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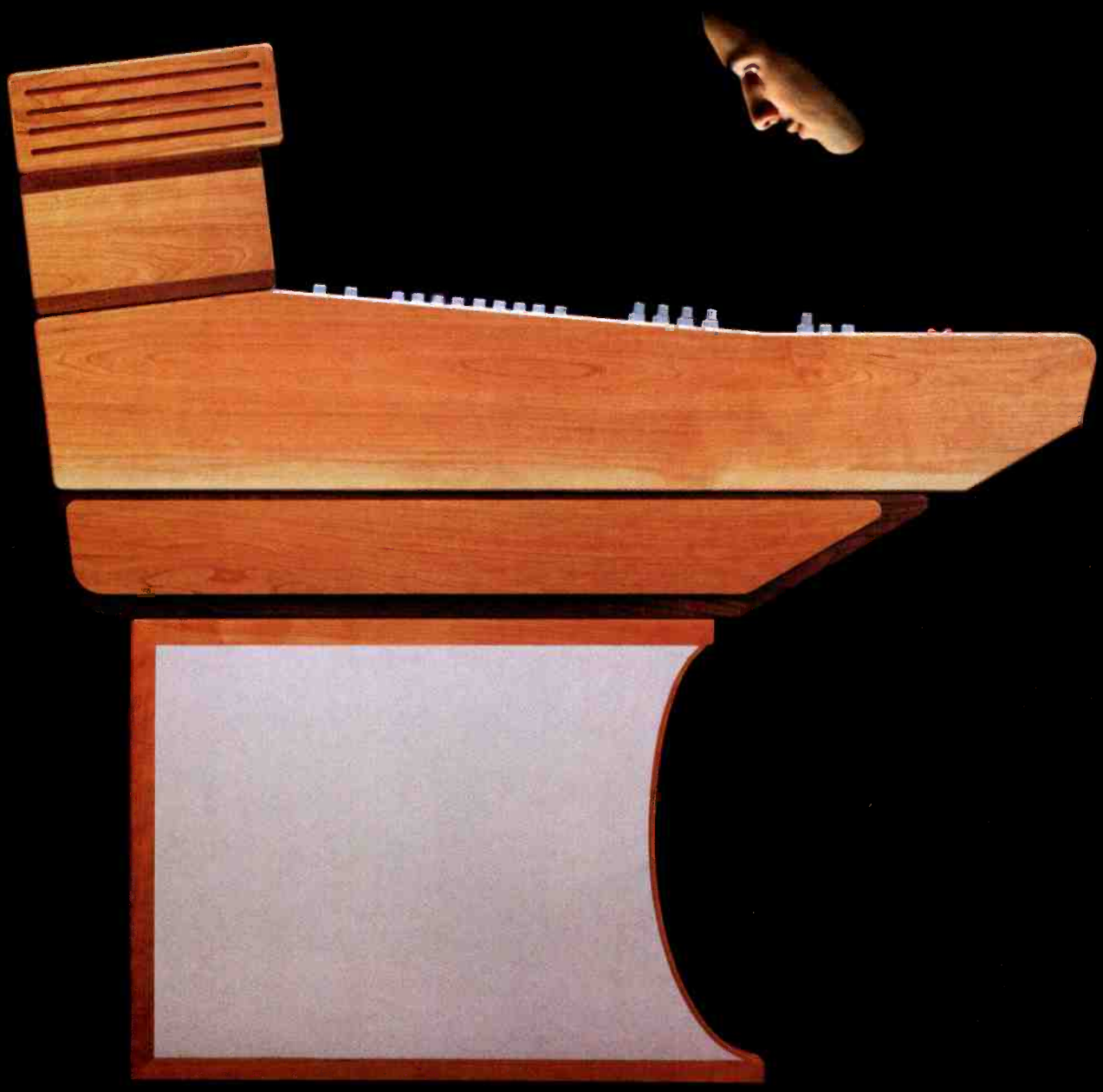

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THE TRUTH ABOUT DTV.

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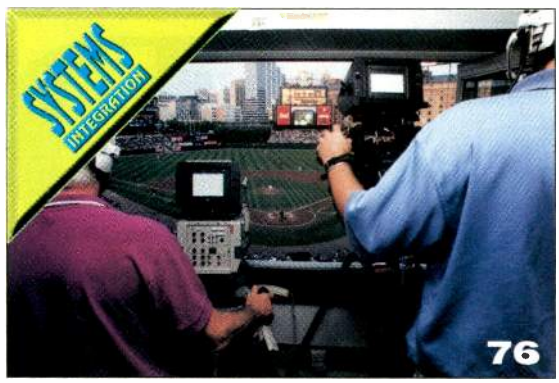

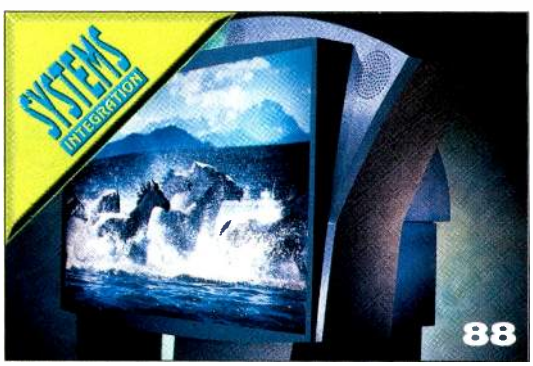

ON THE COVER: On the cover is producer/editor Paula Marcheschi in one of KGO-TV's digital edit suites cutting a topical promo for the 5:00 p.m. newscast on a Scitex Stratasphere. Photo courtesy of Scitex Digital Video. Photography by Douglas Schwartz of The Article Works, Santa Clara, CA.

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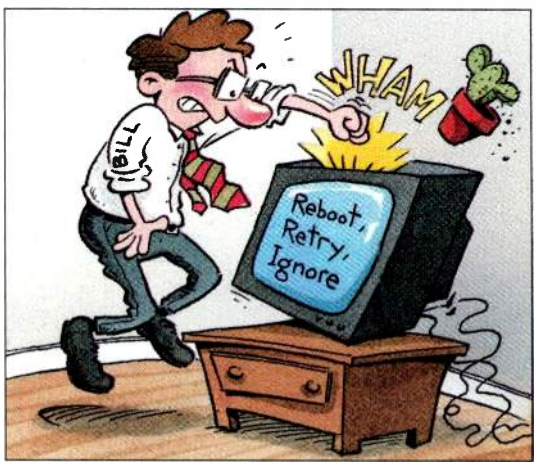
Predictably unreliable

I'm not a computer fuddy duddy. No matter how much I hate the mouse and complain about computer and software reliability, I still willingly rely on and use computers. So, it came as no surprise to me five years ago when the company wired everyone to a network. My staff and some 500 others were connected with a network providing a plethora of conveniences: shared printers, common storage, file exchange and, of course, that business application we all love — E-mail.

Enter the computer geeks. Determined to drag me and my horse-drawn-era computer into the '90s, they also connected me to the network. Voila! Now I was on-line with the rest of the company. Never mind that the network software required so much of my computer's RAM that I couldn't load more than one file or that the spell checker wouldn't work unless I dumped my printer driver and all the word-processor options. It was one thing after another for a couple of weeks until I said enough!



Returning to my engineering roots, I literally pulled the plug to the network. Now, I was back to my trusty dusty old-fashioned (and DOS-friendly) system. It was months before anyone noticed I wasn't connected to the network. Some three years later, and still not on the network, the word came down from on high, "Get yourself connected to the network or else!" This time the computer department gave me a laptop to replace my old desktop computer. "Here you go, Win95 and everything else you'd want," they said. Unfortunately, true to my experience, the high-tech laptop died within a week. So much for new technology and Bill's Win95.

Back to my beloved dinosaur. It still worked and I was still happy. Jump forward a year. Again from on high, "Get your system connected to the network or you won't be here!" Six months later the computer guy arrives with a new computer. This time it's a screaming 150MHz Pentium Pro, with buku RAM, CD-ROM, a 33.3K modem, several other toys and the latest in software.

While the computer guy looked at me with expectant eyes (after all, I was supposed to be impressed) I said, "I'm busy right now, could you wait a week or so to install it?" The disappointment on his face was obvious. He must have thought I was nuts to not be excited about his delivery. From my perspective, I just didn't want to face another uphill and disappointing software/hardware learning curve only to have the #$#%&*#@ thing die on me. And I'm thinking, why would this experience be any different?

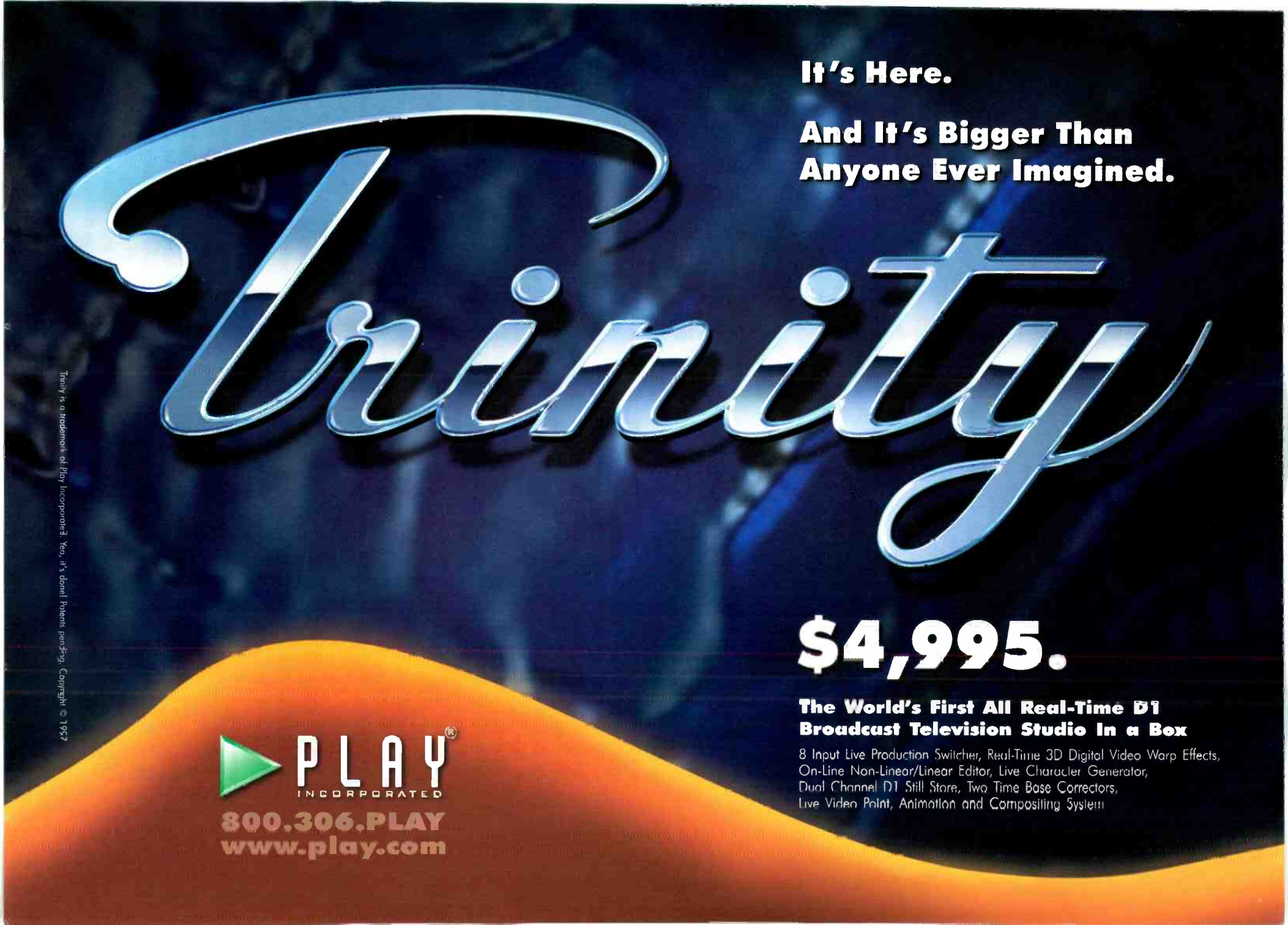
He agreed to wait and stored the computer under my desk. Within a week, I begin to hear voices. I swear it was the computer taunting me. Seductively, tantalizingly, the voice tempted me. "Try me Brad, you'll love what I can do for you. Go ahead, plug me in and let me turn you on."

Finally, I couldn't stand it any longer so I hooked it up. After plugging it all together and turning the system on, I was greeted with the Win95 screen then the program icons. So far, so good. Noticing the cables weren't conveniently routed, I turned the computer off, moved the cables and turned it back on. This time, instead of the program icons, I got a warning screen, "Warning — Windows was not shut down properly. One or more of your disk drives may have errors on it, bla...bla...bla." Then the system displayed a Win95 screen and the keyboard locked up. I could not do anything. Why am I not surprised? It's bad enough when new technology is just hard to run. But it's absolutely crazy when the technology is so unreliable that you can't even turn it off and then back on without having it fail.

I just wish Bill Gates had a TV set that operated as reliably as computer systems. I'll bet if his TV crapped out as often as today's desktop systems do, he'd turn the newly acquired Apple into a maker of living room TV sets.

Brad Dick

Brad Dick, editor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news

By Dawn Hightower, senior associate editor

Hawaii station granted DTV permit

KHVO, Hilo, HI, has been granted the first permit from the FCC to build a commercial digital TV station. The construction permit governs technical specs for transmission equipment. The Mass Media Bureau also awarded the station, owned by Hearst-Argyle, a free second channel needed for the switch from analog to digital.

This FCC action marks the first commercial construction permit since it adopted digital TV rules in April. According to Hundt, the FCC acted on the application within two days of its receipt.

The first all-digital TV station will use JVC's Digital-S as its station-wide format. KITV Channel 4 and the satellite stations KMAU-TV and KHVO-TV will be the first in Hawaii to achieve digital transmission and among the first on the mainland. The stations will offer digital HDTV as soon as the ABC network can deliver an HDTV signal.

The DTV station will operate on Channel 18. Although the FCC has issued permits for stations to experiment with DTV, the KHVO-TV permit moves the playing field to the commercial arena.

KITV has made a major investment in JVC's Digital-S, with the purchase of 22 BR-D85 Digital-S edit recorders, 11 BR-D40 Digital-S dockable recorders, 19 BR-D750 edit recorders and 22 SA-D80 digital I/O boards.

The equipment will be used for recording and airing syndicated programming and for acquiring and airing news and for commercial production, as well as for archiving. The 4:2:2 format will be used to get news from the field using the BR-D40s docked to JVC KY-27C cameras, which will be transferred to Avid Newscutters for editing and then back into Digital-S to air. Avid Air Play and Philips Media Pool also will be used.

FCC confirms Kennard as chairman of choice

It's official. William Kennard will join the FCC as chairman. Joining him as commissioners are House Commerce Committee chief economist Harold Furchtgott-Roth, Justice Department antitrust chief of staff Michael Powell and New Mexico state corporation commission commissioner Gloria Tristani. Rounding off the commissioners is Susan Ness whose term will expire in June 1999.

No one knows for sure what Kennard's position on various broadcast issues will be — whether he will be an adversary or an advocate for the broadcast industry. However, he is no stranger to broadcasting. He graduated from Yale Law School and went to work for the National Association of Broadcasters (NAB). Soon after, he became its First Amendment counsel. While an attorney at the firm, Verner, Liipfert, Bernhard, McPherson & Hand, he represented broadcasters and cable operators. Kennard also has family connections to the TV business. His cousin, Lana Corbi, is vice president of network distribution for FOX. Debra Lee, Black Entertainment Television president, is also related to Kennard.

Kennard's communications expertise helped him in his 1993 appointment as FCC general counsel. If Kennard's performance as general counsel for the FCC is any indication of how he will do as chairman, then he should do well in his new capacity as chairman.

Japanese telecom to sue FCC

KDD, Japan's international telecommunications company plans to sue the FCC over its plan to push foreign telephone companies to set lower connection rates.

The lawsuit will be filed in the next couple of months in the U.S. Court of Appeals. The decision to sue came after the FCC's August adoption of a plan to push for lowering the fees carriers pay each other to complete overseas calls. More international calls originate inside the United States and U.S. carriers are paying more, so the FCC wants to set lower fees to narrow the gap.

SBE elects new president

The votes are in for the new SBE officers who were inducted and began their terms at the SBE national meeting in September. Edward J. Miller, CPBE, engineering manager at WEWS-TV 5 in Cleveland, OH, is president. He had been the vice president for the last two years. Troy D. Pennington, CSRE, chief engineer at WZZK AM/FM, WODL-FM, in Birmingham, AL, is vice president. He had served as the treasurer for the past two years. Thomas P. Weber, CPBE, engineering maintenance supervisor at WISH-TV 8 in Indianapolis, is secretary. Andy Butler, CPBE, director of engineering for Public Broadcasting Service in Alexandria, VA, is treasurer. Outgoing president, Terrence M. Baun, CPBE, Criterion Broadcast Services, Milwaukee, WI, will serve on the board as immediate past president.

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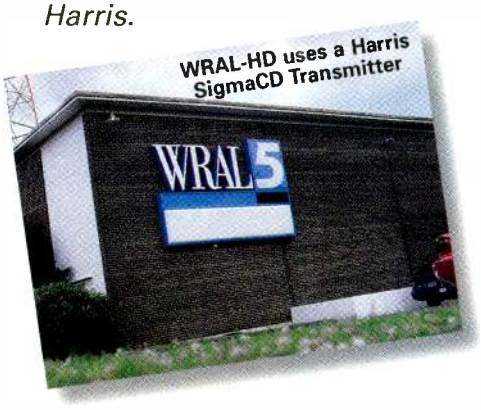
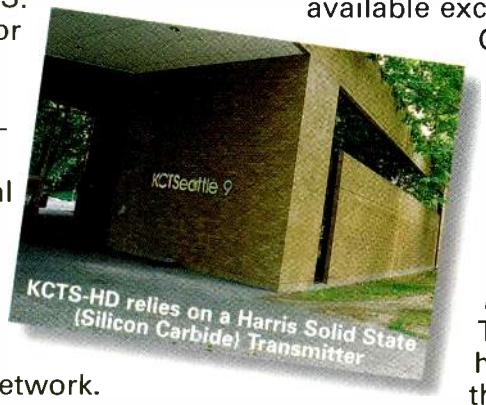


Harris offers the widest range of proven technology.

Harris can provide every step in the digital path — from your studio to your transmitter and antenna — and can do it with more *proven* technology than anyone in the industry. How proven? In 1990, the ATTC used our RF test bed to establish U.S. standards for HDTV. Our studio and teleport systems were instrumental in the launch of America's first all-digital television network.



We delivered the first broadband antenna specifically developed for NTSC-DTV simulcasting. We have more UHF and VHF transmitters on-air in the U.S. than any other manufacturer, *by far.* We're the only company to offer digital-ready IOT *as well as* Solid State UHF transmitters — with a choice of Bipolar, Silicon Carbide or LDMOS technologies. Our Platinum Series VHF transmitters are the world standard in Solid State. And when it comes to the heart of a DTV transmitter — an 8-VSB exciter — Harris is the *only* choice. ***Only we can provide all of this DTV technology right now!***

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5 of the first 7 U.S. stations on-air with DTV selected Harris digital transmitters.

On July 23, 1996, WRAL-HD became the first commercial television station to transmit HDTV signals over the air. Their transmitter? *A Harris SigmaCD.* When KCTS-HD in

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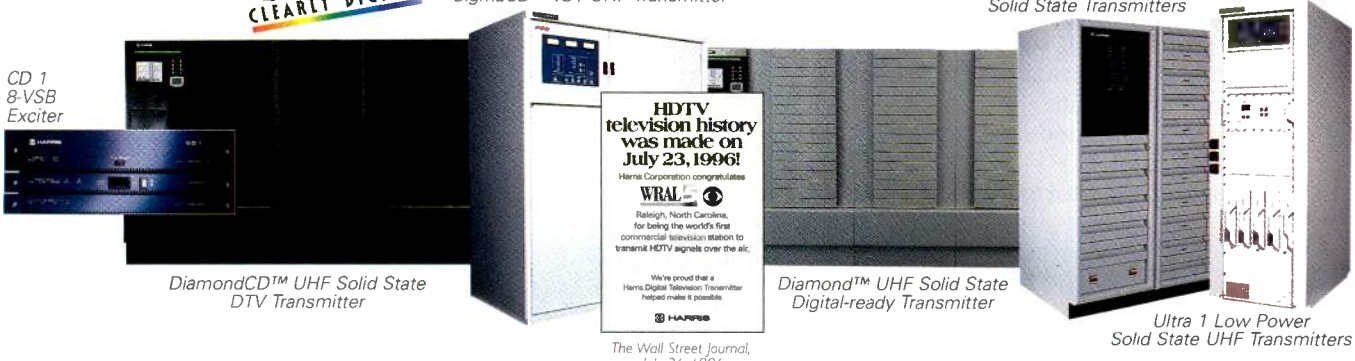

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The Wall Street Journal, July 26, 1996

DEEDS, NOT PROMISES.

Seattle became the first HDTV-capable public broadcasting station, *they too chose Harris.* And WETA in Washington D.C., WCBS in New York and Oregon Public Broadcasting in Portland all rely on Harris transmitters to send their DTV signals over the air. At NAB '97, KLAS-HD used a Harris transmitter to go live as part of the

ATSC on-air demonstration. Why is Harris such a clear choice when choosing a digital transmitter? Because from VHF to UHF...Solid State to IOT...low power to high power...and the only complete 8-VSB exciter, we represent *so many* proven choices. ***Only Harris has this depth of on-air DTV experience!***

Harris provides complete end-to-end systems for DTV.

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No other company matches our level of support.

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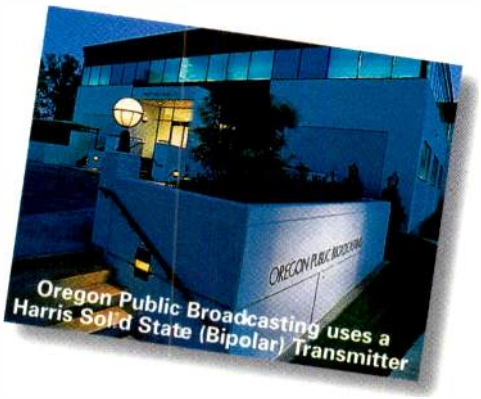

but Harris offers you the benefits of a dedicated training center with ongoing, regularly scheduled general and product training programs. ***Only we can provide this high level of DTV support!***

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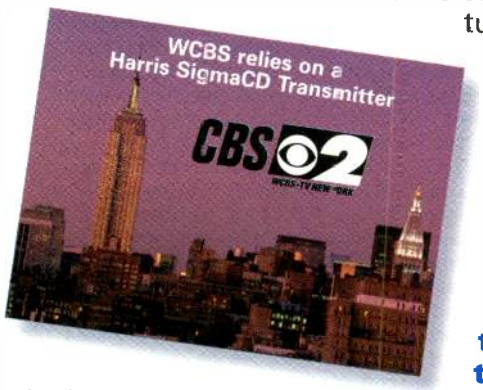
Before you stake your station's future on a promise, ask your prospective partners to prove their claims. Harris welcomes the opportunity to show you how we're most qualified to help you make the most efficient, cost-effective and successful transition to DTV. **For tried and true solutions that best prepare you for tomorrow, *that only we can provide,* contact Harris today.**



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A new world of broadcast solutions

How stations are facing the DTV upgrade

By Steve Tadzynski

Last month, the Philadelphia chapters of SMPTE and SBE held a meeting to discuss the preparation for and implementation of digital television (DTV). Dr. Michael Isnardi (Sarnoff Research Labs) led with an overview of the ATSC system and committee work. Brief presentations were then given by local station and network engineers on how they plan to enter the DTV era.

Work done to date

Charles Jablonski (NBC) stated that NBC has been committed to rolling out DTV. Starting about five years ago, it rebuilt its network origination operation around a 300Mb "set of plumbing" for an 11-disc-based digital network origination center. NBC's O&O stations will be going to a digital tape format with an eye toward DTV. NBC's only incremental investment will be in digital broadcast transmitters and antennas. Jablonski said the network needs to maintain flexibility, it doesn't want to forfeit any formats.

Bob Ross (CBS) talked about its experimental station, WCBS (HD), which has been on-air since NAB '97. Right now, the transmitter pumps a couple of kilowatts into a directional antenna. With that setup, the station has done a number of demos in the New York City area. In November, 1997, the project will go full power with an antenna atop the Empire State Building, broadcasting on Channel 56.

Ross said CBS currently occupies 10 transponders with no room for other programming, so it must first convert its satellite network to digital and compress it to free channels for high-definition or multichannel transmission.

Tom Hankison (ABC) identified three affiliates that must be built-out in 18 months. Two of the stations (Philadelphia and Los Angeles) have problems with the channels they were allotted due to interference with other NTSC stations nearby. In San Francisco, there is so much channel congestion due to surrounding markets that they probably can't get better assignments. After the first three stations are converted, ABC expects to convert more stations in 24 to 36 months. ABC's facility in New York City is 360Mb/s.

Bill Weber (WHYY-TV12, PBS affiliate) explained that PBS has been preparing for a multistream digital service. PBS's network is all digital — it has just migrated to MPEG-2 with all General Instruments techniques. When digital transmission services are launched, PBS will provide HDTV in the evening and go multicast mode (four to six channels) of standard-definition, possibly with some 16:9 during the day.

PBS is about to launch a 19.3Mb stream via satellite to provide a source for experimental stations, like WETA. At the local station level, Weber sees the most cost-effective approach to DTV implementation as receiving the network signal at the transmitter and passing it right through; local ID insertion would come with the next phase.

Weber sees the new format as tailor-made for public television: the network serves niche audiences at times, yet also serves a mass audience. Multicasting frees them from the bonds of being tied to one distribution channel. He also feels that multicasting can promote improved or new educational services.

Ron Lask (Pennsylvania Public Television Network) operates a program distribution service and statewide bidirectional microwave network in Hershey, PA. The network supplies 90% to 95% of PBS's daytime programming for most of the eight public TV stations in Pennsylvania. For example, it records Sesame Street in the morning, then plays it back 10 times during the day. His immediate concern is a potential scheduling problem: if the network schedules seven stations' programming during the day now, what happens if you multiply that by four to six channels per station? He'll need server and facility management systems that can handle all the programming and data communications.

Lask also stated that PBS realizes that most of its stations won't be able to receive HDTV at 45Mb, upconvert to 1.5Gb, do fancy logo insertions and re-encode it, so PBS is planning to originate the encoded ATSC signal, distribute it by satellite along with several other standard-definition NTSC channels (that affiliates already receive). That way, stations can get on the air with a DTV transmitter and just pass through the ATSC signal without having to do anything else.

Bob Good (WGAL-TV8, ABC affiliate) has the leading station in market 45 in Lancaster, PA. The station has been assigned Channel 58 and is not happy about the VHF station being assigned a UHF DTV frequency. Good is concerned about viewer confusion, channel "branding," and that, in its market, one UHF station has been assigned a VHF DTV frequency — Channel 4.

Sim Kolliner (WCAU-TV10, NBC affiliate) itemized his questions: bit format, bit rate, upconvert, downconvert, fiber STL, 45Mb on STL, tower, transmitter power, power to the transmitter, etc. He said that many stations will be in for a big surprise. UHF is different from VHF. UHF needs lots of power in the transmitter and lots of power to the transmitter. At WCAU's tower site, it must take three sections off the top of the tower before installing a new antenna and transmission line. During the three weeks of tower work, the station must transmit its signal from a 200-foot standby at reduced power and still adequately serve all the cable systems and viewers.

Timetable

The assembled group agreed that in all of the discussions, planning and negotiation over DTV, one thing never foreseen was an aggressive, forced transition.

Dr. Isnardi suggested that NTSC's scheduled demise in 2006 might be a soft deadline. The government wants the analog channels returned by then so it can auction off those frequencies for revenue to balance the budget. Although broadcasters want to hold onto their analog channel until less than 5% homes lack DTV, the latest ruling states they must return the channel when more than 85% of their population area are served DTV by air or cable or satellite.

Jablonski joked that he can foresee AARP members writing to congress to complain about the analog shutdown and having to buy new receivers.

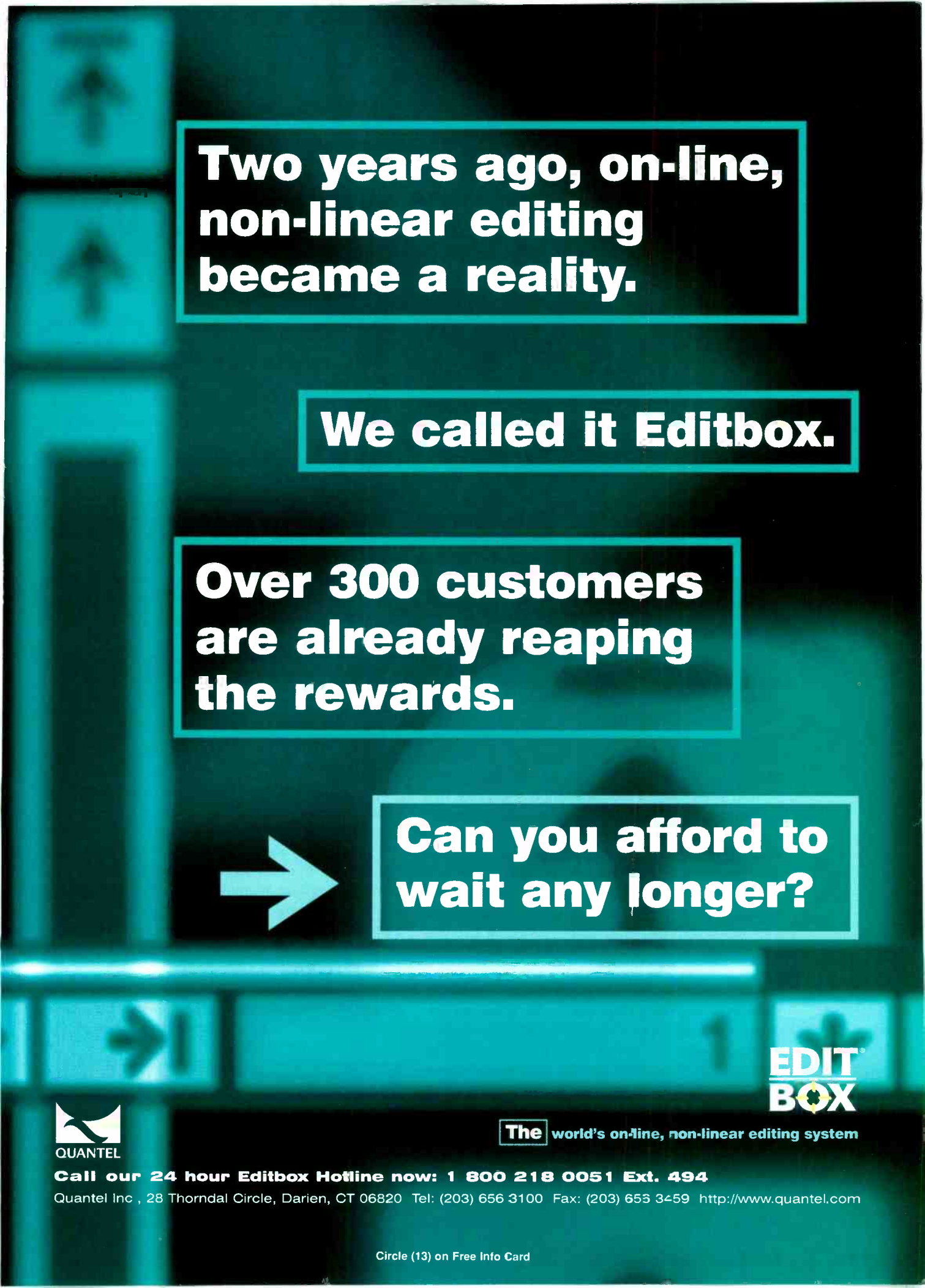
Opportunities

Despite the tremendous challenge of implementing a new technology on a squeezed timeline with many standards yet to be set, there can be an upside. An audience member stated that when broadcasters combine physical facilities and transmission facilities, it will have a huge impact on the ability of small and public TV broadcasters to maintain the service they provide today.

Weber is looking forward to PBS and WHYY beginning datacasting: the digital Barney doll that interacts with a TV program or videotape runs off a datastream from the TV decoder — that's only the beginning of a different kind of service delivered by broadcasters to the home. He has a changing concept of what they do and what business they're in — from program producers to content producers with shared resources. Things that are produced for one purpose can be distributed in many different formats, including on-line, multimedia and video servers for products on demand.

Kolliner stated, engineering managers are now in the position to drive the technology instead of it driving them. He can't wait to get more capital than the news department! ■

Steve Tadzynski is president of Laurel Video Productions in Cherry Hill, NJ. He also is the program coordinator and videographer for the Philadelphia section of the SMPTE.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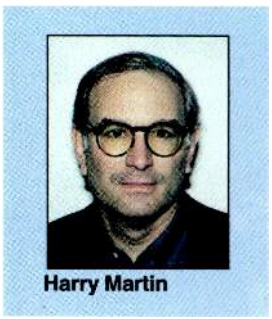
By Harry C. Martin

FCC to pre-empt local zoning for DTV

The FCC has instituted a rulemaking proceeding proposing to pre-empt local zoning and land-use regulations in order to help speed the implementation of digital television (DTV).

The National Association of Broadcasters (NAB) and Association for Maximum Service Television (MSTV) have asked the commission to implement new rules pre-empting local regulations in order to assist DTV implementation. Even though approximately two-thirds of U.S. TV stations will require new or upgraded towers to support DTV service, the FCC is allowing only two to five years (depending on market size) for full implementation. The administrative procedures involved in obtaining local building permits for tower construction can sometimes take years.


Harry Martin

Under the proposed rules, all state and local land use, building and environmental regulations that would limit broadcasters' ability to construct or modify their transmission facilities will be pre-empted unless the local authorities can demonstrate that the regulation is reasonable in relation to a specific health or safety objective. Furthermore, any state or local government decision denying a request for approval of construction will have to be in writing, supported by substantial evidence and delivered to all applicants within five days.

Any broadcasters adversely affected by any such action could, within 30 days of the decision, petition the commission for a declaratory ruling. The commission, in turn, would have 30 days within which to act on the petition. The proposed rule also would authorize the commission to administer dispute resolution.

The FCC is seeking comment on the proposed pre-emption rule. The agency wants a detailed record of the nature and scope of tower siting problems faced by broadcasters. Comments on the duration of delays created by local permit processes would be particularly relevant. The comment deadline is Dec. 1.

More restrictive RF guidelines go into effect

Applications for renewal of license or modification of facilities filed after Oct. 15, 1997, must comply with the commission's new guidelines on radio-frequency radiation. In addition, all new facilities constructed after that date must comply with the new guidelines, regardless of whether an application is filed. Other facilities need not be in compliance with the new guidelines until Sept. 1, 2000.

The major change in the guidelines, other than the fact that they are more restrictive, is that there are now two sets of limits. There is one set of limits for "occupational/controlled" exposure and another set for general "population/uncontrolled." "Occupational/controlled" limits apply in situations where persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. General "population/uncontrolled" exposures apply in situations where the general public may be exposed or in which persons who are exposed through work may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

More information is included in the FCC's revised version of OST Bulletin 65, called OET Bulletin 65.

Kid-vid programming now in effect

Starting Sept. 1, each TV broadcast station is expected to air an average of three hours per week of "core" programming. Core programming is defined as educational and informational programming that: 1) serves the educational and informational needs of children 16 and under; 2) is aired between 7:00 a.m. and 10:00 p.m.; 3) is a regularly scheduled weekly or daily program; 4) is at least 30 minutes long; 5) is identified as core programming in the children's programming report to the commission; and 6) is identified as core programming in the information provided to program guide publishers.

Also, each station must identify on-air, at the beginning of the program, those programs that the station considers to be "core" educational or informational programming for children. ■

Harry Martin is an attorney with Fletcher, Heald & Hildreth, PLC., Rosslyn, VA.

dateline

Dec. 1 is the deadline for TV license renewal applications for stations in Colorado, Minnesota, North Dakota, South Dakota and Montana. Commercial TV stations in the following states must file their annual ownership reports by Dec. 1: Alabama, Georgia, Colorado, Minnesota, Montana, North Dakota, South Dakota, Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

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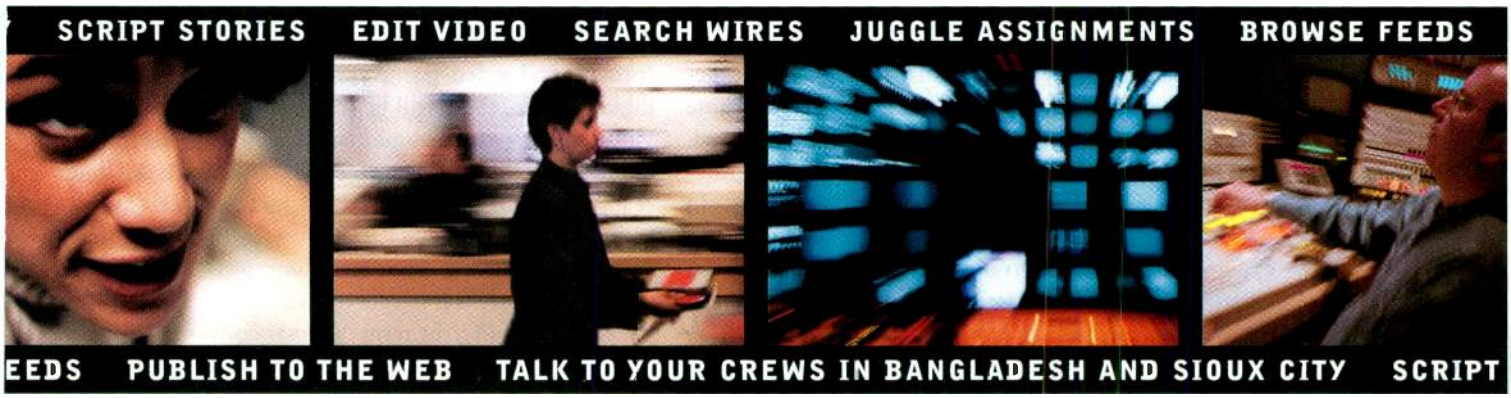

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Circle (5) on Free Info Card

By Chris Ward and Ray Lowe

Implementing pass-through

Sarnoff Corporation, along with Comark, NBC, IBM, MCI, Sun Microsystems, Thomson and Philips have been working to develop a high-definition compressed digital studio. Because major differences exist between compressed and uncompressed video bitstreams, simple things, such as switching, quickly become complicated. (See "Editing MPEG Bitstreams," on p. 36.)

Highly compressed MPEG bitstreams used for transmission are not easily edited. This is due to the predictive nature of the coding schemes. However, these bitstreams can be efficiently stored and transported. Conversely, mezzanine compression levels (an intermediate level between 1.2Gb/s and 19.39Mb/s) that do not use predictive coding are easily edited but are expensive to store and transport. For these reasons, a variety of data formats are expected to co-exist within the studio. (See Table 1.)

The development effort was divided into three separate phases. Phase 1 concentrated on an architecture suitable for a local station pass-through of a network-produced HDTV compressed signal, allowing for insertion of commercials and providing for switching of MPEG-compressed transport streams at the transmission rate of 19.39Mb/s. Phase 2 added the capability for local origination of material at bit rates greater than 19.39Mb/s, as well as sophisticated routing and connectivity via asynchronous transfer mode (ATM) and high data rate satellite links. Phase 3 provides for full-production capability, with high bit-rate compression, HDTV non-linear editing and archiving, browsing for content retrieval, connectivity with external studios and transcoding between different compression formats.

STUDIO USE	PROFILE NAME	MAX DATA RATE	PICTURE TYPES
Origination	Not Applicable	Not Applicable	Any
Studio Production	4:2:2@High Level	300 Mb/s	IP or II
Distribution	4:2:2@High Level	90 or 45 Mb/s	IPB
Broadcast	Main@High Level (ATSC A/53)	19.39 Mb/s	IPB

Table 1. Compression rates expected to be appropriate within an HDTV broadcast environment.

Encoding, decoding and transcoding

The process of transforming uncompressed digital data to a compressed form is called *encoding*. At present, HDTV encoders are expensive and limited in availability. One effort focused on development of a new generation of encoder to simultaneously accommodate the compressed studio requirements (by permitting frame-accurate splice-point marking) and deliver exceptional picture quality. Encoders are being developed to handle data rates up to 300Mb/s. The converse of encoding is *decoding*. As with the encoders, the decoders must handle data rates up to 300Mb/s.

Transcoders are used to maintain compatibility among the many different MPEG-2 studio formats, video formats and video frame rates. Within a compressed digital studio, there will be transcoders for audio only, video only or for a combination of audio, video and data. Typical applications include bit-rate transcoding (e.g., from 300Mb/s to 19.4Mb/s), picture size transcoding (e.g., from 1,920x1,080 to 1,280x720), picture format transcoding (e.g., from interlaced to progressive) and picture frame-rate transcoding (e.g., 29.97fps to 30fps). Usually, the term "format converter" is used instead of "transcoder" when the transcoding unit permits picture size, frame rate and interlace to change. Transcoders used to process combination payloads (audio, video and data) must ensure the audio, video and data alignment at the output is the same as at the input.

HDTV transmission transcoders provide over-the-air transmission of audio, video and data from an HDTV studio. These transcoders accept audio, video and data in a studio format and generate transmission bitstream at the output. Typically, the studio format would be MPEG-2 4:2:2 Profile @ High Level using either all I-frames or an alternating I, P format. For transmission, the compressed MPEG-2 bitstream must be compliant with the ATSC digital TV standard (A/53), which has a transmission bit rate of about 19.4Mb/s and may be transmitted over a single 6MHz channel using 8-VSB modulation.

Facility infrastructure

Effective cable management is difficult in a large TV station. For most, the existing cable infrastructure has evolved over many years. Traditionally, components have been connected in a single wire per signal, point-to-point manner. The result is multiple cables and cable types, as well as multiple routing types. As facilities become more sophisticated, the sheer number of cables may become a problem. For the HDTV studio project,

the desire was to use a single common connector for all studio devices. The ATM short-reach interface connector supports device I/O. ATM's packetized transport allows multiplexing of many signal types on a common medium. ATM supports a hierarchy of data rates well-suited to the transport of audio and video.

ATM networks within the studio provide the flexibility to handle multiple data types and rates. Additional services may be conveniently added as they are identified, and using the Quality of Service (QoS) parameters: bandwidth, cell loss and jitter, may be controlled. Initially, a hybrid solution using OC-3 and OC-12 will be implemented. (See Table 2.) This provides maximum flexibility and cost-effectiveness for early systems, while allowing plenty of bandwidth expansion as required.

ATM	DATA RATE
OC-3	155Mb/s
OC-12	622Mb/s
OC-48	2.48Gb/s
OC-192	9.12Gb/s

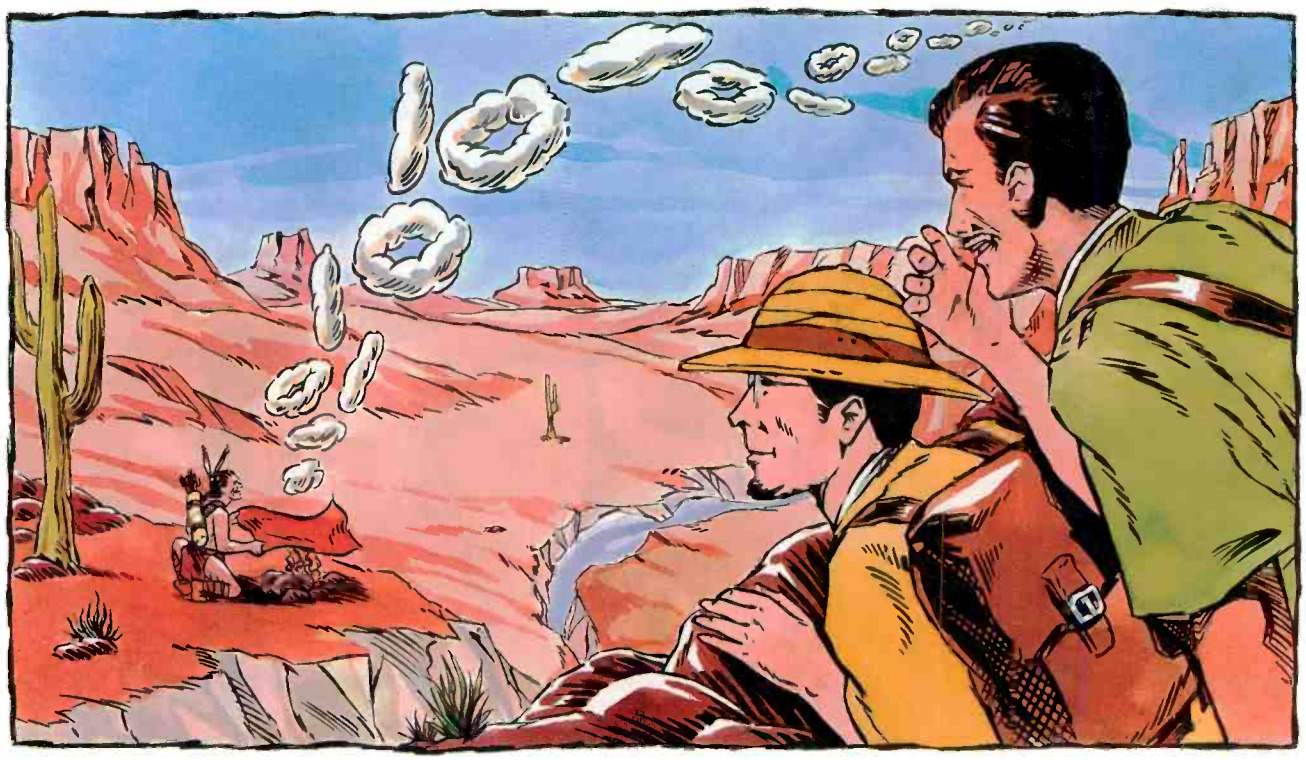
Table 2. Various data rates supported by ATM architecture.

Unlike a conventional routing switcher, the compressed studio router will be an intelligent device based on commercial off-the-shelf technology. As resources are connected, a configuration dialogue occurs that permits the ATM router to know the capabilities and attributes of the particular device. This approach is the television equivalent of "plug-n-play," and permits an ever-more complex system to be dynamic and easily managed.

Asset management

A distributed studio environment that focuses on the delivery of compressed video and audio bitstreams leads naturally to a server-based model. A server-centric view of the studio, rather than a tape-centric view, permits great flexibility in terms of access and cataloging of stored media. Direct-access storage devices permit metadata storage and indexing of all media within the studio. This allows sophisticated content and context-based queries, followed by immediate data retrieval. Server technology also permits the same media source to be efficiently distributed to multiple recipients simultaneously. Finally, a server-centric view of the studio maps conveniently to a networked transport infrastructure. Within the studio, there are likely to be several different classes of servers corresponding to the principal work activities within the studio — in particular, a play-to-air server, network servers and production servers.

The play-to-air server would deliver content, encoded in transmission format, to air. It would also store and manipulate program and commercial segments. The server provides this dedicated function to increase system reliability. The network server would provide server support for general studio operations not di-



"LOOK WILCOX, THE DIGITAL COMMUNICATIONS TREND IS CATCHING ON EVERYWHERE," WHISPERED SNELL.

rectly related to production and provide an interface to library services for query and browsing. The production server would support activities associated with the creation, editing and post-production of program material. The high-quality material associated with the production and post-production services dictates that production servers be able to support mezzanine compression levels at approximately 300Mb/s. It is expected that production servers will, in addition to the general server requirements, be able to perform limited off-line transcoding and non-linear edit-type functions.

Archiving to tape storage using automated tape units will be the preferred mechanism for tape storage for many years in the future. The cost/bit of tape storage dictates this. There are, however, many exciting opportunities associated with the automated retrieval and preloading of these tapes that will require innovative solutions.

The ability to be able to browse media based on content and context is considered an essential characteristic of future studio operations. The integration of automated cataloging and image-recognition software allows for the semi-automated and fully automated cataloging and indexing of video data. This is accomplished using off-the-shelf workstation technology and proprietary browsing software.

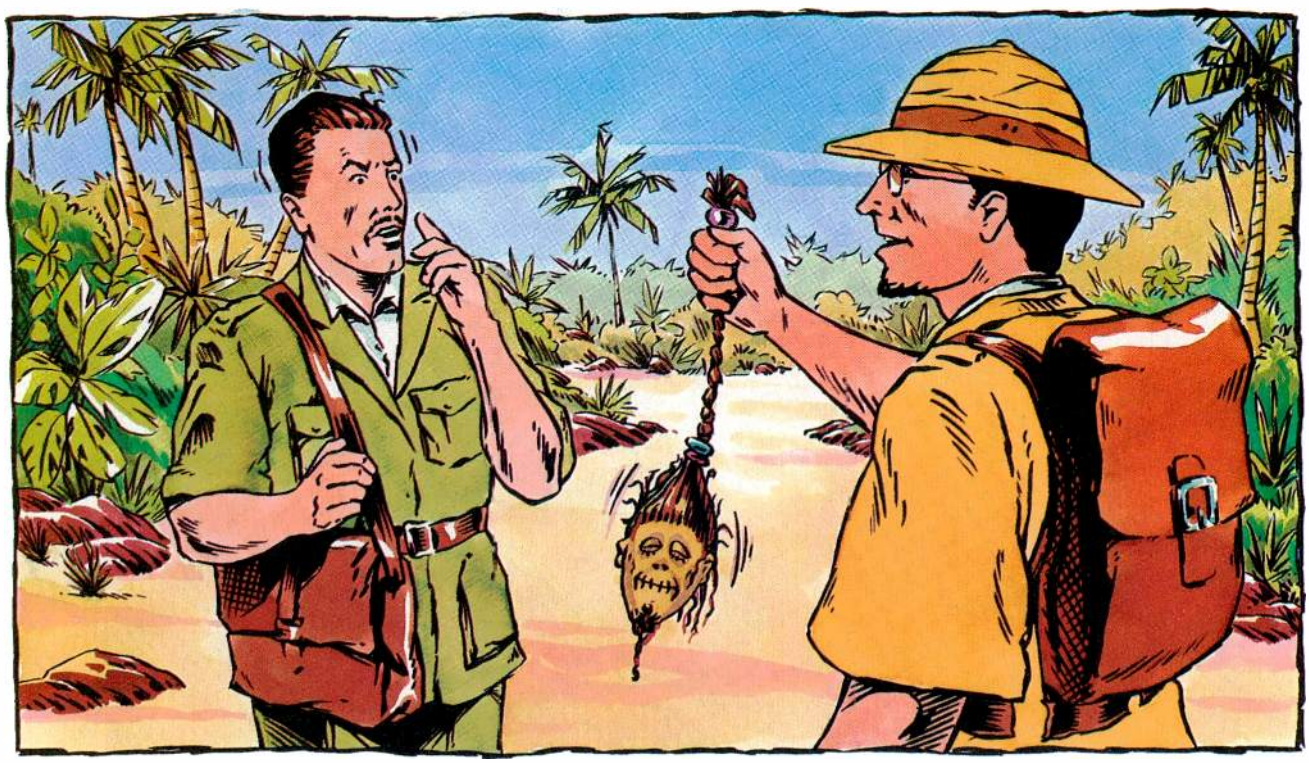
Challenges remain

Today's broadcast chain from the network through the affiliate to the viewer is complex and allows for considerable flexibility. However, moving to compressed HDTV distribution is complicated. For example, insertion of a logo (or "bug") into a program in the uncompressed domain is easily accomplished, however, this becomes complex when the picture is in the compressed domain. Accomplishing this while still in the compressed domain is one area that deserves immediate attention.

Broadcasters and their affiliates are correctly unwilling to accept even the smallest loss of features in this new compressed digital TV era. Without a compressed solution, affiliates will be required to decode to baseband, insert the logo and re-encode for transmission, presently an expensive proposition.

The distributed network-centric studio architecture presents many opportunities. And, comprehensive compressed domain processing tools need to be developed for most of the operations that presently occur within today's compressed studio. ■

Chris Ward leads the command and control and system interconnectivity efforts for Sarnoff Corporation, Princeton, NJ. Ray Lowe heads Sarnoff's studio system architecture work.



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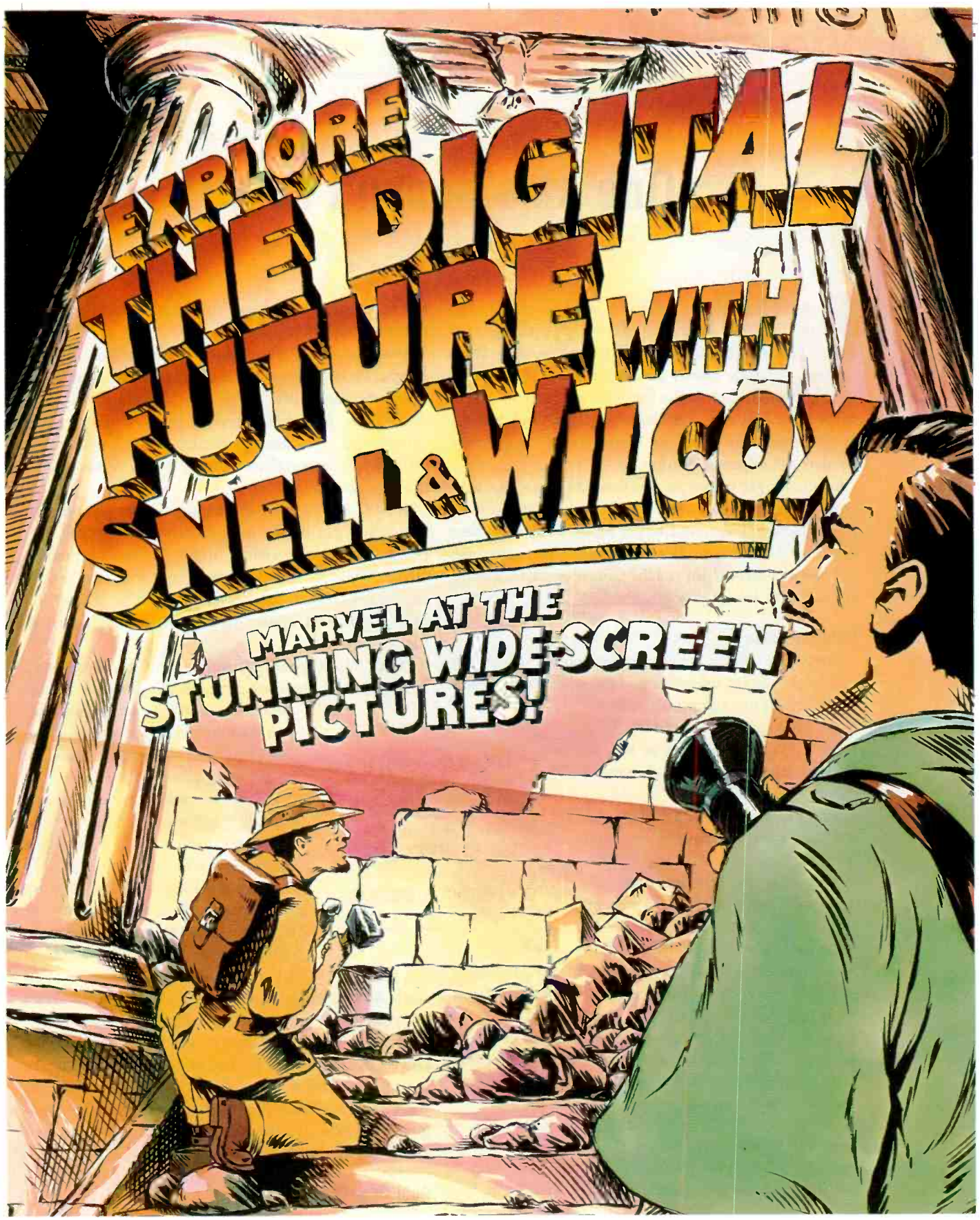

SNELL & WILCOX

Engineering with Vision

Circle (6) on Free Info Card

By Brad Dick, editor

One size doesn't fit all

Baseball legend Pete Rose was once asked who the best manager he'd ever played for was. He said that it was Sparky Anderson. When asked why, Rose replied, "Sparky knows how to get the best out of people. Who to pat on the butt and who to kick in the same place." Sparky Anderson's success was based on recognizing that different management tools were needed for different players.

As a manager of people, do you have only one way of responding to your staff? Is your approach, direction and encouragement based on how they are best directed? Or, are you like many supervisors that use the *one-size-fits-all* approach? Consider the following styles. How would you react?

Different folks

First, there's Alan. He is a master-control supervisor and picks apart everything. His staff knows that mediocrity is not acceptable and mistakes are treated as disasters. Lose three seconds coming out of a news break and Alan thinks it's the end of the world.

Then there's Marsha, a tape operator. She's the visionary. Marsha can't seem to come to a decision. She's often spinning off thoughts and options, even when not asked for them. She's so full of ideas that you sometimes find yourself cutting her off in mid-sentence. Ask her for the time of day and she'll give it to you in 20 locations around the world. If you want options, then Marsha is your person.

The personalities described above may not be much different from what you see in your station. The real issue is, given the wide range of characters you have to deal with, how can you get them to do their best?

Different strokes

Often, supervisors mistakenly believe that others are motivated by the same things that drive them. So, the supervisor tries to motivate a person with the same things he or she personally finds rewarding. Unfortunately, when that doesn't work, the employee is perceived as the "problem."

Back to our examples above. What motivates Marsha, for instance, may not motivate Alan. Does this mean, as their supervisor, you have to have multiple personalities? In a way, yes.

First, realize that your staff is composed of different people. People who are as different from each other as Betacam is from DV. We're not talking about quality differences, just that everyone is *unique*. As their supervisor, you must recognize that fact and use different managerial techniques if you're to achieve the best results.

Second, look for what energizes each person. For some, it might be the opportunity for overtime. For others, working overtime might be seen as punishment. There is always something you can use to encourage and direct a person. If there isn't, then you have a different matter to deal with and it's called firing.

Third, focus your encouragement on a person's strengths, not their weaknesses. It's not that weaknesses shouldn't be addressed, but you'll often get better results if you can find a way to use their strengths to get what you want.

There is always something you can use to encourage and direct a person.

Try this simple example. If you're right-handed, you probably use the computer mouse with your right hand. And, you're likely to be fairly efficient working that way. Suppose your boss suddenly appeared at your desk and said the company had decided that from now on, you could not use your right hand on a computer mouse. You could only drive the mouse with your left hand. After all, you've got two hands, what's the problem?

Go ahead, try it. How does it "feel." First of all, unless you're ambidextrous, having to change hands makes you uncomfortable. It just doesn't "feel" right. Second, you're also inefficient, you're actions are slow and you make mistakes. It's the same thing with people when you don't approach them from their strengths.

Deal from their strengths

So, the next time you want to change someone's behavior, first ask yourself why. Are they really doing something wrong? Or, are you wanting them to change just because they aren't doing it the way you would do it? Second, look for a way to draw on their strengths, rather than focusing on their weaknesses. ■

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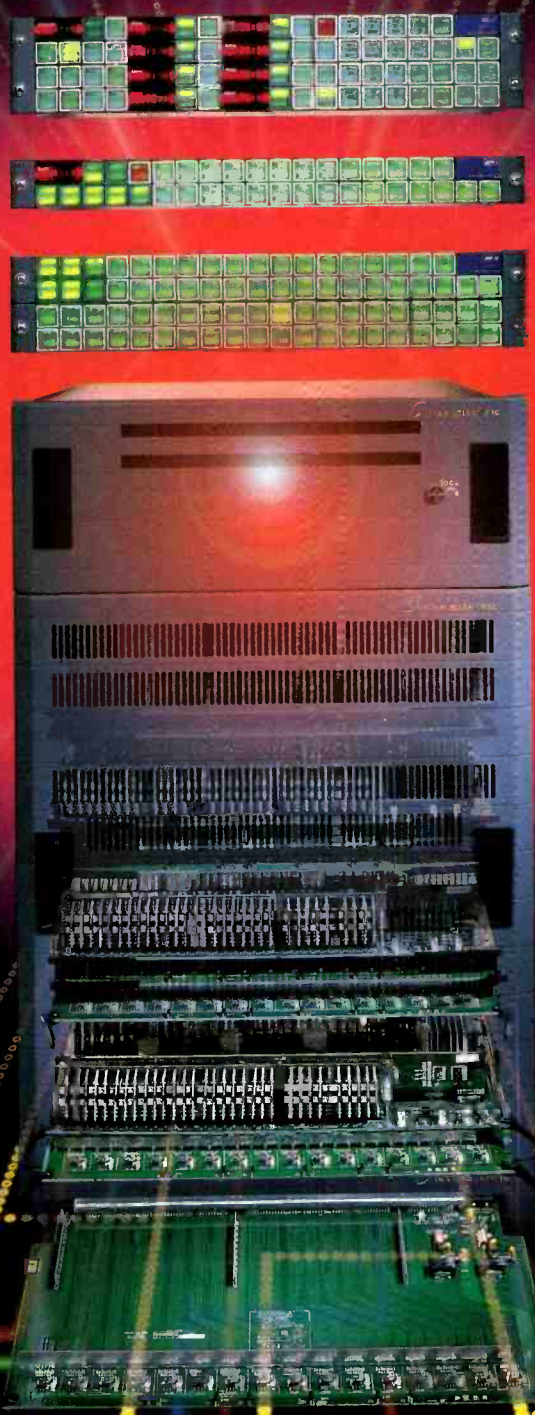

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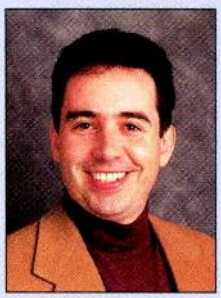
Circle (7) on Free Info Card

By Brad Gilmer

Database backups: One set of files is critical

There are two kinds of hard disks: hard disks that have crashed and hard disks that are going to crash. I'm not going to bore you with another "please backup your hard disk" article. What I'm going to tell you about is the single most important file in your operation.

If you have gone through the fun of losing all the data on your desktop or on your network, then you are probably already a believer in some sort of backup strategy. Think about this though: The ramifications of losing a hard disk on your desktop are nothing compared to losing the database for your video file server — especially if that disk is not backed up.

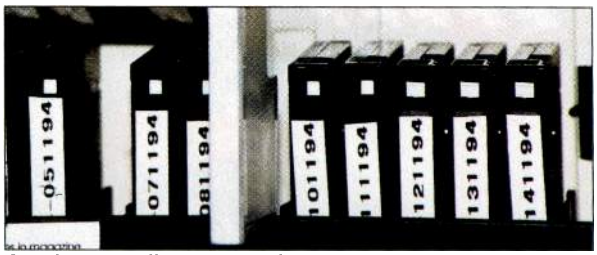


Brad Gilmer

Why are the implications of this so serious? There are several reasons. A failure of this type is catastrophic. It will usually take you off the air when the item currently playing ends. Also, if you do not have any backup of this device, your only alternative may be to reload material on the server. Some material may no longer be available on tape, therefore, spots or promotional items may have to be re-ordered from the agency or re-created by your promotions department. Lastly, it can take a long time to re-load a server. A server with four hours of capacity can hold more than 450 30-second commercials. At three minutes a spot, it could take you almost 24 hours to re-load.

Off-line backup solutions

You are probably most familiar with off-line, or *cold*, backup solutions. These backup methods do not provide instantaneous recovery in the event of a failure. Examples of off-line backup systems include tape drives, diskettes and ZIP drives. They are relatively inexpensive, allow you to store data off site and can be automated to run in the background according to a schedule that you determine.



Autoloaders allow automatic backups for several weeks at a time.

A major disadvantage of cold backup systems is that they do not contain current data. When you restore your database from tape, you will be missing data from the time of the last backup to the time of the crash.

On-line backup solutions

On-line, or *hot*, backup solutions provide instantaneous recovery from hard-disk failures. They are the best choice for backing up critical database files used in automation systems.

Backup options include: *disk duplexing*, *disk mirroring*, *file mirroring across multiple servers*, *server mirroring*, *clustering* and *RAID drives*. All of these options are suitable for backing up a file server, but are not appropriate for small peer-to-peer networks.

Disk duplexing assumes that the drive itself is the most likely part of your system to fail. Duplexing uses a common controller card, but duplicate disks. The advantage of this approach is low cost. The disadvantage is that if the controller card has a fault, both disks will contain bad data. This disadvantage is significant enough that most people do not employ disk duplexing.

Lessons learned the hard way

When we first installed our cart machines, we created a central database on an existing Novell server. Early on, we thought that the information in this server would be critical, so we outfitted it with disk mirroring. This decision has paid off in a big way. Over the years, we have lost three hard disks in the server, but we've never lost a bit of data. Unfortunately, that is not the end of the story.

One day, we received a call from Operations that the database did not seem to be functioning properly. When we investigated, we found that the server was dead. The problem was not a power supply, it was a catastrophic motherboard failure. Luckily, we were able to press another computer into service and had the system back in operation in about four hours. We lost two more motherboards in the space of about six months. It was at that point that we decided to make the jump to mirrored servers. It cost more, but it was money well spent. ■

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Disk mirroring provides two sets of anything having to do with the disk drives in the server, including drives, cables and controller cards. Disk mirroring methods offer automatic operation and automatic change-over, but it does not protect you from other server-related failures. For smaller, less critical, systems this may be a good alternative.

File mirroring across multiple servers usually involves running a third-party software package that, at its most basic level, occasionally copies critical files to another server. More advanced packages monitor the activity in selected files. If the software detects changes, it copies the changes to another file immediately. This is a good alternative if you are only backing up a few critical files and if you already have another server available.

File server mirroring is a big step up in protecting your data, with a cost to match. If your files and file server services are critical, it is the way to go. File server mirroring allows you to protect files on one server with a complete duplicate server. If the active server has a hard-disk crash, power supply failure, network interface card failure or other problem, the other server immediately comes on-line. There is no loss of data and no interruption of file services. Disadvantages include high cost and more complicated installation.

Clustering allows you to backup one server with another. There are several variations on this theme, but basically, if you have two moderately loaded servers, clustering creates an environment in which the servers check on each other to be sure that all is going well. If one of the servers fails, the other picks up the load.

Another option in hot data backup systems doesn't really use a data backup system at all. RAID technology uses multiple hard disks and special hardware to recover from a hard-disk failure. If one of the drives fails, the rest keep on running and the recovery system rebuilds the missing data on the fly. In some RAID systems, when you replace the faulty disk, the new disk is rebuilt in the background as your server continues to run. The biggest advantage to RAID is instant recovery, but there is a sizable cost attached.

This article provides a menu of backup options. In choosing the solution that is appropriate for your operation, think about the importance of your database files. In the server world they are much more important than they used to be. A little money spent wisely (or perhaps a lot of money spent wisely) can pay for itself in one database crash. ■

Brad Gilmer is director of advanced network operations & technology for Turner Entertainment Networks.

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By Skip Pizzi

Processing in audio post

Most broadcasters are aware of the "sweetening" that goes on in audio post-production, but for many readers, the specifics of audio processes that are available today are worthy of further exploration.

Consider first that audio can be manipulated in each of its "dimensions:" the amplitude, frequency and time domain. Common terms for audio processing in each of these areas are *gain reduction*, *equalization* (EQ) and *reverberation*. Note also this basic distinction: Some audio processing seeks to repair problem audio tracks, while other techniques are for special effects. Operational approaches may differ greatly between these two applications.

Gain reduction

The process of lessening an audio signal's dynamic range is called gain reduction, although the terms *compression* and *limiting* are also used. Compression refers to processes that reduce the dynamic range broadly and gently, with the intention of increasing the subjective loudness of a signal. Limiting describes a steep attenuation applied only when a signal exceeds a predetermined maximum level, for purposes of protecting downstream devices from distortion (or to prevent overmodulation of a broadcast signal).

Compression applied to a voice track can improve its audibility or "authority" when mixed over music or sound. It can also help a narrowband signal hold its own

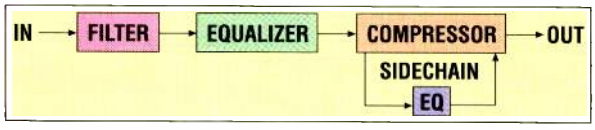

Figure 1. In a typical audio processing chain applied for corrective purpose, the order of the devices is important, with gain reduction generally inserted downstream of equalization. Compressor sidechain allows frequency-selective dynamic effects.

against full-bandwidth studio voices during call-in shows. Limiting can help manage a signal with varying audio levels or act as a guard for unexpected volume surges during live events. Either of these processes can be applied to individual inputs of a mix or on the overall mix.

With its dynamic range "normalized," an audio signal will be at a higher level more often than it would have been without processing. It's this higher average level over time that makes the signal sound "louder" to the listener, even though maximum electrical levels are no higher.

Equalization

The filter is the most basic form of equalizer, which reduces the level in a certain part of the audio band. More comprehensive equalizers allow many, tightly controlled bands to be increased or decreased simultaneously in their relative levels, using several different functions that depict the equalization curve on an LCD panel as it is being set, and memory registers to store and recall EQ settings.

Equalization is a powerful technique that can increase the intelligibility of a muffled voice or sound. Subtractive EQ is preferred, by which parts of the sound's spectrum with excessive energy are reduced in level, rather than boosting the weaker areas. Coupled with compression, EQ can work wonders on problem audio, bringing nearly unusable sound back to life. (See Figure 1.)

Where excessive noise is the culprit, a specialized hybrid of gain reduction and equalization called dynamic noise filtering (DNF) can be used. It acts like a frequency-selective gate or expander, dropping the gain of a selected frequency range when the signal level drops below a certain threshold in that band.

A related device is the *dynamic sibilance controller* or *"de-esser,"* which applies fast limiting to the signal whenever a burst of high frequencies occurs. This can transparently eliminate the problematic shrillness or splattering that some voices exhibit.

Putting it all together

A few new devices incorporate all of these audio processes into a single chassis, sometimes as small as 1RU. Although this can be cost- and space-effective, it can also be difficult for some operators to use optimally. Therefore, some users prefer dedicated devices for different processes.

The most critical part of the process is the skill of the user. You've got to assess the situation with your ears and determine what effect or fix you need, then choose the right device, get it patched in and set it properly.

With the right tools and know-how, these techniques can make a big difference in the overall quality of a program. Whether you're creating a surreal soundscape or salvaging an ENG audio disaster, you'll find audio processing to be an invaluable part of the post-production enterprise. ■

Skip Pizzi is editor in chief of Broadcast Engineering's *sister publication,* BE Radio.

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Circle (17) on Free Info Card

By Steven M. Blumenfeld and Mark Dillon

Tomorrow's entertainment systems

By now we have discussed most of the interactive avenues available to you as a broadcaster. We have spent time chiding you on being the first to market with your local information. We have pleaded for you to take the lead in the TV appliance revolution. Finally, we have tried to help you understand some of the ramifications of interactivity. This month, we are going to try to tie all these technologies and architectures together and take a look at the near future — we call it HybridCast.

Mark Dillon and Steven M. Blumenfeld

Intel calls this technology Intercast, and Microsoft will be pushing a similar concept as its broadcast architecture in Windows 98. Both Intel and Microsoft present the computer as a viable way to obtain TV (broadcast) information. They do this through the use of the Internet and the VBI. However, I believe that these broadcast technologies, as they are currently defined, are too limiting. A much better solution requires a third element to the equation — optical disc/storage.

There are information architectures for the Internet combined with a CD-ROM, but nowhere have we seen an optical disc tied together with the Internet and broadcast television. Think of the immense power of a system that used the strengths of each of these media. Internet for real-time data updates, broadcast for real-time image updates and a large, inexpensive optical storage device for archival and proprietary information.

Broadcast interactivity

Back in 1991, we ran a project called Hybrid TV. We had a Philips CD-I player outfitted with a special genlock/overlay board, a VBI decoder and a 1,200-baud modem. Together with our partners, we delivered broadcast interactivity to 60 million households. However, only 100 of these boxes were made. What was interesting about this trial and technology is that we were doing what Intercast is trying to do today, only our data sources encompassed all three items mentioned above. The one constant in this and all other interactive architectures of this class is the broadcast medium.

Today's network infrastructure and technology will enable the implementation of an outrageous interactive entertainment system. Let me propose a consumer device that incorporates DVD, television and the Internet. This is not all that far off. By the end of the year, Echostar will have a DSS and DVD combo unit. Now, broadcasters can incorporate high-bandwidth 3-D environments on DVD, combined with positional and informational data from the Internet and entertainment from the television. This system will allow rich new experiences to be generated on your customer's TV screen.

In fact, the show will have a life of its own. Communities of interests will spring up to share background and setup data, much like the Music Trading Trees that surround bands such as the Grateful Dead and Phish. Your audience will decide what occurs on the TV screen. I am not talking about the "pick your favorite ending" type of interactivity, but a whole new involvement by your audience. Your audience will have the ability to manipulate objects and control the actors' environments. From a production standpoint, these shows will have to rely a lot more on character and plot development than on location.

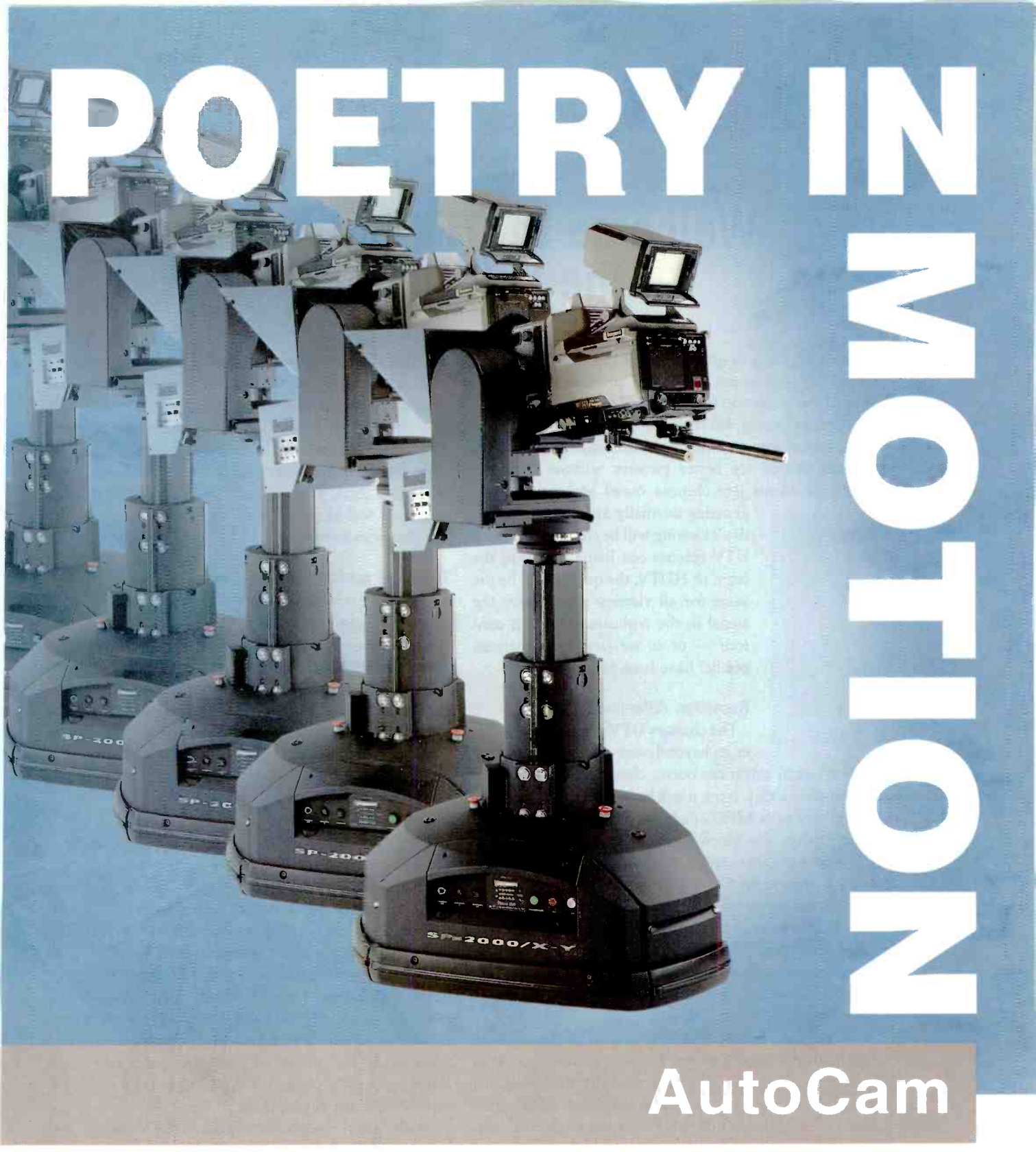
The upshot

As in all new technologies, the first questions need to be "Where is the money?" and "What is the business model?" If you think hard enough, you will see that the combination of these technologies opens new financial possibilities and will give the broadcaster a new, incremental revenue stream. As we advance toward the digital age of television, this type of production will require only an incremental increase in cost, but could generate significant revenue and differentiation for a broadcaster.

Imagine being able to change the look and feel of your station to a selected group of people. You can start with the 18- to 35-year-olds most likely to own computers with DVD and be on the Internet. You will have the ability to give them a truly customized broadcast. OK, so you have heard all this before, and it has been tried in many incarnations, each met with successful press, but dismal financial rewards. What is different this time around? Honestly, the only differences are time and new innovation. Every day the technology grows by leaps and bounds, and the real question is not if you will be involved in a full-fledged multimedia broadcast architecture, but when. ■

Steven Blumenfeld is general manager of GTE Internet Television, and Mark Dillon is vice president of on-line services with GTE.

POETRY IN MOTION



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Circle (8) on Free Info Card

By Louis Libin

Welcome to DTV but beware the "cliff effect"

The most obvious quality change that DTV will bring to NTSC viewers is HDTV programming. With double the resolution of NTSC and a 16x9 aspect ratio, HD programming will certainly be obvious even to the most casual viewer. Even with multicasting programs, viewers should see better pictures without common NTSC problems like chroma crawl and noise. Also, ghosting normally associated with today's viewing will be eliminated. When DTV reaches our living rooms in the form of HDTV, the quality will be the same for all viewers who receive the signal in the replicated Grade B contour — or so we (and the American public) have been led to believe.

Louis Libin

Reception differences

The changes DTV brings to the viewer go beyond mere pictures. Until new technological advances occur, channel surfing will be slower than today. Now, it will be a case of push and wait as the receiver's MPEG decoder finds the channel and locks up on the video before changing the picture. Unfortunately, there will also be some areas that, despite being located in the Grade B area, will receive no service. It's not that the signal will be weak or noisy as in NTSC, but if the receiver cannot decode sufficient data, there will be no image displayed at all. The specifics of digital reception are complex phenomena with many varying conditions — and unfortunately for some viewers — have no simple solutions.

The ongoing debate over VHF and UHF propagation will further confuse viewers. Today, it's often possible to receive an adequate VHF signal, while local UHF signals are noisy because of low signal strengths. Early work leads us to believe that UHF reception may, in fact, extend beyond the radio horizon, but both viewers and station management remain skeptical.

The cliff effect

The dreaded cliff effect could potentially become a station's nightmare as viewers that "should" be getting a good signal report no reception. That's likely to be particularly troublesome to early adopters, especially after they've spent thousands of dollars on that new TV set only to find they can't get all of their favorite stations.

Be sure your staff and management understand how the new digital signals will travel over your coverage area. It's easy to make the mistake of thinking that reception loss will never occur inside your Grade B area and then fall off abruptly outside the boundary, but it doesn't happen that way. In fact, there is likely to be some areas *inside* your coverage pattern that have reception problems. And, even outside your planned coverage area, you will likely still have viewers, perhaps further out than you have now.

Technical assumptions

DTV transmissions, like digital video compression techniques, do not provide for graceful degradation when noise or interference is of high enough levels. As such, similar conditions will exist for many stations when they begin DTV transmissions. A reduction in the carrier-to-noise ratio of as little as 1 or 1db may increase the bit error rate (BER) of your signal to the point where receivers cannot decode the signal. This is simply a characteristic of digital systems. Therefore, the application of the NTSC Grade B coverage (90% time variability factor) does not apply. Service may be lost during the 10% of the time when noise and/or interference increase above their normal Grade B values. For location factor, the 50% value for NTSC calculations is also appropriate for DTV service. Engineers have closely determined what levels (D/U ratios) of both co-channel and taboo interference (NTSC into DTV, DTV into DTV and DTV into NTSC) are appropriate.

The changes DTV brings to the viewer go beyond mere images.

Finally, given the characteristics of DTV signals and our requirement to provide reliable service, an even more appropriate coverage area definition would be a minimum of 99% time availability for reception. To provide this level of service, a good definition of a station's DTV signal radius for noise-limited coverage should be that which yields the highest time availability (for example, 99% of the time). This would have the effect of protecting both station management and viewers from unrealistic expectations. ■

Louis Libin is a broadcast/FCC consultant in New York and Washington.

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Circle (9) on Free Info Card

By Brad Dick, editor

Internet access at 30Mb/s

Yea, sure. In your dreams. Cable modem manufacturers and the cable industry have done about all they can to hype the advantages afforded by cable modem technology — mainly speed. Unfortunately, the fact is, it's all hype.

False claims

Most of the exaggeration has come from the cable modem manufacturers. Naturally, they want to promote the advantages of their products, but unfortunately, the real result has been to overpromise on something they can't deliver. It's true that the design specs for some cable modems equate to 30Mb/s, but that's not real-world performance. Telling a customer that he or she can get Internet access at 30Mb/s is like a Ferrari salesman telling their customers they'll be able to drive to work at 130mph. In both cases, those speeds exist only in test (track) conditions. The claims are false and manufacturers know it.

The other part of the false claims dilemma comes from cable companies. At least they haven't been claiming 30Mb/s access. They realize you have to push that data through their pipes, which in most cases, are limited to less than one-sixth (1.5Mb/s) of that 30Mb/s speed. Let's look at why these lightning speeds are not achievable.

When that lightning-speed cable modem on your desk capable of 30Mb/s hits the cable head-end, data comes to a screeching halt.

System limitations

The speed at which a cable modem operates is only one among many factors that determines the type of performance the end-user sees. The first is the speed of the modem and we've looked at that. The second is the bandwidth provided by the cable path. Users don't get assigned bandwidth (or access), rather, all users share the same amount of bandwidth between the home and cable head-end. Also, the cable system's connection to the Internet is shared access. Typically, that's only a T1 line.

Therefore, when that lightning-speed cable modem on your desk capable of 30Mb/s hits the cable head-end, data comes to a screeching halt. Now, instead of screaming along at something between 10Mb/s and 30Mb/s, the data rate drops to a percentage of that rate dependent upon how many other users are on-line.

For instance, suppose your cable system wanted to provide just a few customers (say about 62) with 10Mb/s service to the Internet. This level of service would require an OC12 (622Mb/s) interconnection! Outside of the Ma Bells, no one has an Internet pipe that big. The bottom line is that users are not going to get even 10Mb/s service, at least consistently, from the typical cable connection.

The computer bottleneck

A second bottleneck exists with cable modems that concerns the capability of the computer and the network used to connect the modem to the computer. Most cable modem installations rely on an Ethernet connection between the modem and the CPU. With this type of interface, the system is automatically limited to 10Mb/s — even with a 30Mb/s modem. Again, despite claims, the need for system overhead and other factors will limit a 10BaseT interconnection to something much less than 10Mb/s performance.

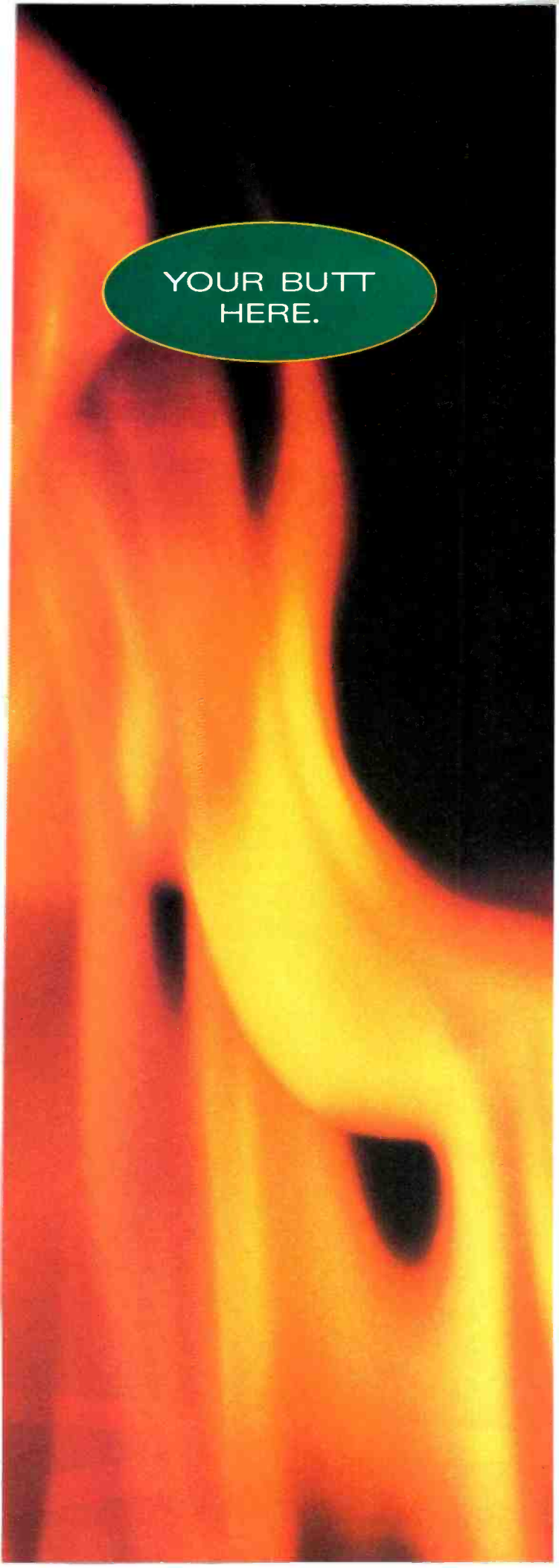
Upstream-downstream

Much has also been made about the need for only high-speed *downstream* access. Because Internet users spend most of their time receiving and little time transmitting, system proponents have claimed that it's only the downstream access speeds that are important. Again, that's not completely true. Let's see why.

Internet browsing is highly receive-intensive. Users select a URL or page, hit fetch and then wait and wait. The key point here is that most of the Internet experience is spent in the receive mode. This means that users want a high downstream speed, but can live with a much slower *upstream* speed. The upstream activity is typically limited to the carriage return and URL.

However, this model does not apply when it comes to desktop video conferencing (another often-hyped use of the Internet). Video conferencing requires high-speed upstream *and* downstream access. Applications

Continued on page 134



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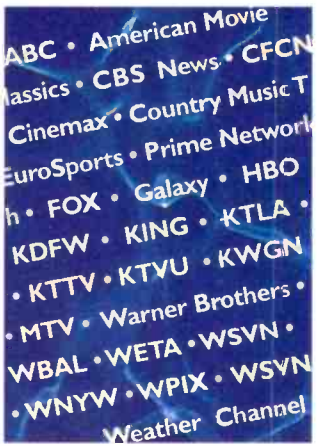

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Circle (18) on Free Info Card

Editing MPEG

bitstreams

Forget about editing. Simply splicing the bitstreams presents its own set of challenges.

By Steve Epstein, technical editor

THE BOTTOM LINE:
MPEG bitstreams are becoming more common in the broadcast environment. Although currently many MPEG bitstreams are used only for point-to-point transport, it won't be long before these bitstreams pass through facilities. When they do, it is likely they will require switching or splicing. Keeping these bitstreams in the compressed domain is challenging, but offers considerable benefits. $

As facilities move closer to the start of DTV transmissions, questions abound. Among them is the question of signal formats. There are no simple answers. Component, composite, analog and digital formats all must be addressed. In addition, progressively scanned graphics formats at various resolutions will also need to be handled. Finally, for cost-effective storage and transport, many of these

Editing MPEG bitstreams

signals are likely to be in a compressed form. At present, some form of MPEG-2 compression is the most likely candidate. Unlike baseband video, switching MPEG bitstreams cannot be done with the simple equivalent of a vertical interval switcher.

MPEG basics

Before delving into the complexities of switching MPEG bitstreams, some background is in order. At present, three MPEG (short for Moving Picture Experts Group) standards are currently in use, MPEG-1, -2 and -4. Rather than being a set of rules on compression, the MPEG standards are more like a toolbox. The MPEG-1 standard is targeted at multimedia and computer applications and uses source input format (SIF) resolution, 352x240 pixels. MPEG-1 is designed to produce optimum data rates of approximately 1.5Mb/s for video and audio bitstreams. MPEG-2 offers full CCIR-601 resolution and provides tools for interlaced video. MPEG-3 was designed to be used for HDTV applications, but was folded into the MPEG-2 toolbox. MPEG-4 uses one-quarter SIF resolution and is designed for low bit-rate applications, such as teleconferencing.

For professional video applications, the standard of most interest is MPEG-2. The MPEG-2 toolbox consists of five profiles and four levels. (See Table 1.) Profiles describe features, while levels are used to determine the upper limits of performance. When specifying MPEG-2, it is done in terms of a profile at a level, for instance Main Profile@ Main Level or MP@ML. Not all profile and level combinations are supported. The compression used in MPEG is based on the discrete cosine transform (DCT). DCT is a lossless mathematical method that transforms a matrix of pixels in the time domain into representative coefficients in the frequency domain. Once in the frequency domain, the coefficients are scaled and quantized. Although the DCT is completely reversible (lossless), the process of scaling and quantization is not. Once the DCT coefficients have been scaled and quantized, some picture information has been lost and is not recoverable After being scaled and quantized, the resultant integers are run-length and entropy-coded. (For more information, see "Video Compression 101," February 1996.)

MPEG takes advantage of the similarity that exists between many of the frames that make up a video sequence. The standard defines three basic frame types: intra (I), predicted (P) and bidirectional (B). I-frames are wholly self-contained frames that are comparable to frames compressed with the JPEG algorithm used for still pictures. MPEG B-frames are based on adjacent I- and P-frames before and after the B-frame. Because B-frames require information from later frames, the transmitted frame sequence is not necessarily the display sequence.

MPEG encoders are used to compress video, while decoders convert the compressed bitstreams back into video sequences. The number of bits required to describe an MPEG frame varies based on the type of frame (I, P or B), the amount of quantization and scaling used, and the actual picture content.

Traditional edit bays such as this one located at Post Logic Studios, Hollywood, operate in the uncompressed domain of SMPTE-259M. However, as we move toward DTV, facilities such as these may also have to handle compressed signals.

sequences must start with an I-frame. To prevent errors from propagating through a clip, I-frames are used to periodically refresh the image. P-frames are predicted from previous I- or P-frames. Using motion-estimation techniques, blocks of pixels can be moved around the screen to accommodate motion. Because many of the pixel blocks remain stationary from one frame to the next, it requires less data to simply inform the decoder of the new locations of any blocks that need to move. I-frames require the most bits, while B-frames typically require the least. Because the number of bits per compressed frame varies and because video frames arrive at the encoder at a fixed rate, the encoder outputs bits in a "bursty" manner. A buffer is used to smooth out the bursts. A buffer at the decoder end performs the inverse function, taking in the bursty data and storing it as needed for regular playback. During the encoding process,

Continued on page 44

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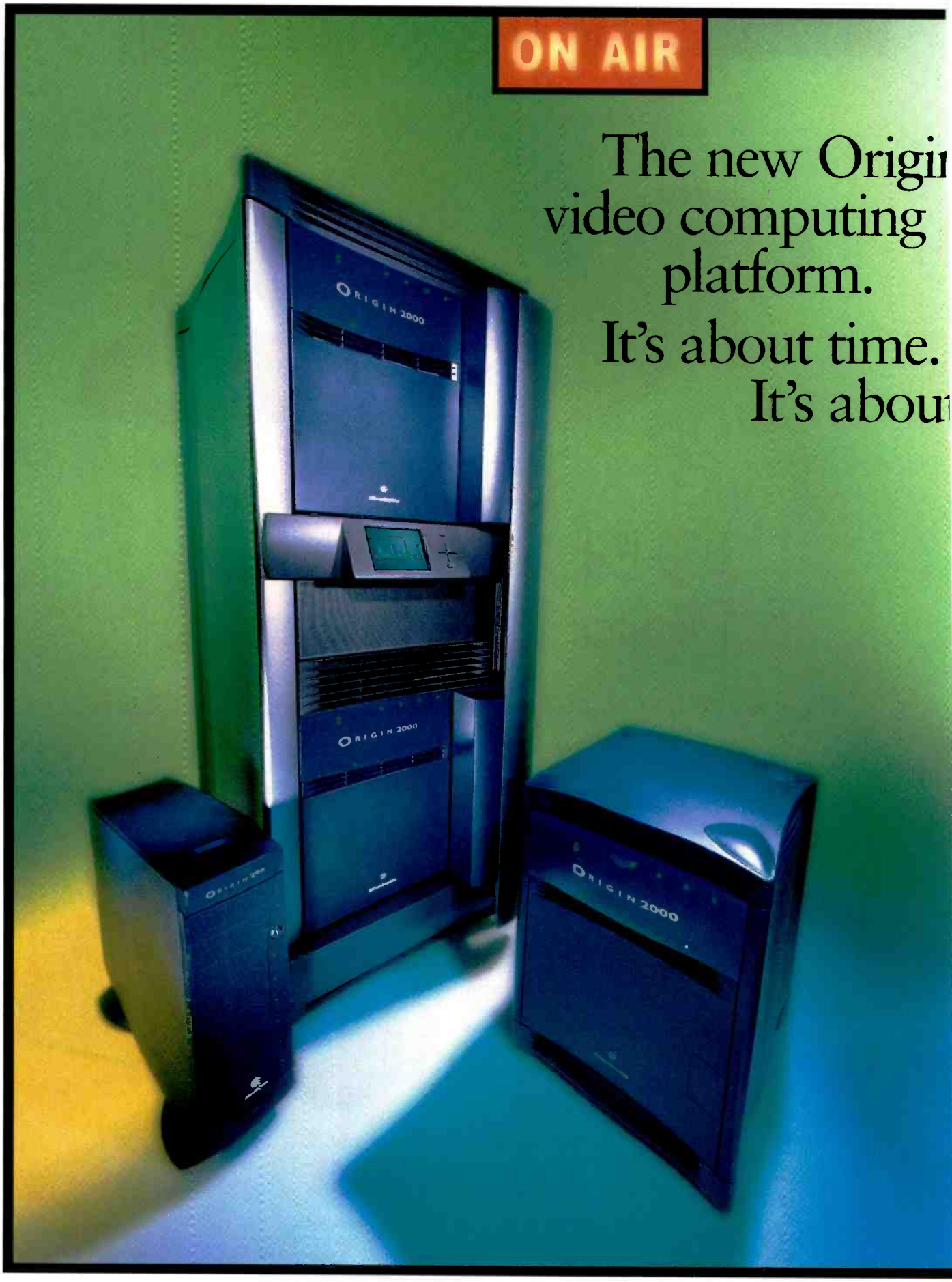

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Glossary of MPEG terms

Although compression systems have been around for some time, there are a variety of terms used that may be unfamiliar. The following list describes many of the more common ones.

- **4:1:1 or 4:2:0 or 4:2:2:** See sampling structures in Figure 1.
- **B-frames:** Bidirectional frames use elements found in I-frames and P-frames before and after the particular B-frame. Decoding a single B-frame requires that the previous I-frame be decoded, as well as any P-frames located between the I-frame and the B-frame. In addition, an I-frame or P-frame after the B-frame must be decoded.
- **Block:** An 8x8 region of pixels. Normally each block of pixels will contain information relative to a single component, either Y, Cr or Cb.
- **Discrete cosine transform (DCT):** A transparent mathematical construction that transforms an array of pixels into an array of coefficients representing the frequencies involved.
- **Elementary stream:** One of the three basic stream types defined by MPEG. Elementary streams contain only a single type of information, i.e., video, audio or data.
- **Entropy encoding:** The practice of encoding commonly used terms with short codes and uncommon terms with longer codes. The goal is to keep the majority of messages as short as possible. Morse code is an example of entropy encoding.
- **Group of pictures (GOP):** The number of frames in an MPEG sequence. A typical GOP sequence of 10 frames might be set up as follows: IBBPBBPBBP.
- **I-frames:** Self-contained frames defined by the MPEG standard that require no additional information to decode.
- **JPEG (Joint Photographic Experts Group):** An international standard-setting body for compressing still pictures.
- **Macroblock:** A group of four luma blocks, plus their associated chroma blocks.
- **Motion JPEG:** The practice of using the JPEG algorithm to compress a sequence of related images as a series of single frames. Motion JPEG sequences are easily edited. Because the JPEG standard was designed for still pictures, video clips are typically stored as sequences of JPEG files and there are no provisions for audio. Audio is added in a variety of proprietary methods. Motion JPEG bitstreams are typically proprietary formats that are not easily interchanged.
- **MPEG-1:** An MPEG compression standard designed for multimedia/CD-ROM applications with data rates in the 1-2Mb/s range.
- **MPEG-2:** An MPEG compression standard designed for a wide range of video applications, including broadcast. MPEG-3 specifications were folded into the MPEG-2 standard, providing support for HDTV. Primary data rates range from 1.5Mb/s up to 15Mb/s and higher.
- **MPEG-4:** An MPEG compression standard designed for low data rate applications, such as teleconferencing.
- **MPEG (Moving Picture Experts Group):** An international standards-setting group involved in defining standards for the data compression of moving pictures.
- **P-frames:** Predicted frames use predicted information, as well as information found in previous I- or P-frames. Decoding P-frames requires the previous I-frame to be decoded, as well as any P-frames located between the P-frame to be decoded and the previous I-frame.
- **Perceptual coding:** Used in lossy compression systems with the purpose of removing information not perceived by the viewer/listener. For instance, the human visual system is more sensitive to luminance information than to color information. This allows the amount of color information to be reduced without being perceived by the viewer. Based on this, NTSC provides only about half the bandwidth for color as is provided for luminance.
- **Program stream:** One of the three basic stream types defined by MPEG. Program streams are composed of related elementary streams that are multiplexed. Program streams are not error tolerant, and, therefore, must be used in applications that are relatively error-free.
- **Quantization:** The technique of assigning a (typically) integer value to a sample. The number of bits used determines the amount of resolution possible. An eight-bit sample can contain any one of 256 values, while a 10-bit sample could be any value from 0 to 1,023.

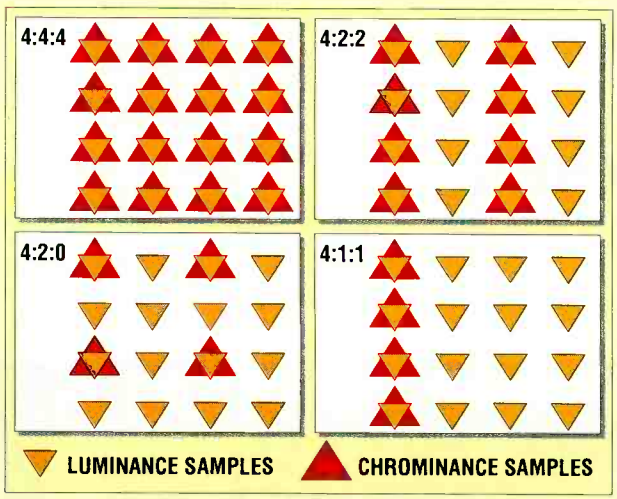
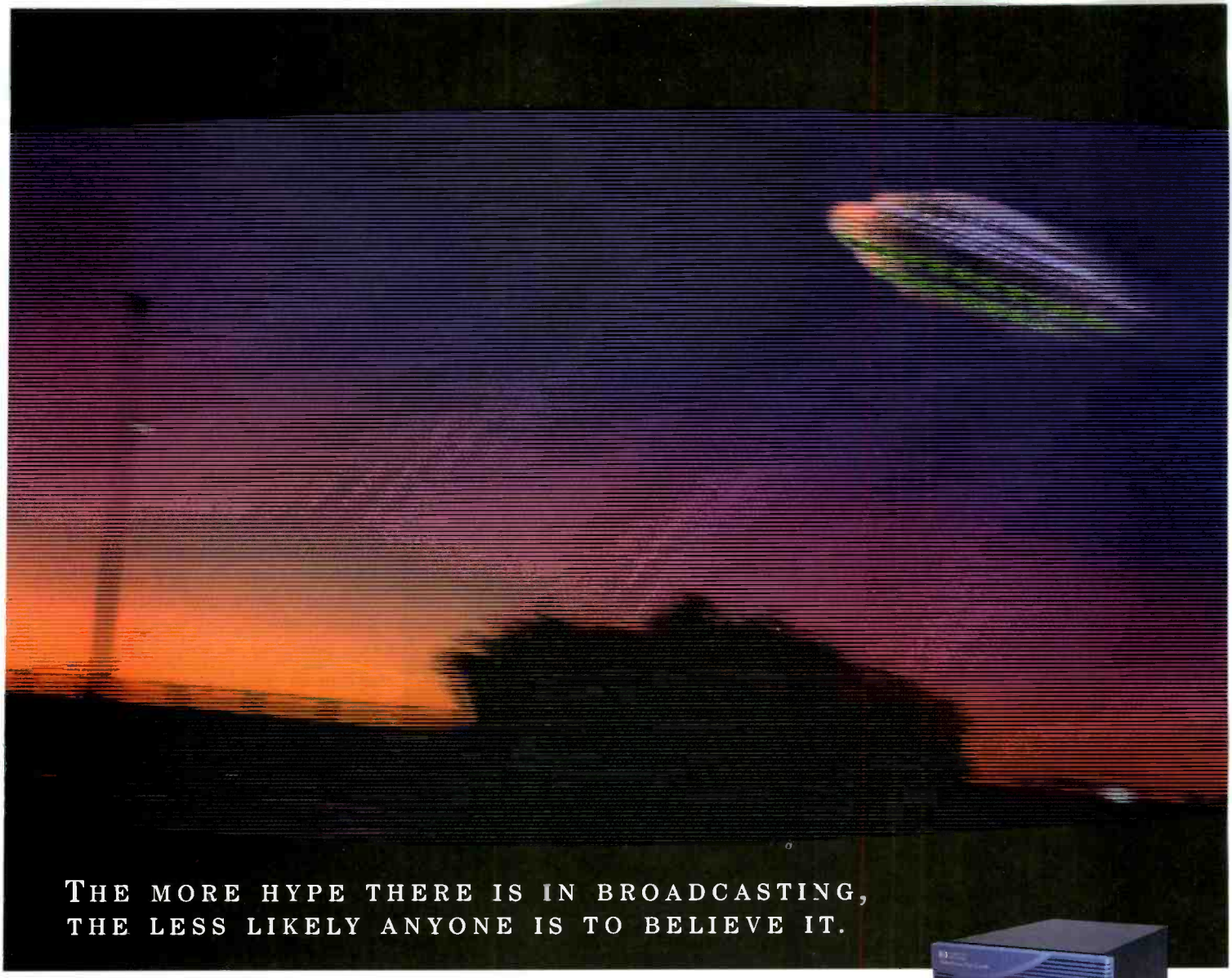


Figure 1. As video has evolved, multiple sampling formats have been used. Most use some form of chroma subsampling. (Artwork courtesy of Hewlett-Packard.)

- **Run-length encoding:** An efficient method of encoding number strings that are expected to contain significant numbers of zeros.
- **Sample:** a single spatial data point of luma or chroma information.
- **Sampling rate:** Rate at which samples are taken, for video this is normally expressed in megahertz (MHz), and for audio, the rate is normally in kilohertz (kHz).
- **Sampling structure:** When video signals are converted to or processed in the digital domain, they are normally handled in the component rather than the composite mode. Nyquist theory calls for sampling rates at least twice the rate of the highest expected frequency. Typical video sampling structures are shown as three numbers separated by colons, i.e., 4:2:2. These designations typically denote multiples of a 3.375MHz sampling rate. The first number typically represents the rate used for luminance and the last two represent the rate for color-difference signals. In 4:2:2, the four denotes luminance sampling at a rate of 13.5MHz and the pair of "2s" calls for sampling of the chroma-difference signals (R-Y, B-Y) at a rate of 6.75MHz.
- **Scaling:** The process of systematically reducing the number of bits used to describe a quantized sample.
- **Slice:** One or more contiguous macroblocks in the same row.
- **Transport stream:** One of the three basic stream types defined by MPEG. Transport streams are composed of one or more program streams and are constructed to be error tolerant. ■



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Editing MPEG bitstreams

Continued from page 38

feedback from a built-in decoder is used to adjust the quantization and scaling process. As the decoder buffer "fullness" increases, additional quantization and scaling is used, reducing the number of bits. Conversely, as the buffer empties, quantization and scaling are reduced, providing additional bits for picture information.

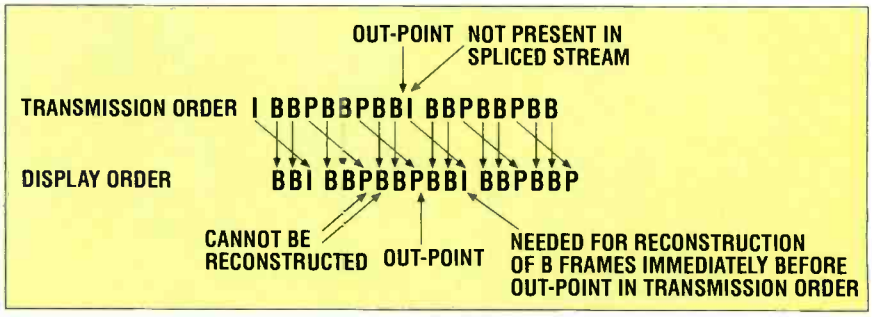

Figure 1. Differences in transmission and display order mean that for proper decoding, splice points must be chosen carefully.

MPEG encoders typically work with a group of pictures (GOP). The GOP structure used determines, to some extent, the data rate required. Larger GOP structures typically require fewer average bits per frame. Typical GOP structures range from two frames up to 15 frames. Normally, MPEG GOPs start with an I-frame and end with a P-frame, although this is not required. One interesting facet of MPEG is the lack of an encoding specification. The only encoding requirement is that the encoder produce a decodable bitstream.

Between encoders and decoders, three basic types of bitstreams are used: *elementary*, *program* and *transport*. Elementary streams contain only a single type of information, either audio, video or data. Program streams are used to multiplex elementary streams. For instance, two elementary audio streams and one elementary video stream could be multiplexed into a single program stream. Program streams are used in error-free environments, such as local area networks (LANs) or from point-to-point within a facility. Transport streams are made up of one or more program streams. Because transport streams are designed to be used in conjunction in applications that are error-prone, they contain mechanisms for error correction, as well as a means for synchronization and jitter correction.

Stream splicing

In today's editing environment, audio, video or both are "spliced" into or onto existing material. In the uncompressed domain, this is fairly simple. It is relatively easy to synchronize two or more video streams. Vertical intervals occur regularly allowing switches to be performed as required. Digital audio is similar and analog audio is even easier because it requires no synchronization at all. However, in the compressed do-

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Editing MPEG bitstreams

main of an MPEG bitstream, several factors must be considered. Among them are the varying number of bits per frame, the use of motion prediction and the fact that frames may not be sent in the order they will be displayed. I- or P-frames that are displayed after B-frames need to be sent before the B-frames for the B-frames to be properly assembled. (See Figure 1.)

Because the number of bits per frame varies, it is virtually impossible to synchronize two MPEG bitstreams. However, bitstreams can be loaded into RAM, and memory pointers can be manipulated. If two bitstreams were loaded into RAM, the pointer used to read the data could be shifted such that after one stream was output, it is followed immediately by a section of the other bitstream. This is much like edits performed by many of today's nonlinear desktop editing systems, except in the editing systems, instead of reading from RAM, data is read from a hard drive using pointers that are essentially a list of frames and their locations.

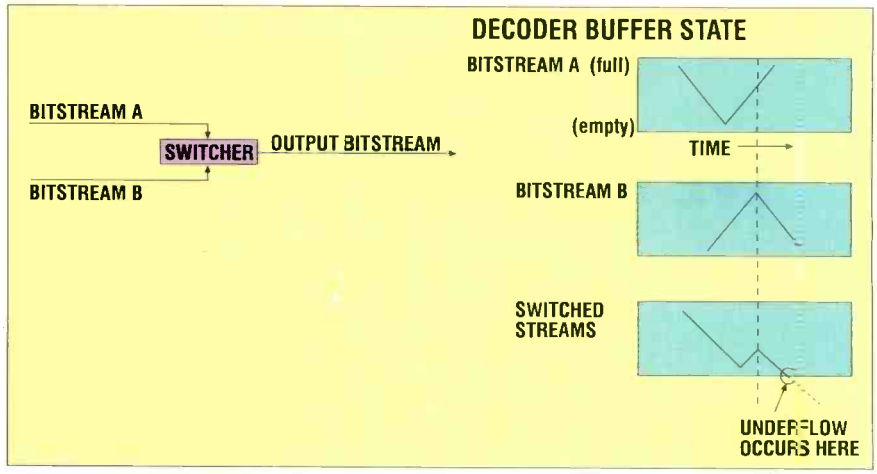

Figure 2. Decoder buffer states must be considered when switching MPEG bitstreams due to the possibility of underflow/overflow conditions in the receiver's buffer.

Most non-linear editors use JPEG compression, which is comparable to an MPEG bitstream composed entirely of I-frames. Jumping from the end of one I-frame to the beginning of another is relatively simple. Bitstreams made up of all I-frames are fine for editing, but inefficient when it comes to storage or transmission. Bitstreams that are far more efficient to store and transport make considerable use of P- and B-frames, but these complicate the editing process.

At present, work is under way to develop tools within the MPEG structure that allow for bitstream splicing while in the compressed domain. One tool thought to be needed is an encoder that marks potential splice points within the stream. One requirement of a

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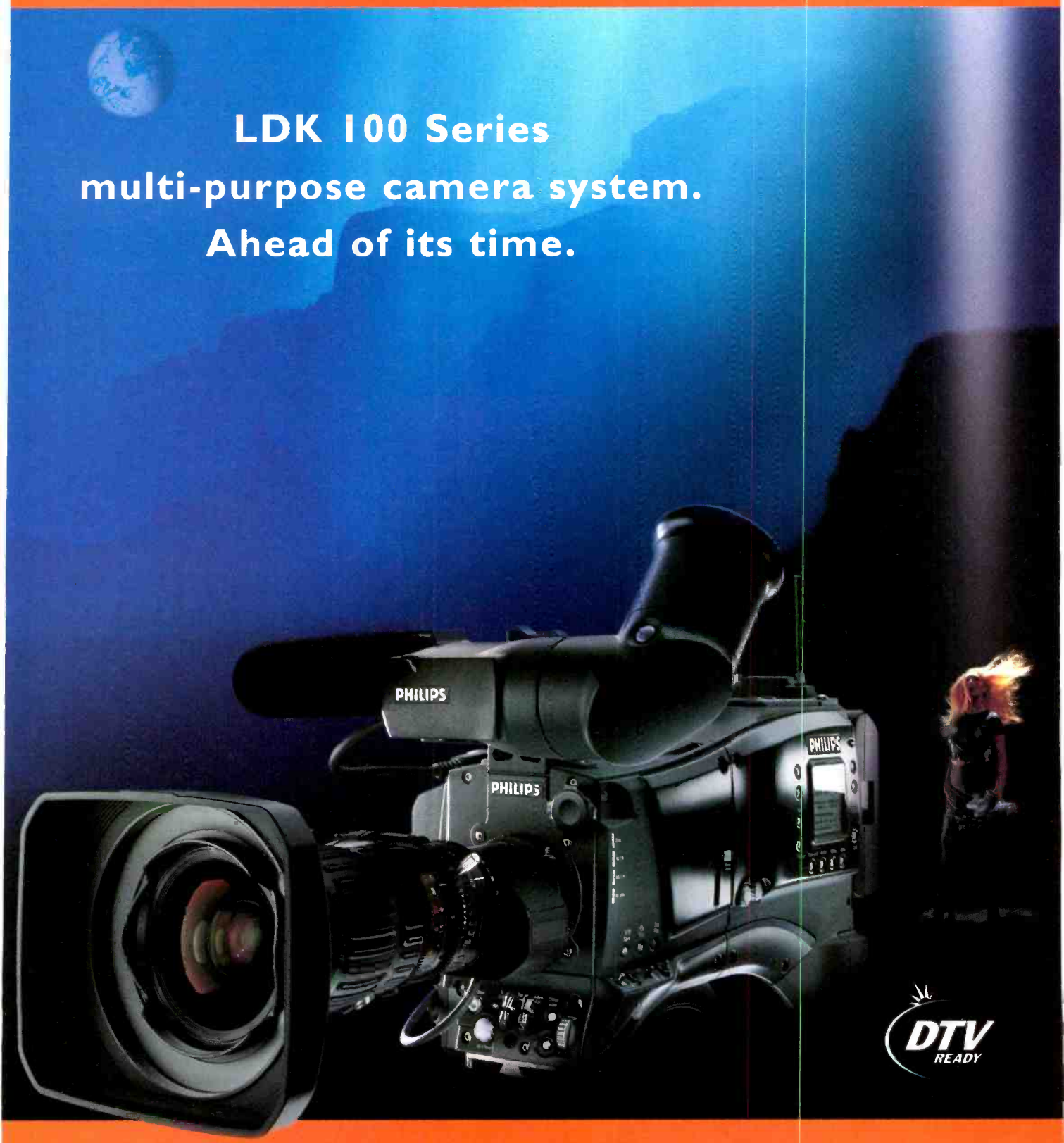

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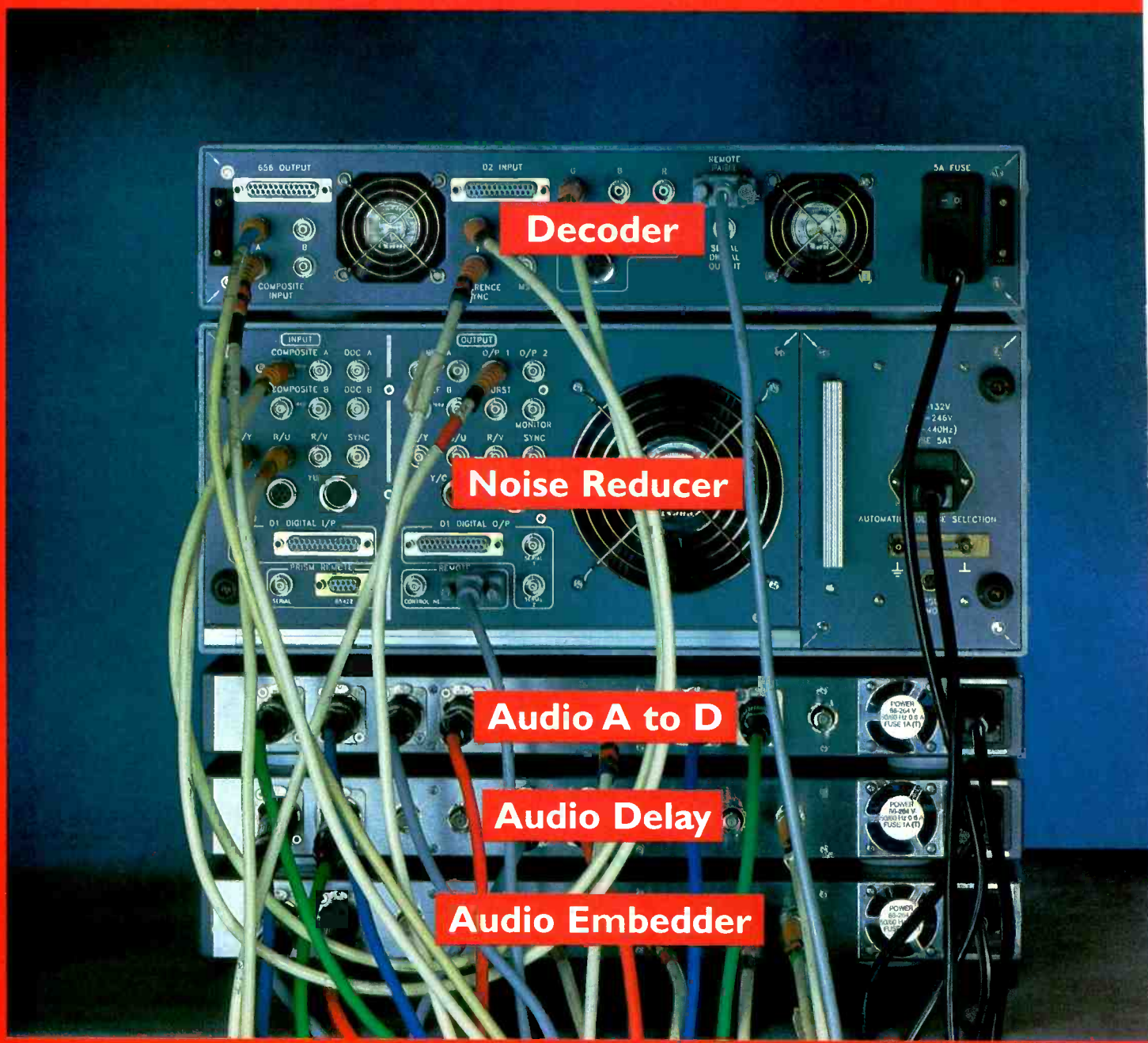

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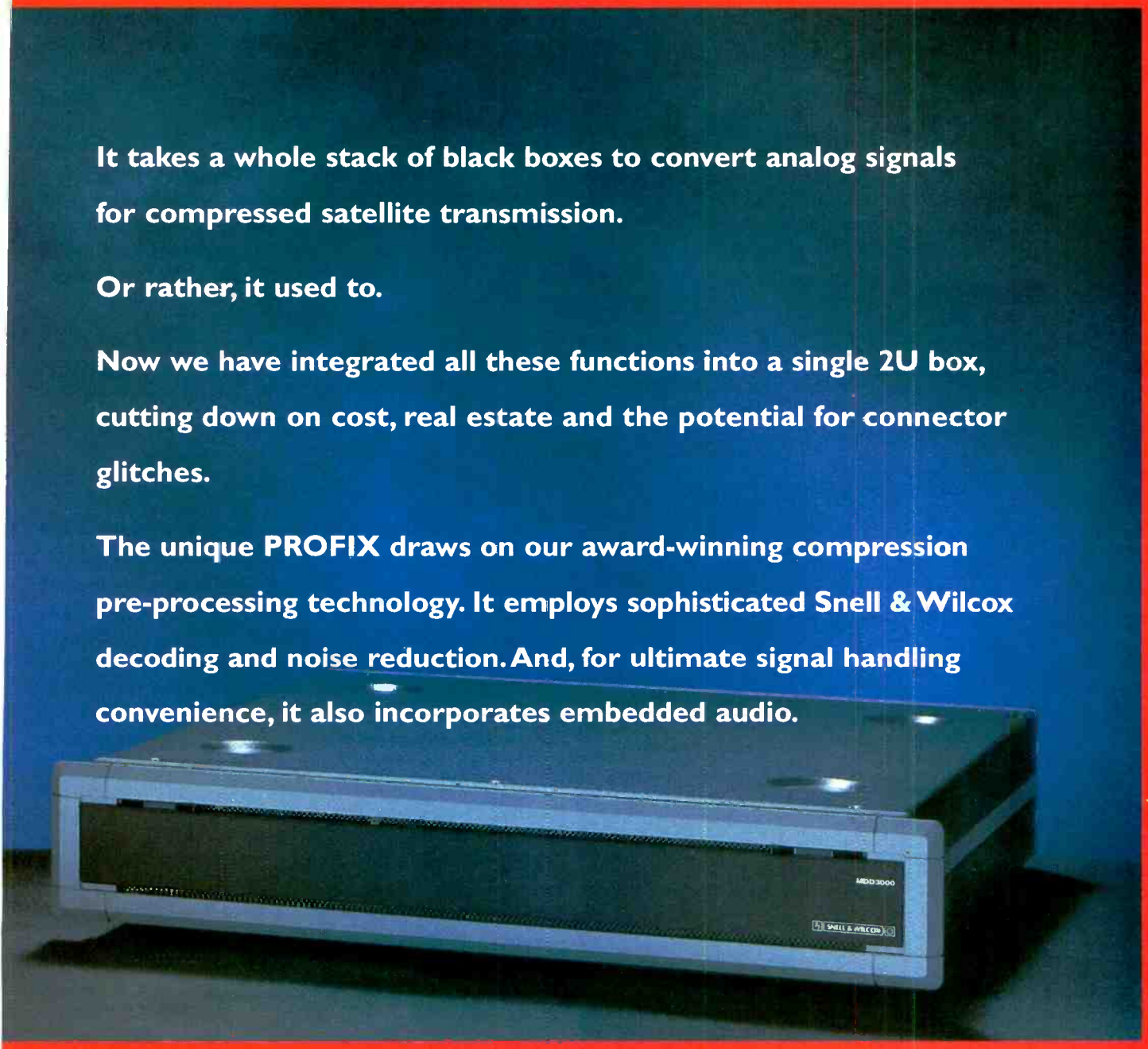

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splice point would be that the first frame after the splice point would be an I-frame. Among other things, an I-frame ensures that no previous frames are needed for proper decoding. A second requirement is that the last frame before a splice point be an I-frame or a P-frame, guaranteeing that all the needed B-frames can be decoded.

Another requirement of a splice point has to do with the state of the buffer in the decoder. This state could be anything from nearly full but emptying out to nearly empty but filling up. Decoder buffer "fullness" is used as part of the encoding process, and as long as we remain within a particular bitstream, it is not likely to cause a problem. However, splicing one bitstream onto another could cause the receiver's buffer to underflow or overflow. This could occur if the stream to be switched from leaves the buffer fairly empty, and the stream to be switched into assumes a nearly full buffer and expects to empty it shortly, resulting

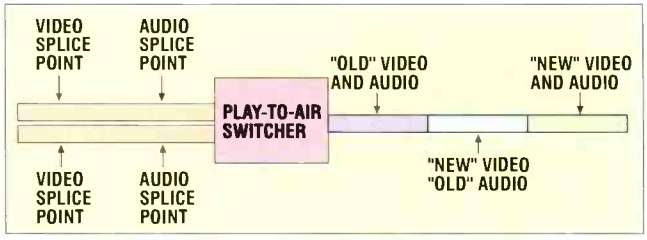

Figure 3. Relative timing of video and audio splice points and the result.

in a buffer underflow. (See Figure 2.) Flushing the decoder buffer is one way to deal with the problem, but this would likely result in the display of black or garbage on the viewer's screen. Another splicing method would be to constrain splice points such that they occur only when the decoder buffer is 50% full, however, this could make potential splice points few and far between.

Although meeting the previously mentioned requirements goes a long way toward solving the splicing problem, it is not a complete solution. Within the datastream are variables such as time stamps that need to be updated to prevent problems at the decoder. Additional datastream processing is required to update these variables properly.

Up to this point, only video splicing has been discussed. Within an MPEG program or transport stream, the audio and video are sent as separate packets. Because the packets are sent serially in a single stream, audio packets end up being sent before or after the video packets they are associated with. To re-synchronize the audio and video, each packet has a presentation time stamp (PTS) that allows the decoder to present the various audio and video packets in a synchronized manner. Both the audio and video signal paths include buffers. However, because of the amount of calculation required to reassemble the video, the video buffer is much larger than the audio buffer. To some extent, the larger the buffer, the larger the signal delay. Because of the additional delay in the video buffer, a bitstream splice that contains "old" audio and video before the splice and "new" video

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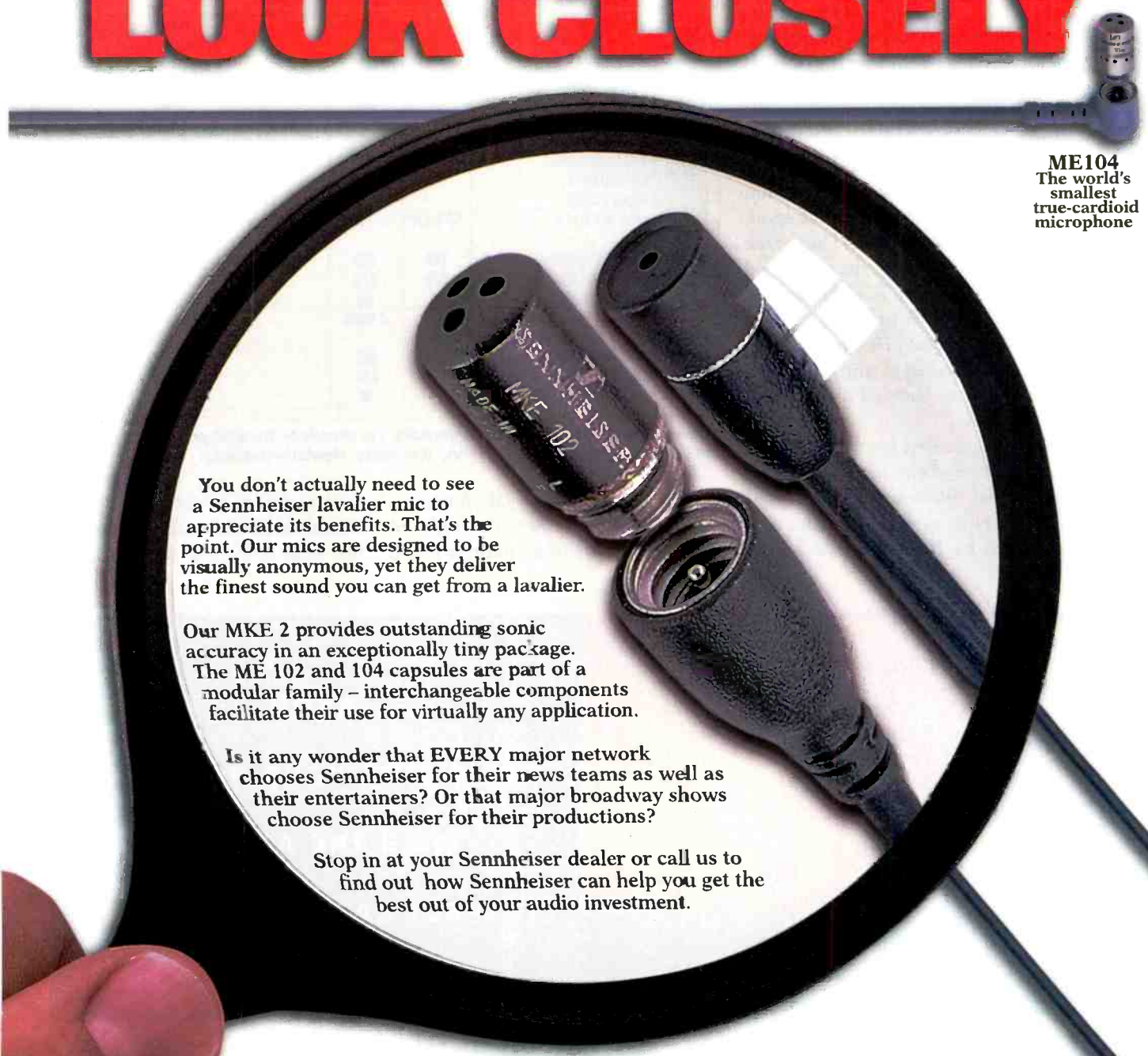

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and audio after the splice will likely be presented to the viewer as two separate splices. The first splice will effect the audio, and because of the longer buffer, the second splice will effect the video. If the audio and video splice points were separated at the splicer, the opposite occurs. (See Figure 3.)

Bitstream splices that result in audio/video mismatches are not seamless, and this problem will need to be addressed. One possible solution would be to fade down the audio before the splice and fade it up afterward. But like most of what has been discussed, this is easier to do in baseband. Finding ways to accomplish these apparently "simple" tasks requires additional research and development.

As in the past, new technologies have brought with them new challenges. Compressed bitstreams have allowed for more efficient use of storage and bandwidth, but have complicated many of the tasks we currently take for granted. As we move closer to the reality of DTV, creative solutions must be found for a variety of problems. Splicing bitstreams seamlessly may be one of the first steps down that long road. ■

LEVELS (SPECIFICATIONS)		PROFILES (FEATURES)				
		SIMPLE	MAIN	SNR/SPATIAL	HIGH	4:2:2
	FRAME TYPES SUPPORTED	I,P	I,P,B	I,P,B	I,P,B	I,P,B
	SAMPLING STRUCTURE	4:2:0	4:2:0	4:2:0	4:2:2	4:2:2
HIGH	MAX BIT RATE		80 Mb/s		100 Mb/s (25 base layer)	
	SAMPLES/LINE		1920		1920	
	LINES/FRAME		1152		1152	
	FRAMES/SEC		60		60	
HIGH 1440	MAX BIT RATE		100 Mb/s	60 Mb/s (15 base layer)	80 Mb/s (20 base layer)	
	SAMPLES/LINE		1440	1440	1440	
	LINES/FRAME		1152	1152	1152	
	FRAMES/SEC		60	60	60	
MAIN	MAX BIT RATE	15 Mb/s	15 Mb/s	15 Mb/s	20 Mb/s (4 base layer)	50 Mb/s
	SAMPLES/LINE	720	720	720	720	720
	LINES/FRAME	576	576	576	576	608
	FRAMES/SEC	30	30	30	30	30
LOW	MAX BIT RATE		4 Mb/s			
	SAMPLES/LINE		352			
	LINES/FRAME		288			
	FRAMES/SEC		30			

Table 1. MPEG-2 profile and level summary. For simplicity, the SNR and Spatial profiles are condensed into a single column. (Courtesy Hewlett-Packard.)

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Newsroom editing low-rez—why bother?

Newsroom editing and low-resolution images go hand in hand.

By David Schleifer

THE BOTTOM LINE:
Workflow in a facility is built around the technology in use and the goal to be achieved. As broadcasters seek new efficiencies, many are looking to non-linear systems. Some sites also are looking for ways to improve the access they have to media, whether it resides on a non-linear editor, server or tape. Shared access in a newsroom can bring with it technological roadblocks, however, as shared high-resolution video slows down editing time and overloads storage capabilities. $

Low-resolution is an answer for broadcasters looking to increase shared access capabilities. With the number of vendors offering low-resolution browsing systems and improving low-resolution quality, broadcasters can now begin to seriously look at low-resolution as a viable newsroom solution.

Quality vs. quantity

Broadcasters have always struggled with two opposing requirements: the need to work with the highest-quality images, a necessity that leads to higher-bandwidth requirements, and the need to lower the cost of storage (on tape or disk), thereby lowering the data threshold requirements for transmission (allowing transmission at lower data rates from the field, for example). Until fairly lossless compression is feasible, these two opposing requirements cannot be satisfied in one product without a compromise of one for the other.

Non-linear systems, which began as off-line systems, have worked their way from being fast and feature-rich editors that lacked the ability to output broadcast-quality pictures, to systems that can now output high-quality images that are ready for air. The ability to "finish" stories on non-linear systems has gained acceptance with technology able to handle higher bandwidth, resulting in higher-resolution images. At the point where the pictures became good enough to go on-air, many broadcasters decided that the benefits of non-linear editing were too compelling to ignore.

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Photo: Low-res.-based newsroom editors offer users many advantages.

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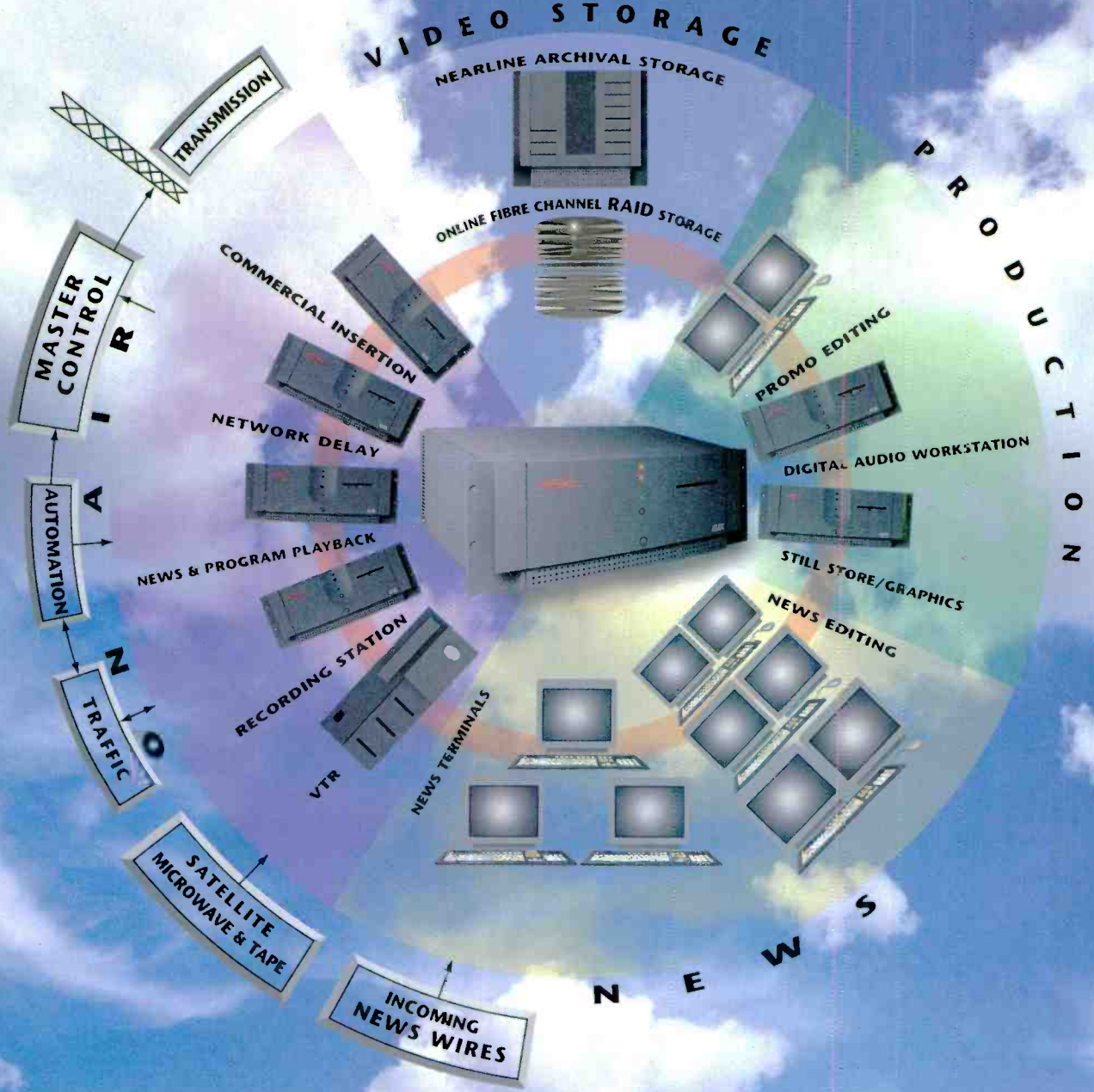

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Newsroom editing low-rez — why bother?

algorithms have not changed appreciably. The result is that non-linear systems are delivering on-air quality by increasing the bandwidth that they are capable of handling. The result is improved picture quality, but at a cost of increased storage and bandwidth requirements.

Non-linear advantages

Non-linear editors are gaining acceptance because they offer a better way to edit. They allow last-minute changes, are more flexible in the creative process and ultimately produce a better on-air product. As stand-alone systems, they have proved their ability to deliver flexible feature-rich editing tools at a cost-effective price.

Non-linear newsrooms also offer more collaborative operations, which require the sharing of information between edit locations. (See Figure 1.) Information can arrive simultaneously from several sources — text on the newsroom computer system, video from a satellite or microwave feed or background information over the phone. Often, several people will be working on a story at once. Additionally, several versions of a story may be edited from the same source material. These additional requirements have pushed vendors toward the development of several shared storage solutions.

One distributed solution is to push the video around, duplicating it wherever it is needed. This model imitates the traditional tape-based environment where a tape must be copied to be used in a second location or in order to be viewable at a second location while editing continues. The benefits of using disk-based, non-linear systems with this workflow are that unlike tape, quality does not degrade when copied, and as technology allows, copies could be made at faster than real-time. The drawbacks are the extra time it takes to make copies and the need to track and manage multiple versions of every file across your system. No matter how quick the system, editors pay enormous costs for storing files in several locations.

A second server-centric solution for sharing stories between editors is to place all of the stories in a central location, allowing all of the editors to use the same media at the same time. The advantages of this type of solution are no transfer time for re-use of media, no additional cost of storage (other than the original) and simpler media management. The disadvantages are that bandwidth issues constrain the system to a specific number of simultaneous users. If requirements are below the system's top-end, bandwidth is not an issue, but unlimited scalability becomes difficult.

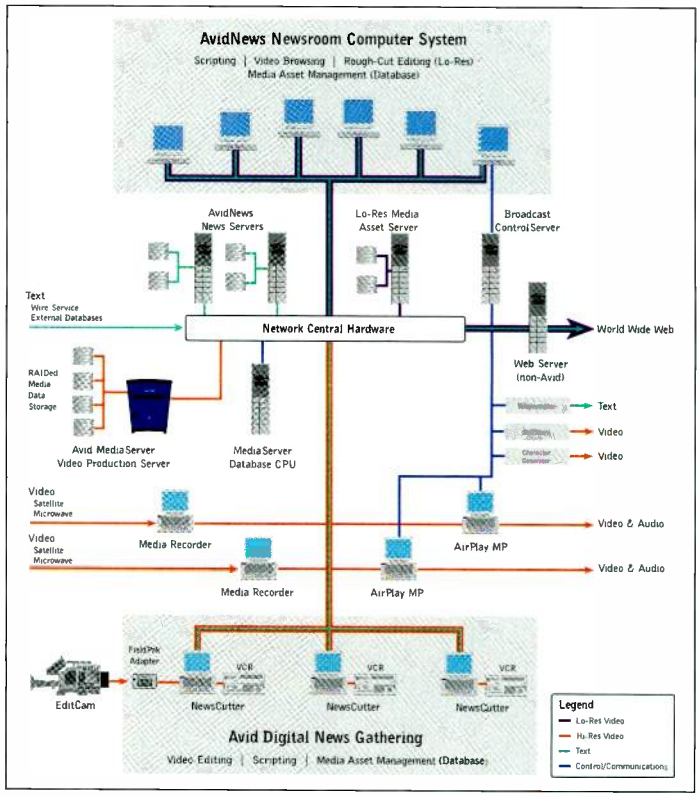

Figure 1. Sample workflow of digital news production on an Avid computer system.

Making media accessible

Today, neither of the solutions described are cost-effective for sharing media to every desktop in a newsroom. If the goal is to make video and audio available to every desktop, the cost of doing it in high-resolution becomes prohibitive. Even so, there are good reasons why a facility would want to get the media to the desktop. The primary reason is because it is at this point where broadcasters can start to change workflow to realize the benefits of disk-based computing.

Systems that require copying of files or that limit access to your media to less than the number of users in a newsroom lend themselves to improving existing workflow processes. For example, a system where video and audio are stored on disk instead of tape, then copied to an editor for editing, then moved to an on-air buffer for playback may take advantage of disk, networking and computers to get the job done, but will ultimately use this technology to deliver incremental improvements in transfer time, flexibility and accessibility of the media. A system that restricts the number of users to a total lower than newsroom requirements will also leave the need to develop workarounds to manage workflow requirements.

A solution that could increase the accessibility of media available with a server-centric system could solve these issues. The only way to solve the problems posed by a distributed solution is to speed transfer time to the point where it is of negligible consequence, and to reduce the cost of storage to the point where the cost of keeping multiple copies is no longer a disadvantage.

Low-resolution versions of media can offer solutions to many of these problems. Smaller, lower-resolution pictures can be moved faster and take up less space to store than broadcast-quality images.

But there are challenges. First, the low-resolution images are by definition non-broadcast quality. Second, the most popular and open compression codec for low-resolution (MPEG) is not easily editable. This means that low-resolution can not replace high-resolution versions, but can be used to supplement or extend the reach of the high-resolution media. Interestingly, it can offer advantages to server-based, stand-alone or even tape-based facilities.

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Newsroom editing low-rez — why bother?

Overall benefits

By pairing editable high-resolution pictures with low-resolution images that can be made accessible simultaneously to a number of users, systems can be designed that allow users to access media almost anywhere in the newsroom. The low-resolution system needs to give simultaneous multi-user access to a clip or story and it also needs to allow the decision-making process to start.

Because the low-resolution images are not broadcast quality, there is no real need to edit them. What is needed is the ability to make decisions, preview them and then create a broadcast-quality version as quickly as possible. With a server-centric solution, broadcasters can reduce the need for more clients by off-loading the previewing, pre-editing or simple editing processes to the low-resolution system. A site may be able to manage with two channels that go to air, four high-resolution editing systems and a low-resolution media system that allows an additional 10 or 20 users to preview and perform the equivalent of cuts-only edit decisions at their workstations.

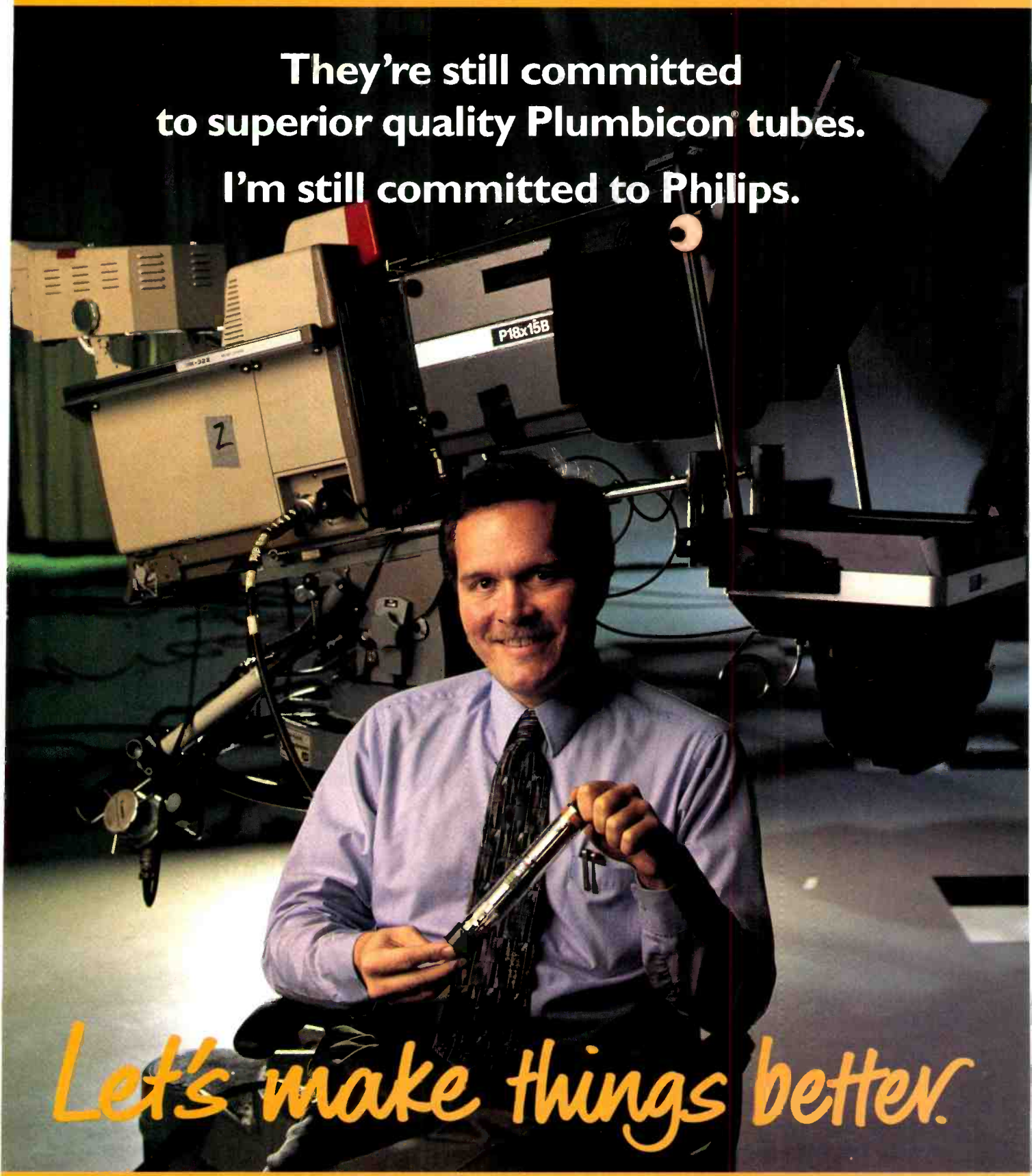
Pairing low-resolution with a system designed to move video around between multiple small servers raises some tough technical issues. First, the issue of media management is more complex and needs to be resolved if broadcasters ultimately want to conform the decisions made against the low-resolution images with the high-resolution images. Broadcasters need to know that pictures will be available, and that they are, in fact, the same clips.

Additionally, for the quickest turnaround between low- and high-resolution systems, broadcasters need a system that can take an edit decision list created with low-resolution images and play back the high-resolution version on the fly. Systems that create edited stories by playing out video in real time and re-encoding a new complete story will always introduce a delay between making a decision in low-resolution and playing back to air.

Some of the more interesting benefits that innovative use of low-resolution video can offer come with the ability to pair these systems with tape. Video coming into a facility can be dual digitized to tape and to a low-cost PC-based MPEG video-browsing system. The low-resolution images can be available with the incoming feed to allow editors to start making decisions, pulling clips and building stories or lists of selections.

Several users can now have access to the material that was previously locked up onto a single tape. They can even edit pieces using that material at the same time. Because all the users are using low-resolution images, they still need to build broadcast-quality versions to go to air. The easiest way to do this is to use a stand-alone, non-linear editor that should be capable of taking the EDL generated from the low-resolution sessions and then batch digitizing the relevant clips, creating the edited piece in the process. In its simplest implementation, a low-resolution system paired with tape would allow a producer to walk

Continued on page 126



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SYSTEMS INTEGRATION

4:2:2 or 4:1:1? What are the differences?

Deciding the best way to compress audio and video data can be difficult.

By Kenneth Hunold

THE BOTTOM LINE:
The composite NTSC signal uses a form of compression. Interlaced scan and a reduced chroma bandwidth were among the compromises that allowed the broadcast TV signal, including audio, to fit within the allotted 6MHz channel. Although today's compression systems use more sophisticated techniques, they can also leave significant artifacts in the image. Understanding the basics of modern compression systems makes it easier to avoid a variety of problems that can occur when compressed signals are used in the broadcast chain. $

Data compression for video signals has become almost as commonplace as the automatic transmission — you have to ask to be sure it's not included. The idea is to reduce the amount of data used to describe an image (and often the sound that goes with it). Ideally, the process should be lossless, however, lossless compression schemes can only go so far. Usually, it is not far enough, and the next step is to discard portions of the data that are (hopefully) not needed. Today, compression systems operate on digital video and audio data. Vision and hearing for humans is largely an analog process. To convert these continuously varying analogs to digital codes requires them to be frozen in time (sampled) and converted to a digital code (quantized). The sampling process and its structure are critically important in the acquisition of the data used to represent an image.

Photo: Tape room at WNBC. Photo courtesy of A.F. Associates, Inc. Photo by Andy Washnik Studio.

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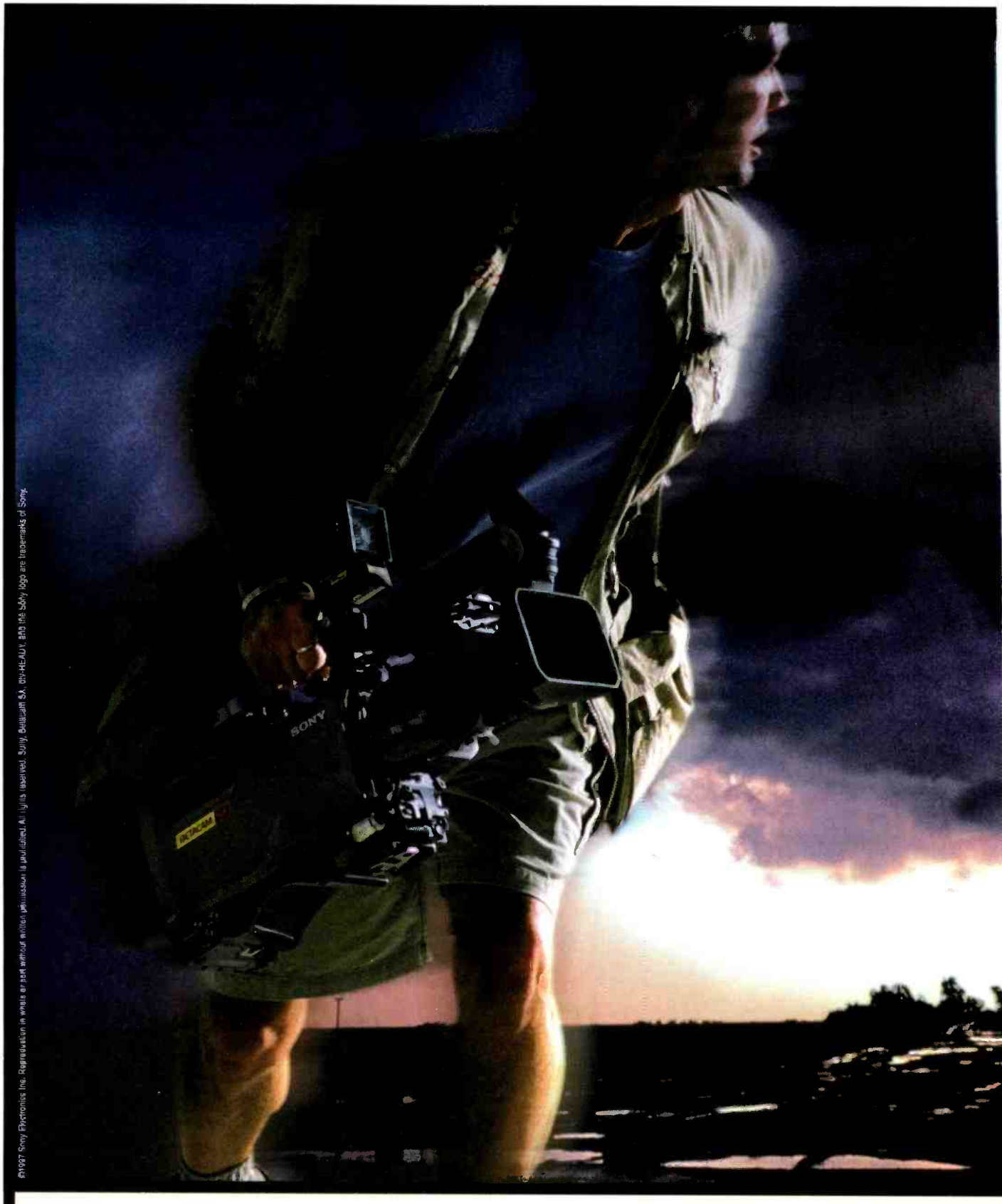

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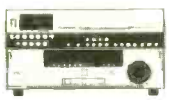

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4:2:2 or 4:1:1? What are the differences?

Today's compression algorithms

Many types of compression algorithms are in use today. Some of the most popular are MPEG, JPEG and DV. These systems use the discrete cosine transform (DCT) to convert video signals from the time domain to the frequency domain. This is a mathematical process, and does not reduce the amount of data in and of itself. Once the signal is in the frequency domain, it can be thought of as a spectrum display of information vs. frequency. Portions of the spectrum without a lot of information can sometimes be discarded. Ideally, this process is invisible, but if not, the results will (hopefully) not be objectionable. Varying the threshold below which the data is discarded determines how much data reduction can be accomplished.

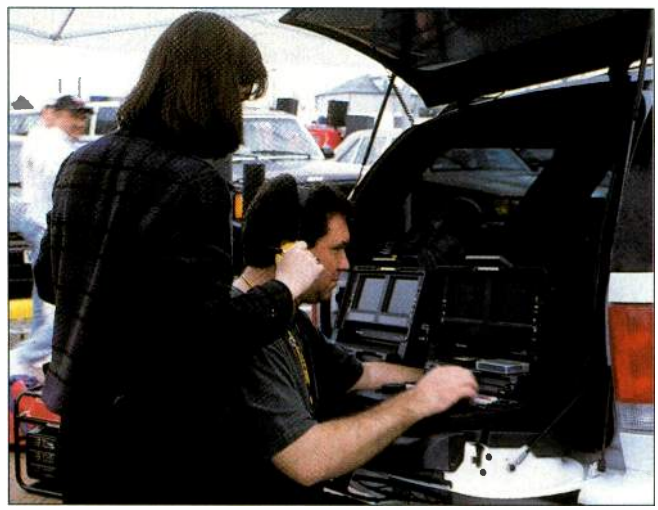
Both JPEG and DV compression algorithms operate on single frames of video, often described as intraframe compression. MPEG, because it was designed to work with moving pictures, has another tool in its arsenal that exploits the redundancy normally found in multiple frame sequences. Through pattern matching, MPEG can recognize portions of the image that have changed position in the raster. Instructions are then sent to the decoder about where a portion of the previous frame needs to be moved to assemble the current frame. This requires less data than retransmitting the repositioned picture data.

The "cost" of this multiple-frame compression efficiency is not being able to switch or edit on every frame. Comparing the data of two or more frames means the picture cannot be changed or edited during the frames being compared. The ability to edit at each and every frame is lost in an MPEG system. How often frames can be edited depends on how many frames are compared. In general, this is the same as the group of picture (GOP) structure.

Sampling methods

Data in a picture can also be reduced by reducing the amount of data used to describe the picture in the first place. A great deal of research into the Human Visual System (HVS) was conducted in 1950 when the National Television System Committee (NTSC) developed the standard for adding color information to the monochrome TV signal then in use. It was found that the HVS has less visual acuity to color information than to brightness or luminance information. Put another way, the HVS has less ability to resolve changes in color compared to changes in luminance.

This was the rationale behind restricting the bandwidth of the I and Q color signals in the 1953 NTSC color system. The research went on to show that, even though the human "color resolution" was less than the "luminance resolution," the eye and brain's response to certain colors was different than the response to other colors. This resulted in the determination that the bandwidth of the "in phase" or "I" signal (which corresponded to the eye's greater color sensitivity) could be reduced to 1.3MHz, while the "quadrature" or "Q" signal could be further reduced to 0.5MHz. This bandwidth reduction goes a long way toward explaining why chroma-key signals derived from NTSC-encoded signals often do not look as sharp as you would like. Key signals derived from full-bandwidth RGB (or GBR) primaries almost always look better.



Compression technology has helped make compact digital video equipment a reality. Portable editing units, like this Panasonic AJ-LT75 in use at WFXT, Boston, allow field footage to be edited on location.

Broadcast NTSC in 1953 was one of the earliest modern examples of "subsampling." Backed by the research into the HVS, color bandwidth was reduced. Modern NTSC encoders and decoders often use equal-bandwidth filters for both the I and Q signals. In fact, the NTSC encoder specified in SMPTE 170M (the studio NTSC standard, as opposed to the 1953 broadcast standard) uses equal bandwidth filters of 1.3MHz for both chroma-difference signals.

SMPTE 170M does not specify an upper limit for the frequency response of the luma portion of the signal, which explains why monitors with 600 to 900 lines of resolution are available or even needed. However, when SMPTE 170M signals are broadcast, a low-pass filter in the transmission chain limits the entire composite signal to4.2MHz. This filter also cuts off the upper sidebands of the chroma subcarrier, reducing the effective chroma bandwidth to about 0.6MHz.

4:2:2 or 4:1:1? You probably thought I would never ask. The x:y:z nomenclature has come to be a definition of the way we describe video. It refers to a ratio of the sampling rates used in the sample-and-hold circuits in analog-to-digital converters. Because Nyquist and others have said that the sample rate must be at least twice the highest frequency of interest, the nomenclature also relates to the bandwidths of the signals. The term "4" dates from when multiples of the color subcarrier frequency were being considered for the sample rate. For NTSC, this frequency would be 4x the 3.58MHz color subcarrier or approximately 14.3MHz.

This concept resulted in different sample rates for the different TV systems used worldwide. Fortunately, international organizations agreed to a single sampling rate that was related to both the 50 and 60Hz frame rates (and their related line rates.) The "4" term now

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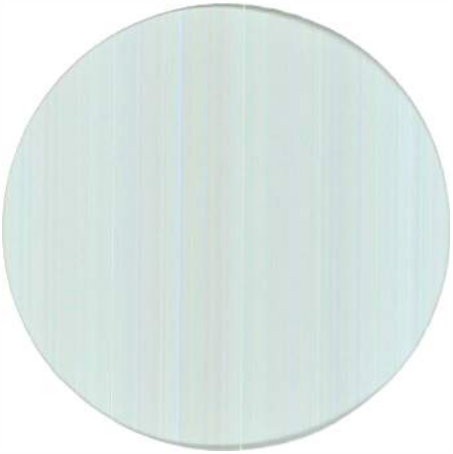
[THE IMAGE OF PERFECTION]



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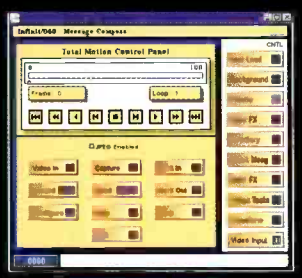

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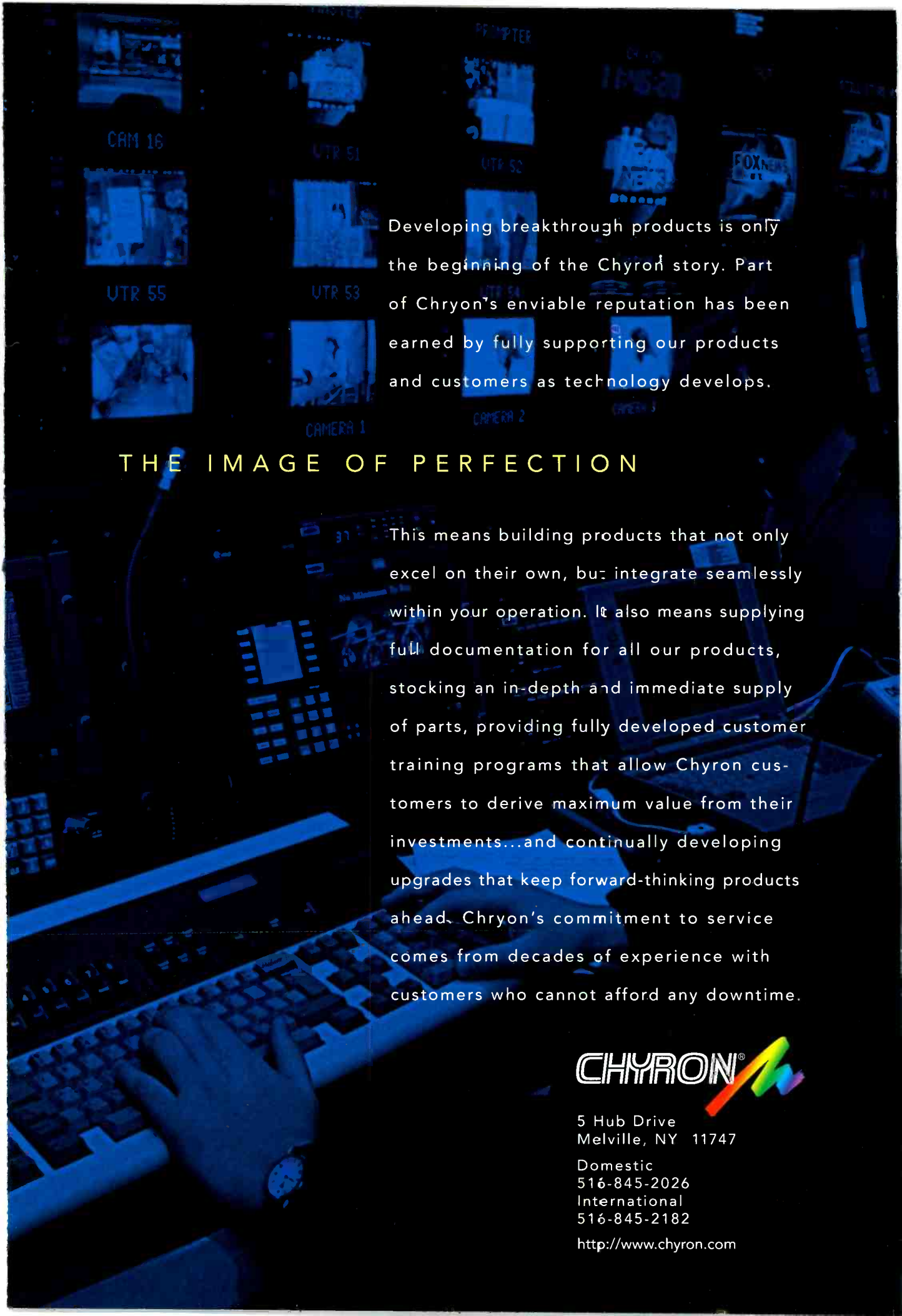

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4:2:2 or 4:1:1? What are the differences?

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refers to 13.5MHz, which is not that different from the 14.3 sampling frequency still used in NTSC composite digital systems. Thus, the 4:2:2 standard nomenclature refers to the luma signal being sampled at 13.5MHz, and the two color-difference signals each being sampled at 6.75MHz.

How could composite NTSC be described in this notation? If we use the 4:2:2 notation to describe the ratio of bandwidths, let's use 4 to represent 4.2MHz, the upper limit of broadcast NTSC. The ratio of the luma bandwidth to the color-difference bandwidth would become 4.2:0.6:0.6, or with the first term normalized to 4, 4:0.57:0.57.

It's not quite as easy to state a ratio for studio NTSC because of a lack of any hard-and-fast limit on luminance bandwidth. If we cheat and use 6.75MHz (because it is one-half the luminance sample rate in ITU-R 601 systems), we can describe studio NTSC as 6.75:1.3:1.3 or 4:0.77:0.77. All of these examples ignore any roll-off or "filter factor" of any anti-aliasing filters. 4:2:2 or 4:1:1? I guess when it comes to composite NTSC, it really doesn't matter. But before we blindly rely on computed ratios to make our decision, let's look at the big picture (literally) and into the future.

Modern broadcast cameras originate video signals as three equal bandwidth green, blue and red primary colors. If these color primaries are all converted to digital, they should all use the same sampling rate. Following our notation, which uses 4 to represent the 13.5MHz sampling rate, a system could be described as using 4:4:4 sampling. (Indeed, there are production devices that work with video signals that have been sampled in this manner.) These G, B, R primaries can be mixed (or matrixed) in the analog domain into luma and two color-difference components. This is essentially a lossless process that can maintain the full bandwidth of the original primaries, if desired. Unfortunately, these matrix equations are not universal, and different coefficients are used in different TV systems. (HDTV system operators beware.)

Acknowledging the lack of color acuity of the HVS, the ITU recommends that the color-difference signals be filtered so they can be sampled at half the sample rate of the luma signal. This results in the 4:2:2 sampling that forms the basis for most digital video systems. The quality of this system, as far as resolution is concerned, is generally considered acceptable for standard-definition TV production.

Studio production

Recalling our earlier observation that broadcast NTSC could be described as 4:057:0.57, it is important to note that 4:2:2 digital systems are expected to be robust enough to be used in complex production processes. There must be sufficient "headroom" to allow for manipulation and possible degradation downstream. Some of the complex pro-

4:2:2 or 4:1:1? What are the differences?

duction processes these signals will be subjected to include chroma-keying, color correction and image re-sizing. These processes benefit from working with signals that have the most detailed, highest quality visual information available. It's much easier to create a signal with a lower resolution from a high-resolution source than it is to "create" additional information through interpolation.

Unfortunately, we work (and live) in a world where bandwidth is not an unlimited commodity. Real-world VTRs and transmission systems have finite bandwidth, even though these restrictions are becoming less severe and/or less costly every day. Considerations such as size, weight and cost were factors that led to the development of compressed video systems, both analog and digital.

One way to make an overall compression system more efficient is to reduce the amount of data the compression "engine" must deal with. Economic and operational pressures are constantly pushing to do more with less. As observed previously, usually we want to preserve as much luma resolution as possible. Perhaps an area where such a "brute force" reduction of data might be possible is in the color-difference signals.

4:1:1 sampling describes just such a compromise. 4:1:1 sampling is used in the consumer DV format and the various professional enhancements to the format (many of which include the letters DV in their name.) Just to confuse the issue a little, DV compression can be (and is) also used in systems that use 4:2:2 sampling. In 4:1:1 sampling, luma signals are still sampled at 13.5MHz, but the sampling rate for the chroma signals is reduced to 3.375MHz or one-fourth the luma sample rate. This still allows for a chroma bandwidth of about 1.5MHz, still greater than the color bandwidth of SMPTE 170M (studio NTSC).

As usual, keep in mind the intended application and end result of the product when considering different video formats. One extreme is the distribution of 35mm motion pictures on VHS tape. In this case, no further production operations are intended (or even allowed in most cases) and the quality is considered acceptable.

If applications call for NTSC-originated material with little additional post-production, 4:1:1 systems are essentially transparent. Also, if size and weight are a concern, then the data reduction offered by 4:1:1 systems can lead to smaller recording systems, both tape- and disc-based.

It has been generally accepted that ITU-R 601 video represents the top of the standard-definition production system. Even so, systems with greater resolution exist, ranging from 4:4:4 systems described earlier, up to special 8:8:8 systems for film transfers. There is even a 4:2:2-sampled system for widescreen standard definition that uses an 18MHz luma sample rate (with the color-difference sample rate similarly enhanced.) If applications are more along the lines of acquiring information that will be subjected to further post-production, it is appropriate to acquire and record the most data possible.

Be aware, once 4:2:2 sampled video is passed to a 4:1:1 system, the extra data present in the 4:2:2 representation will be lost. Again, this may be acceptable, depending on the material's ultimate destination. At the risk of sounding a little like a motivational speaker, you have the power to decide how to mold and shape your images by your choice of acquisition format. Because sampling is the first step in the conversion to digital, it is crucial that the sampling be done "right." It sets the tone for the rest of the digital process. If information is lost in the sampling process, it is impossible to later reconstruct it accurately. Also, 4:2:2 and 4:1:1 are by no means the only type of sampling structure that images may be passed through. There are other options for sampling used by some systems and processes using compressed data.

For the highest possible quality, it is important to make sure that your choice of sampling structure is consistent, comparable or compatible with the rest of the production and delivery system that your product will be passed through on its way to the viewer. ■

Kenneth Hunold is an audio/video project engineer at the ABC Engineering Laboratory in New York.

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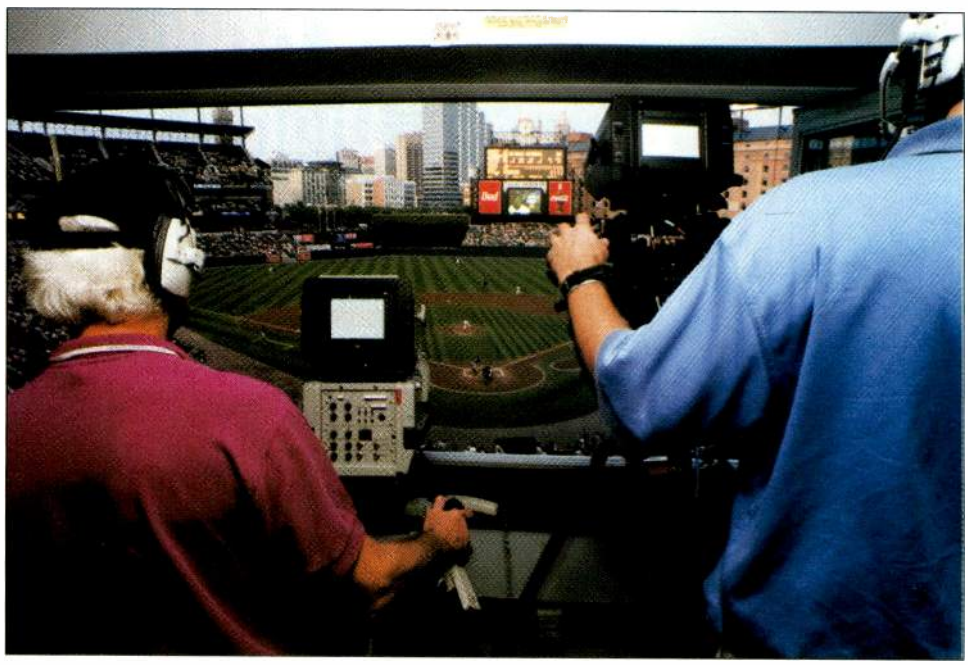

It's not 100% digital, but HDTV production is real today, and has been for some time.

By Steve Epstein, technical editor

THE BOTTOM LINE:
Despite the endless positioning on the RF side, high-definition television is a reality. On Sept. 16, 1997, the high-definition pictures and CD-quality sound of a baseball game between the Baltimore Orioles and the Cleveland Indians were broadcast digitally. A variety of equipment was assembled to handle this "first-ever" event. This successful broadcast proved not only that it could be done, but also how good television's future can look. $

In television, there are few things with more disaster potential than live production. One reason is the unpredictable nature of live events, while another is the minimal time available to recover from failures and/or mistakes. For some, live events provide a needed source of adrenaline, for others, the events are nothing short of terrifying. Despite this, in late August, Harris Corporation, along with a host of others, including Turner Engineering, began planning the first HDTV broadcast of a major league sporting event. The event, a baseball game between the Baltimore Orioles and the Cleveland Indians, was broadcast live and in high-definition, from Baltimore's Camden Yards on Sept. 16. About 300 or so viewers, including broadcasters, journalists and government officials, had the opportunity to watch the broadcast on a 16-foot by nine-foot screen at the National Press Club in Washington, DC.

The feed

Six Sony HDC-500 cameras with CCD imagers were used around the ballpark. Five of the cameras used Canon lenses and the sixth used a Nikon

Photo: For the broadcast, HDTV cameras and operators worked side by side with their NTSC counterparts. (Photos courtesy of Harris.)

Video Security In the Palm of Your Hand

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lens. The cameras were setup behind center field, behind home plate and in high and low locations along the first and third base lines. The camera outputs returned to HDVISION's production truck through multicore fiber-optic cables. Camera signals, as well as those used for production within the truck, were analog 1,125/60 interlaced. A Chyron HD Scribe character generator provided the graphics, while a pair of Panasonic HD D-5 decks provided slow-motion, as well as playback of sponsor messages (commercials) and pre-recorded segments. A Sony HDS-1000T seven-input, two M/E switcher, combined with a Sierra Video Systems downstream keyer, was used to produce the program feed. An AMEK audio console was used to produce embedded surround sound and everything was recorded for archive purposes on a Sony HDD-1000 uncompressed one-inch HD recorder.

Two separate output paths provided redundancy for the game feed. (See Figure 1.) One path used an RGB output from the truck. The video and audio were fed to an Alcatel/Teletra DS-3 encoder provided by Global Broadcasting. The encoder's 45Mb/s output went through Bell Atlantic/MCI fiber landlines to the Model HDTV station, WHD, in Washington. At WHD, the DS-3 decoder provided audio and RGB outputs. A small production switcher at WHD allowed the insertion of a logo. The signal was then fed into the Grand Alliance (GA) encoder. The GA encoder's output, a

Announcers for the HDTV broadcast included (left to right) Jim Palmer, Tom Davis (Baltimore Orioles announcers) and Jud French from Harris Corporation.

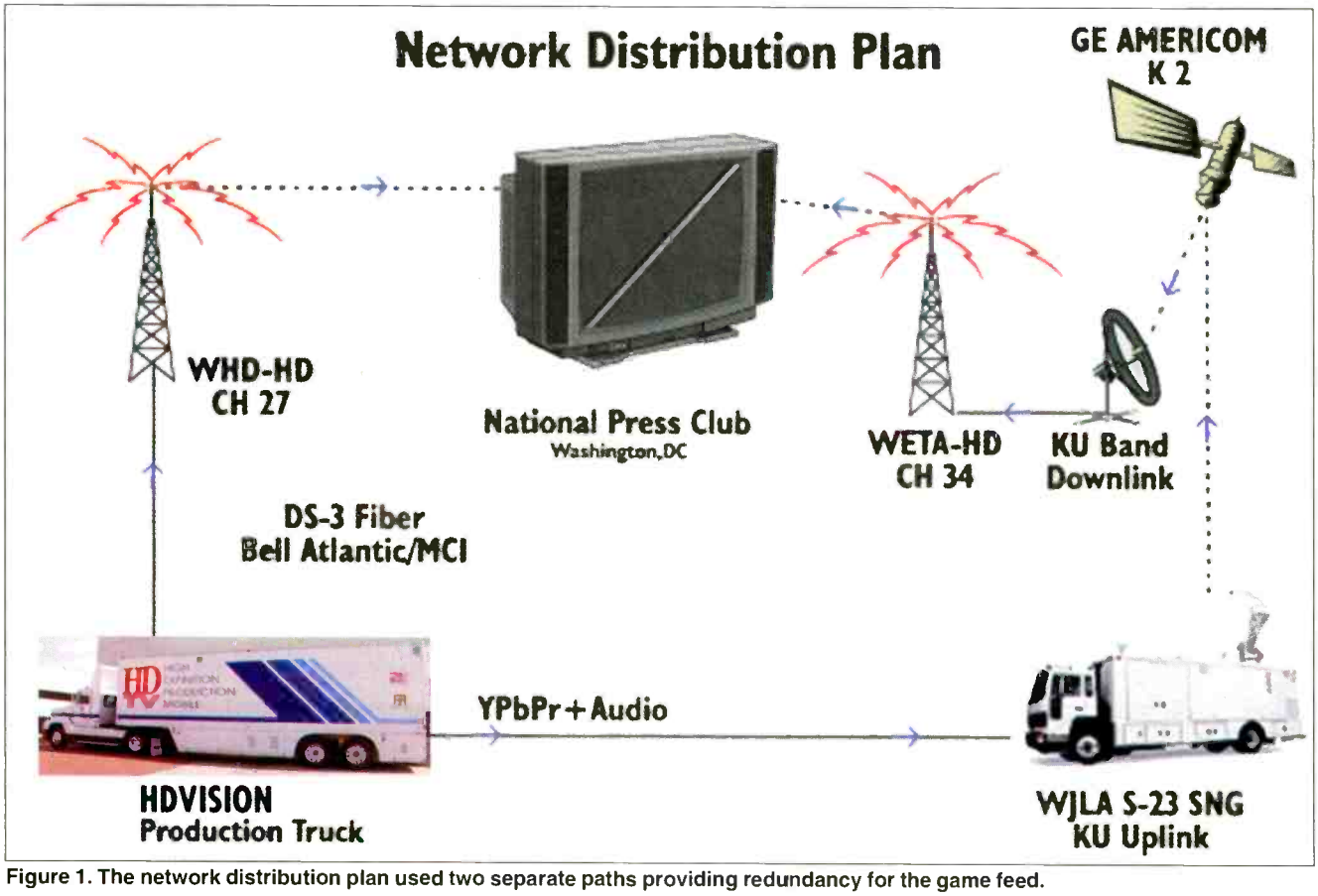

Figure 1. The network distribution plan used two separate paths providing redundancy for the game feed.

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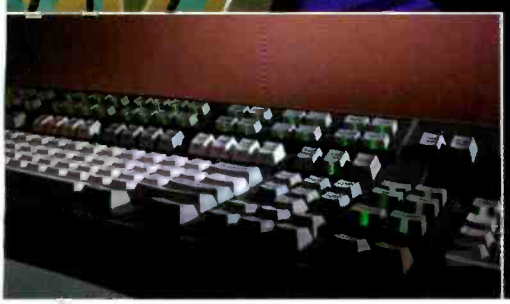

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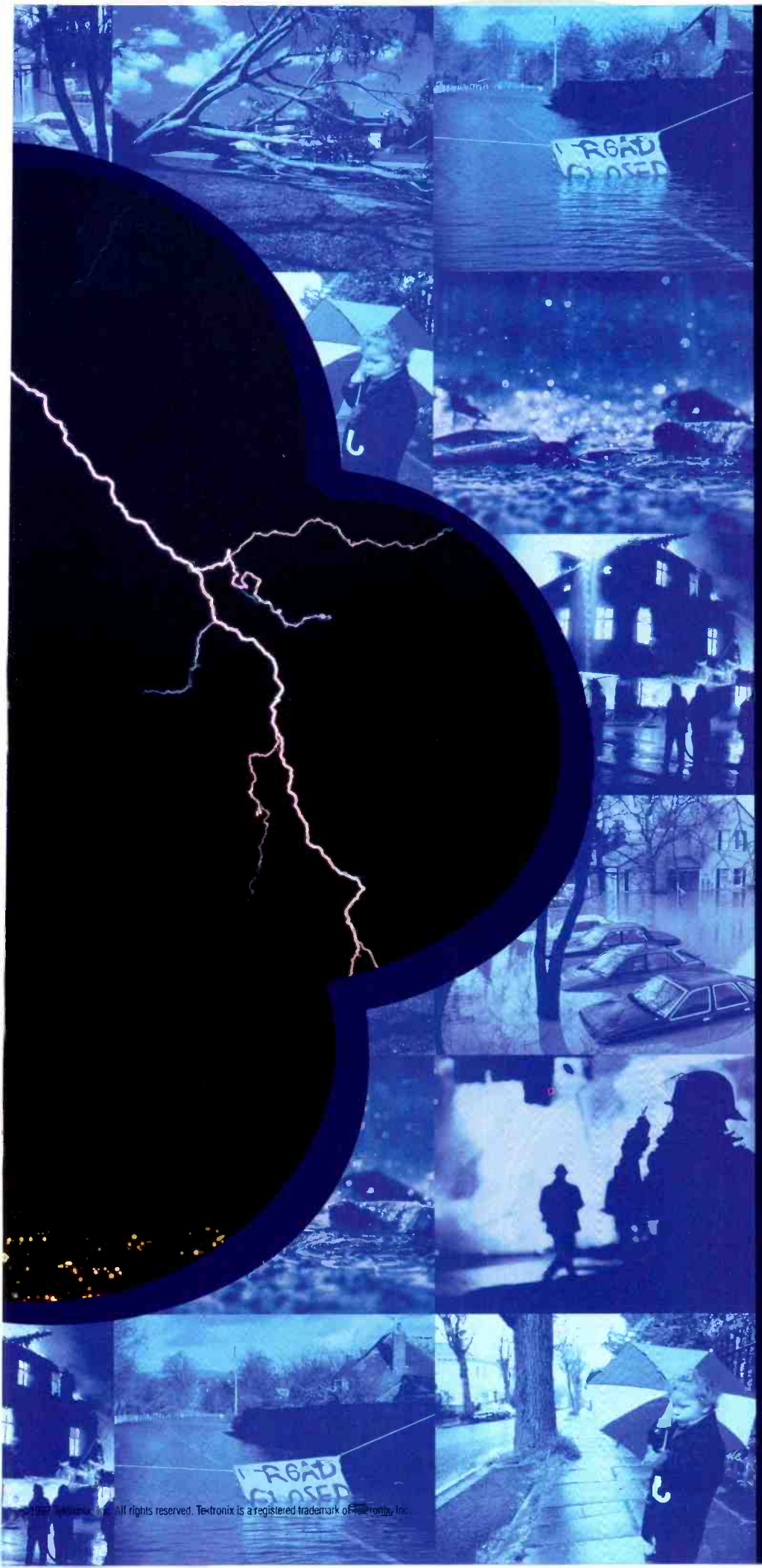

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19.39Mb/s parallel datastream, was converted to serial digital and broadcast on Channel 27 using a Harris SigmaCD transmitter.

The second path used a YPbPr output from the truck. This signal, along with its associated audio, was fed into a Melco ATSC encoder and converted to the 19.39Mb/s ATSC signal. The encoder's output went through a converter and then to a 45Mb/s QPSK satellite modem. The modem's digital output was uplinked to GE Americom's K2 satellite using WJLA's Ku-uplink truck. The signal was downlinked at WETA, demodulated back to the 19.39Mb/s ATSC bitstream and fed directly into WETA's Harris SigmaCD transmitter, which broadcast it on Channel 34.

At the receive end, the National Press Club in Washington, a UHF antenna pulled the signals off-air. A Zenith ATSC demodulator output the 19.39Mb/s datastream, which was level-converted and passed to a Melco ATSC decoder. The decoder provided YPbPr and audio outputs to the display and sound systems. (See Figure 2.) The large viewing area, setup to resemble Camden Yards, used a Hughes/JVC projector aimed at a 16-foot by nine-foot screen. A smaller Ampro display provided pictures outside the main viewing area and a return audio feed allowed the announcers at the stadium to hear comments from the podium at the National Press Club.

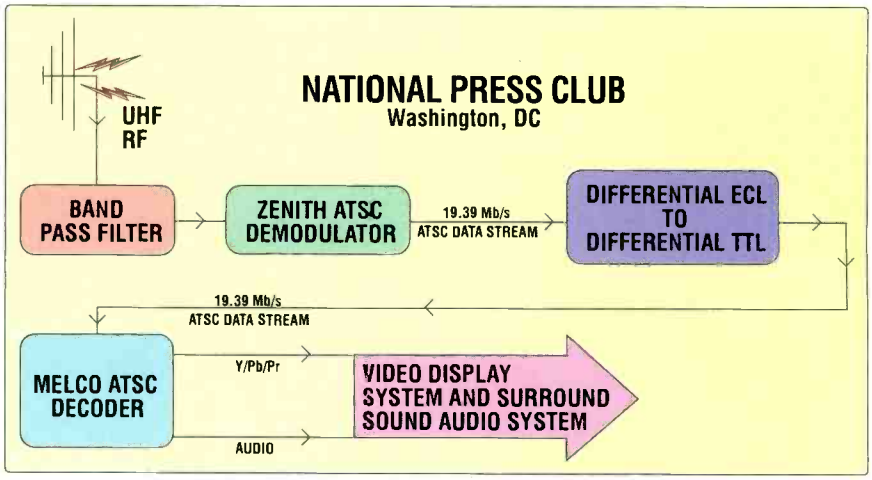

Figure 2. Several different pieces of equipment were required at the National Press Club to convert the broadcast HDTV signal into high-definition picture and sound.

Gauging the response

On the surface, with peanuts, pretzels and hot dogs, the event had all the trappings of a major league baseball

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game and provided an excellent venue for the promotional event. Beyond that, however, it provided a "proof-of-concept." For skeptics, it left little doubt that HDTV is possible — today. The overall audience response was positive, but what would you expect when they were looking and listening to an audio-video system that retailed for more than most luxury automobiles? The pictures showed some artifacts, mainly lag on highlights, and there were a few technical problems, but like scars in fine leather, they were simply proof of the authenticity of the broadcast.

The folks at Harris put together this event in just three weeks, which for a live broadcast, is not bad. For an HD broadcast, it is even more impressive, and the company deserves to be congratulated. Technical hurdles were around every corner; many of the ins and outs of the equipment used are not standardized, and in some instances, the equipment used was one of a kind, making backup systems out of the question. Level and signal converters had to be employed just to get from one device to another. And finally, much of the technology was analog, simply because the required digital versions were unavailable or not ready for prime time.

As good as these HD pictures looked, there is little doubt that in two to five years, they will look even better. Digital cameras using newer CCDs and processing technology, combined with the latest in lens technology are sure to produce even sharper pictures. A completely digital signal path will effectively eliminate degradation through the production chain. And finally, improved display technology will provide the viewer with an entirely new experience. Much like the early days of black-and-white television, as technology throughout the signal chain improves, so too will the quality of the final product. It has been said that a chain is only as strong as its weakest link. The Sept. 16 HDTV broadcast proved that despite a few weak links the HDTV broadcast chain is real. ■

Equipment list

At Camden Yards:
HDVISION's HDV-2 production trailer including:
- Six Sony HDC-500 CCD cameras
- Five Canon HD lenses
- One Nikon HD lens
- One Chyron HD Scribe CG
- Two Panasonic HD D-5 VTRs
- Sony HDS-1000T seven-input, two M/E switcher
- Sierra Video Systems downstream keyer
- Sony HDD-1000 uncompressed 1-inch HD recorder
- AMEK audio console

Telco feed used:
- Alcatel/Teletra DS-3 encoder and decoder
- Bell Atlantic/MCI fiber landlines
- Grand Alliance encoder
- WHD's Harris SigmaCD transmitter (Channel 27)

Satellite feed used:
- Melco ATSC encoder
- 45Mb/s QPSK satellite modems
- GE Americom's K2 satellite
- WJLA's Ku-uplink truck (Harris S-23)
- WETA's Harris SigmaCD transmitter (Channel 34)

At the National Press Club:
- Zenith ATSC demodulator
- Melco ATSC decoder
- Hughes/JVC projector and 16-foot by nine-foot screen
- Ampro rear-projection video display

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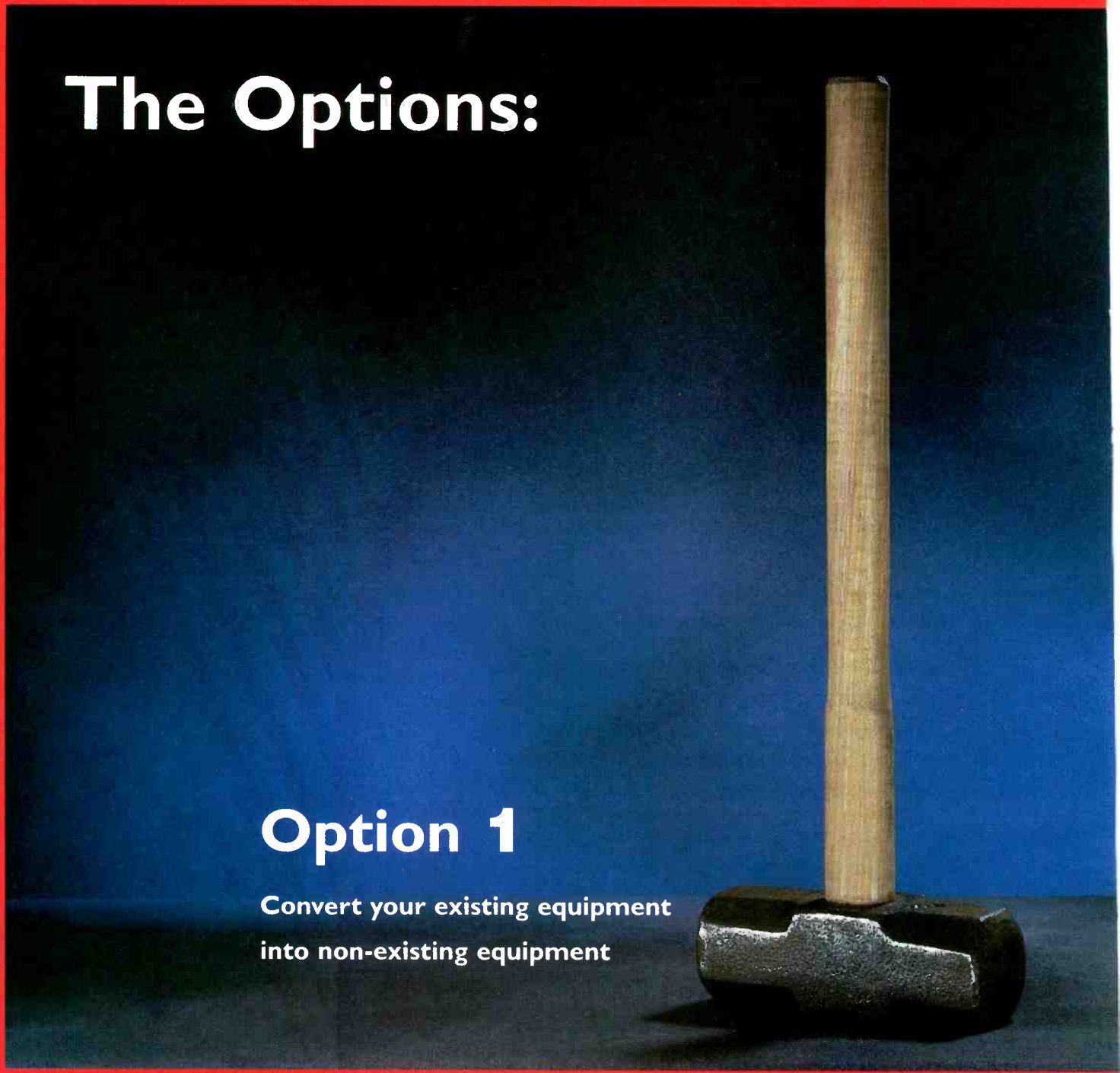

The HD6000, with serial digital I/O and a data rate of 1.5Gbps, is one of a range of ten HDTV processors from Snell & Wilcox designed to provide a seamless transition between all conventional and high definition standards.

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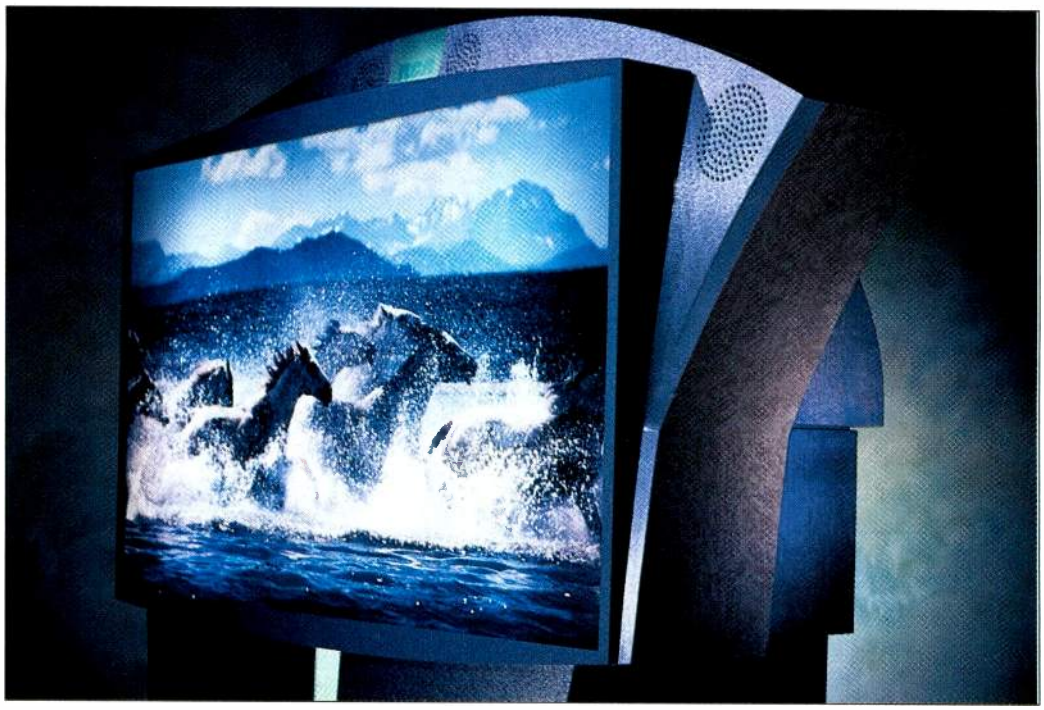
SYSTEMS INTEGRATION

HDTV update



Dealing with the Bonanza factor.

By Jerry Whitaker

THE BOTTOM LINE:
Now that the dust has settled from nearly a decade of serious standardization work on HDTV, the implementation phase is beginning to ramp up. Unfortunately, much work remains, not the least of which is to define just what the TV station of the future will be. $

After decades of research by companies and organizations around the world, and after years of standardization efforts and testing, a digital transmission system for high-definition television (HDTV) is finally here. This historic action by the FCC paves the way for consumers to enjoy the benefits of top-quality video and accompanying audio from a diverse group of industries, including:

- terrestrial TV broadcasting;
- cable television;
- direct-broadcast satellite television;
- personal computers; and
- video-on-demand services.

The formal process, which began in 1987, has lead to the establishment of a versatile new TV broadcasting standard. It is, in fact, the third American TV broadcasting standard — monochrome and color being the other two.

From the viewpoint of history, the battle over HDTV was simply a repeat of the two previous U.S. standardization fights, with a few new twists. Until the formation of the Grand Alliance (GA) in 1993, which brought together the competing digital HDTV systems, the fight — and it was a fight — represented politics on a grand scale. The process evolved from a discussion of technical merits to one centered on national pride and national security.

The grand plan

Although the FCC had said in the spring of 1990 that it would determine if all-digital technology was feasible for a terrestrial HDTV transmission standard, most observers viewed that technology as at least 10 years in the future. Later the same year, however,

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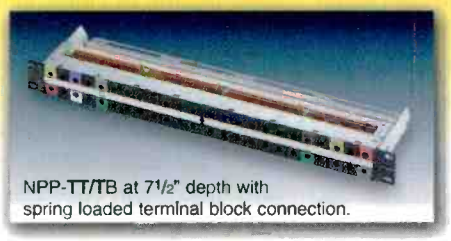

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General Instrument become the first proponent to announce an all-digital system. Later, all-digital systems were announced by MIT, the Philips-Thomson-Sarnoff consortium and Zenith-AT&T.

The FCC correctly anticipated the need for interoperability of the HDTV standard with other media. Initially, the focus was on interoperability with cable television and satellite delivery; both were crucial to any broadcast standard. But the value of interoperability with computer and telecommunications applications became increasingly apparent with the advent of all-digital systems.

The all-digital systems set the stage for another important step, which was taken in February 1992, when the Advisory Committee on Advanced Television Systems (ACATS) recommended that the new standard include a flexible, adaptive data allocation capability (and that the audio also be upgraded from stereo to surround sound). At its February 1993 meeting, the Advisory Committee also adopted a resolution encouraging the digital HDTV groups to find a way to merge the four remaining all-digital systems. The committee recognized the merits of being able to combine the best features of those systems into a single "best-of-the-best" system. With this encouragement, negotiations between the parties heated up, and on May 24, 1993, the seven companies involved announced the formation of the Digital HDTV Grand Alliance.

Well, the rest, as they say, is history. The key components of the Grand Alliance system include:

1. Support of two fundamental pixel arrays: 1,920x1,080 and 1,280x720. Each of these pixel formats supports a widescreen, 16:9 aspect ratio and square pixels — important for computer interoperability. Frame rates of 60, 30 and 24Hz are supported, yielding a total of six different possible scanning formats — two different pixel arrays, each having three frame rates. The 60 and 30Hz frame rates are important for video source material, while the 24 and 30Hz frame rates are important for film. A key feature of the system was the GA's commitment to using progressive scanning, also widely used in computer displays.

2. Video compression using the MPEG-2 international standard, which allows HDTV receivers to interoperate with MPEG-2 and MPEG-1 computer, multimedia and other media applications.

3. Packetized data transport, also based on MPEG-2, which provides for the flexible transmission of virtually any combination of video, audio and data.

4. CD-quality digital audio in the form of the 5.1-channel Dolby AC-3 surround-sound system.

5. 8-VSB, the modulation system selected for transmission, which facilitates maximum coverage area for terrestrial digital broadcasting.

The GA format employs principles that make it a highly interoperable system. It was designed with a layered digital architecture that is compatible with the international open systems interconnect (OSI) model of data communications that forms the basis of virtually all modern digital systems. This compatibility allows the system to interface with other systems at any layer, and permits many different applications to make use of various layers of the HDTV architecture. Each individual layer of the system is designed to be interoperable with other systems at corresponding layers.

Because of the interoperability of the system between entertainment television and computer and telecommunications technologies, the GA HDTV standard was expected to play a major role in the establishment of the national information infrastructure (NII). It was postulated early on that digital HDTV could be an engine that helped drive deployment of the NII by advancing the development of receivers with high-resolution displays and creating a high-data rate path to the home for a multitude of entertainment, education and information services.

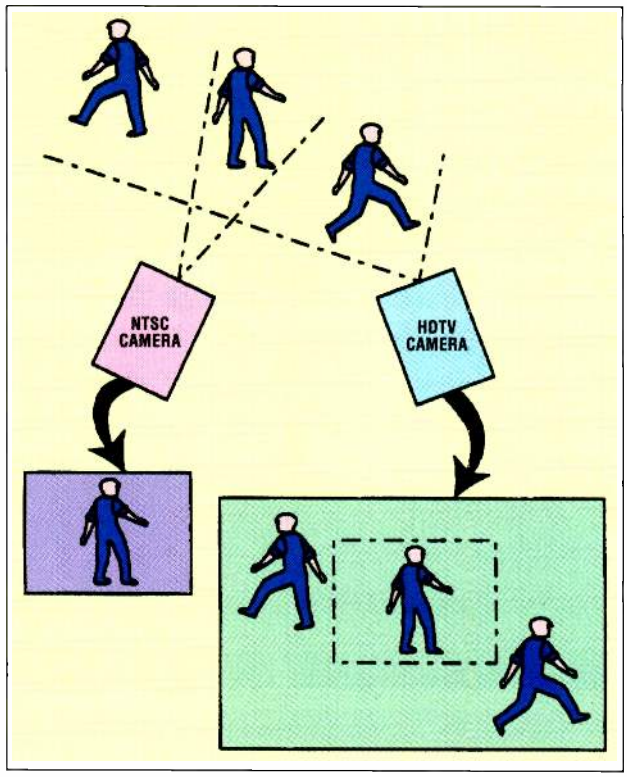

Figure 1. An illustration of the differences in the scene-capture capabilities of conventional video and HDTV.

Theory meets reality

As with many things technical, the plans of the designers and those of the end-users do not always coincide. It was assumed from the beginning of the standardization process for HDTV that the end result would be a system specifically for the delivery of pictures and sound of superb quality — a quantum leap over NTSC. The reality today is shaping up to be a bit different. TV stations and networks are asking themselves at this juncture in the HDTV roadway, do I really want to transmit HDTV or would I rather transmit more of the same stuff that I send out now?

As mentioned previously, the flexible nature of the GA system permits broadcasters to decide whether they would like to send to viewers one superquality HDTV program or several "NTSC-equivalent" programs. As of this writing, some networks and large station chains have made their intentions known. Predictably, the choices have

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caused a bit of controversy within the industry.

The arguments for full-quality HDTV are obvious: great pictures and sound — a completely new viewing experience. Numerous programs could greatly benefit from the increased resolution and viewing angle thus provided; sporting events and feature films immediately come to mind. There are also many programs that would gain virtually nothing from HDTV. The world does not need to see *Roseanne* in widescreen, for example. As with most issues in broadcasting, the programming drives the technology. What the industry needs today is the equivalent of *Bonanza* for the widescreen.

Arguments for the multiple-stream approach to digital broadcasting follow along similarly predictable lines. Broadcasters have long felt constrained by the characteristics of the NTSC signal: one channel, one program. Cable companies have no such constraint. As with "true HDTV," programming will drive the multistream business model. For example, a station might allocate its channels as follows:

- regular broadcast schedule channel;
- 24-hours news channel (which would simply feed off or to the main channel operation);
- special-events channel (public affairs shows during the day and movies at night); and
- text-based informational channel.

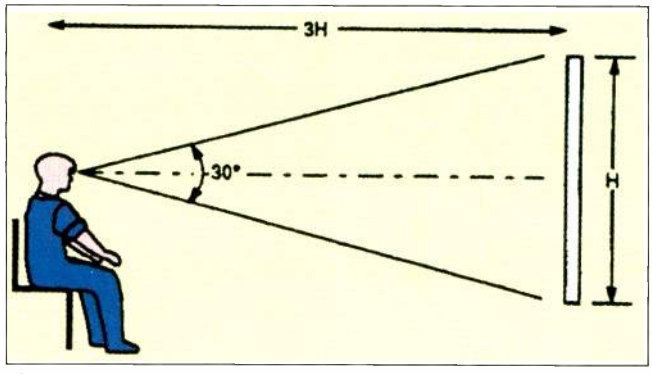


Figure 2. Viewing angle as a function of screen distance for HDTV. Remember, the viewing angle for conventional NTSC is on the order of 10°.

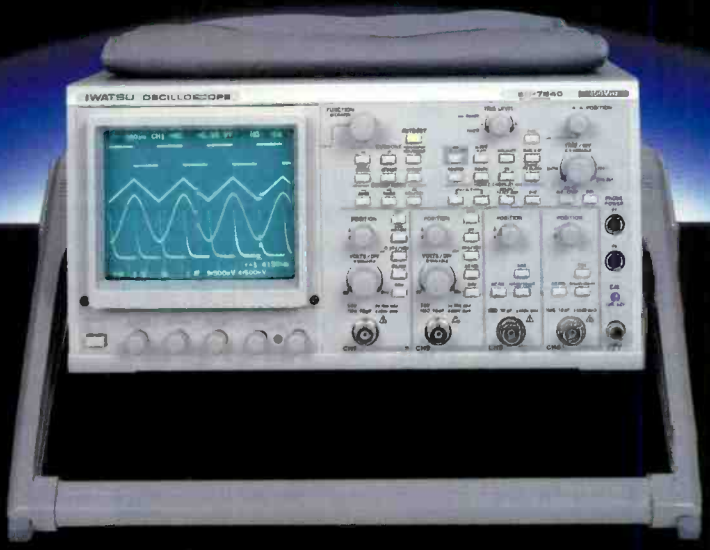
It is reasonable to assume such a model could be successful for a station in a major market. The question must be asked, however, how many such services can a single market support? Furthermore, aside from the news — which is expensive to do, if done right — programming will make or break these come-along channels?

With the types of options available under the Grand Alliance system, it is no surprise that the correct designation today for HDTV is DTV (digital television). Choose your model; place your bets.

Characteristics of video images

Before you can make a choice of DTV models, you must first appreciate what HDTV has to offer. High-definition

ANALOG Oscilloscopes



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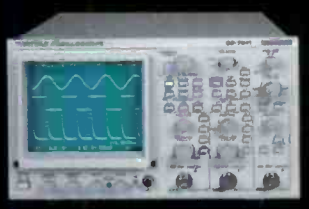

100 MHz

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television has improved on earlier video techniques primarily by calling more fully upon human vision. The primary objective of HDTV has been to enlarge the visual field occupied by the video image. This has called for larger, wider pictures that are intended to be viewed more closely than conventional video. To satisfy the viewer at this closer inspection, the HDTV image must possess proportionately finer detail and sharpness of outlines.

In its search for a "new viewing experience," NHK conducted an extensive psychophysical research program in the early 1970s. (It was NHK and other Japanese firms, of course, that got the HDTV ball rolling in the first place.) A large number of attributes were studied. Non-technical people were exposed to a variety of electronic images, whose many parameters were then varied over a wide range. A definition of those imaging parameters was being sought, the aggregate of which would satisfy the average viewer that the TV image portrayal produced an emotional stimulation to that of large-screen film cinema experience. [1]

Central to this effort was the pivotal fact that the image portrayed would be large, much larger than current NTSC TV receivers. Some of the key definitions being sought by NHK were precisely how large, how wide, how much resolution and the optimum viewing distance to this new video image.

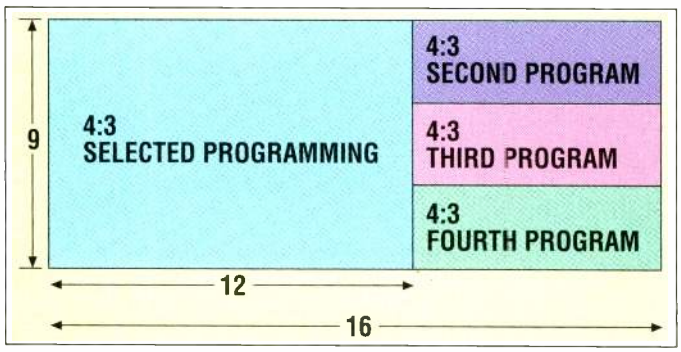

Figure 3. The characteristics of the 16:9 display permit multiple programs to be displayed simultaneously, as illustrated here.

A substantial body of research gathered over the years has established that the average U.S. consumer views the TV receiver from a distance of approximately seven picture heights. This translates to perhaps a 27-inch NTSC screen viewed from a distance of about 10 feet. At this viewing distance, most of the NTSC artifacts are invisible on a CRT display, with perhaps the exception of cross color. The scanning lines are invisible. The luminance resolution is satisfactory on camera close-ups. A facial close-up on a modern, high-performance 525-line NTSC receiver, viewed from a distance of 10 feet is quite a realistic portrayal. But the system quickly fails on many counts when dealing with more complex scene content.

Wide-angle shots represent one simple and familiar example of the limitations of NTSC and the marginally better PAL and SECAM systems. TV camera shooting, however, has long adapted to this inherent restriction of 525 NTSC — as witnessed by the continuous zooming in for close-ups on most sporting events. The camera operator accommodates for the technical shortcomings of the present TV system and delivers an image that meets the capabilities of NTSC and the other common formats reasonably.

There is, however, a penalty. (See Figure 1.) The average home viewer is presented with a narrow angle of view — on the order of 10°. The video image has been rendered "clean" of many inherent disturbances by the 10-foot viewing distance, and made adequate in resolution by the action of the camera operator; but in the process, the scene has become a small "window." The now acceptable TV image pales in comparison with the sometimes awesome visual stimulation of the cinema.

The primary limitation of the conventional TV system is, therefore, one of image size. A direct consequence is further limitation of image content;

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the angle of view is constantly constricted by the need to provide adequate resolution. There is significant, necessary and unseen intervention by the TV program director in the establishment of the image content that can be passed on to the home viewer with acceptable resolution.

HDTV, on a direct-view CRT monitor, displays a technically superb picture. The *information density* is high; the picture has a startling clarity. However, when viewed from a distance of about seven picture heights, it is virtually indistinguishable from a good NTSC portrayal. The wider aspect ratio is the most dramatic change in the viewing experience at normal viewing distances.

If HDTV is to find a home for the consumer, it will find it in the living room. If consumers are to retain the average viewing distance of 10 feet, then the minimum image size required for an HDTV screen for the average definition of a new viewing experience is about a 75-inch diagonal. This represents an image area in excess of present 27-inch NTSC (and PAL and SECAM) TV receivers. The viewing geometry translates into a viewing angle close to 30°, and a distance of only three picture heights between the viewer and the HDTV screen. (See Figure 2.)

The problem at this point is the display device. Despite all of the advancements made in projection systems, they still pale in comparison to a direct-view CRT in terms of resolution, picture clarity, lack of artifacts, speed of rewrite, brightness and cost when taken on a picture-for-picture comparison. The promise of a "picture frame" flat-panel display is still a long way off. Researchers have been predicting that a practical flat-panel display of high resolution would be available in about five years — since about 1960. Given the size and weight restrictions of CRTs, the maximum practical screen size is perhaps 38 inches in diagonal. After that point, the sheer mass of glass necessary to maintain the vacuum becomes unmanageable.

The race is on

A significant component of the FCC decision on DTV was, of course, the timetable for implementation. Few industry observers believe that the timetable can be met. Fewer believe that the deadline will really stick. Be that as it may, the most basic question for TV stations today is what to do with the information-carrying capacity of the DTV system. The choice of HDTV programming or multiple-stream programming has an immense impact on facility design and budget requirements. Once that decision has been made, the implementation problems must be dealt with, including:

- weighing signal coverage requirements against facility costs;
- tower space availability for a DTV antenna;
- transmitter trade-offs and choices;
- STL, IRC and satellite links;
- master-control switching and routing;
- production equipment (cameras, switchers, special-effects systems, recorders and related hardware); and
- studios and sets for widescreen presentations.

One of the major problems facing stations that are now planning for this conversion is that, for many issues, the answers are not yet known. In some cases, the *questions* are unknown. Hardware vendors and consultants are scrambling to meet the demands for answers and equipment. It is likely, however, to be a slow process.

The comparison is often made between the conversion from NTSC to DTV and the conversion from black-and-white to color decades ago. Many of the lessons learned in the late 1950s and early 1960s, however, are of little use today, because the broadcast paradigm has shifted. The most important lesson from the past, however, is still valid: build the technology around the programming, not the other way around (the *Bonanza factor*). ■

Jerry Whitaker is a consulting editor for Broadcast Engineering *magazine.*

References:
1. Thorpe, Laurence J., "Applying High-Definition Television," in Television Engineering Handbook, *revised edition, K.B. Benson and J.C. Whitaker editors, McGraw-Hill, New York, 1992.*

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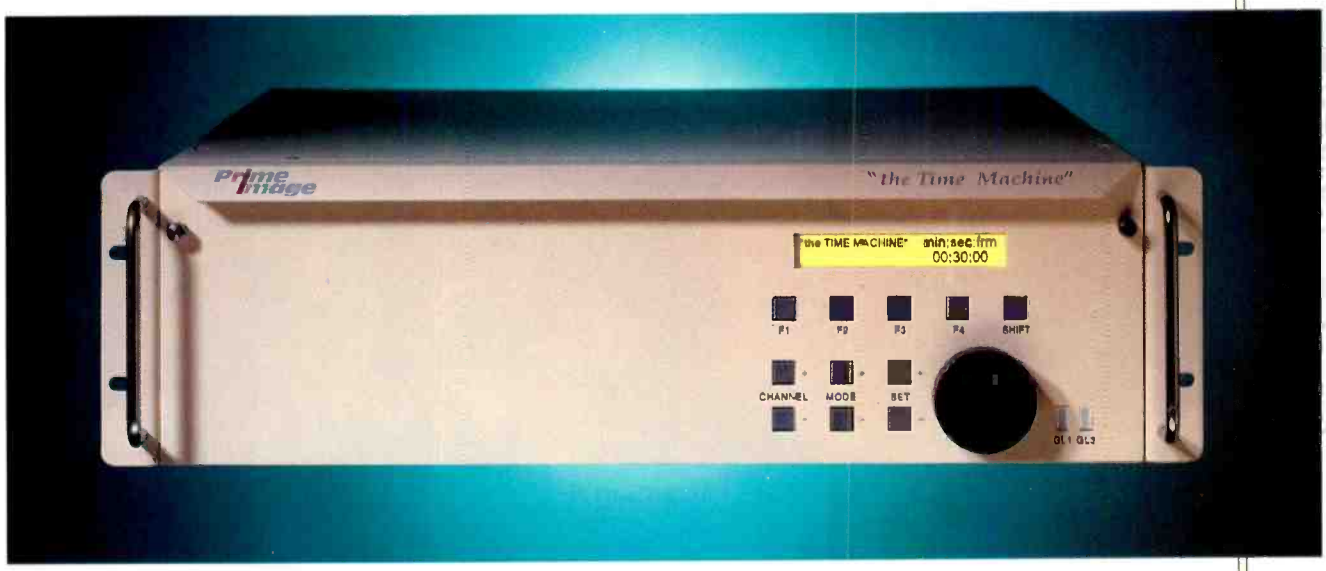

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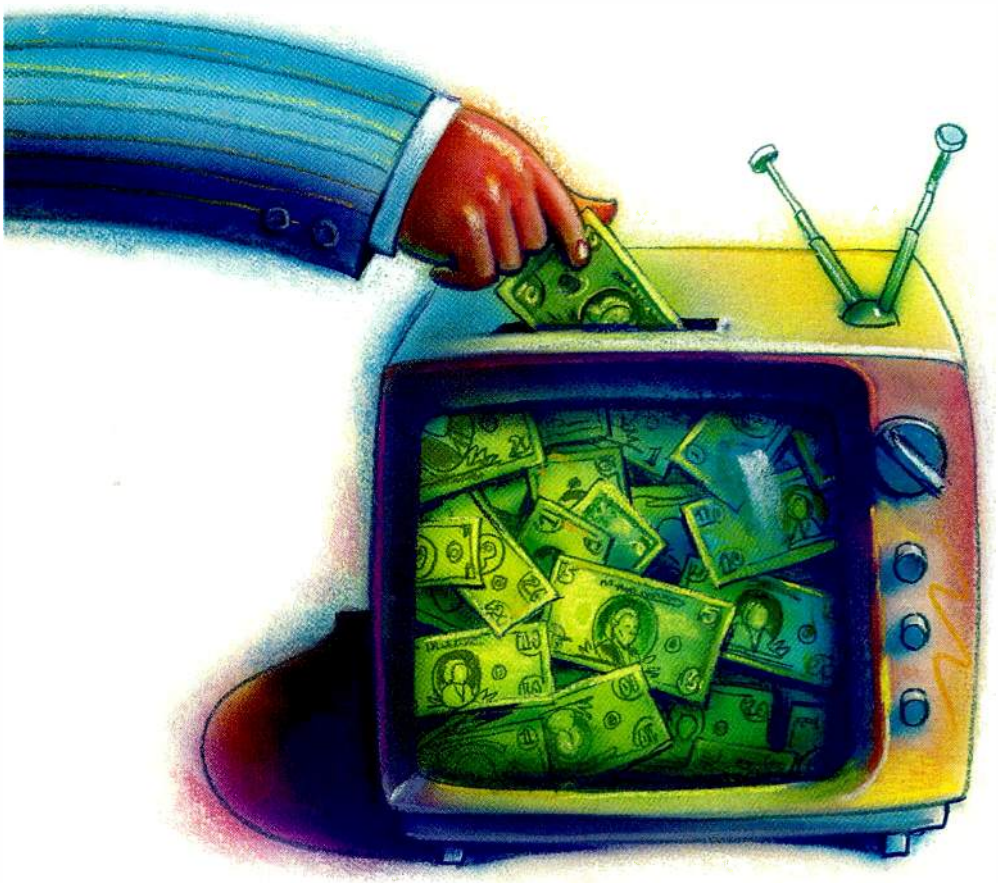
1997 Salary Survey



Financial futures are holding steady.

By Dawn Hightower,
senior associate editor

With autumn comes falling leaves, cooler temperatures and the results of *Broadcast Engineering's* annual Salary Survey. The results are in. To check out your financial future, look to the tables to find out how your salary really compares to your peers in similar job positions. The good news is that salaries for most job titles held steady or increased slightly across the board this year.

New in this year's survey was a section on "Industry Developments," where we asked you about HDTV and digital transmission. Check out the sidebar, "DTV in the Air," on p.102, to find out how many stations plan on installing digital capability. The answer may surprise you.

Look to the tables

Five tables representing the salaries for Executive/General Management, VP/Director of Engineering, Broadcast Chief Engineer, Staff Engineer and

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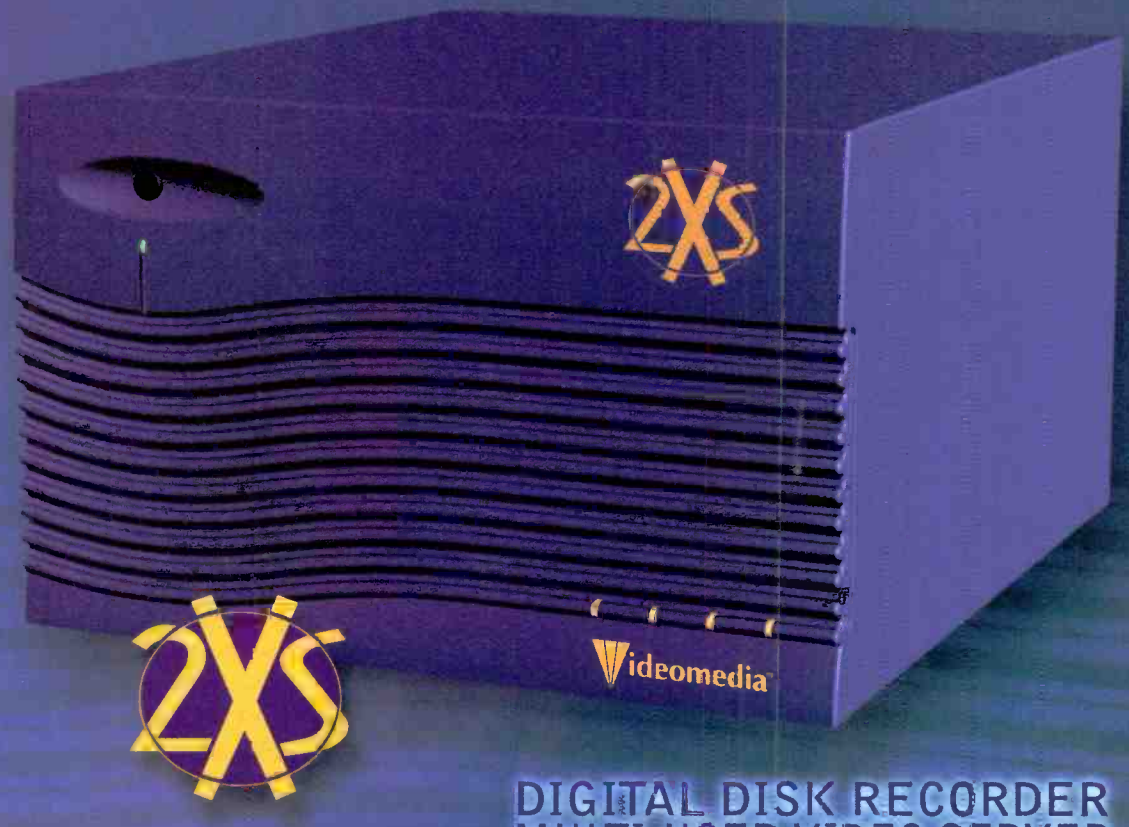

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• Two Channels of Video	Independent 4:2:2 Play/Rec, or Sync as a Key Channel
• Four Channels of Audio	Append Any/All to Either Video Stream
• Industry Standard Interfaces	Composite, Y/C, Component, SDI, RS 422, V-LAN
• Internal or External RAID	Four Drives Internal, or Many More External
• Ultra SCSI or Fibre Channel	Up to 125 Drives with Fibre Channel, Shared 2XS's
• User Selectable M-JPEG	Lossless 1.7:1 to 2.5:1, or Lossy 2.5:1 to 20:1
• Network Ready	Ethernet, Fibre Channel, and V-LAN
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EXECUTIVE/GENERAL MANAGEMENT

Salary Level	Broadcast Top 50	Broadcast Below Top 50	Cable	Production
Less than $25,000	7.7%	8.7%	18.5%	17.1%
$25,000 to $34,999	0%	13%	11.1%	7.3%
$35,000 to $49,999	0%	13%	18.5%	24.4%
$50,000 to $74,999	15.4%	30.4%	22.2%	31.7%
$75,000 to $99,999	26.9%	21.7%	11.1%	4.9%
$100,000 or more	50%	13%	18.5%	14.6%
Est. Median Salary	$100,000+	$61,666	$52,500	$51,250

VP/DIRECTOR OF ENGINEERING
(Includes Chief Engineer for Cable and Production)

Salary Level	Broadcast Top 50	Broadcast Below Top 50	Cable	Production
Less than $20,000	0%	0%	0%	0%
$20,000 to $24,999	0%	0%	2.4%	7%
$25,000 to $29,999	0%	9.1%	9.5%	2.8%
$30,000 to $34,999	0%	9.1%	11.9%	5.6%
$35,000 to $39,999	0%	9.1%	4.8%	4.2%
$40,000 to $44,999	9.3%	18.2%	9.5%	9.9%
$45,000 to $49,999	11.6%	13.6%	19%	9.9%
$50,000 to $54,999	7%	9.1%	11.9%	14.1%
$55,000 to $59,999	9.3%	9.1%	7.1%	8.5%
$60,000 to $64,999	7%	9.1%	0%	4.2%
$65,000 to $69,999	7%	9.1%	2.4%	2.8%
$70,000 to $74,999	9.3%	0%	4.8%	4.2%
$75,000 to $79,999	4.7%	0%	4.8%	2.8%
$80,000 to $84,999	0%	0%	2.4%	5.6%
$85,000 to $89,999	2.3%	0%	2.4%	1.4%
$90,000 to $94,999	2.3%	0%	2.4%	2.8%
$95,000 to $99,999	2.3%	0%	2.4%	7%
$100,000 or more	27.9%	4.5%	2.4%	7%
Est. Median Salary	$69,999	$48,333	$48,749	$53,999

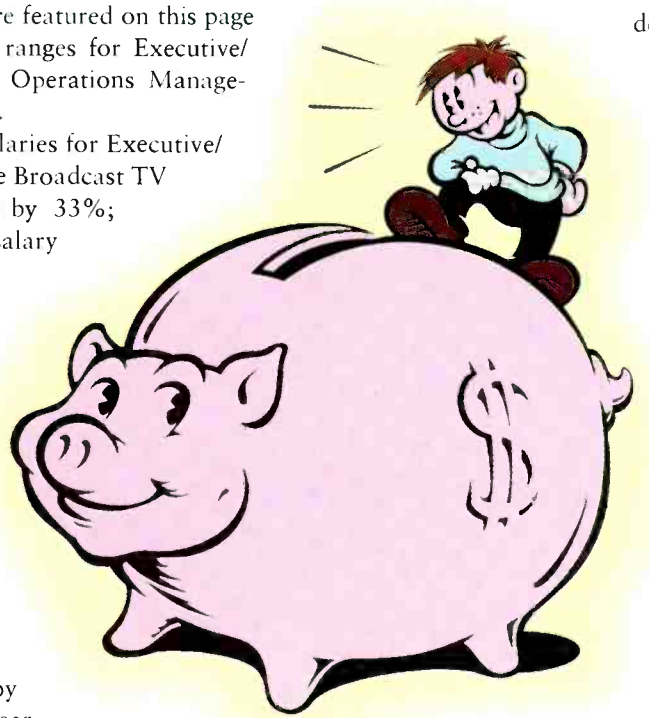
BROADCAST CHIEF ENGINEER
(See VP/Director of Engineering for Cable and Production)

Salary Level	Broadcast Top 50	Broadcast Below Top 50
Less than $20,000	2.9%	0%
$20,000 to $24,999	0%	2.5%
$25,000 to $29,999	0%	2.5%
$30,000 to $34,999	8.8%	6.3%
$35,000 to $39,999	0%	16.5%
$40,000 to $44,999	8.8%	22.8%
$45,000 to $49,999	5.9%	17.7%
$50,000 to $54,999	8.8%	15.2%
$55,000 to $59,999	11.8%	6.3%
$60,000 to $64,999	14.7%	2.5%
$65,000 to $69,999	2.9%	3.8%
$70,000 to $74,999	14.7%	0%
$75,000 to $79,999	14.7%	2.5%
$80,000 to $84,999	0%	1.3%
$85,000 to $89,999	0%	0%
$90,000 to $94,999	0%	0%
$95,000 to $99,999	0%	0%
$100,000 or more	5.9%	0%
Est. Median Salary	$62,000	$44,999

Operations Management are featured on this page and page 102. The salary ranges for Executive/ General Management and Operations Management have been condensed.

Starting at the top, the salaries for Executive/ General Management in the Broadcast TV Top 50 category increased by 33%; with an estimated median salary of 100,000+, more than $25,000 higher than last year. The Broadcast TV Below Top 50 category increased by $10,000, from $51,666 to $61,666.

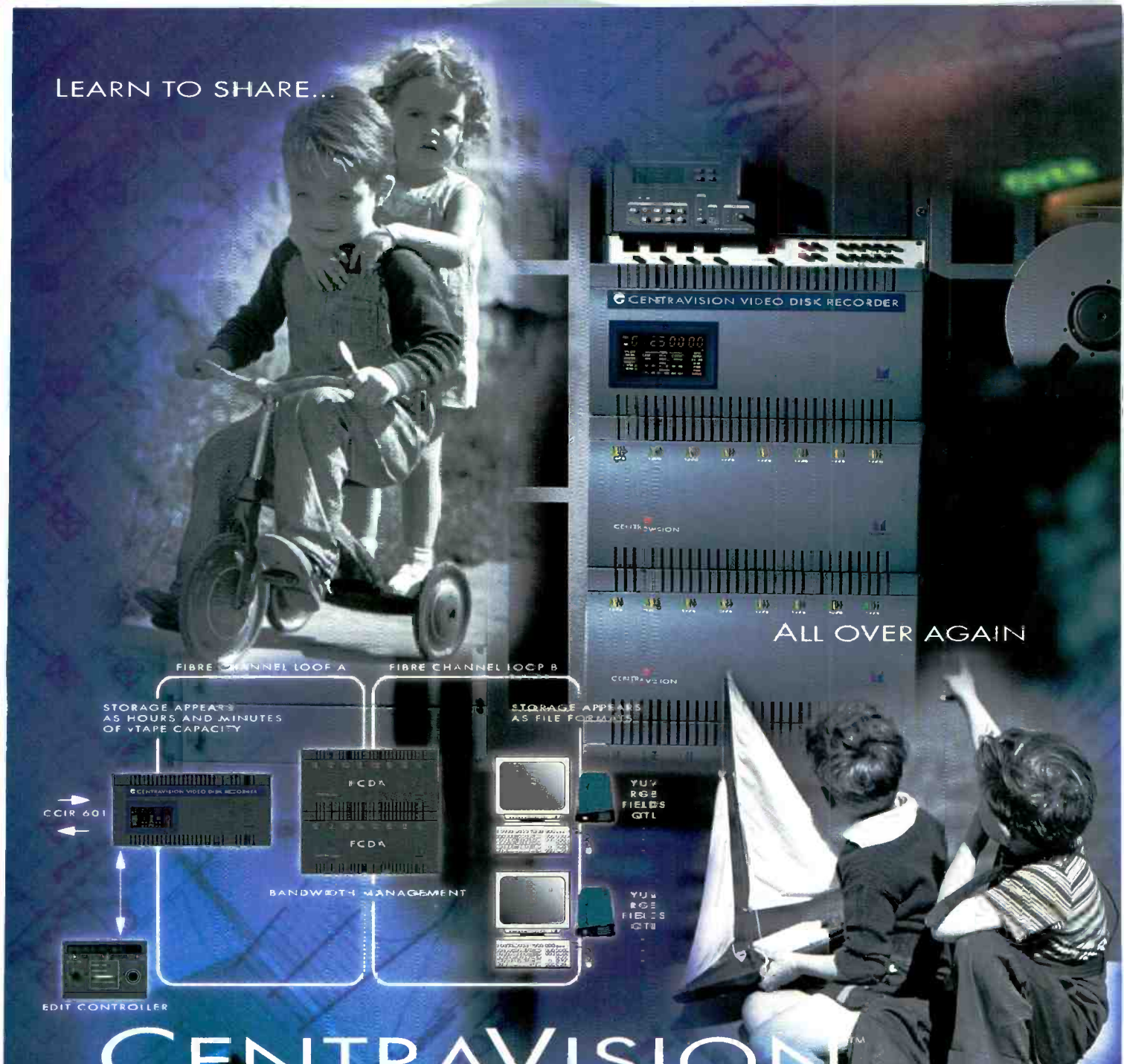
Cable and Production salaries in this position also increased moderately. Cable salaries rose by $4,167 from $48,333 to $52,500, and Production salaries rose by almost $3,000 over last year from $48,333 to $51,250.



The VP/Director of Engineering salaries increased slightly in three out of the four segments. Surprisingly, the Broadcast TV Top 50 dropped slightly by only less than $1,000 from $70,833 to $69,999. The good news is that Broadcast TV Below Top 50, Cable and Production salaries rose, with Production salaries increasing by more than 11%. The Broadcast TV Below Top 50 increased from $47,000 to $48,333 and Cable salaries rose from $47,083 to $48,749. (The Chief Engineer title for Cable and Production is included in this table.)

This year, Chief Engineer salaries decreased slightly in the Broadcast TV Top 50, but by less than $1,000 from $62,727 to $62,000. The Broadcast TV Below Top 50 category saw an increase of less than $2,000, up from $43,076 last year to $44,999 this year.

The Staff Engineer salaries saw an increase across the board this year. The Broadcast TV Top 50 and the Cable salaries increased by more than $4,000. The Broadcast TV Top 50 rose from $44,999 to $49,090, and Cable rose from $42,500 to $47,000. The Broadcast TV Below Top 50 and Production categories saw less of an increase, with the Below TV Top 50 rising to $33,333 from $31,000 and Production rising from $43,888 to $44,999.



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STAFF ENGINEER

Salary Level	Broadcast Top 50	Broadcast Below Top 50	Cable	Production
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$20,000 to $24,999	0%	8.7%	3.3%	5.4%
$25,000 to $29,999	4.1%	26.1%	6.7%	13.5%
$30,000 to $34,999	6.1%	26.1%	10%	2.7%
$35,000 to $39,999	14.3%	26.1%	13.3%	18.9%
$40,000 to $44,999	8.2%	8.7%	6.7%	10.8%
$45,000 to $49,999	22.4%	0%	16.7%	8.1%
$50,000 to $54,999	6.1%	0%	10%	8.1%
$55,000 to $59,999	14.3%	0%	13.3%	5.4%
$60,000 to $64,999	14.3%	4.3%	3.3%	8.1%
$65,000 to $69,999	8.2%	0%	3.3%	8.1%
$70,000 to $74,999	0%	0%	3.3%	2.7%
$75,000 to $79,999	0%	0%	0%	2.7%
$80,000 to $84,999	0%	0%	3.3%	2.7%
$85,000 to $89,999	2%	0%	0%	0%
$90,000 to $94,999	0%	0%	0%	0%
$95,000 to $99,999	0%	0%	0%	0%
$100,000 or more	0%	0%	0%	2.7%
Est. Median Salary	$49,090	$33,333	$47,000	$44,999

OPERATIONS MANAGEMENT

Salary Level	Broadcast Top 50	Broadcast Below Top 50	Cable	Production
Less than $25,000	0%	11.1%	24.3%	12.5%
$25,000 to $34,999	18.2%	25%	37.8%	27.5%
$35,000 to $49,999	36.4%	50%	21.6%	30%
$50,000 to $74,999	12.1%	13.9%	10.8%	22.5%
$75,000 to $99,999	15.2%	0%	0%	5%
$100,000 or more	18.2%	0%	5.4%	2.5%
Est. Median Salary	$48,749	$39,999	$31,000	$39,166

The Operations Management salaries decreased this year in the Broadcast TV Top 50, Cable and Production categories. TV Top 50 dropped from $59,999 to $48,749. Cable dropped by more than $3,000 from $34,582 to $31,000, and Production decreased from $42,000 to $39,166. The TV Top 50 category held steady this year at $39,999.

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Editor's note: The complete results of the 1997 Salary Survey are available for $75 each. Contact Amy Katz at 913-967-1946 or fax 913-967-1905 for more information.

DTV in the air

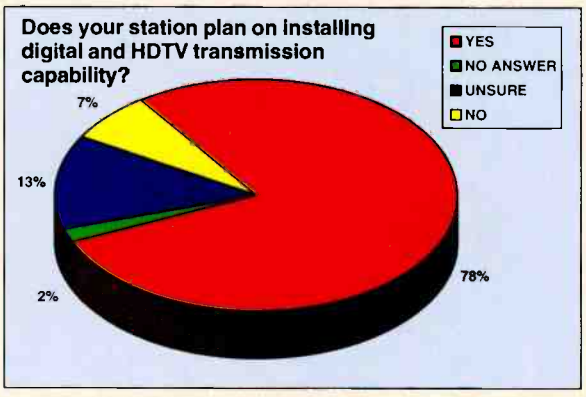
For the first time as part of the Salary Survey, we questioned respondents as to whether their stations plan on installing digital and HDTV transmission capability. More than three out of four stations do plan to install digital capability. (See the pie chart for the breakdown.)

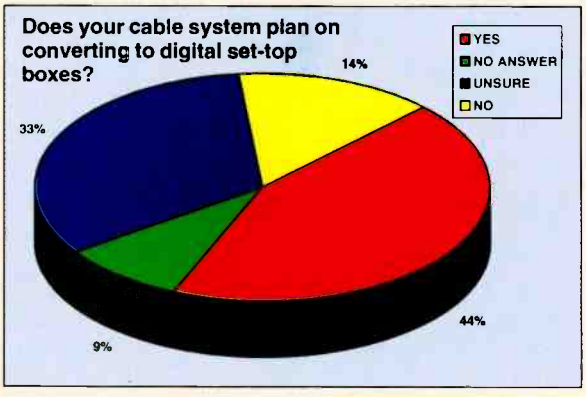
On the cable side, almost half of the cable systems plan on converting to digital set-top boxes, while 33% are still unsure about their plans. (See the pie chart for the breakdown.)

On the production side, only two out of five production facilities are planning on providing HDTV editing/production capability.

Going digital is causing mixed feelings in the industry. Here's what some of you had to say:

- *"Conversion to digital is going to separate the committed from the casual."*
- *"DTV implementation is the biggest problem and opportunity. The challenge is to find the means to build the plant and then develop strategies to recover cost."*
- *"Broadcasters should embrace DTV and use this technology to our benefit. I think it is short-sighted for TV stations to question why they have to move to DTV; they should ask how can we use DTV to strengthen our industry and stations."*
- *"The time frame for HDTV conversion is unreal."*
- *"DTV will keep engineers employed for at least the next 10 years, no one will have to worry about not having a job as long as they keep up with digital technology."*
- *"DTV is not going to be worth all the trouble."*
- *"If DTV does occur, small stations will go dark, along with small production companies. I do not think the technology is ready, let alone being semi-affordable."*
- *"Integrating equipment is becoming more difficult due to many networking and video formats."*
- *"Correlation of broadcast and cable digital activities."*
- *"How to use the analog systems after the switch."* ■





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By Ronald Gibbs

Managing RF

Recently, the FCC established stricter radio-frequency (RF) radiation exposure standards. The commission also proposed guidelines to govern health-related antenna siting disputes between broadcasters/wireless carriers and local government officials. New transmission systems will have to meet the revised RF standards beginning Oct. 15, 1997. Existing systems have until Sept. 1, 2000, to bring facilities into compliance. However, if any changes or system modifications are made after Oct. 15, or if a broadcaster's license comes up for renewal, facilities must be brought into immediate compliance.

Ronald Gibbs

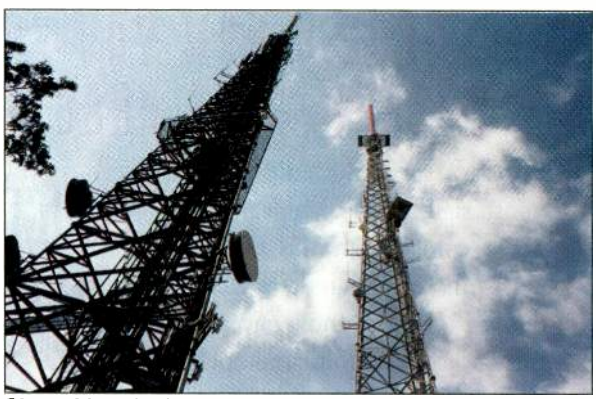
What is involved?

Several issues must be understood for broadcasters to comply with the standards and manage RF. These include distinguishing *controlled* vs. *uncontrolled environments* and the related challenges of rooftop and mountaintop facilities where broadcast antennas are located close to the ground (or rooftop) level. Verification of compliance issues will be important, as will the penalties associated with non-compliance.

Understanding the difference between controlled and uncontrolled environments is crucial for effective management of RF levels. A controlled environment is a transmitter site that is secured and has been marked with warning signs. People working in the area have an understanding or have been informed of RF and the potential hazards. An uncontrolled environment is an area, such as a rooftop, which may be marked with warning signs, however, it is accessible to a variety of people who have not been informed or do not have an understanding of RF and its potential hazards.

Managing RF on rooftops will be influenced by building height and location. Some rooftops present fewer problems because of the height of the building. Sites, such as New York's World Trade Center or Chicago's Sears Tower, pose reduced risk because these buildings are much taller than nearby structures. However, there are increased challenges with rooftops where the surrounding buildings are of equal or greater height. In these situations, broadcast antennas can potentially be radiating into adjacent buildings where people are working. Communications antennas located on adjacent rooftops may also need to be considered when calculating the total RF field, possibly adding to the potential RF hazard.

Oftentimes, mountaintop sites have broadcast antennas mounted on extremely short towers. The height above mean sea level (AMSL) allows broadcasters to obtain maximum coverage without a tall tower. Mt. Wilson in Los Angeles is approximately 5,600 feet AMSL and Sandia Crest in Albuquerque, NM, is approximately 10,000 feet AMSL. The mountain provides the height rather than the tower. In addition, on such sites, there are multiple broadcasters operating in close proximity to one another. Under such circumstances, the combined level of RF at ground level can be compounded, presenting a potentially greater hazard.



Sites with multiple antennas, and/or multiple towers will need to manage the total RF output, especially those sites with antennas located near ground level.

Verifying compliance

Initially, the FCC requires an affidavit from someone in authority stating that a site is in compliance. Under the standards, a state or local municipality cannot impose guidelines that are in excess of those established. However, state and local government agencies could require broadcasters to provide detailed engineering evidence demonstrating site compliance.

Rather than state and local governments enforcing the standards, the more likely scenario is that public or community action groups will file complaints with the FCC, suggesting a site is not in compliance. In such cases, the FCC will be required to investigate, requesting greater documentation from the site owner demonstrating compliance. Non-compliant sites could result in penalties, including non-renewal of the station's license.

Several issues must be considered for co-located sites.

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The guidelines indicate that the license holder is responsible for compliance. If one user at a co-located site is in non-compliance by 5% or greater, all users at the site are also non-compliant. Potential liability exists for an owner/operator of a co-located site relative to effective management of the site's total RF. It is incumbent upon owner/operators to assume greater responsibility for RF management. Unfortunately, there are inexperienced site owners unaware of these new requirements.

Co-located rooftop sites present greater challenges. RF hazard signs must be prominently posted. People who go onto these rooftops must be informed of the potential hazards regarding RF. These signs may serve as a "wake-up" call to inexperienced site owners, because they may suddenly realize the potential liabilities associated with RF exposure. If a license holder loses its license at a co-located site, the owner may be exposed to further liability. To add greater complexity to the problem, if a building owner sells or refinances the building, it is possible that the buyer or lender may require an environmental impact study for the rooftop due to the potential RF hazard. Such circumstances may cause building owners to re-evaluate the benefits and risks associated with using their rooftop as a communications site.

Dealing with the problem

So, what can be done? We must educate everyone about RF, from the technicians, to the sales and marketing staffs. Broadcasters must educate building owners to ensure that unrelated persons, such as building repairmen, are aware of the potential RF hazards in controlled or uncontrolled environments.

RF needs to be measured on any given site regularly using reliable technology and test equipment. For example, broadcasters must invest in and use RF measuring test gear and/or computerized modeling software to manage their sites. Precautionary measures should also be taken — site workers may have to wear personalized RF measuring devices, detecting maximum levels of RF exposure. Sites that exceed the maximum permissible exposure (MPE) should be marked. Then, if the level of RF is known through reliable measurement techniques, a broadcaster can reduce the power of transmitters to bring the site into compliance with a safe level of RF. If a site exceeds the MPE, broadcasters must have a plan to reduce power levels when necessary, reducing the RF to a safe level while people are at the site.

Is the RF situation under the new standards hopeless? No. Can RF be dangerous? Yes, if not properly managed. Can RF be managed? Absolutely. RF is an issue that every broadcaster must know and understand. The matter can be dealt with through education, organization, planning and, unfortunately, with money. ■

Ronald Gibbs is president of Lodestar Towers Inc., North Palm Beach, FL.

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By Dave Cooper

Philips LDK cameras

As athletes pushed themselves to reach the highest limits of their physical abilities at the 1997 Extreme Games in San Diego, CA, this past June, VTE Mobile Television Productions tested the limits of its newest state-of-the-art camera equipment from Philips BTS.

To cover the XGames for ESPN, VTE provided three mobile units equipped with nine Philips BTS LDK 10 studio cameras, 22 LDK 20PS digital portable triax cameras and 12 Super XPanders. The Philips BTS Super XPanders allowed conversion of the LDK 20PS portable cameras into full-fledged studio cameras, providing added flexibility for a myriad of camera requirements.

One of the 12 telemetry-controlled POV cameras from VTE Mobile Unit No. 13 gets a street-level view of the luge competition.

In addition to the camera systems, VTE's mobile units were also outfitted with three Chyron Infiniti's, 13 Philips BTS digital Beta recorders, three Philips BTS Venus routing switchers and seven Sony BVW 75 Beta recorders.

VTE Mobile Unit No. 14 covered the events at the Mariner A venue, located in Mission Bay. The events included street and vert in-line skating; BMX street and vert; and skateboard street and vert.

Mission Bay was also the setting for the Mariner B venue, which included wall climbing, snowboarding and a full roster of water sports. VTE's Mobile Unit No. 12 covered this venue. To capture the full excitement of these events, which were each spread out over a wide area, an LDK 20PS camera was mounted on a 65-foot Aceta crane. This gave us an outstanding vantage point for wide coverage of the events.

An LDK mounted on a jib accommodated the tough angles of the climbing wall.

VTE Mobile Unit No. 13, one of VTE's two 601 serial digital trucks, covered the Oceanside Hill events, including downhill competitions for the luge and in-line skating. The unit was also equipped with four digi betas, three betas, one laser disc and the Scitex DVEous twin dual DVE. It also accommodated 12 POV and robotic camera feeds through telemetry control as input devices. More than 35,000 feet of triax was used on this venue alone.

The Extreme Games were held under extreme conditions, including salt water and high temperatures. Having completed the installation of 27 new Philips BTS LDK 10 and LDK 20PS digital camera systems only four days prior to the start of our XGames coverage, we approached this project with well-founded confidence.

One important aspect of the new LDK cameras was their ability to interface with cameras from other manufacturers, especially the slow-motion systems and Ikegami RF cameras. During the XGames, it was not uncommon to see one of our cameras mounted to an 80-foot jib over 30 feet of ocean water or to see the camera mounted upside down on the climbing wall. Despite the salt water, humidity and high temperatures of sunny Southern California, the LDKs performed well.

The Philips BTS LDK camera was chosen because we saw distinct advantages in its state-of-the-art 12-bit A/D video conversion and 24-bit digital internal processing technology. We were also impressed with the ability to switch to a 16:9 format without a block change or change in lens complement, significantly enhancing an already streamlined ease of operation.

VTE produced more than 60 hours of programming. In addition to covering the various sporting events, VTE's Mobile Unit No. 13 also acted as master control for ESPN's Winter XGames. Mobile Unit No. 12 provided coverage of the Miracle Mile downhill events at Big Bear this past winter. For the past two years, Mobile Units No. 12 and No. 14 were involved in production of the summer games under the former owner, SolJay Productions. ■

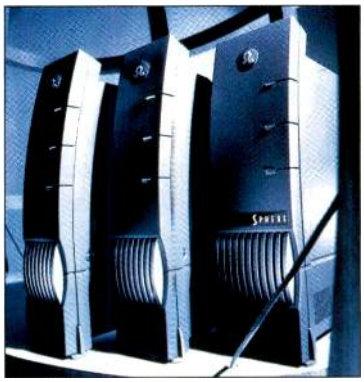
Dave Cooper is vice president of engineering for VTE Mobile Television Productions, Inc., Torrance, CA.

By Greg Saunders

KGO moving to all-digital production

KGO-TV Channel 7, serving the San Francisco/San Jose market, is placing itself directly in the forefront of the digital revolution by aggressively moving toward tape-free operation. Our chief engineer, Jim Casabella, decided that the promotions operations in our creative services department should be the first to convert to all-digital production.

We recognized that the competitive nature of broadcast television forces us to constantly push the envelope on how quickly we can produce the most compelling promos to attract an audience to our news broadcasts and other time-sensitive, topical operations. In addition, because we need to create multiple versions of the same spots on a regular basis, the advantages of digital disk-based editing would free us from linear tape assemblies.



KGO-TV's three Scitex StrataSphere editors handle in-house production for the station.

We auditioned several brands of digital edit systems and decided on the VideoCube because of its ease of use and the high-quality video it could produce. To me, it felt like a simple A/B roll editor laid out on a timeline, and I liked the fact that within a few minutes of walking into the room and looking at the data screen, I could tell what was going on. As soon as the TurboCube version came out, we purchased a second system for ourselves, and put a third TurboCube in the programming department. When Scitex started shipping the new StrataSphere system, all three systems received the upgrade.

Stepping away from analog

The power of digital editing has relegated our old analog, linear tape edit bay to tagging the pre-built commercials fed to us for our daytime programming line-up. With the release of the latest software, version 1.5, these three StrataSphere editors form the fulcrum of our in-house production for promos, news features and mini-docs. The next step will be to implement serial storage architecture (SSA), which will let us share files between our three StrataSpheres at faster than real time, thereby greatly increasing our storage capacity by eliminating the need to duplicate files on individual systems.

We've found that the real benefit of the speed of digital editing systems is that they let us do more, and do it better and faster. Our analog tape edit system could sometimes take a whole day to construct a promo. Now we can create the spot in half the time and clone off different versions with the click of a mouse — all with full stereo sound and video that doesn't suffer from multiple generations. If we had to return to cutting tape, we'd never get all the work done.

More changes

KGO-TV also implemented a Storagetek (Wolfcreek 9360) archive system as a video library and the final digital step in our production chain went on-line when we installed a BTS/Philips Media Pool server. It is used to provide playback of all on-air programming, commercials and promotional announcements. The Media Pool can also be configured to insert customized promos for our shows crafted for selected cable customers in distinct market areas. In addition to our current NTSC signal on Channel 7, a 100kW Harris HDTV signal transmitter is already on order to serve our over-the-air broadcast audience on Channel 24. We feel confident that our digital capabilities will enable us to conform to whichever HDTV standard is adopted.

Once we install a digital master router next year, the StrataSpheres will be connected to each other through SSA — they will talk to the router via a coder/decoder translator and share media files with the newsroom in standard CCIR-601 digital video — and feed the Media Pool directly from their output. At that point, KGO-TV will have a tape-free digital throughput for all our in-house production and signal distribution.

KGO-TV will be the first in our market to go completely digital. We know there is still no magic to TV production, even with a digital signal path. The key is still program content and it will always be the people behind the equipment who will determine our success in this growing market, but we're striving to provide our creative personnel with the tools they need as we move into the all-digital future. ■

Greg Saunders is creative services director, KGO-TV, San Francisco.

By Michael Robin

Ancillary data multiplexing

Digital techniques of signal generation, processing, recording and distribution have produced a variety of benefits. The main benefit is the transparency as video and audio signal impairments are limited to the single-pass A/D and D/A process provided that the signal is recorded, processed and distributed in digital form.

The distribution of digital signals

The need to satisfy complex distribution patterns typical of large teleproduction centers led to the development of the bit-serial digital signal distribution concept embodied in the ANSI/SMPTE 259M standard. This consists in reading out sequentially the 10-bit (or eight-bit) parallel data and sending the resulting bit-serial digital signal on a single coaxial cable. This results in high bit-rates, such as 270Mb/s (4:2:2/10 bits), 177Mb/s (4fsc PAL/10 bits) and 143Mb/s (4fsc NTSC/10 bits).

The development of digital audio distribution followed a route of its own resulting in the AES/EBU standard. This standard established a preferred sampling frequency (48kHz), sample resolution (20 bits per sample with a capability of 24 bits per sample) and a complex and sophisticated 32-bit data packaging concept resulting in a 3.072Mb/s bit-serial dual audio channel (left and right for example) distribution. The initial AES/EBU standard specified the use of standard analog audio cables and a balanced 110Ω electrical interface impedance. This aspect of the specification has been revised, and an unbalanced 75Ω interface impedance and video-type coaxial cable are currently preferred.

Space for other signals

The manner in which component and composite analog video signals are represented in the digital domain results in a great deal of overhead. This is because a great number of samples located in the horizontal and vertical blanking interval (VBI) convey no useful information. These samples could be eliminated without affecting the picture, thus obtaining a moderate bit-rate reduction. Alternately, ancillary data could be inserted in these empty spaces.

Table 1 summarizes the ancillary data space available with the two dominant sets of digital video standards. The essential bit-rate required by each standard is shown in row 1 of the table. It results from the elimination of non-essential samples in the horizontal and vertical blanking intervals. The horizontal ancillary (HANC) capability (overhead) of each standard is listed in row 2 and indicates the bit-rate available for insertion of ancillary data in the horizontal blanking interval. The vertical ancillary (VANC) capability (overhead) of each standard is listed in row 3 of the table and indicates the bit-rate available for insertion of ancillary data in the vertical blanking interval. The total overhead, listed in row 4 of the table, represents the sum of the HANC and VANC capability of the system. This value may be reduced by 10% to 20% by the data formatting used and the exclusions peculiar to the standard. Row 5 of the table lists the nominal (total) bit-rate of each standard.

The most important use of the ancillary data space is for the insertion of audio signals accompanying the video signal. The overheads of the two 4fsc composite digital standards allow two AES/EBU signals (two stereo pairs or four individual audio channels), with a combined total bit-rate of 6.144Mb/s to be accommodated in the ancillary data space. This still leaves a moderate overhead (3.9381Mb/s in 4fsc NTSC and 5.0785Mb/s in 4fsc PAL) for other uses.

The 4:2:2 component digital standards have a considerable amount of overhead. They can easily accommodate eight AES/EBU signals (eight stereo pairs or 16 individual audio channels) with a combined total bit-rate of 24.576Mb/s, still leaving a considerable amount of overhead (30.7114Mb/s in 525/60 and 32.968Mb/s in 625/50) for other uses.

	4fsc NTSC	4fsc PAL 525/60	4:2:2 625/50	4:2:2
1. ESSENTIAL BIT-RATE (Mb/s)	133.0995	166.1212	214.7126	212.456
2. HANC OVERHEAD (Mb/s)	7.995	9.2	42.1678	43.72
3. VANC OVERHEAD (Mb/s)	2.0871	2.0225	13.1196	13.824
4. TOTAL OVERHEAD (Mb/s)	10.0821	11.2225	55.2874	57.544
5. TOTAL BIT-RATE (Mb/s)	143.1816	177.3437	270	270

Table 1. A summary of the ancillary data space available with the two dominant sets of digital video standards.

Ancillary data embedding

The ANSI/SMPTE 272M document defines the manner in which AES/EBU digital audio data, AES/EBU auxiliary data and associated control information is embedded into the ancillary data space of the bit-serial

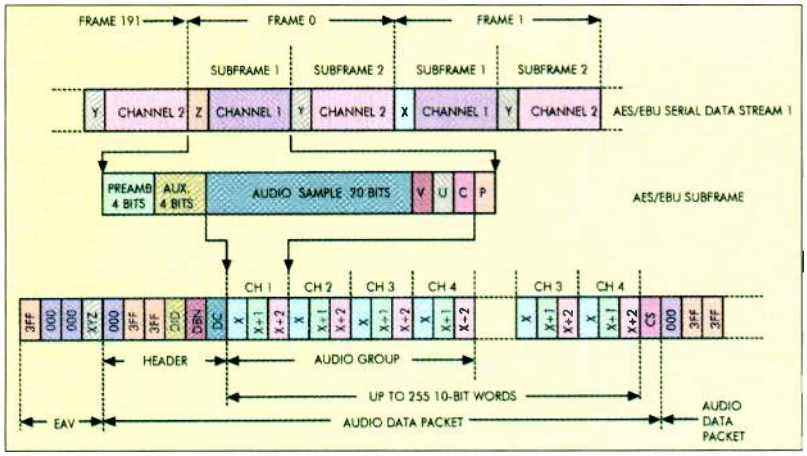


Figure 1. The AES/EBU embedding concept.

digital video conforming to the ANSI/SMPTE 259M standard. The 4:2:2 525/60 component digital signal can accommodate 268 ancillary data words in the unused data space between the end-of-active video (EAV) timing reference and the start-of-active video (SAV) timing reference. Figure 1 shows the manner in which two AES/EBU 20-bit digital audio datastreams (two stereo channels or four individual mono channels) are formatted for embedding into a 4:2:2 525/60 component digital bit-serial signal. The data words are organized in packets and inserted in the space between the EAV and SAV. Each packet can carry up to a maximum of 262 10-bit parallel words. A six-word header precedes the ancillary data and contains:

- a three-word ancillary data flag (ADF) marking the beginning of the ancillary data packet;
- an optional data identification (DID) word identifying the user data;
- an optional data block number (DBN) word; and
- a data count (DC) word describing the number of user data words in the packet.

The embedded audio channels 1 and 2 originate from the AES/EBU datastream 1 (shown in the top row of the drawing), while channels 3 and 4 originate from the AES/EBU datastream 2 (not shown). This example shows how subframe 1, of frame 0, of audio datastream 1, is stripped of the four-bit preamble, the four auxiliary bits and the P bit. The remaining 20 bits of audio and the V, U and C bits, a total of 23 bits, are mapped into three consecutive 10-bit words identified as words X, X+1 and X+2 of channel 1. The following triplet of 10-bit data words, identified as channel 2, represents the mapping of subframe 2, of frame 0. Channels 3 and 4 represent the mapping of frame 0 of the AES/EBU datastream 2. The following group of 10-bit words would represent the mapping of subframe 1, of frame 1,

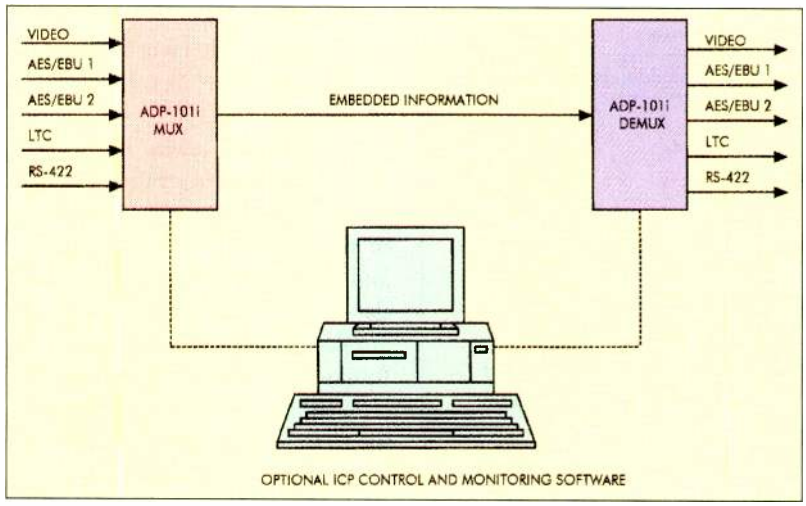


Figure 2. The two selectable configurations of the ADP-101i developed by Miranda.

of audio datastream 1 and so on. The audio data packet closes with a check sum (CS) word.

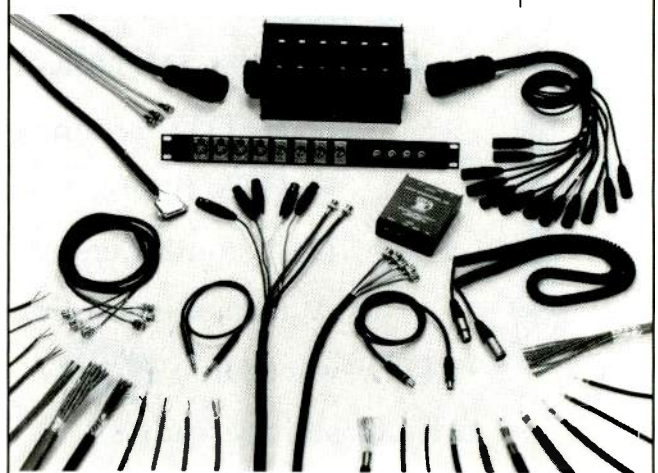
Miranda's advanced embedding solutions

Although the most common use of the ancillary data space is for embedding digital audio, embedded audio is only one of many types of signals that can use that space. Given the considerable overhead of the 4:2:2 bit-serial signals, and even the limited overhead of the 4fsc bit-serial signals, it's possible to add additional embedded data, such as time-code information, remote-control strings and even Ethernet messages to the digital videostream, and thus exploit the full potential of the ancillary data space.

With this idea in mind, Miranda Technologies developed the ADP-101i, which has at its core, a powerful and flexible DSP engine. The unit can:

- embed several types of data commonly used in a teleproduction environment, such as AES/EBU digital audio, time code and RS-422 control signals into the digital datastream;
- operate in the 4:2:2 (525/60 or 625/50) or 4fsc (NTSC or PAL) digital format following the user's selection;
- operate as an embedder or a de-embedder, as configured by the user, therefore, simplifying equipment purchasing; and
- provide full EDH implementation on input and output serial signals.

Figure 2 illustrates the two selectable configurations of the ADP-101i.



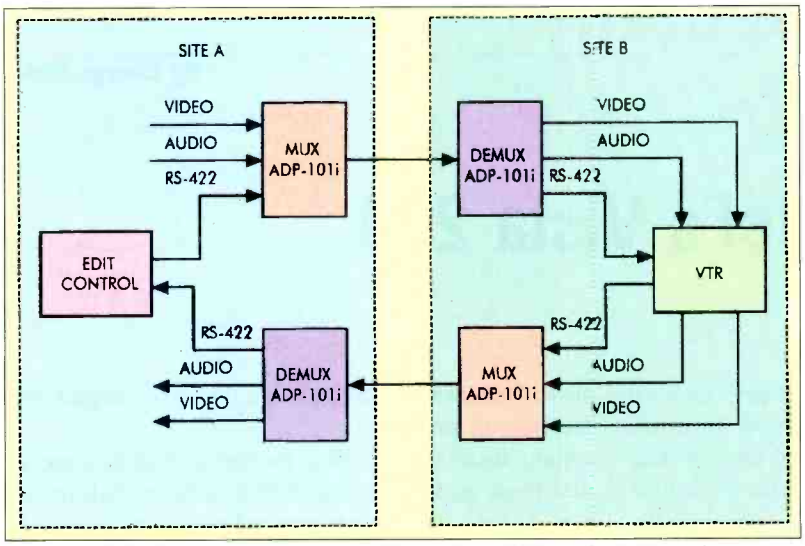


Figure 3. A typical application using the power of Miranda's ADP-101i.

Figure 3 shows a practical application fully using the power of the ADP-101i. In this application, site A needs access to specific equipment only available at remote site B. Using a pair of ADP-101i and a bit-serial connection (coaxial cables for short distances, optical fibers for long runs) the edit controller in room A sends embedded remote-control messages to site B and thus takes full control of the DVTR. The DVTR, in turn, sends to site A its video and audio output signals along with time-code information and remote-control status messages. All of this is frame-accurate due to the negligible latency introduced by the ADP-101i.

The Miranda ETH-101i, an Ethernet MUX/DEMUX, can embed Ethernet information within the bit-serial digital video stream. A typical use for the ETH-101i is the interconnection of two Ethernet networks in a campus of buildings linked using bit-serial digital video signals. The ETH-101i provides a full 10Mb/s sustained data rate and easily connects to any computer, router or Ethernet hub. The combined use of ADP-101i and of ETH-101i allows for the full implementation of uncompressed multimedia information exchange (video, audio, time-code, remote control and data network) that can be used by post-production and broadcast facilities to improve the connectivity of their video and computer installations.

The ADP-101i can be fully controlled from remote computers using Miranda's ICP remote control and monitoring software. The ICP-S software architecture is based on a client-server concept and the link between the client and the server is carried-out using the TCP/IP protocol.

The ADP-101i and ETH-101i are pure digital units. The interconnection with analog equipment is easily accomplished using any of the Miranda video converters and the newly developed audio converters resulting from the AAVS-Miranda partnership signed late last year.

Miranda's ADP-101i and ETH-101i fulfil data and function distribution needs of the broadcasting and teleproduction communities, by using the ancillary data space in the 4:2:2 and 4fsc digital signals. In addition, they open new avenues toward a convergence of the computer, the teleproduction and the broadcasting worlds. ■

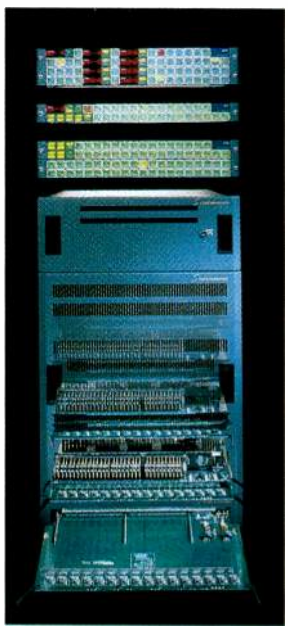
Michael Robin is a broadcast consultant and a former project engineer with the Canadian Broadcasting Corporation (CBC).

By George Maier

Artel's Vista 270

The Hong Kong handover was a unique historical event, but for Artel, it was business as usual, helping Hongkong Telecom deliver real-time, broadcast-quality video signals over fiber-optic lines to broadcasters serving the international TV community. Hongkong Telecom employed more than 100 of Artel's DigiLink fiber-optic transmission systems to convert analog video and audio signals into uncompressed 12-bit digital bitstreams for transport at 270Mb/s over single-mode fiber-optic lines. Eighty percent of the single-channel digital video fiber-optic transmission systems used by the world's telephone companies to serve their broadcast customers with point-to-point and switched video services have been manufactured by Artel Video Systems.

With the acquisition of Utah Scientific and technological advancements enabling real-time non-compressed SMPTE 259M serial digital fiber transport, Artel is broadening its market to include the broadcaster as a direct customer. Artel's Vista 270 product line, an integrated digital switching and fiber transport network, is a family of components that work in tandem to deliver NTSC, PAL or SDI via the robust, standards-based 270Mb/s format the broadcaster needs to use the facility's existing coaxial video infrastructure.



The Utah SC-3 network control system.

The new Vista

The Vista 270 line includes: DigiLink, for analog or serial digital video (user-selectable); MegaLink, for dedicated serial digital video; MegaWav, for optical wave division transport multiplexing; MegaMux, for embedding and extracting of AES/EBU audio, time-code and machine-control information; the Utah-300, a scaleable serial digital video routing switcher capable of 360Mb throughput and the SC-3 control system, for controlling multiple levels of current and legacy routing switchers, as well as routers made by most other vendors.

Although broadcasting has always involved transmitting signals from one place to another, today's proliferation of broadband video formats and standards and the advent of digital fiber-optic networks have made transmitting signals a far more complex and challenging process.

Many facilities are feeling the pressure as they transition from an analog to a 270Mb/s digital infrastructure, expand their operations and prepare to broadcast in the new DTV standard. For example, to take advantage of the merits of workstation-based non-linear editing and graphics creation, all-digital workstation islands have been springing up in the midst of a predominantly analog infrastructure.

DigiLink was designed primarily to transport analog (NTSC, PAL and SECAM) over fiber. However, it has evolved to handle analog and serial digital component (i.e., D-1 format) video in the same piece of equipment. By adding a new user-selectable 270Mb/s serial digital interface, DigiLink becomes ideal for hybrid environments. The UTAH-300 also supports hybrid environments, meaning it is able to switch analog video up to 60MHz and digital video signals up to 360Mb/s, thus allowing broadcasters and post-production facilities to use their existing facility infrastructure for routing, and fiber for native rate interfacility and campus applications.

With the next-generation all-digital fiber-optic transport product, MegaLink, Artel has included a feature-rich SMPTE-259M/ITU-R 601 serial digital interface to take full advantage of the inherent 270Mb/s capacity to send and receive all serial digital video in real time. MegaLink supports unidirectional and bidirectional point-to-point and point-to-multipoint configurations, and handles up to 270Mb/s an unrepeated distance of 120km on single-mode fiber (and a distance of 1,000km when repeaters are used). This capacity makes MegaLink ideal for wide area networks, whether broadcasters wish to annex buildings on their campus or digitally link their studio operation with affiliated facilities and public venues in the metropolitan area or further.

MegaLink was recently tested with a new front-end that will enable it to transmit and receive serial digital video signals at bit rates as high as 360Mb/s, which is sufficient for the bandwidth demands of non-com-

pressed 16x9, 525-line video (i.e., D-5 format) and mezzanine-quality HDTV video (that is slightly compressed at 3:1). With this new version of MegaLink, now being beta tested, facilities will be able to continue using their existing coaxial video infrastructure, which can also handle a maximum of 360Mb/s, then upgrade to fiber-optic cable throughout their facility as their resources allow. In addition, the UTAH-300 router supports NTSC, PAL and SECAM analog, as well as SMPTE/ITU component or composite signals up to 360Mb/s, the same speed it will travel over the fiber-optic network.

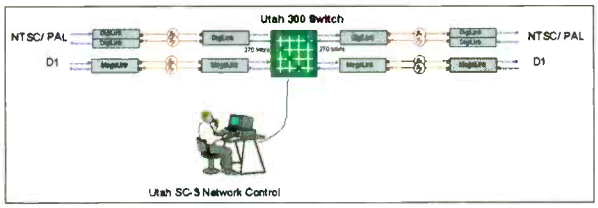


Figure 1. With the Utah-300 router at its heart, the Vista 270 can switch any input, analog or digital, to any output on the network.

When Artel's new dense wave division multiplexing (DWDM) module is used in conjunction with DigiLink or MegaLink, multiple systems/channels can be combined to travel over the same fiber-optic cable, increasing capacity on an as-needed basis. High video bandwidth together with optical multiplexing will enable broadcasters to meet the challenges of the digital multichannel, multiservice environment that's taking shape.

Making the transition

In the transitional phase of DTV, broadcasters will most likely simulcast the same program content on their DTV and NTSC channels. Multiple channels will emanate from the same studio master control room. In the early stages of the transition, if broadcasters choose to devote the entire DTV bandwidth allotment to the broadcast of a single HDTV channel, MegaLink will allow them to feed both transmitters in parallel with one 16x9 uncompressed 525-line 360Mb/s signal. Once at the transmitter, the signal could be upconverted to the Grand Alliance HDTV standard and simultaneously downconverted to an NTSC signal. In this way, they would not have to maintain two studio-to-transmitter links or STLs.

As HDTV matures, more and more 360Mb/s compressed high-definition material is expected to become available for playback. From all appearances, Vista can serve two masters: SDTV at 270Mb/s and 16x9 SD or compressed HD at 360Mb/s. If broadcasters are not locked into a 270Mb/s infrastructure, they'll have a ready migration path to a system capable of handling 360Mb/s, while maximizing their present investment. ■

George Maier is vice president, business development for Artel Video Systems, Marlborough, MA.

By Charles Cataldo

Louth Automation at HBO

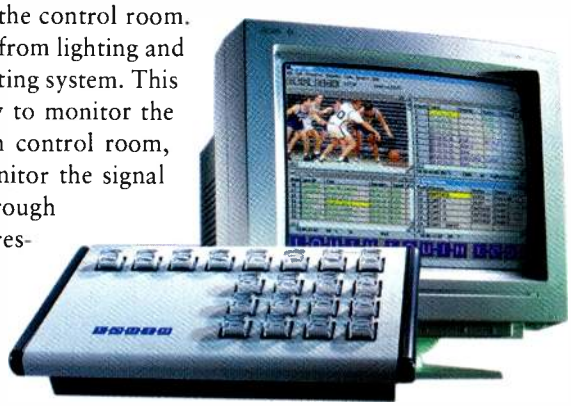
The HBO Communications Center went on-line in October 1983 and, at that time, was acknowledged to be one of the most sophisticated facilities of its kind. In keeping with the company's plans to expand the number of networks and improve the technology, HBO will soon complete a wide-ranging upgrade of this 14-year-old facility. Needing to originate, monitor and transmit multiple networks while maintaining high-quality standards, HBO chose to replace most of the facility's current equipment from videotape recorders to the digital transmission compression system.

The changeover from analog to digital began in September of 1996, beginning with the transfer to the CCIR-601 digital component format and using the General Instruments' Digicipher II compression system.

Two identical network control rooms and completely redundant network origination systems were designed to be operated by one technician for as many as 10 networks simultaneously. Each new digital control room incorporates the Tektronix Profile, BTS Saturn master control switchers and Venus routers, Chyron Max!, Dolby Systems Digital Surround Sound processor, Tektronix scopes and Barco monitors.

To assist the technician monitoring these new control rooms, a Crestron touchscreen control system was installed. This system uses all touchscreen selections with the ability to modify and customize screens for enhancements made later to the control room. Crestron controls everything from lighting and temperature to the Venus routing system. This makes it extraordinarily easy to monitor the 10 feeds coming out of each control room, allowing a technician to monitor the signal from the tape machines on through to the scrambling and compression systems.

A part of the redesign included six Louth ADC-100 automation systems. The selection was based on the following criteria:



The Louth ADC-100 automation system.

- Engineered and constructed for long-term durability;
- The ability to be integrated into day-to-day operations with ease of training and the company's intensive in-house support;
- Louth's willingness to work with HBO to develop and revise software and hardware when needed; and
- Louth's extensible object-oriented software design approach.

HBO uses three Louth systems in each control room. One system handles HBO and Cinemax feeds, one system is for multiplexed HBO and Cinemax feeds, and one system in each control room is used to backup all of the aforementioned services.

This system uses all touchscreen selections.

The Louth automation system gave us the resources to tie the tape machines, cart machines, switchers and character generators together. The concept is to use a true client/server architecture, interconnected on a local area network (LAN). This network consists of file servers, rack-mount, dual PSU device servers, client PC workstations and data entry via the database. Tape database workstations run a program called TurboMedia and are used to enter tape information used by the program schedule. Program titles, time codes for the start and end of programming and program ID numbers are all stored within the database.

We use two Sony A-510 Digital Betacam tape machines installed in Sony Flexicarts. HBO chose the Philips BTS Saturn switcher and Venus router for their ability to handle multiple networks using one master control switcher head; this equipment provides the primary and backup switching systems used to route the network's signals. Using Louth Airprotect software, HBO engineering devised a unique implementation, where a single Venus router is used to backup serial Saturn master control switchers.

To compensate for the time delay of the various targeted time zones (Pacific and Mountain), each of the specified networks for HBO and Cinemax are delayed using a Tektronix PDR-100 Digital Profile System with a customized time-delay software option package. This package records East Coast network feeds and plays back a two-hour delay for Mountain time zone and a three-hour delay for Pacific time zone. Depending on the destination for each network (digital compression or analog encryption), a Zaxcom AES limiter/compressor is used to convert to analog and correct any possible lip-sync delays.

Expanding on the facility's complete conversion to digital, a number of additional projects have been implemented that include redesigning our duplication and edit rooms and designing a new server to transfer the HBO interstitials between the various HBO buildings, again using Louth Automation systems.

The digital edit room has been redesigned beginning with two Sony DVW A-500 Digital Betacam machines and three Sony DVR-28 D-2 machines. The supporting equipment includes Grass Valley's 1000 switcher and the G/V VPE251 editor. Audio mixing is performed by a Graham-Patten D/ESAM 829. The room is also equipped with an Abekas A-57, Quantel Picture Box, Chyron Infinit!, Tascam D-88 cassette and the Fostex DAT machine.

The digital edit room has been redesigned.

The addition of 16 new networks has prompted the need for a faster, more effective means to transfer information throughout the company quickly. A compatible system using server-based architecture is currently being designed to improve the efficiency for the transfer of the HBO interstitials. HBO and Louth have recently developed a direct interface between the Ampex ACR-225 and the Louth TurboMedia, which allows the network to transition our inventory while offering a full complement of caching-type features. In addition, we are evaluating the SGI Origin 200's server-based architecture for this project, but have made no commitment. The combination of SGI Origins, Tektronix PDR-100s and the Tektronix PDR-200 file server with an Ampex DST archival unit may soon enable HBO to provide a high-performance data transfer from edit room to network air, using 100% server-based technology and intelligent software solutions. ■

Charles Cataldo is vice president of broadcast operations at HBO, Hauppauge, NY.

new products

By Deanna Rood

HDTV lenses

Canon

• HDTV HD lenses: these lenses incorporate Canon's internal focus (IF) technology for superior optics and allow for creative filter work, because the front element does not rotate; other features include an ergonomically designed grip and a specially designed protein paint that absorbs perspiration; the full line of ENG-style HDTV lenses includes the HJ15X8B IRS/IAS standard zoom lens that weighs about 3.5 pounds, the HJ18X7.8B IRS/IAS long zoom for an unprecedented 18X zoom ratio and a 7.8mm wide-angle (as well as a focal length of 7.8-288mm when using the built-in 2X extender), the HJ9X5.5B IRS/IAS wide-angle zoom that achieves the widest angle in the world for HDTV lenses and delivers a 5.5mm wide-angle, while offering a 100mm telephoto focal length with its built-in 2X extender.

Canon, One Canon Plaza, Lake Success, NY 11042; 800-321-4388; bctv@cusa.canon.com
Circle (254) on Free Info Card

Non-linear editor with shared Fibre Channel disk storage and software RAID technology

ASC

• VR300 NLE: this non-linear editing system features ASC's FibreDrive, which implements Fibre Channel as an ultrahigh bandwidth storage interface, thus allowing up to 12 editors to have unrestricted, instant access to every frame stored on a system; the FibreDrive technology eliminates the need to transfer or transport data files and supports up to 96 hours of on-line RAID-protected digital storage; ASC's non-linear editors (based on Windows NT platform) also eliminate digitizing as a separate step by recording directly from the field tape to the timeline.

ASC, 3816 Burbank Blvd., Burbank, CA 91505; 818-843-7004; fax 818-842-8945
Circle (257) on Free Info Card

HDTV digital waveform monitor

Leader Instruments

• LV 5150D: a monitoring unit that handles both serial digital and analog components for HDTV signals in the 1125/60 (59.94) format; full waveform monitoring functions include line select, cursors and memory presets of test setups; a picture display of the Y or G component, with a line select strobe is also provided, and the unit offers a vector display of chroma component and a Lissajous display for stereo audio; two SDI inputs are accommodated with an active output of the channel selected for observation and the waveform display and decoded picture monitor output may be set to GBR or YPbPr form.

Leader, 380 Oser Ave., Hauppauge, NY 11788; 516-231-6900; fax 516-231-5295
Circle (266) on Free Info Card

Second-generation Tomahawk drives

Micropolis

• Tomahawk AV Gold 20: a 20GB 3.5-inch drive designed for audio-video applications; these off-the-shelf drives are optimized for the AV industry.

• Tomahawk 18 and 9LP drives: designed for high-performance server and workstation environments, these drives provide enhanced data integrity through round-trip CRC data protection throughout the entire path, automatic retries and state-of-the-art ECC with on-the-fly correction; an enhanced S.M.A.R.T. implementation incorporates fly-height monitoring and allows the drive to trigger an alert condition when any of the vital statistics fall below the threshold.

Micropolis, 21211 Nordhoff St., Chatsworth, CA 91311; 800-395-3748 or 818-709-3300; fax 818-701-2730
Circle (253) on Free Info Card

Audio/video matrix switcher

Extron

• MAV 62: a six-input/two-output composite video and two-channel stereo audio (balanced or unbalanced) matrix switcher; it is capable of switching up to six independent video and stereo audio sources to two independently matrix switched outputs; the MAV 62 allows any one of the inputs to be switched to any one or both of the two outputs; features include RS-232 control, audio-follow-video switching and breakaway and vertical interval switching capabilities for smooth, seamless switching between input sources.

Extron, 1230 S. Lewis St., Anaheim, CA 92805; 800-633-9876 or 714-491-1500; fax 714-491-1517
Circle (250) on Free Info Card

Two-way radio interface
Clear-Com

• TW-40: this two-way radio interface replaces the TW-20 and is compatible with Clear-Com, RTS and other intercom systems; it allows existing walkie-talkies or other two-way radios to be connected to a channel of intercom; it provides a two-way audio connection and push-to-talk transmitter keying from any intercom station on the line, allowing remote personnel to join in without being hardwired to the intercom channel; the interface can be customized to the keying, level and signaling requirements of the system being used; the interface features extensive RF and EMI isolation to prevent electromagnetic interference from affecting the audio quality of communications.

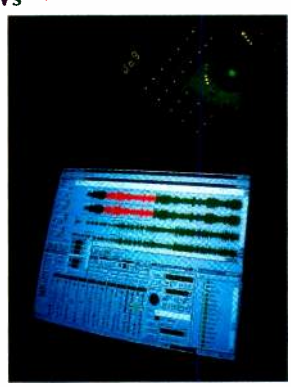
Clear-Com, 945 Camelia St., Berkeley, CA 94710; 510-527-6666; fax 510-527-6699; www.clearcom.com
Circle (252) on Free Info Card

Digital video exciter
Radýne ▶

• DVE5050: a high-speed digital video exciter that is fully compliant with European Telecom Standard (ETS), DVB and MPEG-2 standards; it features a high-speed video modulator with synthesized C-band or L-band output in a 1RU (1.75-inch) chassis; the DVE5050 is designed as a high-speed frequency-agile multidata rate uplink package and is ideal for use in digital video hub uplinks, transportable systems and mobile satellite news-gatherings vehicles.

Radýne, 5225 S. 37th St., Phoenix, AZ 85040; 602-437-9620; fax 602-437-4811
Circle (259) on Free Info Card

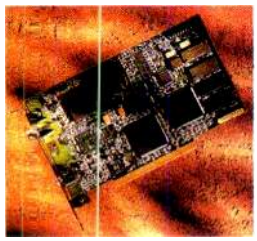
Production version 3 software for SADiE and Octavia DAWs ▼
SADiE



• V3 software: production version 3 software designed to operate on SADiE and Octavia DAWs that integrates with the hardware's digital audio I/O, DSP processors and fast SCSI disk interface; it features the dynamic reallocation of DSP (DRD) system that allows the AT&T's DSPs found in the SADiE and Octavia systems to perform real-time functions, such as EQ or dynamics processing; with DSP functions, the systems can handle multiple audio tracks.

SADiE, 1808 W. End Ave., Suite 1119, Nashville, TN 37203; 615-327-1140; fax 615-327-1699
Circle (265) on Free Info Card

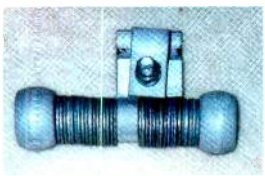
Next-generation MPEG-2 decoder board ▼
Vela Research



• CineView: a line of low-cost decoders that feature MPEG-2 decoding direct to a PC VGA monitor and an NTSC or PAL monitor (optional); a key feature of CineView is push technology, which is the ability as a client to receive data without requesting it when operating in a client/server environment; with CineView, an application can be designed that "waits" for the video to be pushed or broadcast to the decoder via an Internet, Intranet, LAN or WAN, and when CineView senses the networked broadcast video, the decoder is activated for immediate playback without user intervention.

Vela Research, 2501 118th Ave. North, St. Petersburg, FL 33716; 813-572-1230; fax 813-573-2508
Circle (261) on Free Info Card

High- and low-frequency vibration dampers ▼
AR Products



• MOD VI, MOV VII & MOD VIII: these three models of high-frequency vibration dampers have a range of 11 clamp sizes from 1/2-inch cable diameter to 1 7/8-inch; they can be used on new or older towers where the old Stockbridge dampers need to be replaced; the new AR damper is designed to avoid damage from dynamic loads, ice and hurricane winds; test data is available.

• Sandamper System: this system is designed to control low-frequency vibration and features a unique method of damping that is not subject to wearout; it is combined with snubbing action for effective control of guy galloping; the damper is located on each guy cable near the top of the tower where tower motion is greatest; a tether cable is attached from the Sandamper device to the tower leg at the next lower guy and safety devices prevent excessive guy loading.

AR Products, 3 Wingate Rd., Lexington, MA 02173; phone/fax 617-862-7200
Circle (251) on Free Info Card

Aurora workgroup editing solution
Alex Informatics

• Aurora: this software-based shared-storage solution for Windows NT has been dubbed a "virtual server;" it concurrently delivers real-time MJPEG or uncompressed video to up to 100 workstations and can provide an entire post-production team with shared video file storage, eliminating tape and file transfers; in an Aurora system, the workstations are connected to a centralized storage array via a high-speed Fibre Channel or SSA backbone; the Aurora software acts as a distributed file management system for Windows NT and is installed on each workstation; the uncompressed or MJPEG digital video files are delivered to the workstations on-demand and in real time.

Alex Informatics,1930 rue Gagnon, Lachine, Quebec, Canada J8T 3M6; 614-422-0022; fax 514-422-0020; www.alex.com
Circle (255) on Free Info Card

DVD player
Panasonic

•DVD-T2000: a DVD player designed for professional applications and offers RS-232 computer control for interactive applications; permitting multiple camera angle shots and seamless branching, it allows the user to choose between different story lines and viewing angles with the touch of a key; the DVD-T2000 combines the quality of 500 lines of horizontal resolution and the ability to play back DVD discs, as well as video and audio CDs; it delivers a video signal-to-noise ratio of 65dB, audio signal-to-noise ratio of 106dB and a dynamic range of 96dB; the player delivers ultrahi-fi 96kHz/20-bit linear PCM audio that exceeds even CDs and includes a Dolby Digital (AC-3) decoder for playing Dolby Digital Surround soundtracks.

Panasonic, One Panasonic Way, Secaucus Way, NJ 07094; 800-524-0864
Circle (275) on Free Info Card

Software that increases editing capabilities and adds real-time titling
Scitex

• SphereOUS for MicroSphere version 1.4.6 (combined with the Enhanced Production Package): MicroSphere is a dual-stream editing system that uses the Truevision Targa 2000 RTX card, which offers users the ability to work more efficiently with the release of this significant upgrade; some of the new features include unlimited layering capability for the DveousFX video effects engine with build to disk, additional real-time 3-D warp patterns, the ability to output projects to tape with or without time code, the ability to batch import AIFF and CD audio files, and controls for turning on and off any of the audio tracks one through four available in print to tape with time code; in addition, the number of keyboard shortcuts has been increased.

Scitex, Court Square Bldg., 200 E. Lexington St., Suite 705, Baltimore, MD 21202; 415-599-3183; www.scitexdv.com
Circle (272) on Free Info Card

Edit desk
Winsted Corporation

• Model E4403: a 94-inch-wide edit desk featuring a keyboard/mouse shelf that can be positioned at tabletop level, tilted or dropped down to achieve the most comfortable height; the desk comes with two 24½-inch (14U) racks that can accommodate most editing CPUs, hard drives and decks; a four-inch riser shelf keeps monitors at the correct viewing height, and it can be mounted anywhere along the back edge of the desk.

Winsted, 10901 Hampshire Ave. South, Minneapolis, MN 55438-2385; 800-559-6691 or 612-944-9050; fax 612-944-1546; www.winsted.com; racks@winsted.com
Circle (274) on Free Info Card

Fibre Channel disk array available with built-in fiber hub
MegaDrive

• Aria: a Fibre Channel disk array with an optional built-in four-port copper hub that allows additional devices to be daisy-chained with the benefits of hub resiliency and loop redundancy; the built-in hub works well for small workgroups where multiple hosts need to be direct-attached to a single Aria array or when additional local storage is necessary; the high-performance data storage systems are based on the Fibre Channel Arbitrated Loop interconnect standard (FC-AL) and offer virtually unlimited upgrade path and performance up to 2.5 times faster than current SCSI-based systems; the eight-slot disk array is built around a low-noise active backplane that delivers maximum data integrity by eliminating noise-reducing internal cables.

MegaDrive, 9201 Oakdale Ave., Chatsworth, CA 91311; 818-700-7600; fax 818-700-7601; www.megadrive.com; sales@megadrive.com
Circle (268) on Free Info Card

Seamless flooring system for studios
Crossfield Products

• Dex-O-Tex: this seamless flooring is a durable, water-phase resin material that is applied with a trowel in a series of coats to achieve a smooth finish; the grout coats allow the applicator to remove slight depressions that could cause camera flutter; for a like-new finish, you can roll on a fresh coat of topcoat sealer at any time; the flooring comes in several formulations and finishing coats and can be installed over concrete, metal or wood surfaces.

Crossfield Products, 3000 E. Harcourt St., Rancho Dominguez, CA 90221; 310-886-9100; fax 310-886-9119; www.dexotex.com
Circle (260) on Free Info Card

Non-linear video editing software
Matrox

• Version 4.0RT of in:sync Speed Razor: version four of this non-linear video editing software takes advantage of the Matrox DigiSuite boardset to offer users uncompressed D-1 video quality, 48kHz DAT audio quality, real-time A/B roll and graphics editing; it also includes a full complement of more than 100 real-time wipe, tile and dissolve transition effects; some other new features include Bezier curve control for software effects and support for real-time audio effects.

Matrox, 1025 St-Regis Blvd., Dorval, Quebec, Canada H9P 2T4; 514-685-2630; fax 514-685-2853; www.matrox.com/video
Circle (267) on Free Info Card

High-density mixed-signal routing switchers
Pro-Bel

Freeway: a range of low-cost, high-density mixed-signal modular routing switchers that can handle serial digital video, AES digital audio, analog video and stereo analog audio formats; any combination of signal type can be housed in the same chassis; Freeway also offers the possibility of format-independent audio signal routing.

Pro-Bel, Danehill Lower Earley, Reading Berkshire RG6 4PB, United Kingdom; +44 (0)118 986 6123; fax +44 (0)118 975 5787; sales@pro-bel.co.uk; www.pro-bel.com
Circle (273) on Free Info Card

Single-channel fiber video transport
Artel

• DigiLink 1220: this fiber-optic transport provides broadcast-quality NTSC and D-1 in the same unit; the DigiLink 1220 can be used in its analog mode today and in the digital mode in the future by simply selecting the front-panel switch for D-1; the DigiLink 1220 is fully compatible with industry-standard routers, as well as the DigiLink and MegaLink product lines; a front-panel display allows monitoring of output power, audio, laser status and receiver levels.

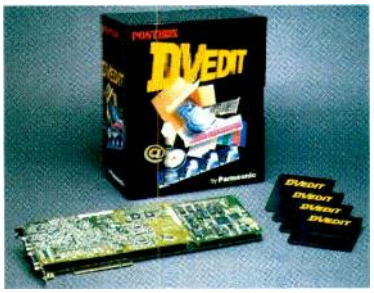
Artel, 237 Cedar Hill St., Marlborough, MA 01752; 508-303-8200; fax 508-303-8197; www.artel.com
Circle (263) on Free Info Card

Background I/O software utility
Discreet Logic

• Backdraft: this background I/O utility manages the movement of media assets, such as clips, audio and images, within a facility freeing up effects systems, such as Inferno and Flame; framestores can be archived without effecting the application that is using it; Backdraft is built on top of Wire facilitating acces to and transport of information across the network.

Discreet Logic, 10 Duke St., Montreal, Quebec, Canada H3C 2L7; 514-393-1616; fax 514-393-0110; info@discreet.com; www.discreet.com
Circle (264) on Free Info Card

Non-linear editing system
Panasonic



• DVedit: an affordable, all-digital DVCPRO-based non-linear editing system for the Windows NT platform;DVedit features the DVCPRO version of the Targa 2000 RTX video engine, Panasonic's Postbox editing software, Jog Pak edit controller and RS-422 VTR control card; the completely integrated non-linear system includes a 200MHz Pentium Pro class machine, Adaptec dual SCSI controller and Seagate video hard-drive storage.

Panasonic, One Panasonic Way 2A-2, Secaucus, NJ 07094; 800-524-0864 or 201-392-4319; fax 201-392-6001
Circle (271) on Free Info Card

Multiplexer
Thomson Broadcast Systems

• DBX2200: this transport stream multiplexing and re-multiplexing product accepts up to 12 separate physical inputs for transport streams, each carrying one or more services in their TS format with SI/PSI and delivers a fully MPEG-2-DVB compliant transport stream, including updated SI/PSI information; it provides drop in and drop out of individual segments or program streams and accepts user data, such as conditional access information, data for interactive services developed using the OPEN TV platform and EPG data all at data rates up to 8Mb/s; these features make the DBX2200 well-suited to digital TV broadcast centers, as well as cable head-ends where local programming insertion and retransmission are frequently required.

Thomson Broadcast Systems, 17 rue du Petit Albi , BP 8244/ 95801 Cergy-Pontoise cedex, France, 33 (1) 34 20 70 00; fax 33 (1) 34 20 70 45
Circle (269) on Free Info Card

Lighting systems
Sachtler

• Coolscreen: a range of rugged, modular designs that conform to CE wiring standards; the studio version has an input for existing analog or DMX dimmer circuits while the second version is a universal model for mobile use and for new studios; the universal model also features a built-in electronic dimmer that can be controlled by analog or DMX control; the control system can be changed at any time without changing the lighting or its operation and flicker-free performance is guaranteed for any control system.

Sachtler, Gutenbergstrabe 5, D-85716 Unterschleibheim, (0 89) 3 21 58-200; fax (0 89) 3 21 58-227
Circle (270) on Free Info Card

Newsroom editing low-rez — why bother?

Continued from page 60

into an edit room with a printed list of tape IDs with accurate time-code markers for every clip needed.

Workflow changes

With a system that allows a number of users simultaneous video access, broadcasters can begin to work in different ways. They have the ability to make low-resolution video available to many users and the ability to be productive with that video earlier in the process.

Traditional tape-based systems create linear workflow processes. Video arrives and is recorded. After recording is complete, video can be edited. Then, the source tape can be handed to someone else to start editing another project with the same material. Broadcasters have developed workarounds to make this process more efficient, such as double-recording important feeds and logging material as it comes in to speed the clip selection process.

By using low-resolution video properly, broadcasters can begin to create non-serial, non-linear workflow. They can begin several processes in parallel. Video can come into the facility and editing can begin simultaneously at several locations. New approval processes can be set up based on the system's ability to make material available over the network, without disrupting ongoing processes. A workstation can also access video and text in the same workspace.

Price/performance

Systems that are efficient at pairing high- and low-resolution images will deliver more functionality and access to media with today's technology. Because the process of storing and distributing high- and low-resolution images and sound rely on the same base technologies, the spread in cost between the two will always be about the same. As high-resolution systems become cheaper and faster, so will low-resolution systems by about the same factor. No matter how cheap disk storage gets, it will always be much cheaper to store low-res images. With many users desiring systems that will keep many years of material online, low-resolution-based systems will offer a more cost-effective solution.

Working with low-resolution images will offer new possibilities with wide-area networking, possibilities that will always benefit from systems that require lower-bandwidth requirements.

Systems that make use of low-resolution images are about to arrive in force. Properly implemented, these systems will be compelling solutions to many of the workflow issues faced in newsrooms. They will also offer benefits that will not be canceled or replaced as technology makes video on disk cheaper. ■

David Schleifer is product marketing manager, newsroom systems, Avid Technology, Tewksbury, MA.

industry briefs

Business

Leitch Technology Corporation, Chesapeake, VA, will acquire ASC Audio Video Corporation, Burbank, CA. The move broadens Leitch's offerings and gives it a strong foothold in the market for the design, manufacture and sales of video digital disk recorders. Under terms of the agreement, ASC will continue to operate as a separate entity in the short term, and sales/support services should not be affected.

Tektronix, Inc., Beaverton, OR, has agreed to purchase Siemens Communications Test Equipment (SCTE) GmbH, a wholly-owned subsidiary of Siemens based in Berlin. All of SCTE's approximately 230 employees and a majority of the 45-person sales force are expected to join Tektronix.

Columbine JDS (CJDS), Golden, CO, has acquired Media Solutions International, New York City. Media Solutions produces MediaLine for Windows, a software solution for direct response television. The acquisition expands CJDS's suite of software applications for the media business, including solutions for media reps and TV stations.

Columbine also acquired UK-based Broadcast Software Systems (BSS). The flagship product of BSS, the Broadcast Master software suite, was the first fully integrated suite of PC-based software for the programming area of television.

ABC Television's first all-serial digital mobile unit, ABC-1, has been completed by A.F. Associates (AFA), Northvale, NJ. AFA designed and built the video production system to assume the flagship position in the network's Sports Production Fleet.

Photo courtesy of Andy Washnik Studio.

The custom trailer measures 53 feet and is comprised of a 12'x14' production control room, video and audio control rooms, a transmission area and a graphics room. The unit also includes a 38-foot curbside expandable section for operations space. Two roadside sections expand for monitor walls, capable of supporting 25 cameras.

CBS-owned station KDKA, Pittsburgh, has taken delivery of 143 pieces of Panasonic DVCPRO equipment to upgrade its station and news in the field operations. Included in the order are 25 AJ-D700 camcorders, 18 AJ-D750 studio editing VTRs, 44 AJ-D230 desktop VTRs, nine AG-A850 edit controllers and an AJ-LT75 laptop editing system. The equipment will be assigned to the field, multiple news bureaus, satellite and microwave trucks and two helicopters.

In another important deal for Panasonic, Reuters Television has chosen Panasonic DVCPRO equipment for all field acquisition and field-editing requirements. Reuters will be installing DVCPRO equipment in a phased program over the next three years in all of its international offices. Principle equipment includes the AJ-D800 2/3-inch camcorder, the AJ-LT75 laptop editor and a range of VTRs.

ABC affiliate KITV-TV in Honolulu, which has received the first DTV construction permit from the FCC, will launch the nation's first all-digital TV station using JVC's Digital-S as its station-wide format. A Hearst-Argyle TV station, KITV has made a major investment of more than $500,000 in Digital-S with the purchase of 22 BR-D85 edit recorders, 11 BR-D40 dockable recorders, 19 BR-D750 edit recorders and 22 SA-D80 digital I/O boards.

JVC, Elmwood Park, NJ, also announced that Wabash Communications, owners of network-affiliated TV stations in Terre Haute, IN, and Fort Meyers, FL, has made an investment of more than $1 million in Digital-S. The purchase included studio editing and

field-recording equipment to enable the stations to acquire, edit and feed local news in 4:2:2 component digital.

Harris Corporation, Quincy, IL, recently transmitted a Major League Baseball game between the Baltimore Orioles and the Cleveland Indians from Oriole Park at Camden Yards in Baltimore to the National Press Club in Washington, DC. The game was captured on DTV cameras and transported via fiber and satellite to WHD and WETA stations in Washington and broadcast live by Harris transmitters at each station.

Spotlight Production Services Inc., Dallas, took delivery of three IFpro 18x lenses from Canon USA, Lake Success, NY. Spotlight is building a three-camera mobile switching system that will incorporate the three 18x9 lenses, as well as three new Sony DXC-D30 digital cameras.

Canon's 18X family of lenses, which includes the YJ18X9B KRS and YH18X6.7 KRS, offer the longest zoom ratio in its class, the widest angular field of view (52.1° x 40.3°) and a short MOD (0.9m). All optical accessories, including wide and tele-side converters are also available.

In addition, VTE Mobile Television Production, Torrence, CA, recently purchased 30 Canons for its mobile production units. The orders include six 70X, 10 J55X, 12 J20aX and three J9aX lenses. The lenses will be employed in VTE's NFL, NBA and Major League Baseball coverage, as well as other field productions.

Quantel, Darien, CT, has confirmed that discussions are under way between Quantel and Matsushita, Panasonic's parent company, with a view to Quantel offering native DVCPRO compatibility in its products.

BBC Outside Broadcast has purchased, from Thomson Broadcast, France, the world's largest production switcher and installed it in a new 20-camera DMCCR remote truck. The switcher, called the 9348, is based on the Thomson 9300 and uses the same electronics mainframe for video and key processing. Offering two mix effects banks, plus a third ME downstream, the mixer uses a special control panel that provides the operator direct access to 48 production sources, plus the additional 16 available on the upstream router as secondary signals.

Dielectric Communications, Raymond, ME, has been chosen by Miller Tower, Co., New York City, to provide a complete RF package, including multistation combiner equipment, a computerized protection system, dual high-power coaxial transmission lines, nitrogen pressurization equipment and master antenna, for a new tall tower project to be built in Cedar Hill, TX. The tower will accommodate TV and FM transmission.

Exabyte Corporation, Boulder, CO, announced an agreement by which it will begin supplying its Mammoth 8mm tape drive to QuVIS, Topeka, KS, for incorporation into its QuBit digital video recorder. The 40GB, 6MB/s Mammoth will provide rapid and high-capacity digital storage for QuBit, a 12-bit motion image recording device. QuVIS is now shipping the first production units of QuBit to its customers.

CBS affiliate WWL-TV, New Orleans, has invested in a second Quantel editing system less than 18 months after the purchase of an Editbox non-linear, on-line editing system. The new system has been purchased by 4th Dimension, the production arm of WWL-TV that posts commercials, infomercials, long-form and corporate work for numerous out-of-house clients.

NDS, Newport Beach, CA, has selected Zenith Electronics Corporation, Glenview, IL, to supply digital set-top boxes for its new end-to-end digital video system. The Zenith World Box is designed and configured to interact seamlessly with NDS Software, conditional access and head-end products.

People

Peter S. Wilmott, president and chief executive officer of Zenith Electronics Corporation, Glenview, IL, announced his retirement. Wilmott will lead the search for a successor and will remain on the Zenith board of directors.

Rick Plushner has been named president of Solid State Logic, North America, New York City. Plushner most recently served as vice president of sales, Americas, at Euphonix.

Stephen Jensen has been appointed RF design engineer for Broadcast Electronics, Quincy, IL.

David Linick has joined the senior engineering staff of A.F. Associates, Northvale, NJ.

The board of directors for the National Captioning Institute, Vienna, VA, has elected Gerald I. Isenberg, Margery Kraus and Jack Shea to join the board. ■

QUICK DIAL 72

MILLER

Fluid Heads and 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

- Dynamic fluid drag control
- Sliding/quick release camera platform
- Weighs 4 lbs. – handles up to 22 lbs.
- Counterbalance system compensates 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 leveling.

Miller 25-Series II Fluid Head

- 100mm ball level fluid head • Robust, lightweight, low profile design
- Quick release camera platform • Weighs 7lbs.–handles up to 25 lbs.
- Multi-step fluid drag system and integrated counterbalance system provide ultra-smooth, repeatable pan-and-tilt fluid control and finger-tip camer balance for ENG camcorders, industrial CCD cameras or small studio cameras

#601-Lightweight Tripod

- Weighs 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 and 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 #338—Miller 20 Head, 601 Lightweight Tripod, On Ground Spreader
System 20 ENG #339—Miller 20 Head, 649 2-Stage Aluminum, On Ground Spreader
System 25 #500—Miller 25 Head, 611 Lightweight Tripod, On Ground Spreader
System 25 ENG #502—Miller 25 Head, 641 2-Stage Aluminum, On Ground Spreader

Vinten

Vision SD 12

Pan and Tilt Head with Serial Drag

The Vision SD 12 head features "Serial Drag" pan and tilt system. System consists of a unique, permanently-sealed fluid drag and an advanced lubricated friction drag. You 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.

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 & spirally wound carbon fiber construction (Model #3523). They incorporate torque safe clamps to provide fast, safe & 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

Vision 12 systems include #3364-3 SD 12 dual fluid & lubricated friction drag pan/tilt head, single telescoping pan bar & clamp with 100mm ball base.

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

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

VIN-5ST and VIN-10ST

- Compact & lightweight, they maintain Vision performance and quality.
- Provide total stability and durability with payloads up to 33 lbs.
- Ideal for the latest generation of dockable and one-piece camcorders.
- Compatible with all Vision accessories.

VIN-5ST includes Vision 5LF head, single stage toggle clamp tripod, spreader and soft case.
VIN-10ST includes Vision 10LF head, single stage toggle clamp tripod, spreader and soft case.

QUICK DIAL 74

Canon

IF+ Series 1/2-inch & 2/3-inch Zoom Lenses

Canon's IF+ family of lenses are engineered to meet the needs of the next generation of broadcasting while meeting the standards of today. Besides having the widest wide angle lens available, the IF+ lens series have wider angles at shorter M.O.D. (Minimum Object Distance), provide higher MTF performance and incorporate Hi-UD glass for reduced chromatic aberration. In addition to superb optics they're all designed with Canon's "Ergonomic Grip" for fatigue-free shooting over an extended time. IF+ lenses are your assurance of unsurpassed quality and performance for today and tomorrow.

J15ax8B

A next generation internal focusing lens with the shortest MOD and widest angle of any standard lens, the J15aX8B IRS/IAS is a standard ENG lens that lets you shoot in tight or restricted areas at the closest minimum object distance ever possible and capture more of the subject. It incorporates all the great features of IF+lenses including a built-in 2X extender, high MTF performance, Hi-UD glass, square lens hood and Canon's "Ergonomic Grip".

J20ax8B IRS/IAS

Excellent for ENG, sports and production, the J20aX8B IRS/IAS lets you squeeze in shots from 8mm and still take you all the way out to 320mm with its built-in extender. Incorporates all IF+ features, plus is the only lens (besides the J9aX5.2B IRS/IAS) with aVari-Polar lens hood, enabling rotation of attached filters.

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
- 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 allows flicker-free shooting of a computer screen
- Full Time Auto White circuit lets you move from incandescent to fluorescent to outdoor lighting without changing white balance or the filter wheel.
- Quick Record Mode - when turned on the camera is set to the auto iris even if lens is set at manual. Also activates Automatic Level Control and Extended Electronic Iris which provides both variable gain and variable shutter. Shoot continuously from dark room to bright outdoors without having to adjust gain, iris or ND filter.
- Dual output system allows camera output to be connected directly to an external recorder

NEW! KY-D29 3-CCD Color Video Camera

One of the most sensitive cameras ever developed, the KY-D29 sets the standard for 3-CCD cameras and is also ideally suited for today's digital recording formats. With a sensitivity F11 at 2,000 lux, the KY-D29 can shoot in light as low as a remarkable 0.35 lux. It also offers a signal-to-noise ratio of 65 dB (with its DNR function on), and delivers 850 lines of horizontal resolution. The exceptional resolution and sensitivity of the KY-D29 are achieved by three new 760,000 pixel 2/3" interline transfer (IT) CCDs, the highest pixel count in the industry.

All-New Digital Signal Processing
- Advanced 14-bit Digital Signal Processing (DSP) and 3-dimensional Digital Noise Reduction (3D DNR) circuitry make this camera ideal for acquisition with todays popular digital formats, especially JVC's revolutionary new Digital-S.
- DSP within the camera provides astonishingly crisp, high-quality images, while minimizing analog distortions and noise. DSP also makes the camera more flexible and easy to use. It even smooths the transitions between gain and white balance settings so that viewers won't notice sudden changes of settings while the tape is rolling.
- Digital signal processing is enhanced with new 3D digital noise reduction circuitry to make it even more practical. By mixing multiple frames to cancel out random noise, then using motion detection to minimize lag. JVC's exclusive 3-D DNR produces dramatic results, far superior to any other DSP camera.

Super LoLux for Extremely Low Light Shooting
- Incredible new Super LoLux technology allows you to obtain a broadcast-quality picture in light as low as 0.35 lux. This extraordinary low light capability is the best ever achieved' and is made possible by utilizing JVC's exclusive LoLux dual pixel readout technology (increasing gain by 6 dB without introducing noise) while at the same time doubling the pixel readout integration time to 1/30 second.

Versatile Docking Capability
- Extremely high quality 4:2:2 digital recordings can be made by docking the KY-D29 to JVC's Digital-S BR-D40 dockable recorder. This digital combo produces recordings far superior to any component analog camcorder, or 4:1:1 digital camcorder.The KY-D29 also docks directly to JVC's BR-DV10 DV-format and BR-S422 S-VHS dockable recorders andcan dock to Betacam SP recorders using an adapter.

Features for a Wide Range of Applications
- The KY-D29 is loaded with a wealth of high-performance features, making it ideal for a wide range of broad cast and professional applications. Built-in continuous auto black (CAB) continuously takes a black balance setting, and full-time auto white for continuous compensation of color temperature changes, balance the camera in real time, all the time. This allows you to concentrate on getting the shot, and not on adjusting the camera.
- Because different shooting situations require flexibility, the KY-D29 offers selectable vertical resolution. In the Standard Mode, the camera produces 380 TV lines of vertical resolution. However, in the "V-Plus" high vertical resolution mode, the camera puts out 420 TV lines of vertical resolution, allowing you to increase vertical resolution without sacrificing sensitivity or lag, while maintaining 850 TV lines of horizontal resolution.
- Focusing is easier than ever with Accu-Focus. By momentarily decreasing depth of field, fast & critical focus is achieved instantly.
- Commonly used features can be activated without having to scroll through layers of menus. Features such as shutter control, variable scan, black stretch, black compress, CAB, iris modes, Accu-Focus, DNR and zebra are all menu-free. And for those times when events move so fast it prevents you from making any settings whatsoever, the KY-D29 's Full Auto Shooting (FAS) mode controls all of the camera's requiring you control only the focus, zoom and trigger.
- Other camera features include a built-in time/date, built-in zebra level selection switch, an f-stop display in the viewfinder, and a "battery remaining" display for Anton Bauer battery packs. A special Black

Panasonic

Broadcast & Television Systems

AG-DP800H UPERCAM

S-VHS 3-CCD Digital Signal Processing Camcorder

- Three high-density 380,000 pixel CCDs with half-pitch pixel offset achieves 750 lines of horizontal resolution, S/N ratio of 60dB and sensitivity of f8 at 2000 lux. Additionally the Frame Interline Transfer (FIT) CCDs minimize vertical smear even in very bright illumination.
- Digital Signal Processing circuitry provides four valuable benefits
  1) Consistently reliable up-to-spec performance.
  2) Fine adjustment of a wide range of parameters.
  3) Memory storage and instant recall of specific settings.
  4) More flexible and higher quality image processing, easier maintenance.
- Super High Gain mode allows 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.
- Has a 26-pin connector for convenient backup recordings using an additional VCR equipped with a 26 or 14-pin connector
- Phantom power can be supplied to an optional mic. Power can be switched off to prevent battery drain when not in use.

wDP-800H "LS" Package:
- DP-800H Supercam 3-CCD camera head with 1.5" electronic viewfinder and Anton Bauer Gold Mount battery plate
- Fujinon S14x7.5 BRM 14:1 servo zoom lens
- CC-S800 soft carrying case
- WV-QT700 tripod mounting plate

DP-800H "XL" Package:
- DP-800H Supercam 3-CCD camera head w/1.5" electronic viewfinder and Anton Bauer Gold Mount battery plate
- Fujinon S14x7.5 BRM 14:1 servo zoom lens
- CC-H800 Thermodyne hard shell carrying case
- WV-QT700 tripod mounting plate
- Two Anton Bauer Digital Trimpack 14 batteries
- Anton Bauer 2-position quick charger

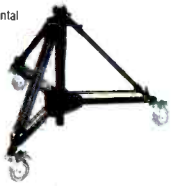
QUICK DIAL 72

sachtler

VIDEO 14/100 FLUID HEAD

- Sachtler Touch and Go System
- Integrated sliding battery plate
- Strengthened dynamic counterbalance in 2 steps
- Frictionless leak proof fluid damping with three levels of drag
- Vibrationless vertical and horizontal brakes
- Built in bubble for horizontal leveling

HOT POD TRIPOD SERIES



Especially developed for use in ENG, the Hot Pod Tripod is the fastest in the world. The central locking system is activated on all three legs at the same time, while the pneumatic center column easily makes it possible to have the lens at a height of over 7 feet. The elevation force of the center column is factory set and doesn't require any setup. When moving to another location it can be carried by its handle located at the center of gravity.

ENG TWO-STAGE TRIPOD SERIES

Sachtler two-stage tripods have an enlarged height range (lower bottom and higher top position) so they are more universal. Legs can be locked in seconds with Sachtler's quick clamping. There are also heavy duty versions for extra stability. The heavy duty aluminum has a 20mm diameter tube vs. 16mm and the heavy duty carbon fiber has a 24mm diameter tube vs. 22mm. All heavy duty two-stage tripods have a folding tripod handle.

NEW! Sachtler CADDY systems

Now Sachtler quality is available to low budget users. The price of a CADDY system includes the new 7-step dampened CADDY fluid head, ultra-light but rugged carbon fiber tripod, lightweight spreader and either a soft bag or cover.The CADDY fluid head features an adjustable pan arm, 7 step adjustment for quick counter balance and the self-locking Sachtler Touch and Go System.

CAD 01 Single-Stage ENG Carbon Fiber System:
- CADDY Fluid Head • ENG Single-Stage Carbon Fiber Tripod
- SP 100 Lightweight Spreader • Transport Cover 100

CAD 2A 2-Stage ENG Carbon Fiber System:
- CADDY Fluid Head • ENG 2-Stage Carbon Fiber Tripod
- SP 100 Lightweight Spreader • Soft padded ENG Bag

Libec MATTHEWS

P100 Portable Pneumatic Pedestal

The P100 is a small size pedestal that offers great flexibility without taking up too much space. Featuring an advanced air pressure system, the P100 smoothly handles loads up to 66lbs., easily accomodating professional cameras used in a studio. Ideal for CATV, small studios, event and wedding video as well as all kinds of industrial and institutional applications.

Air Pressure System:
- Air pump attached to the main body frame allows air to be pumped into a column anywhere and anytime – even while a camera is mounted on the pedestal. This allows you to check and adjust the air pressure while using the pedestal and avoid over-filling of air.
- Air pressure can be gradually adjusted by discharging air through a bleed valve when too much air has been pumped into the column. There is also a relief valve that automatically lets air out when air pressure inside the column exceeds the uniform value, bringing it below the uniform value.
- Large double wheel 5" casters allow the P100 to move smoothly and quickly. Wheels and caster axiles are easily fixed by the double stopper system.
- A track lock mechanism locks the wheels of the pedestal so that it only moves in a desired position.
- Cable guards prevent the casters from rolling over and becoming tangled in camera cables when the tripod is moved around in a studio.
- Large steering wheel affords greater ease in handling when shifting columns up and down or when moving the pedestal.
- Maximum and minimum height is 31" to 61". By attaching the optional LA-100 Low Angle Adapter to the dolly for shooting at low angles. (Height from the ground to mount is only 10").
- The column and dolly can be quickly disassembled for convenient transport. The column weighs 18 lbs. and the dolly 16 lbs.

H80 Professional Fluid Head

A premium fluid head, the H80 incorporates a patented drag control system that provides the smoothest pan and tilt available.
- Unlike conventional drag systems that have click stops at predetermined points, Libec's Continuous Drag Control System provides infinite control of drag tension allowing smooth, rapid movements as well as very slow movements.
- Continuous Counter Balance Control System provides optimum camera balance with tilt angles of + 90° or -90°.
- Designed to withstand the most demanding environments, the H80 is fully operational even in temperatures as low as -22°F.
- H80 supports up to 37 lbs. and has a 100mm claw-ball to simplify camera leveling.

H70 Professional Fluid Head

The H70's patented counter balance mechanism supports various operating configurations including stand-alone cameras, camcorders and studio cameras with large viewfinders.. Perfect balance can be obtained with settings from 0 to 3, depending on camera weight (from 15 to 33 lbs.) and tilt angle.
- Sliding balance plate features a locking mechanism and allow a total of 4" (100mm) of travel for camera balance. Has a 100mm claw ball.

VIDEO and PRO AUDIO

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Announcing our relocation on September 2, 1997 to a larger expanded facility at 420 Ninth Avenue (Between 33rd & 34th Streets) New York, N.Y. 10001

B&H PHOTO - VIDEO - PRO AUDIO

QUICK DIAL 74

NRG

POWER VEST SYSTEM

The Power Vest combines the comfort and convenience of a photo-journalist style vest with the power of NRG's highest capacity power belt. Available in two styles, the **Field** model is designed for use in a field production environment, while the **Event** model is for shooting events where style is everything. The Field model is rugged-ly constructed from black high density weatherized ballistic nylon and has an open-cut style that makes it comfort-able to wear in a variety of climates. Also has a highly adjustable design to fit almost any physical pro-portion.

- Internal and external pockets for blank tapes and accessories, a clear insert window for a press pass or business card, D-rings for cables and microphones, and an integral padded camera rest on the right shoulder.
- Cleverly concealed inside the vest is your choice of 12-volt 86 watt hour or 13.2-volt 95 watt hour nicad cell packs.
- A control box on the front features dual power outputs (dual cig-arette, dual XLR or mixed).
- 7-stage "fuel-guage", charge status indication and auto-reset short/overload protection.

The **Event** model is very similiar to the **Field** except in place of rugged fabric and pockets it features shoulder to sternum black satin tux fabric. Worn under a suit coat, the **Event** model is indis-tinguishable from a formal dress vest and it still retains interior and low exterior pockets. Both vests include 300-series charger (12 hrs.) and can be used with the optional Intelliquick Fast Charger (2 hrs.).

POWER CAN SERIES

For powering single or multiple pieces of 12v DC equipment for extended periods of time, nothing beats the power and convenience of NRG's Power-Can Series. It integrates an ultra-high capacity, high-discharge-capable UPS type lead acid power cell, a world-wide fast charger, and computer-controlled monitoring system with display—in a single, rugged package. Connect up to four pieces of equipment simultane-ously. From a midnight emergency scene to a wedding reception in the park, the Power-Can delivers ample power for extended running time.

- Recharge in 8-10 hours by simply plugging the Power-Can into any source of AC power (90-250v AC)
- LCD display shows discharge/charge status, voltage etc.
- An optional "Power Dolly" allows the Power-Can to be rolled for easy transport.
- Available in 18, 28 and 40 amp versions, each Power-Can has either four cigarette lighter connectors, four 4-pin XLR connec-

HORITA

BSG-50

Blackburst/Sync/Tone Generator

The BSG-50 provides an economical means for generating the most common RS-170A video timing signals used to operate vari-ous video switchers, effects generators, TBCs, VCRs, cameras and video edit controllers.

- 6 BNC video/pulse outputs
- Now available: 6 blackburst, 4 sync, 2 subcarrier
- Each sync output individually settable for composite sync, com-posite blanking, H-drive, or V-drive.
- Separate buffer for each output—maximum signal isolation
- 1KHz, 0dB sinewave audio tone output, locked to video
- Outputs can easily be configured to meet specific user and equipment needs..... **$269**

CSG-50

Color Bar/Sync/ Tone Generator

- Generates full/SMPTE color bars, blackburst and composite sync signals.
- Built-in timer can automatically switch video out-put from color bars to color black after 30 or 60 seconds. Easy and convenient for producing tape leaders and striping tapes with color bars and black.
- Front panel selection of full-field or SMPTE color bar patterns or colorblack (blackburst) video output.
- Includes crystal-controlled, 1KHz, 0dB audio tone output.
- Outputs: video, sync, ref frame, 1 KHz, 0dB
- Audio tone switches to silence and color bars change to black when using 30/60 second timer
- Fully RS-170A SC/H phased and always correct. No adjustment required..... **$349**

WE STOCK THE FULL LINE OF HORITA PRODUCTS INCLUDING:

WG-50 -	**Window Dub Inserter**
TG-50 -	**Generator/Inserter**
TRG-50 -	**Generator/Inserter/Search Speed Reader**
TRG-50PC -	**Has all of the above plus RS-232 control.**
VG-50 -	**VITC Generator, LTC-VITC Translator**
VLT-50 -	**VITC-To-LTC Translator**
VLT-50PC -	**VITC-To-LTC Translator / RS-232 Control**
RLT-50 -	**Hi8 (EVO-9800/9850)TC to LTC Translator**
TSG-50 -	**NTSC Test Signal Generator**
SCT-50 -	**Serial Control Titler "Industrial" CG, Time-Date Stamp, Time Code Captioning**
SAG-50 -	**Safe Area, Convergence Pattern and Oscilloscope Line Trigger and Generator**

QUICK DIAL 72

GLIDECAM INDUSTRIES

V-16 AND V-20

Professional Camera Stabilization Systems

The GLIDECAM V-16 and V-20 Camera Stabilization Systems allow you to walk, run, go up and down stairs, shoot from moving vehicles and travel over uneven terrain without any camera instability or shake. Designed primarily for professional video and 16mm motion picture cam-eras, the Glidecam V-16 stabilizes cameras weighing from 10 to 20 pounds and the V-20 from 15 to 26 pounds. They are both perfect for shooting the type of ultra-smooth tracking shots that take your audience's and client's breath away – instantly adding high production value to every scene. With either of the "V" series stabilizers you'll be able to offer the type of profes-sional shooting techniques that were previously available only to clients with full budgets. Whether you are shooting commercials, industrials, documentaries, music videos, news, or full length motion pictures, the Glidecam "V" series will take you where few others have traveled.

The Glidecam Support Vest

The lightweight and comfortable Support Vest can be adjusted to fit a wide range of operators. High endurance, closed cell, EVA foam padding and integral T6 aluminum alloy create a vest which can hold and evenly distribute the weight of the Glidecam V-16 and V-20 mays-tem across the operator's shoulders, back, and hips. For safety, quick release, high impact buckles allow the vest to be removed quickly.

The Three Axis Gimble

A free floating, precision Gimble incorporating Integrally Shielded Bearings creates the super-smooth and pivotal connections between the front end of the Dyna-Elastic Arm and the Camera Mounting Assembly. The Three Axis Gimble provides the operator with finger tip control over fluid tilting, panning and rolling. A locking mechanism allows the Gimble to be placed at varying positions on the Central Support Post. Moving the Gimble effec-tively adjusts the Systems Center of Gravity. The upper portion of the Sled's central support post includes guide markings. These markings allow for accurate gimble positioning.

The Dyna-Elastic Arm

The Exoskeletal, Dyna-Elastic Support Arm is designed to coun-teract the weight of the combined camera and Camera Mounting Assembly by employing high carbon alloy springs. The arm may be boomed up and down, as well as pivoted in and out, and side to side. It is the combined booming and pivoting action of the arm which creates the shock absorption necessary for ultra-smooth camera movement and mobility. The spring force is field adjustable to allow for varying camera weights. For safety, a Dual-Spring design is employed to reduce spring failure damage.

QUICK DIAL 74

lowel

ViP Video Lighting System

Designed for video, ViP systems provide 55 to 500 watt capabilities, powered by AC or DC. Mount one on-camera, on-stand, or hand hold it. Some ViPs feature adjustable beam angles. All are light weight and convention cooled.

V-light

Efficient enough to light a small room yet small enough to fit in a large pocket, the V-light provides a broad key light, back light or fill light (with umbrella or gel)

- Extreme wide-angle multi-use halogen source
- Mounts on stand, clamps, boom, wall, window, door-top
- 500 watt, AC powered (lamps not included)

i-light

Battery powered light provides excellent fill light, eye-light, or high-lights, with good contrast control for news and documentary shooting.

- Small and lightweight (18 oz.) for on camera use
- Multi-use 6:1 focusing range with i-100 lamp (lamps not included)
- 55 or 100 watt (12/14 volts DC)
- Includes cig. lighter connector or optional 4-pin XLR

Pro-light

Can be used as a low-level key or accent light, fill light (w/diffusion), backlight or background light.

- Multi-use halogen, focusing/tilting controlled with one hand.
- 125 or 250 watt AC, 100 watt 12 volt, or 200 watt 30 volt DC
- Optional cigarette, 4-pin and 5-pin XLR connectors
- Lamps not included.

Complete line of Lowel lights, lighting kits and accessories in stock...Call

Tota-Light

Provides a base or bounce light, backlight, or background light. Use it with an umbrella or gel frame with a diffusion kit. It is an ideal fill light or small soft key or illumination for copy work.

- Multi-use halogen source with 360° no-yoke tilting
- Choice of 300, 500, 650, or 750 watt AC lamps (not included
- Gull-wing reflectors close compactly for storage and travel

Omni-Light

Produces the ideal key or back-light, and with diffusion or an umbrella, it becomes a great soft fill source. With accessories, hand hold the Omni, camera mount it, or choose from a wide variety of mounting systems.

- Multi-use halogen source provides a non-crossover beam
- Choice of optional quick-change Super-Spot Reflector for exceptionally long throws at all voltages
- Choice of lamps: 420 or 500 watt 120v AC; 650 watt 220/240v AC; 250 watt 30 volt DC; 100 watt 12 volt DC (lamps not included)

DP System

Only 3.9 pounds the DP Light offers a very powerful key, backlight, or background light with or without diffusion. When used with its umbrella or diffusion it provides a soft key, fill, or side light. It includes a #1 reflector for an 8:1 focusing range and a large cool-operating hand grip and knobs.

- Multi-use halogen source with 170° no-yoke tilting
- Choice of 500, 750, or 1000 watts 120 volts; 650 or 1000 watts 220/240 volts (Lamps not included).

anton bauer

Logic Series DIGITAL Gold Mount Batteries

The Logic Series DIGITAL batteries are acknowledged to be the most advanced in the recharge-able battery industry. In addition to the comprehensive sensors integral to all Logic Series batter-ies, each DIGITAL battery has a built-in microprocessor that communicates directly with Anton/Bauer InterActive chargers, creating significant new benchmarks for reliability, perfor-mance, and life. They also complete the communications network between battery, charger and camera. With the network in place, DIGITAL batteries deliver the feature most requested by cam-eramen: a reliable and accurate indication of remaining battery power.

DIGITAL PRO PACS

The ultimate professional video battery and recommended for all applications. The premium heavy duty Digital Pro Pac cell is designed to deliver long life and high performance even under high current loads and adverse conditions. It's size and weight creates perfect shoulder balance with all camcorders.

- **DIGITAL PRO PAC 14 LOGIC SERIES NICAD BATTERY**
  14.4v 60 Watt Hours. 5 1/8 lbs. Run time: 2 hours @ 27 watts, 3 hrs. @ 18 watts
- **DIGITAL PRO PAC 13 LOGIC SERIES NICAD BATTERY**
  13.2v 55 Watt Hours. 4 3/4 lbs. Run time: 2 hours @ 25 watts. 3 hours @ 17 watts

DIGITAL TRIMPAC

Extremely small and light weight, the Digital Trimpac still has more effective energy than two NP style slide-in batteries. High voltage design and Logic Series tech-nology eliminate the problems that cripple conventional 12 volt slide-in type batteries. The professional choice for applications drawing less than 24 watts.

- **DIGITAL TRIMPAC 14 LOGIC SERIES NICAD BATTERY**
  14.4 v 43 Watt Hours. 2 3/4 lbs. Run time. 2 hours @ 20 watts, 3 hours @ 13 watts.

InterActive 2000 Power/Chargers

QUAD 2702/2401

Four-Position Power/Chargers

The lightest (and slimmest) full featured four position chargers ever. They can fast charge four Gold Mount batteries and can be expanded to charge up to eight. They also offer power from any AC main: all in a package the size of a notebook computer and weighing a mere four lbs! The 40 watt 2401 can charge ProPacs in two hours and TrimPacs in one. Add the Diagnostic/ Discharge module and the QUAO 2401 becomes an all purpose power and test system. The 70 watt QUAD 2702 bundles all Power/Charger features in the ulti-mate professional power system.

Dual 2702/2401

Two-Position Power/Chargers

The DUAL 2701 (70 watt) and 2401 (40 watt) are sleek, rugged and economi-cal two position Power/Chargers that have all the features of InterActive 2000 technology including DC camera output and LCD display. The DUAL 2701 will charge any Gold Mount battery in one hour, the DUAL 2401 charges ProPac batteries in two hours and Trimpacs in one. Their compact, lightweight package design makes them the ultimate trav-el Power/Chargers. They can also be upgraded with the Diagnostic/Discharge Module and/or with the Expansion Charge Modules to charge up to six batteries of any type.

PROFESSIONAL VIDEO TAPES

QUICK DIAL 71

FUJI

Professional Grade VHS

P6-30	2.29	P6-60	2.49	P6-120	2.69

Superior Grade Double Coated VHS

SG-30	3.39	SG-60	3.99	SG-120	4.49

H471S S-VHS Double Coated

ST-30	6.99	ST-60	7.49	ST-120	7.99

M221 Hi 8 Double Coated

Metal Particles				Metal Evaporated	
P630HMP	4.99			E630HME	8.39
P660HMP	6.49			E660HME	10.49
P6120HMP	8.49			E6120HME	13.99

M321SP Metal Betacam (Box)

05S	17.95	10S	18.49	20S	19.95
30S	22.95	60L	31.95	90L	49.95

DP121 DVC PRO

12M (Med.)	8.29	23M	9.99	33M	12.99
63M	22.49	64L (Lg.)	23.99	94L	34.99
123L					46.99

maxell

Hi8 Metal Particle (XRM)

P6-120 XRM	6.59

Broadcast Quality Hi8 Metal Particle

P6-30 HM BQ	5.39	P6-60 HM BQ	6.09
P6-120 HM BQ			7.99

P/I PLUS VHS

T-30 Plus	1.69	T-60 Plus	1.99	T-90 Plus	2.09
T-120 Plus	2.19	T-160 Plus			2.69

HGX-PLUS VHS (Box)

HGXT-60 Plus	2.69	HGXT-120 Plus	2.99
HGXT-160 Plus			3.99

BQ Broadcast Quality VHS (Box)

T-30 BQ	5.49	T-60 BQ	6.19	T-120 BQ	7.39

BQ Professional S-VHS (In Box)

ST-31 BQ	7.19	ST-62 BQ	8.09		
ST-126 BQ	8.39	ST-182 BQ	17.49		

Betacam SP

B5MSP	15.75	B10MSP	17.75	B20MSP	19.75
B30MSP	20.50	B60MLSP	29.75	B90MLSP	46.49

Panasonic

Mini DV Tape

AY DVM-30	9.95	AY DVM-60	11.99

DVCPRO

AJ-P12M (Medium)	10.99	AJ-P23M	12.99
AJ-P33M	15.99	AJ-P63M	29.99
AJ-P64L (Large)	29.99	AJ-P94L	49.95
AJ-P123L			64.95

SONY

Hi-8 Professional Metal Video Cassettes

P6-30 HMPX	4.59	P6-30 HMEX	7.99
P6-60 HMPX	6.59	P6-60 HMEX	11.49
P6-120HMPX	8.89	P6-120HMEX	15.49

Hi-8 Metal Evaporated Editor (HMEAD)

E6-30 HMEAD	10.49	E6-60 HMEAD	14.89
E6-120 HMEAD			20.19

PR Series Professional Grade VHS

T-30PR	2.39	T-60PR	2.59	T-120PR	2.79

PM Series Premier Grade Professional VHS

T-30PM	3.49	T-60PM	3.99	T-120PM	4.79

BA Series Premier Hi-Grade Broadcast VHS (In Box)

T-30BA	3.59	T-60BA	3.99	T-120BA	4.79

MQ Master Quality S-VHS (In Box)

MQST-30	7.49	MQST-60	7.99	MQST-120	8.39

BRS 3/4" U-matic Broadcast Standard (In Box)

KCS-10 BRS (mini)	8.29	KCS-20 BRS (mini)	8.99		
KCA-10 BRS	8.19	KCA-20 BRS	8.69		
KCA-30 BRS	9.69	KCA-60 BRS	13.39		

XBR 3/4" U-matic Broadcast Master (In Box)

KCS-10 XBR (mini)	8.79	KCS-20 XBR (mini)	10.19		
KCA-10 XBR	9.29	KCA-20 XBR	10.69		
KCA-30 XBR	11.99	KCA-60 XBR	15.69		

KSP 3/4" U-matic SP Broadcast (In Box)

KSP-S10 (mini)	9.59	KSP-S20 (mini)	11.09		
KSP-10	10.09	KSP-20	11.59		
KSP-30	12.99	KSP-60	16.99		

BCT Metal Betacam SP Broadcast Master (Box)

BCT-5M (small)	14.99	BCT-10M (small)	15.99		
BCT-20M (small)	17.99	BCT-30M (small)	18.99		
BCT-30ML	21.49	BCT-60ML	27.99	BCT-90ML	41.99

Mini DV Tape

DVM-30EXM w/Chip	15.99	DVM-60EXM w/Chip	19.95
DVM-30EX "No Chip"	12.95	DVM-60EX "No Chip"	14.99
DVM-30PR "No Chip"	9.95	DVM-60PR "No Chip"	12.95

Full Size DV Tape with Memory Chip

DV-120MEM	29.95	DV-180MEM	34.95

PVD Series Professional DVCAM Tape

PDVM-12ME (Mini)	24.50	PDVM-22ME (Mini)	26.95
PDVM-32ME (Mini)	29.50	PDVM-40ME (Mini)	31.95
PDV-64ME (Standard)	39.95	PDV-94ME (Standard)	44.95
PDV-124ME (Standard)	49.95	PDV-184ME (Standard)	59.95

CORPORATE ACCOUNTS WELCOME

Circle (78) on Free Info Card

VIDEO and PRO AUDIO

VISA · MasterCard · DISCOVER NOVUS · AMERICAN EXPRESS Cards

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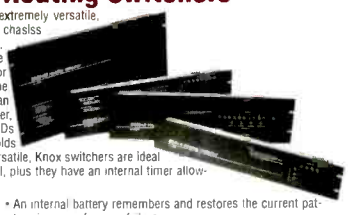
B&H PHOTO - VIDEO - PRO AUDIO

QUICK DIAL 72

KNOX VIDEO

RS4x4/8x8/16x16/16x8/12x2

Video/Audio Matrix Routing Switchers



Knox's family of high performance, 3-channel routing switchers are extremely versatile, easy-to-use and very affordable. Housed in an ultra-thin rackmount chassis they accept and route (on the vertical interval) virtually any video signal, including off-the-air and non-timebase corrected video. They also route balanced or unbalanced stereo audio. The audio follows the video or you can route the audio separately (breakaway audio). Each of the switchers offers easy manual control via front panel operation. They can also be controlled remotely by a computer, a Knox RS Remote Controller, or by a Knox Remote Keypad via their RS-232 port. Front panel LEDs indicate the current routed pattern at all times, and an internal battery holds and restores current patterns in case of power interruption. Totally versatile, Knox switchers are ideal for applications such as studio-feed control and switcher input control, plus they have an internal timer allowing timed sequence of patterns for surveillance applications as well.

- Accept and routes virtually any one-volt NTSC or PAL video signal input—including off-the-air and non-timebase corrected –to any or all video outputs.
- Accept and route two-volt mono or stereo unbalanced audio inputs to any or all audio outputs.
- Video and audio inputs can be routed independently (breakaway stereo audio), they don't need to have the same destination.
- Can store and recall preset cross-point patterns. (Not available on RS12x2.)
- Front panel key-pad operation allows easy manual operation.
- Can also be controlled via RS-232 interface with optional RS Remote Controller or Remote Keypad.
- Internal timer allows manual or automatic timed sequence of patterns —ideal for surveillance applications.
- Front panel LED indicators display the present routing patterns at all times.
- An internal battery remembers and restores the current pattern in case of power failure.
- Internal vertical interval switching firmware allows on-air switching.
- Housed in a thin profile rackmount 1" chassis.
- Also except the RS12x2 are available in S-Video versions with/without audio.
- Models RS16x8 and RS16x16 are also available in RGB/component version.
- With optional Remote Video Readout, the RS16x3 and RS16x16 can display active routes on a monitor at remote locations, via a composite signal from a BNC connector on the rear panel.
- The RS4x4, RS8x8 and RS16x16 are also available with balanced stereo audio. They operate at 660 ohms and handle the full range of balanced audio up to +4 dB with professional quick-connect, self-locking, bare-wire connectors.

nova SYSTEMS, INC.

StudioFrame

Modular Video Processing System

The Nova StudioFrame Series is a modular, flexible, digital/analog signal processing system. It is designed to efficiently and effectively combine a wide variety of individual function (or processor) boards such as A-D and D-A converters, video signal encoders and decoders, audio and video distribution amplifiers and frame synchronizers into more complex function groups, all in one equipment mainframe. The scalable nature of the StudioFrame design allows it to be easily reconfigured and/or upgraded as today's video standards and requirements continue to evolve. The system is based on two rackmount frame models (the SF-3 and SF-1) allowing up to thirteen front loading processor boards and thirteen rear mounted passive interface cards to be accommodated in a single chassis. Both the StudioFrame SF-1 and SF-3 chassis are designed to meet the most stringent broadcast requirements. The SF-3 is a thirteen slot, 3RU chassis while the SF-1 is a 4 slot, 1RU chassis. All studio cards as well as the two chassis' are backed by a two year warranty on parts and labor with guaranteed 24-hour turnaround service. The units are ruggedly constructed to endure studio rackmount, production van and OB (Outside Broadcast) mobile applications. A universal power supply operates at either 110 or 240 VAC, 50/60 cycle. DC operation is optionally available as is a redundant supply with automatic switchover. Dual exhaust fans maintain proper airflow and cooling. "Hot swappable" front card loading allows power-on removal/insertion of individual processing modules without disturbing others in the system. All cabling can remain in place while you service any module. An intelligent "centerplane" provides power, sync, timing and data distribution, facilitating expansion to more complex, more cost-effective signal processing functions.

NovaASD/NovaSDA

Analog to Serial Digital & Serial Digital to Analog Converters

Components of the Nova StudioFrame series, the NovaASD and the NovaSDA incorporate the latest digital video processing techniques for high speed A-D and D-A signal conversion. They are designed to meet the most stringent broadcast requirements and their "hot swappable" front card loading facilitates servicing without disturbing other cards in the system. The NovaASD is ideal for for interfacing analog signals with digital video formats and the NovaSDA for interfacing serial digital signals with

SDA-1 Serial Digital Component to Analog Component Converter
- SMPTE 259M 4:2:2: Serial Digital Component (D1) input.
- Equalized and reclocked serial digital component output
- Analog component video (Y, R-Y, B-Y/YUV), RGB or RGB/S outputs
- 10-bit D/A converters
- Output level control
- NTSC and PAL compatible

SDA-2 Serial Digital Component to Composite and S-Video Converter
- SMPTE 259M 4:2:2: Serial Digital Component (D1) input.
- Equalized and reclocked serial digital component output
- Dual composite & dual S-Video outputs
- Color bar output selectable
- 10-bit D/A converters
- Output level control
- NTSC and PAL compatible

SDA-3 Serial Digital Composite to Analog Video Converter
- SMPTE 259M Serial Digital Composite (D2,D3) input.
- Equalized and reclocked serial digital composite output
- Four analog composite video outputs
- Color bar output selectable • 10-bit D/A converters

ASD-1 Analog Component to Serial Digital Component Converter
- Analog component video (Y, R-Y, B-Y/YUV), RGB or RGB/S input
- Dual SMPTE 259M 4:2:2 Serial Digital Component (D1) outputs
- 10-bit D/A converters
- Picture positioning control
- NTSC and PAL compatible

ASD-2 Analog Composite and S-Video to Serial Digital Component Converter
- Analog composite and S-Video input
- Dual SMPTE 259M 4:2:2 Serial Digital Component (D1) outputs
- 10-bit D/A converters
- NTSC and PAL compatible

ASD-3 Analog Composite to Serial Digital Composite Converter
- Analog composite video input
- Dual SMPTE 259M 4:2:2 Serial Digital Composite (D2/D3) outputs
- 10-bit D/A converters
- Input gain adjustment

NovaMNR Median Noise Reducer

The NovaMNR is a StudioFrame card that eliminates impulse and transmission noise, cleans up satellite, microwave and fiber feeds and fills in CODEC and time-based corrected videotape drop-outs. It features full bandwidth, uncompressed 10-bit digital processing for ultimate video transparency as well as analog composite inputs and outputs.
- Eliminates "sparklies", those black and white dots that sometimes appear on remote video feeds. The NovaMNR incorporates a proprietary adaptive three-dimensional median filter that analyzes pixels from several fields of video and replaces the impulse noise with uncontaminated, clean video.
- Universal drop-out compensation replaces missing video information, whether it is from a time-base-corrected VCR source or the decoded output of a CODEC feed. The NovaMNR effectively fills in drop-outs with replacement video from the surrounding pixels and previous video field.
- Control's are accessible locally or remotely. A three position threshold switch (off/low/high) adjusts system noise sensitivity while a bypass/operate switch is also included. Both switches are remoteable via RJ-11 jack.
- Also available in PAL and PAL-M versions.

NC-8 RGB/Component to Composite/S-Video Encoder

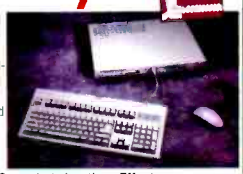
- 10-bit processing, 8-bit D/A conversion
- Zero insertion delay, frame of memory
- Two composite and one S-video output
- Analog RGB (Sync on Green or all three), RGB/Sync and YUV (Betacam) inputs. Also available with looping inputs.
- Variable luminance notch filter
- Y and C pre-comb filtering for maximum encoding performance
- Remote serial control • Output level control
- Color bar output selectable
- Designed to meet the most stringent broadcast requirements.
- "Hot swappable" front card loading facilitates servicing without disturbing other cards.
- Available in PAL and PAL-M versions.

VIDEONICS

Animated Postscript Character and Graphics Generator

POWER Script™

QUICK DIAL 74



The most advanced character generator ever designed for video production, multimedia and industrial applications, PowerScript delivers the huge range of titles and graphics supported by PostScript display technology, plus animation, effects, transparency and color keying. It features two GPI inputs, anti-aliased, 17.5 ns (nanosecond) pixel resolution and 4:2:2 broadcast-quality video. It also offers high-speed RISC processing to provide real-time Level 2 PostScript imaging and fast rendering—even with the most complex images. The PowerScript works stand-alone or with a computer, has a built-in TBC, offers a powerful and intuitive interface, and is suitable for the desktop or can be rackmounted.

Powerful Character Generator
- Choose from 35 built-in fonts or download PostScript fonts from your PC. PowerScript's high-speed RISC processor provides real-time PostScript imaging.
- Characters can be rotated at any angle, scaled to any size, stretched horizontally or vertically.
- Styles include variable bold and italic, underline and shadow (drop shadow, variable displacement and opacity). Each character can be adjusted separately.
- Text can be positioned anywhere on the screen or automatically centered, vertically or horizontally. Left, right, top, bottom and center justification is also provided.
- Characters are automatically kerned, using the font's standard kerning information. Spacing is highly flexible with variable word and letter spacing and line spacing (leading).

Intuitive User Interface
- Built-in real-time object-based drawing tool and text editor—no computer or software required. Design can be done ahead of time and displayed later, or can be done on the fly.
- Supplied keyboard and mouse are used with easy on-screen menus to place and modify graphics and text.
- Change fonts, colors, and other characters instantly.

Transparency and Colors
- Characters can be made transparent (0-100%) over video, other characters and graphics with 64 levels of transparency.
- Opaque characters can use over 4,000,000 colors , transparent characters can use over 8,000.
- Different colors can be used for fill and outline (variable width) as well as each letter and each graphic.

Roll, Scrawl, Animation, Effects
- Variable speed roll, crawl and push (slide) in all directions.
- Every text object, graphic and logo can be animated. Complex animations include having elements follow paths, bounce, etc.
- Elements can change outline and/or fill color, transparency, position as they move and results are displayed in real time.
- Move individual characters in different directions; make colors change; flash words; make letters and words bounce; spin a letter across the screen. Use fades and wipes to transition between titles and video or between two pages of titles.

Backgrounds and Graphics
- Titles can be placed on solid color, patterned or graduated backgrounds, or they can be genlocked to incoming video.
- Lines, squares, rectangles, ovals and circles can be created and placed anywhere on the screen. Each graphic object can use a different color, transparency, rotation, size, fill and outline.

Imported Logos and Graphics
- Accepts most PostScript or PCX format graphics without modification. Imported images can be any size and can be scaled, skewed, and rotated when placed on screen. Transparency and anti-aliasing can be defined when graphic is generated.

Expansion Capabilities

Although PowerScript operates on its own, you can still add peripherals and connect to a computer or network. Two PC-card slots allow the addition of non-volatile flash-RAM and Ethernet cards. RS-232 port allows connection to desktop computers for added storage and downloading of fonts or graphics from a PC.

QUICK DIAL 72

LEADER

Manufacturing test and measurement equipment for over 40 years, Leader instruments is the standard which others are measured against for reliability, performance, and most important—cost effectiveness. Before a product is brought to market, an exceptional degree of energy and effort go into its design. Prototypes are built and tested to withstand environmental and other factors far exceeding actual operating conditions. These include high humidity, extremes of heat, cold, shock and vibration. Manufacturing quality is built in every step of the way and only the finest parts are used. At each production run, subassemblies are separately tested before they are integrated into the finished product, then each product is tested again. This is why less than half of 1% of all Leader products are ever returned for warranty repair or adjustment.

5860C WAVEFORM MONITOR

A two-input waveform monitor, the 5860C features 1H, 1V, 2H, 2V, 1 s/div and 2V mag time bases as well as vertical amplifier response choices of flat, IRE (low pass), chroma and CIF-STEP. 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.

5850C VECTORSCOPE

The 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.

5100 4-Channel Component / Composite WAVEFORM

The 5100 handles three channels of component signals, plus a fourth channel for composite signals, in mixed component / composite facilities. Features are overlaid and parade waveform displays, component vector displays, and automatic bow-tie or "shark fin" displays for timing checks. Menu-driven options select format (525/60, 625/50, and 1125/60 HDTV), full line-select, vector calibration, preset front-panel setups and more. On-screen readout of scan rates, line-select, preset numbers, trigger source, cursor time and volts.

5870 Waveform/Vectorscope w/SCH and Line Select

A two-channel Waveform/Vector monitor, the microprocessor-run 5870 permits overlaid waveform and vector displays, as well as overlaid A and B inputs for precision amplitude and timing/phase matching. Use of decoded R-Y allows relatively high-resolution DG and DP measurements. The 5870 adds a precision SCH measurement with on-screen numerical readout of error with an analog display of SCH error over field and line times. Full-raster line select is also featured with on-screen readout of selected lines, a strobe on the PIX MON output signal to highlight the selected line, and presets for up to nine lines for routine checks.

5872A Combination Waveform/Vectorscope

Models 5872A offers all the operating advantages of the 5870, except for the following: SCH is deleted from the 5872A (line select retained), making it ideal for satellite work.

5864A Waveform Monitor

A two-input waveform monitor that offers full monitoring facilities for cameras, VCRs and video transmission links. The 5864A offers front panel selection of A or B inputs, the choice of 2H or 2V display with sweep magnification, and flat frequency response or the insertion of an IRE filter. In addition, a switchable gain boost of X4 magnifies setup to 30 IRE units, and a dashed graticule line at 30 units on screen facilitates easy setting of master pedestal. Intensity and focus are fixed and automatic for optimum display. Supplied with an instruction manual and DC power cable.

5854 Vectorscope

A dual channel compact vectorscope, the 5854 provides precision checkout of camera encoders and camera balance, as well as the means for precise genlock adjustments for two or more video sources. Front panel controls choose between A and B inputs for display and between A and B for decoder reference. Gain is fixed or variable, with front panel controls for gain and phase adjustments. A gain boost of 5X facilitates precise camera balance adjustments in the field. Supplied with a DC power cable.

Designed for EFP and ENG (electronic field production and electronic news gathering) operations, they feature compact size, light weight and 12 V DC power operation. Thus full monitoring facilities can be carried into the field and powered from NP-1 batteries, battery belts and vehicle power. Careful thought has been given to the reduction of operating controls to facilitate the maximum in monitoring options with the operating simplicity demanded in field work.

ALL ITEMS ARE COMPLETE WITH ALL ACCESSORIES AS SUPPLIED BY MANUFACTURER

Continued from page 34

like CU-SeeMe try to work around the asymmetry by providing buffering to help compensate for the delays in Internet performance. Using user datagram protocol (UDP) instead of TCP means bidirectional handshaking isn't needed. However, the key performance requirement here is high-speed access in *both* upstream and downstream directions.

> The bad news is that despite all the promises, high-speed cable modem access isn't here — yet. The good news is that it will be.

Unkept promises

So, where does this leave the average Internet user desperate for faster access times? Waiting and waiting might be the most honest answer.

Cable modem manufacturers have promised much, but delivered little. Part of the reason is they don't have control over the entire communications loop. They can't direct how much bandwidth a cable system assigns the data communications side of their business. System noise and numbers of users are other key factors uncontrollable by the modem vendors.

However, and most important, modem vendors have failed to keep promises of a common standard. Although they claim to be working on one, there is no cable modem standard. A LANcity LCP cable modem won't replace a Motorola CyberSURFER, which won't substitute for a Zenith The Godfather modem. Until standardization happens, costs will remain high — and usership low.

The bad news is that despite all the promises, high-speed cable modem access isn't here — yet. The good news is that it will be, if nothing else, because the cable industry is worried that the telcos just might get their collective butts together and implement ADSL. If so, that could blow the cable modem makers, not to mention the cable companies, right out of the water. ■

For more information on cable modems, check out these Internet sites:
www.cablemodem.com
catv.org/modems/trials

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HELP WANTED

AccuStaff Incorporated, the fourth largest staffing agency in the nation is partnering with Discovery Channel Latin America to hire the following contract positions for Discovery's Latin AmericanTelevision Center in Miami, Florida. Contracted through AccuStaff, employees selected for the listed positions will be working on-site at the Television Center:

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TRANSMISSION ENGINEER: Minimum of 3 years engineering experience with satellite transmission provider, TV transmission facility, or network control/operations center. Knowledge of video, audio and RF signal parameters and quality control standards required, including maintenance of Satellite Uplink Systems. PC literacy required, experience with digital compression system (Scientific Atlanta Power Vu and/or General Instrument Digicipher preferred). Knowledge of Philips/BTS master control/routing and Louth Automation systems a plus. Spanish and/or Portuguese a plus. 24/7.

MAINTENANCE ENGINEER: Successful candidates will have a primary expertise in either systems, RF, video or audio. Minimum of 3 years maintenance experience including significant experience in a ITU-R 601 digital environment. Ability to diagnose to component level, familiarity with test signals and equipment, analytical software, and computer programming. AA degree in electronics or computer systems required. Military or other significant experience/training can be substituted for degree requirements. SBE certification and FCC general class license strongly preferred. Spanish and/or Portuguese a plus. 24/7.

Send resumes to: AccuStaff Incorporated, 1101 Brickell Ave. Suite 1003, Miami, FL 33131
Fax: 305-381-9588 • email address: paulag@accustaff.com
No calls to Discovery Channel please.

Intertec Publishing, a leader in the technical magazine and book publishing industry, is seeking an editor to plan, develop and implement the editorial content of their publication, *Sound & Video Contractor*. To qualify for this career opportunity, the successful candidate will possess an in-depth knowledge of sound and/or video systems design, installation, maintenance, or product sales, along with excellent public speaking and communication skills. Writing and editing experience in a related industry and the ability to conceptualize magazine design are preferred. To apply for this opportunity, complete with a competitive compensation and benefits package, send resume and salary requirements to: Intertec Publishing, Human Resources Dept., Editor-GH, 9800 Metcalf, Overland Park, KS 66202.

EOE

ASSISTANT CHIEF ENGINEER WTVM-TV is seeking a highly motivated, multi-skilled, hands-on individual with management ability to become our Assistant Chief Engineer. Minimum of 5 years experience in Broadcast or related field. Must possess systems planning, maintenance, and installation experience. Strong computer skills and experience with networks is desired. FCC General Class license and/or SBE Certified is preferred. Pre-employment drug test required. Send resume to: Martha Smith, WTVM-TV, PO Box 1848, Columbus, GA 31902. EOE

TV MAINTENANCE ENGINEER - WDSE-TV in beautiful Northern Minnesota is looking for a quality person to repair our broadcast equipment, including VTR'S, edit controllers, graphics, and more. Requires a minimum of 3 years TV broadcast maintenance experience, 2 year electronics tech degree or equivalent experience, and FCC General Radiotelephone License or SBE certification, both a plus. Computer skills and remote broadcast experience desired. Excellent pay, benefits and conditions. WDSE-TV is a top rated PBS affiliate located near the Boundary Waters Canoe Area Wilderness, Voyageurs National Park, Superior National Forest, and Lake Superior. Super boating, fishing, snowmobiling, and skiing with a strong local economy, clean environment, excellent schools, and low crime! WDSE-TV, 1202 E. University Circle, Duluth, MN 55811. 218-724-8567. Rex Greenwell, Director of Engineering & Operations. E.O.E.

BROADCAST MAINTENANCE TECHNICIAN needed in Los Angeles area. Install and maintain all types of audio, video and transmission broadcast equipment. Must be able to lift up to 70 pounds. Preferred Qualifications: Associate degree in electronics or its equivalent. Three plus years of broadcast equipment maintenance experience. Must have knowledge and experience with analog and digital broadcast equipment, and multiple video tape formats. Other duties as assigned. A drug test is required for successful applicants. Non-smoking environment. Send your resume with salary requirements to: TCI-National Digital TV Center, 15240 Raymer St., Van Nuys, CA 91405. Attn: Kevin Thompson. You may fax your resume to (818) 787-9965.

ENGINEER/PROJECT MANAGER Experience in repair, maintenance, integration/installation of broadcast equipment for teleproduction, presentation and sound systems. We're located in Phoenix and have career opportunities for engineers and project managers. We offer a generous compensation package and 401K plan. Please fax resume and salary history to 602-274-7416 Attn: J.L. EOE.

MAINTENANCE ENGINEER Come grow with us in the nations rnost exciting market. The NBC affiliate in Las Vegas, Nevada is seeking a candidate w/2 years experience repairing broadcast TV and computer electronic equipment and trouble shooting to component level; must be able to obtain a Nevada driver's and FCC license; and SBE certification desired. Send resume/salary requirements to: Personnel Department, KVBC-IV, 1500 Foremaster Lane, Las Vegas, NV, 89101. E.O.E.

MAINTENANCE ENGINEER: Seeking candidate with 3 years experience maintaining Studio, ENG Microwave equipment and VHF Transmitters down to the component level. SBE certification is desirable. Contact Barry Gries, 4247 Dorr Street, Toledo, Ohio 43607. Phone: 419-531-1313

DIRECTOR OF ENGINEERING A midwest television station is looking for a Director of Engineering. 5 to 10 years engineering management experience preferably in TV. Thorough knowledge of analog and digital. Must have a proven track record in budgeting and administration of same. We offer an competitive benefits package. Please send resume to: Classified Ad Coordinator, Broadcast Engineering, Dept. 788, 9800 Metcalf, Overland Park, KS 66212-2215.

TV BROADCAST MAINTENANCE ENGINEER Immediate part-time opening for television broadcast engineer at independent Central Florida station. Applicants should have a minimum of five years experience in television maintenance with Sony VTR, studio and remote truck experience. Assist with UHF transmitter, microwave systems. Commercial B drivers license a plus. Send or fax resume to: WTGL TV52, 653 W. Michigan Street, Orlando, FL 32805. (407) 422-0120. EOE/AA

WAFF TV HUNTSVILLE, NBC UHF station is looking for supervisor of engineering maintenance and master control staffs. FCC General Class License a must, experience with UHF transmitters a plus. Must have ability to do component level troubleshooting. Individual must possess five years experience in TV, leadership skills, and ability to manage people and projects. Great opportunity to join growing Raycom Media group in booming southern market. Send resume to: WAFF-TV, PO Box 2116, Huntsville, AL 35804. ABSOLUTELY NO PHONE CALLS. WAFF is an Equal Opportunity Employer and encourages applications from women and minorities.

ASSISTANT CHIEF ENGINEER/MOBILE UNIT ENGINEER: Qualified candidates will have 2 years technical education, 5 years broadcast maintenance experience as well as Remote broadcast experience. Candidate required to work with clients/crews for remote productions, all aspects of equipment maintenance, supervision and training skills and knowledge of computer systems. Resume to Personnel, WKJG-TV, 2633 W. State Blvd., Fort Wayne, IN 46808. No phone calls accepted. EOE.

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MAINTENANCE TECHNICIAN Electronic maintenance of television broadcast, computer and telephone systems including project design and installation of new systems. Requires 5 years experience in broadcast maintenance including trouble shooting and repair of studio, audio, graphic and computer systems. Knowledge of microwave, satellite and transmission systems and FCC General Class or SBE certification strongly desired. Knowledge of Novell, Microsoft NT, Microsoft Office and Windows 95 with applicable certifications also preferred. Send resume to: Kathy Copeland, KGW, 1501 SW Jefferson St., Portland, OR 97201. EOE M/F/V/D

ENGINEER Regular, full-time. Responsible for maintenance and system design of digital and analog editing systems. Requires ability to troubleshoot to board level, knowledge of Sony VTR's inc. DBETA, BETA SP, 1", D2, 3/4" VHS, Ampex DCT, Sony Editors, Switchers, DME, Ampex ADO, Avid and Macintosh. Requires a high level of PC and Macintosh literacy and networking, 2-5 years experience, self-motivation, good people skills, good communication skills and must be detail-oriented for documentation. Fax resume and salary requirements to Human Resources/HMS 703/243-4023. EOE-M/F/H.

VIDEO REPAIR TECHNICIAN Alpha Video, the leader in digital video solutions, is looking for an experienced repair technician to provide service on professional and consumer VCR's, cameras and monitors. Experience on SVHS and knowledge of digital video equipment required. Send cover letter, resume and salary requirements to: Stan Stanek, Alpha Video, 7711 Computer Avenue, Edina, MN 55435. Fax: 612-896-9899; E-mail: stan@alphavideo.com; Phone: 612-896-9898. EOE

TV CHIEF ENGINEER KOED-TV, Tulsa, is seeking a hands on chief engineer with a strong transmitter and studio maintenance background. Supervisory and organizational skills will be essential. 3 years broadcast experience required. Send resume and salary history to Personnel, Oklahoma Educational Television Authority, P.O. Box 14190, Oklahoma City, OK 73113. AA/EEO

THE AGE OF DTV IS HERE, and Univision Television Group, Inc. is seeking an ENGINEERING COORDINATOR to assist the Director of Engineering in the planning, design, construction and maintenance of studio and transmission facilities for this new era of broadcasting. This person will also provide support to the engineering departments of Univision's twelve full power UHF-TV stations, not only in planning and implementing this new technology, but also in maintaining existing NTSC facilities during this transitional period. Travel for this Los Angeles based position is required. Applicants with at least 10 years of hands-on broadcast experience as a Chief or Assistant Chief Engineer may fax resumes with salary requirements to: Univision Television Group, Inc., Attention: "Engineering Coordinator Position", FAX# (310) 348-3659. Univision Television Group, Inc. is an Equal Opportunity Employer.

ASSISTANT CHIEF ENGINEER: Supervise engineering maintenance and master control staff, serve as a liaison with other departments, assure compliance with FCC and OSHA rules, implement routine maintenance and quality control procedures, assist in preparing and meeting capital and operating budgets, train and evaluate engineering personnel, and be generally responsible for the day to day operation of the department. A minimum of five years experience in hands-on commercial television maintenance are required, as well as some supervisory experience. Experience in broadcast transmitter maintenance and troubleshooting is preferred, as is SBE certification. Request an application from: Tricia Thurman, WTOC-TV, PO Box 8086, Savannah, GA 31412. NO PHONE CALLS, PLEASE! We are an equal opportunity employer - women and minorities are encouraged to apply.

MAINTENANCE/REMOTE ENGINEER. Repair and adjust television/radio equipment, assist in construction of new equipment or modification of existing facilities, and frequently assist remote production team in an engineering capacity at remote site. Back-up driver for mobile unit. FCC Radiotelephone Operator License, General Class or other certification and background in analog and digital troubleshooting required. Television UHF and FM radio transmitter experience desirable. Possess valid Florida CDL Driver License or obtain within three months of employment and have driving record acceptable to WMFE insurance provider. Resume to: Personnel, WMFE, 11510 E. Colonial Dr., Orlando, FL 32817. Position open until filled. EOE.

ASSISTANT CHIEF ENGINEER Group-owned television station, offering the best of all worlds for a hard-working person interested in opportunity and career development. Must possess excellent systems planning knowledge, management ability, foresight and a practical approach, VHF transmitter experience, ability to drive satellite truck and uplink, and strong computer skills. Hands on required. An FCC General Class License or SBE Certificate preferred. Location, climate and benefits are a plus. To apply, send resume and letter of introduction to Chief Engineer, WIS Television, PO Box 367, Columbia, SC 29202 (NO PHONE CALLS, PLEASE.) EOE

TECHNICIAN Successful candidate will have a minimum of 3 years experience in a major market TV station. Master control, VT & audio experience required. Send resume and cover letter (no calls/faxes) to Irwin Ross, Director of Engineering, WPVI-TV, 4100 City Line, Suite 800, Philadelphia, PA 19131. EOE

MAINTENANCE ENGINEER Immediate opening for person with minimum 3 years experience maintaining broadcast equipment to component level. The ideal candidate has experience with Sony, Grass Valley, Ikegami, Quantel, and Chyron. RF experience a plus. Send resume to David Boettcher, K*USA, 500 Speer Blvd., Denver, CO 80203. We are an Equal Opportunity Employer.

ad index

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By Paul McGoldrick

A TV station for less than $150

The ad reads "Own your own TV station for less than $149.95?" It's from one of those companies that regularly advertise in in-flight magazines. Maybe the question mark at the end of the headline gives them a legal out for the product's performance, or lack thereof.

The ad is written like a technical report with the author's name bylined. The product is actually a room-to-room transmitter/receiver system and, quoting from the report, the ad reads:


Paul McGoldrick

"Using Digital Video System, or DVS, the Wireless Video Sender is capable of transmitting high-quality visual images and stereo sound to any television in your home, for up to 100 feet away.

The key to this system is its use of the new 2.4GHz technology. This frequency has a broad signal range which means that more video information can be transmitted. This results in cleaner pictures, reduced signal interference and multiple channels. What's more, because it's used much less than the old 900MHz frequency, the 2.4GHz range is virtually uncluttered.

In the past, many wireless products used 900MHz technology, by which signals were sent in linear transmissions. Unfortunately, linear transmissions can be blocked by studs and objects within the walls of your home. The 2.4GHz range of the Wireless Video Sender creates a circular polarization signal to provide clear, powerful retransmission of audio and video signals throughout your home — unobstructed by walls, ceilings or floors. Even if there is a wall stud in the path of the signal, virtually the entire wave gets to your remote television."

The ad goes on to explain that there is no multipathing with this system because the antennas are so directional and there is no "ghosting." Also, the units can be switched between four different channels (just in case your neighbor is pouring watts of 2.4GHz at you), so you can operate more than one system in your house at the same time.

Any truth?

Do you think it works? It probably does OK between two adjacent rooms provided the antennas are high enough off the floor and the dog is not always running between them. Of course, aligning narrow-aperture line-of-sight antennas between rooms must be quite an amusing pastime, but I suspect that if I couldn't get it right, I can't blame the supplier for shipping me a silly product. The 100-foot claim needs to be taken with a large dose of something, but if it wasn't for this ad, I would never have known of this new description for a *linear transmission.*

This same company offers several other technology products most of which (like using the power wiring in your house as a high-gain TV antenna) can be brutally laughed off. In one sense, it is frightening that the company is still there; people must be buying this stuff! Although this is a digital video column, I'm not sure this product qualifies for inclusion.

This company offers a non-video product that I just want to believe works and I need your help. There must be a reader out there who has purchased a device called the Phazer, which the author of the tacky ad ascribes to Rocky Mountain Radar. Allegedly, this product is a "jammer" for police radars and lasers. When it receives an X, K or Ka band radar signal, it sends it back with a modulation "chirp" mixed in that tells the radar unit on one reading that the vehicle is doing 15mph and on the next reading it's 312mph, confusing it into saying it cannot make a reading. On the laser side, it is active, firing infrared pulses out of the windshield from LEDs. Allegedly, the laser gun also gets confused.

Well, does it work? For $199, it's not that risky, but I'm not going to try it. The only way I could check it out would be deliberately driving through a speed trap at a gross speed. Even though the warranty claims the manufacturer will pay the ticket, it just strikes me as suicidal. Let me know, and if it doesn't work, we will keep your name anonymous.

When I was younger and the transistor radio made its debut, everyone knew that the more transistors a radio had, the better it was; six transistors implied it was a superhet. Then came a receiver from the Soviet Union with eight transistors! Wow! The problem was that four of them were not connected to the receiver's circuit. They were probably factory duds as well. Maybe the phrase "let the buyer beware" still applies today. ■

Paul McGoldrick is an industry consultant based on the West Coast.

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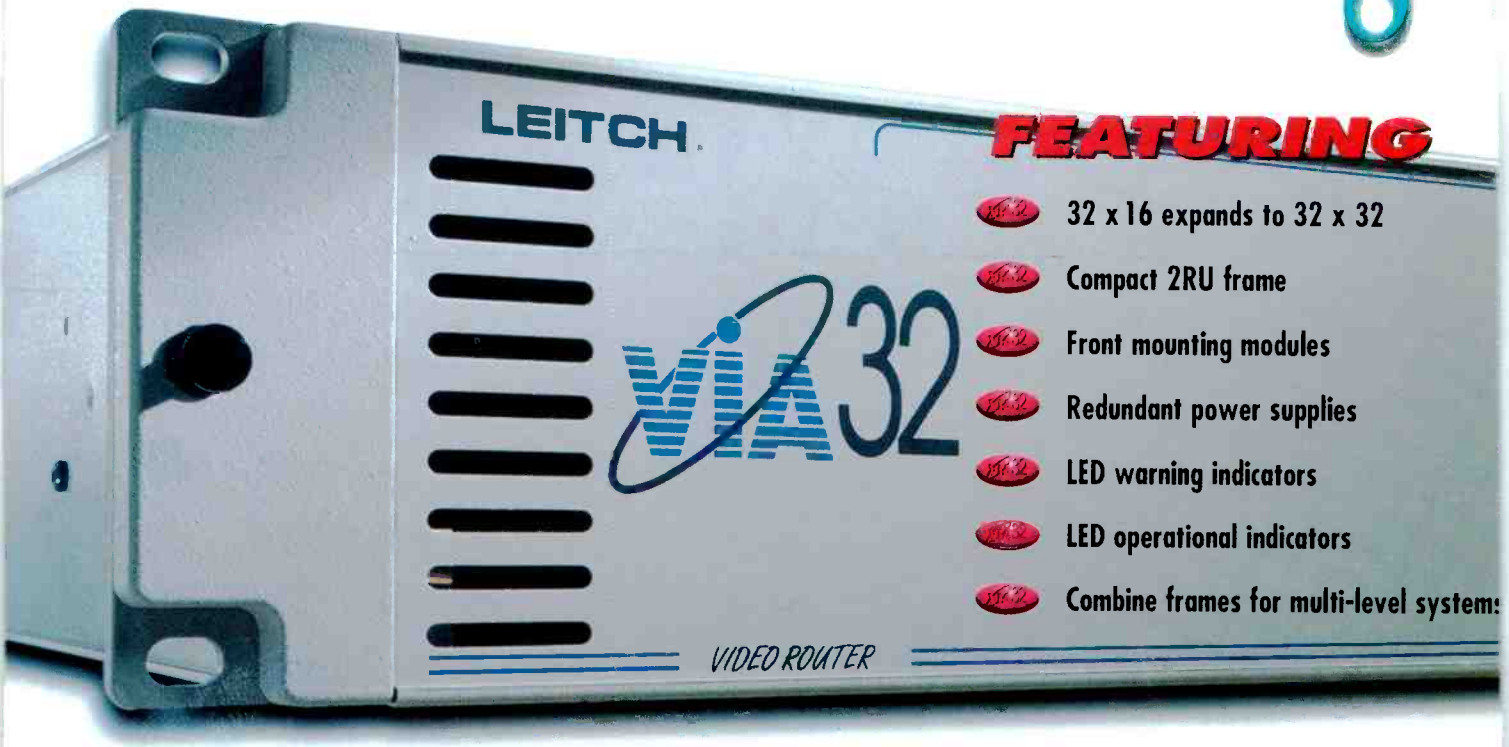

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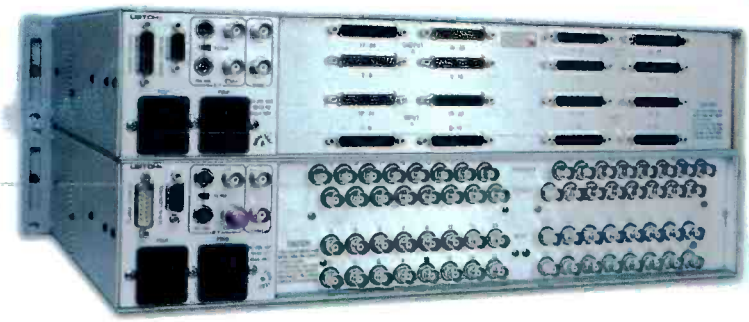

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