Abekas A-53D-30,000
Sony BVM-1910-3,000
Sony PVW-2650-14,000
Sony BVW-507 w/18X-21,000
Tektronix-1750 w/f/vect-3,500
Grass Valley 3400 DA-2,000

Non Linear
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Panasonic AG1960 record decks (2), 1 can play back Hi-Fi & normal tracks together, AG95 edit controller, mint condition, $1600; Sony VO5850 decks (2) w/RM440 edit controller, mint, $5500. 808-823-6130.

Chyron RGU-2 CG, $1000; Colorgraphics Artstar Paint Box, $15,000; Dynair series 10, 10x10 router, $500; Evertz E2, A/D VTR control, $500 or B/O; Fast Forward Video F-21, TC read/gen, $125; Panasonic WV-RC30 CCU for WV-777, $200; RCA Hawkeye M-format system, B/O; Sigma PDA-100A pulse dist amp, $150; Sony Type 5 U-matic edit system, $4300; Teac X-300R, 1/4" audio reel to reel deck, $500; United Media Commette A/B/C roll editor, B/O. Mark, 1-800-236-4000.

Laird 1500 CG, 1543 software/hardware upgrade, dual disk, 1032 color encoder, over 120 fonts, $1150. David, 205-823-0088.

Media control system for conference room, TOA A-903A amp, Crestron CMU-1, Crestron CVC-2, Crestron function switcher, Crestron AVCS, FSR Inc BVT-4R, Barco RCVDS 400 S-quad, York Controls IRL-1 infared learner, in Amco rack on wheels interface cards, power supplies & many cables, new in 1991, $3500. Dave, 616-776-1633.

Rouge Research video processor, custom built, $250 or B/O; Panasonic WJ220 video only switcher, B/O. Steve, 402-438-4989.

Sony EVV9000 Hi 8mm dockable VCR, $1200. R MacDonald, 407-452-4326.

JVC CP-5000U 3/4" player, good condition, $100 + shipping, will take small switcher in trade. Ken, 216-920-8035.

Sony BVW40, exc condition, low hrs on head, works as editing master record or source, $6000 or B/O. J Boyer, 208-746-8335.

Sony VO5800 source VCR, exc condition, $1400; Sony VO5600 rec/player, exc condition, $900; (2) Sony VP5020 players, like new, $500 ea; Ampex VPR2/TBC2, 1" type C VTR, slow mo, $5000. Gene, 702-727-0498.

Panasonic AG-1970, (2) SVHS recorders, Panasonic AG-A96 editing controller, good condition, $2300. Bob, 305-946-8025.

Sony 3/4" SP U-matic VO8800, VO5800, BVU800, BVU870, VP700, VP7040, VP5000; JVC CR850U 3/4" SP w/only 250 hrs; 3/4" tape, 60 minute 6.50 bulk; Videotek RS12, RS10, new. JB Salazar, 210-278-3523.

Sony BVU110, 3/4" portable w/BP-90 batts, $750; JVC VHS-C compact portable, HR-C3U w/carry case, 10p camera connector, batts & AC adapter/batt recharger, $550. Terry, 800-748-4982.

Sony 5850, 3/4" edit VTR (2), w/RM-440 controller, $4500 or B/O, will sell separate; Panasonic MXJ12 switcher, $1400 or B/O; Hotronics AE-61 TBC w/Proc amp, $450; 3M D-5000 CG, $1500 or B/O; Vidcraft audio/video switcher 4x4, $450; SDA 140-DA 1x4, $50; Shintron 317 color sync generator & black burst, $250. Gary, 818-996-5812.

Sony EVV9000 (2) Hi 8, very low hrs, exc condition, mates to camera back or VA90 adapter also available, $1800 ea firm. Eye in the Sky TV, 908-832-2050.

Sony VO8800, w/Porta Brace, exc condition, one owner, $1650. Mike, 307-733-7871.

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Sony VO5800 VTR, 3/4", low hrs, $1900 or B/O. D Smoot, 205-539-5003.

Panasonic WJ5600, Sony VO5850, Chyron VP2 w/keyboard & fonts, RM-440 w/cables, 2 TBC's, all good working condition, $5500. Mark, 410-343-1599.

Sony BKU806 timecode card for 800 series, 3/4", $700. Michael, 612-227-9520.

JVC CR850U, 3/4" Pro editing VCR, $2200; JVC edit system, CR8250U, CP5550U, RMG810U edit controller, $1800; portable system, JVC CR4900U VCR, Panasonic WVV3 3 tube camera, cables, batts, chargers for both, $1000; JVC 8200 editing VCR w/upgrade, $300; Sony VP5000 player, $300; all items in exc condition, prices negotiable. Alan, 610-649-0560.

Sony BVU150 portable 3/4" SP U-matic videotape deck, mint condition, including timecode board, Porta Brace case, AC power, 3 Anton Bauer Pro Pac 90 batteries, manuals, $3500. David, 617-547-2073.

BVW35 BetaSP VCR, $6000; ADO100, $3000; VO5600, $600; VP7020, $500. AVPS, 703-527-1200.

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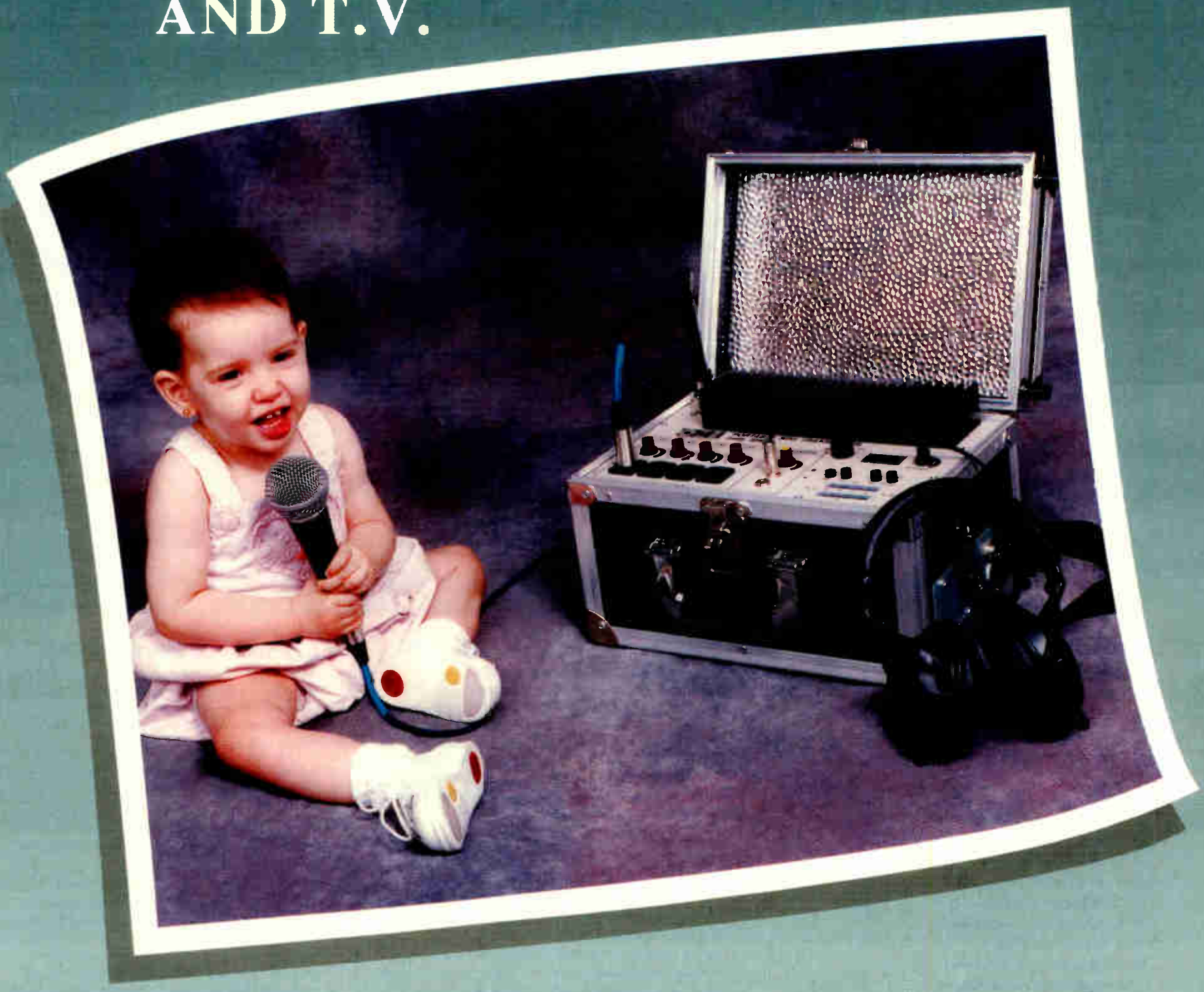

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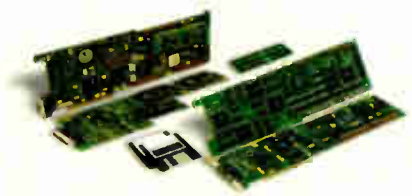

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