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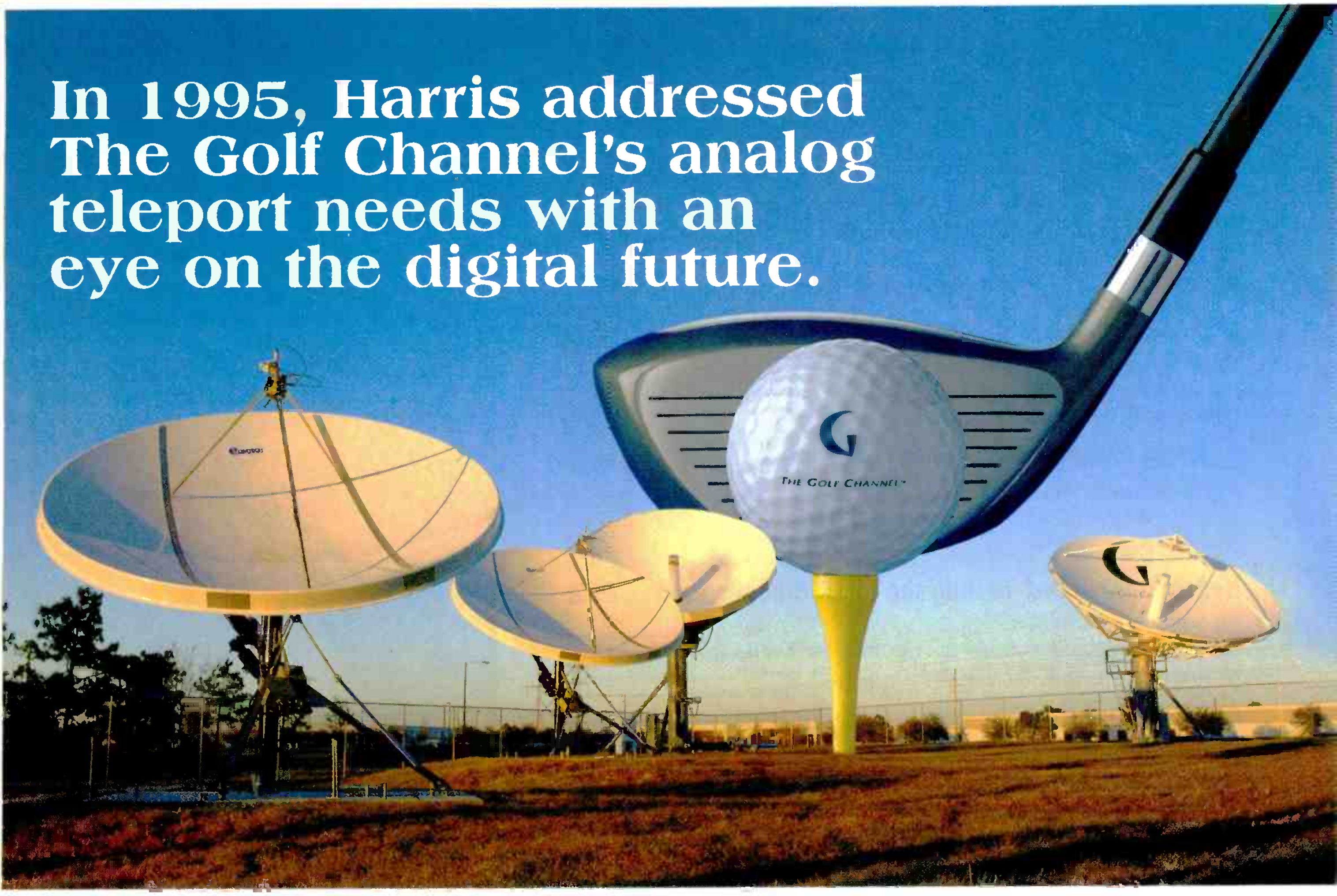

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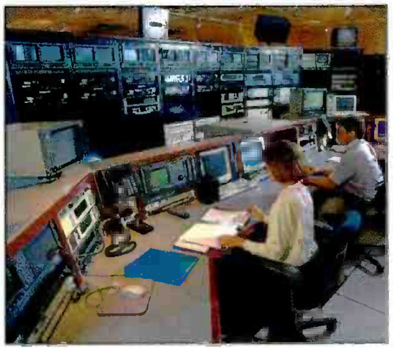

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BROADCAST ENGINEERING®
November 1997
Volume 39, Number 12

features

columns

departments

ON THE COVER: New testing procedures and equipment will be needed in the DTV era. The cover illustrates the concept of "just noticeable difference" and the electronic implementation of this human optical ability. Cover courtesy of Tektronix.

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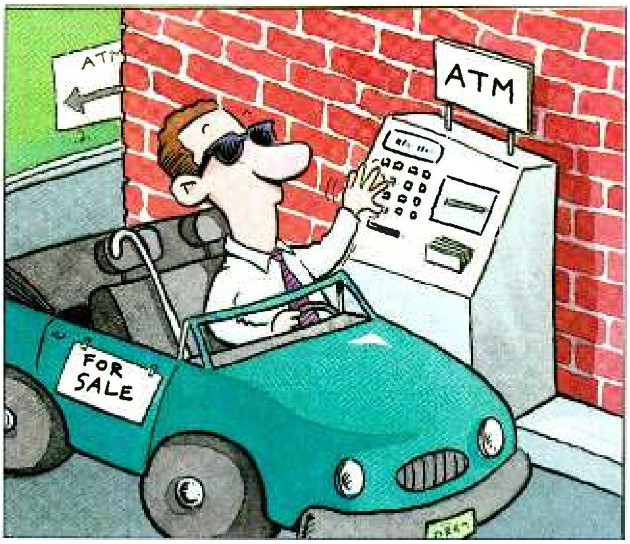
editorial

Stupid rules

On my way to the AES convention, as I was settling into the second leg of the trip in the flying cattle car, my eye caught the safety instruction card in the seat pocket in front of me. You know, that card the cabin attendants always hold up and tell you to read, but you've never looked at? Well, this time I did.

In big letters it said, "If you are sitting in an exit row and you cannot read this card or cannot now see well enough to follow these instructions, please tell a crew member."



What? Now let me get this straight. First, if I can't read the card's instructions, how would I know I'm supposed to do anything. Second, if I can't *see* well enough to read the instructions, how would I . . . well you get the picture.

The whole thing just struck me as another example of dumb governmental regulations. How many times have you asked yourself "why" there was a rule or law about something?

Here are a couple more examples. Did you know that as a result of a threatened lawsuit in Kansas, all drive-up ATMs are required to have Braille labeling on the buttons so blind drivers can operate the machines. Yep, no kidding, labeling for blind drivers.

Here's another example. Did you know it's against the law in this town to have a "For Sale" sign in your car? You can be given a $40 ticket if you even carry a sign that says your car is for sale. Guess the car dealers bought the right politicians. But, then in Kansas City, politicians seem to be for sale all the time.

Somewhere, common sense needs to be the final test for any new governmental regulation. If the proposed new law doesn't make common sense, then the law shouldn't be adopted. So what does this have to do with anything?

After just completing a week-long trip to visit clients and readers on the West Coast, one recurring theme was obvious. The FCC can dictate dumb rules all day long, but they can't control technology. Broadcasters are looking for opportunities and DTV is certainly filled with them. However, putting the cart before the horse won't make the cart go any faster. Let's get moving on this adventure, but at the same time be realistic. Until viewers sign on, broadcasters certainly won't want to. Nor should stations be bankrupted just trying to stay in business.

Let's adopt a realistic timetable now — without adding new burdens for public service and free TV time for politicians. The last thing viewers want is to see more commercials about re-electing the same folks who gave us OSHA, the IRS — and only nine years to implement DTV.

Brad Dick

Brad Dick, editor

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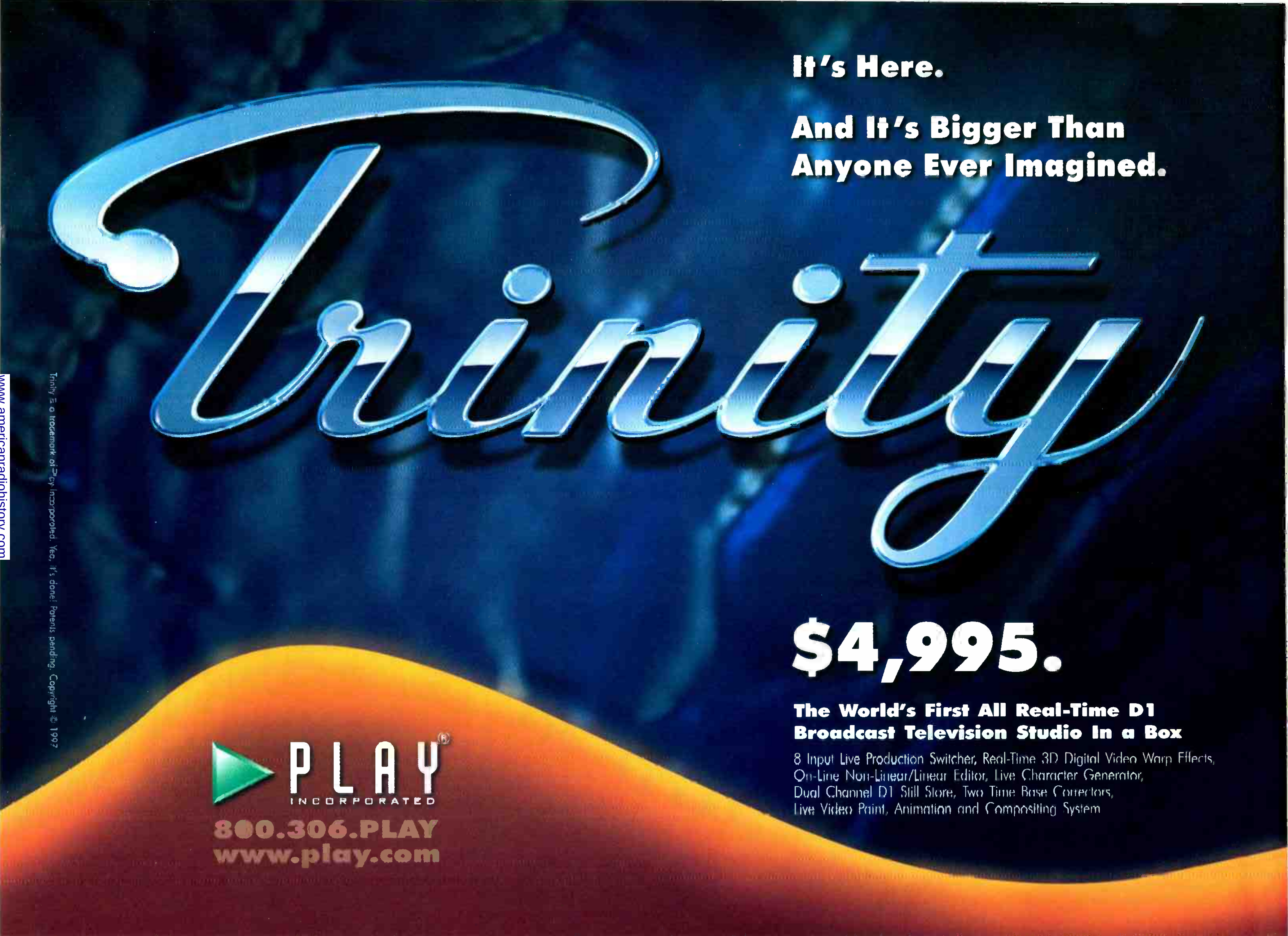
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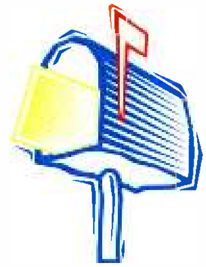

SDI and embedded audio

It sure is nice to read articles with substance. Keep it up.

At the Pennsylvania Public Television Network, we are pro embedded audio. We primarily record and distribute programs to our member stations and have no requirement to mix audio on the finished product as delivered to us. One caveat that I would like to give your readers is a problem that plagued us for almost two years.

From the standard ANSI/SMPTE-272M-1994 for Television — Formatting AES/EBU Audio and Auxiliary Data into Digital Video Ancillary Data Space, item 6: audio data packet formatting, item 6.3: the order that the channel pairs are transmitted within a group is not defined *(emphasis added). As an example, the channel pair containing Channels 3 and 4 could precede the channel pair containing 1 and 2.*

The manufacturer of the digital videotape recorder (DVR) assumed that the order would always be 1-2-3-4-1-2-3-4. If I remember correctly, the manufacturer of the embedding equipment, in order to obtain best performance, embeds the four channels of audio in the sequence 1-2-1-2-3-4-3-4. Therefore, when we digitize and embed more than two channels of audio, the DVR will play back a most annoying digital hash on audio Channels 3 and 4.

In fairness to the DVR manufacturers, the machine was probably designed before the SMPTE standard was finalized. They finally came up with a fix and we modified circuit boards. Once the problem was resolved, we completed the transition to total in-house digital video distribution with embedded audio.

RONALD T. LASK
DIRECTOR OF OPERATIONS & ENGINEERING
PUBLIC TV NETWORK

I enjoyed reading Jim Boston's piece entitled "SDI and Embedded Audio." Frankly, I am surprised that excess bandwidth is not being used for information transfer. I think a parallel would be cable companies that are now starting to use their excess bandwidth to provide high-rate, high-quality Internet access.

I also appreciate the injection of common practices like professional equipment commonly uses 48kHz audio and most lines have six samples, but every 12th line has eight.

I have a question related to this article that I know may have to go unanswered:

If SMPTE-259M streams carry audio data in the horizontal blanking interval, what bandwidth is left for data in the vertical blanking interval? The combination of four channels of embedded audio and ancillary data may help justify the investment in special hardware.

STEVE BELVIN

Jim Boston responds:

First, a little history. D-1 format tape machines were originally eight-bit devices. The EBU originally specified the vertical interval ancillary data (VANC) space use and it was at eight bits. So, VANC could be recorded on early D-1 machines. When SMPTE developed SMPTE-125M, the analog video sample and format standard, it left VANC at eight bits. The horizontal ancillary data space (HANC) was specified at 10 bits in 125M. The only other thing specified in 125M concerning HANC/VANC is the 000 3FF 3FF ancillary data headers.

How to actually format AES/EBU data and multiplex it into the SDI stream specified by SMPTE-259M is described in SMPTE-272M. SMPTE-259M for component digital specifies how parallel 125M data is converted to serial data, channel coding for that data, physical layer attributes and ancillary data preamble words for the actual AES/EBU data. Because of the possibility of grandfathered eight-bit-only data in the VANC, no AES/EBU data was intended for that area.

HANC doesn't have to carry only AES/EBU data. It can carry any type of data. Flags in the AES/EBU data indicate to AES/EBU decoders whether valid audio data is present. As for VANC, you could send 10-bit data in it (as long as the devices in the path would pass 10-bit data). But, there is no standard that I know of that would specify how to handle that data. So, if you created a standard on to yourself or convinced SMPTE that it was time to revisit that issue, then that space could be used.

An example of that is serial digital data interface (SDDI). There is a proposed standard where the active video portion of the SDI signal can be replaced with data. The most common use would be to put MPEG data where the video used to be. One field of MPEG data would take up a fraction of video data space. In fact, MPEG data at 18MB/s (4:2:2 Profile@Main Level) would have four frames of information in approximately one half of one field of active video space (8:1 compression). The rest of that space could be used for any other kind of data.

JIM BOSTON

Continued on page 89

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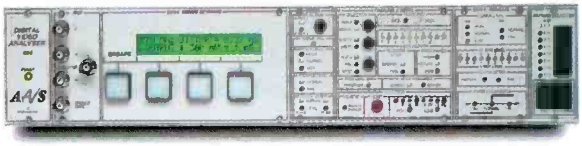

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news

By Dawn Hightower, senior associate editor

NATAS honors Emmy winners

The National Academy of Arts and Sciences (NATAS) awarded the 1996-1997 technical achievement and scientific development Emmy awards at a black tie affair in New York on Oct. 7. According to NATAS president John Cannon, the Emmy awards are a reflection of television's unlimited technological future.

The Emmy award winners include:

- The Canadian Broadcast Company and DirecTV won an Emmy for the pioneering application of SMPTE 270Mb/s serial digital technology to large-scale TV facilities.
- Zenith won an Emmy for the pioneering development of wireless remote controls for consumer television.
- Pinnacle Systems, Quantel and Scitex Digital Video won an Emmy for the development of real-time 3-D manipulation for non-linear editing.
- US Precision Lens, Inc., Art R. Tucker and Henry E. Kloss won an Emmy for the pioneering development of 3-CRT video projectors.
- General Instrument, LSI Logic, BBC and Snell & Wilcox won an Emmy for the pioneering development of real-time hardware for motion estimation.

ATSC conducts HDTV broadcast in Australia

The Advanced Television Systems Committee (ATSC) conducted its first over-the-air broadcast of digital HDTV service in the southern hemisphere in October. The digital signals originated from the TCN Channel 9 tower in Willoughby and were received at the Observatory Hotel in Sydney where government and industry leaders enjoyed the demonstrations and learned about the ATSC digital TV standard.

The HDTV demonstrations, lab and field tests were organized with the assistance of the Federation of Australian Commercial Television Stations (FACTS).

The Sydney demonstrations were supported by several member organizations of ATSC, including the Advanced Television Technology Center, which provided integration and technical support; Harris Corporation, which provided the digital transmitter; Zenith Electronics, which developed the digital transmission systems incorporated in the ATSC DTV standard; Dolby Laboratories, which developed the multichannel surround-sound audio system contained in the standard; Mitsubishi Electronics America, which provided video decoding equipment; and CBS, Snell & Wilcox and Sony Electronics, which provided equipment and technical support. JANDS Electronics also provided equipment to support the demonstrations.

FCC appoints PCIA president to EAS National Advisory Committee

Jay Kitchen, president of the Personal Communications Industry Association (PCIA), has been appointed to serve on the Emergency Alert System's National Advisory Committee, by the FCC's compliance and information bureau.

In 1994, the Emergency Broadcast System Advisory Committee was restructured and renamed the National Advisory Committee (NAC). It assists the FCC in overseeing the Emergency Alert System. The NAC plays a vital role in advising the FCC on all matters concerning the EAS, including policies, technologies, plans and procedures at the national, state and local levels.

SBE publishes "Introduction to DTV"

The Society of Broadcast Engineers is publishing a book titled, "Introduction to DTV RF." The book was authored by Douglas W. Garlinger, CPBE, director of engineering at LeSEA Broadcasting Corporation. The book is a practical guide to assist broadcast engineers in understanding the technical issues faced by all TV stations in the transition to DTV. The book has more than 100 pages and will provide the basic knowledge needed to prepare for television in the 21st century.

The book focuses specifically on the 8VSB transmission system selected by the FCC. It provides an overview of the 188-byte MPEG-2 digital transport system used to carry the compressed video, audio and data bitstreams to the transmitter. The Dolby AC-3 system capable of 5.1 audio channels per bitstream is covered along with the eight types of audio services that will be available with DTV.

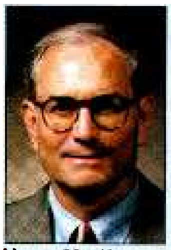
The SBE is offering the book at a pre-publication price of $39 for SBE members and $49 for non-members, plus shipping charges, through Dec. 31. The book is scheduled to ship Jan. 1, 1998. To order, call the SBE at 317-253-1640 or download the order form from the web site at www.sbe.org. ■

Make headlines
make deadlines

By Harry C. Martin

Settlement caps lifted

Settlement caps for broadcast applications have been lifted. The Budget Reconciliation Act of 1997 authorizes the FCC to issue construction permits (CP) for new broadcast stations through public auctions where there are mutually exclusive applications pending for the facility. However, until Jan. 30, 1998, the FCC also can waive its restrictions limiting the amount of funds that may be paid to dismissing applicants as part of a settlement. This 180-day "settlement window" applies *only* to those applications that were filed before July 1, 1997.


Harry Martin

Pending comparative cases may be settled in several ways. The first is through a straight buy-out, whereby one party buys out all of the remaining applicants for the facility. One variation is for an outside party (a "gray knight") to acquire a minority interest in the prevailing applicant, finance the settlement by buying out the dismissing applicants, finance construction of the station and hold an option to acquire the controlling interest in the permittee shortly after the station goes on the air. Although the FCC has not addressed it, it also may be possible for an outside party (a "white knight") to buy out all of the applicants in a mutually exclusive proceeding and obtain the CP directly.

Two other means of achieving a settlement are through a private auction or mediator. With the auction, the highest bidder obtains the construction permit for the station and the losing applicants share in the proceeds of the winning bid.

With mediation, an experienced neutral person works with the applicants as a group and on an individual basis to find a solution. Mediation provides an opportunity for creative solutions that may not arise in negotiations among the parties. Because a mediator is not an arbitrator and does not impose a disposition of the proceeding, mediation can be a risk-free means of attempting to resolve conflicts among applicants.

After the settlement window closes on Jan. 30, 1998, the settlement caps go back into effect. It is unclear whether the FCC will permit parties to enter into any form of settlement after that time or whether it will require these applications to be subject to a public auction, as is the case with applications filed on or after July 1, 1997.

The act directs the commission to allow an adequate period of time in scheduling public auctions to permit notice and comment on the proposed auction procedures before issuing the new bidding rules, and to ensure that interested parties have sufficient time to develop business plans and assess market conditions before any auction. Although the FCC is in the process of drafting proposed auction rules, it is doubtful that any auctions will be held for new broadcast facilities before next spring.

New commissioners grilled

The Senate Commerce Committee held hearings on the nominations of the four new commissioners on Sept. 30 and Oct. 1.

Questioning of the nominees Michael Powell, Gloria Tristani and Harold Furchtgott-Roth centered on the FCC implementation of the 1996 Telecom Act. All three nominees agreed that failure to adopt the new ratings system might be a reason for reviewing a license renewal application more closely. None of the candidates would commit to not renewing a license on this basis.

The separate hearing on Kennard's nomination to chairman also focused on the FCC's implementation of the Telecom Act. Senator John McCain (R-AZ) questioned Kennard about the TV ratings system and Kennard stated that the commission has a role in determining the acceptability of the ratings system. McCain did not ask Kennard whether failure to adopt the ratings systems should be a factor in license renewal. Industry observers believe that McCain's failure to ask for and Kennard's failure to give a commitment linking the ratings systems and license renewals means the Senator has retreated from the hard line he has taken against NBC, which has refused to adopt the rating system. ■

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

Dateline

Renewal applications are due for TV stations in the following states on Dec. 1: Minnesota, Montana, Colorado, South Dakota and North Dakota.

Ownership reports are due Dec. 1 for commercial TV stations in Alabama, Colorado, Connecticut, Georgia, Maine, Massachusetts, Minnesota, Montana, New Hampshire, North Dakota, South Dakota, Rhode Island and Vermont.

Tower registrations are due between Dec. 1-31 for towers in Alabama, the District of Columbia and Maryland.

By Jerry Whitaker

Intrafacility digital networks

Step-by-step, the analog elements of video production centers are being replaced by digital systems. Systems based on digital technology allow for, and sometimes require, new approaches to signal routing, switching and networking. Within a given facility, the options are numerous. The operating paradigms for a digital production center vary from one basic application to the next, however, the common thread is a high-speed network that ties disparate elements of the system together.


Jerry Whitaker

When considering networks, it is important to take into account not only the networking architecture *within* a digital facility, but also *among* several digital facilities. It is this aspect of digital technology that promises to radically change the TV station of the future.

Getting from here to there

Three basic methods are used to move video from one physical location to another:

1. *Wireline*, including coax and twisted pair;
2. *Electromagnetic*, including satellite and point-to-point microwave systems; and
3. *Optical*, including single-mode and multimode fibers.

Each method has its strengths and weaknesses, but the important point here is that choices exist. In the final analysis, it is not important what method — or combination of methods — is used, but rather that the necessary bandwidth is available upon demand and at an affordable price.

Network communications is defined as the transport of data, voice, video, image and/or facsimile from one location to another. Numerous variables are involved in network analysis, design and implementation. A structured methodology must be followed to ensure that a network, once implemented, will meet the communications needs of the intended facility. Let us begin by examining — in general terms — the digital services suitable for video transmission that are available from the public switched telephone network (telco), with an eye toward how telco services may translate into the wide-area video networks of the future.

The telco template

Nearly as old as electronic communications itself, the telephone company paradigm includes valuable concepts for future wide-area video distribution systems. The public switched telephone network consists of users with telephones connected to a switching system over an *access network*. To allow communication between users that are not connected to the same switching system, the individual switching systems are all connected to each other over a *trunk network*. Although access networks are usually localized to the area surrounding the switching system, trunk networks can span cities, countries and even the globe.

A structured methodology must be followed to ensure that a network, once implemented, will meet the communication needs of the intended facility.

Today, the majority of connectivity in the trunk network and much of the connectivity in the access network is provided using fiber-optic transmission. These elements are referred to as the *transport infrastructure*. This infrastructure also provides direct digital connections between businesses for private voice, data and video networks.

Networks are created by combining network elements and systems. *Hubs* and *cross-connects* are used to interconnect *linear systems* to each other and to *rings*. The elements and systems used depend upon the application and topology of the network and the degree of survivability required. *Automatic protection switching* offers the ability to detect a network failure and then transfer the affected traffic to another line. The most basic protection system is a linear 1+1 system (one working fiber, plus one standby fiber).

Although the physical implementation of such a system is hierarchical in nature, the logical implementation (from the user standpoint) appears *flat*; that is, any device anywhere on the system is available to any other device. It is upon this basis that existing video networks have been built. The real changes in intrafacility video transport will come not so much from changes in the fundamental telco communications systems, but in the way those communications systems are controlled and accessed.

User demands are the driving force behind the current and emerging wide-area network (WAN) services offered to video customers. Users want simple, transparent access to variable amounts of bandwidth as required. In addition, WAN access must offer support for the transmission of a variety of data, including video, still-imaging, fax and voice. Furthermore, it is no surprise that one of the primary driving forces for increased capacity and sophistication of WAN systems is the explosive growth of smaller *local area network* (LAN) systems. As individual production centers and facilities embrace a LAN-based architecture, the WAN-based system is the next, natural extension.

The sophisticated combination of switches and transmission facilities comprising the telco infrastructure is known as the *network architecture*. Communications companies offering WAN services have two major technologies to integrate into a cohesive system. The options are illustrated in Figure 1. Switching architectures, such as *circuit switching* and *packet switching*, assure the proper routing of information to its destination.

The basis of practical WANs is the establishment of *virtual paths* for signal routing. Modern network architectures treat the application layer as an abstraction. The virtual network thereby created may bear little resemblance to the actual physical network. Indeed, the physical network may change at random times to reflect the optimum use of available bandwidth. Such fluid, virtual connections make on-the-fly WAN connections possible.

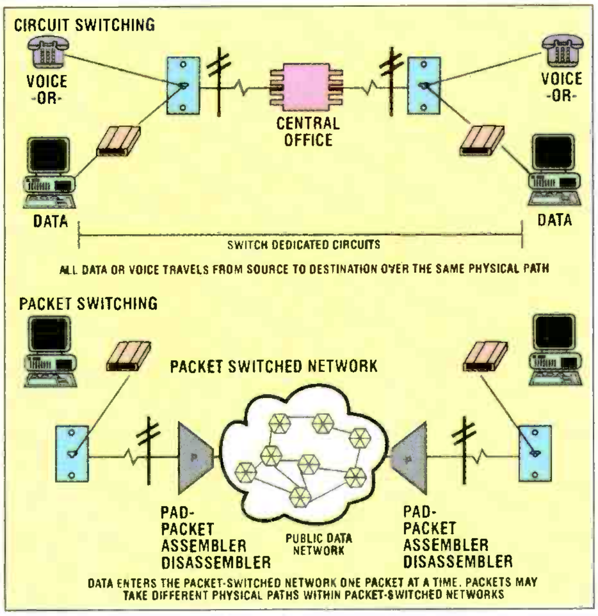


Figure 1. A comparison of circuit-switching vs. packet-switching techniques.

CLASSES OF DIGITAL TELECOMSERVICES	BITRATE	MONTHLY RATES	APPLICATIONS
BASIC ISDN (2B+D)	128kb/s	$25 - $100	DESKTOP VIDEO TELECONFERENCING (15 fps) QUICKTIME AND AVI ISDN MODEMS MOTION-JPEG
PRIMARY ISDN (23B+D)	1.288 - 1.472Mb/s	$600 - $1,200	HIGH-END VIDEO TELECONFERENCING (30 fps) ISDN MODEMS MOTION-JPEG MPEG-1
DS1 (T1)	1.536Mb/s	$400 - $1,000	"APPROVAL QUALITY" VIDEO LOW-SPEED CABLE MODEMS MOTION-JPEG MPEG-1 MPEG-2 ON MULTIPLE T1
DS3 (T3)	44.736Mb/s	$2,000 - $10,000	"BROADCAST QUALITY" & COMPRESSED NTSC HIGH-SPEED CABLE MODEMS MOTION-JPEG MPEG-1 MPEG-2 01 ON BUNDLED 0S3

Table 1. Common digital telecom services of interest to broadcasters.

Practical implementations

Table 1 lists four digital telecom services for digital video applications. As shown, DS1, DS3 and two forms of ISDN involve paid carriage over multiple twisted pairs. It should be noted that DS1 and DS3 are also known as T1 and T3, but in the strictest telco definition, this terminology only applies to the copper implementations of service networks at these data rates. The classes of service vary with bandwidth capacity. As a benchmark, remember that uncompressed serial digital component video requires about 240Mb/s. Compare this with an MPEG-2 datastream, which requires a pipeline of about 3 to 30Mb/s, depending upon the amount of compression applied.

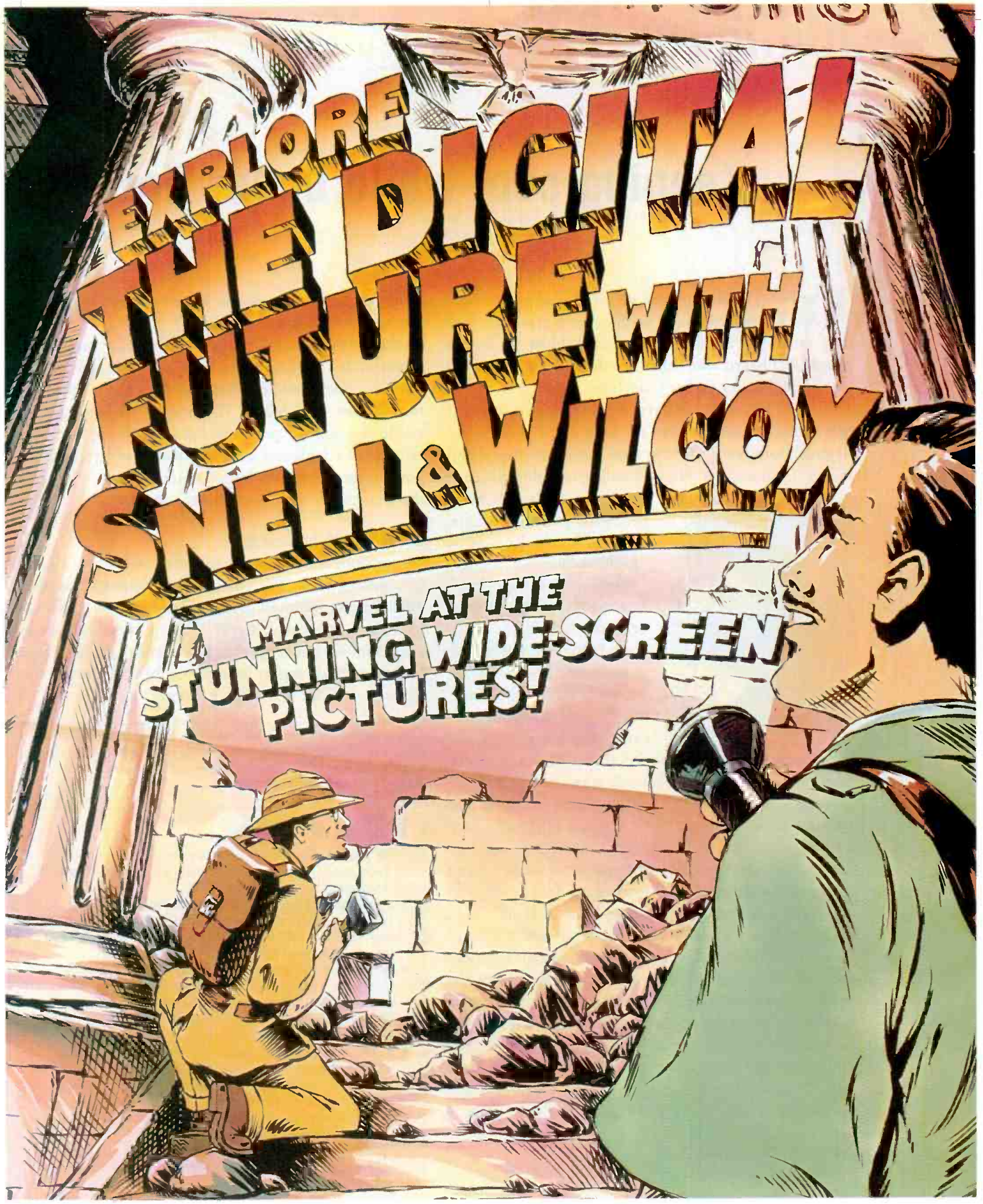
As we move into the digital future, networks will allow facilities to operate with resources scattered over a variety of physical locations. Building the necessary infrastructure today will make it easier to integrate worldwide networks into facilities tomorrow. ■

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

Author's note: This article has barely scratched the surface of telco-based WAN systems. For more information, readers may want to consult the following:

1. *Whitaker, Jerry C., "Routing Technology,"* Broadcast Engineering, *Intertec Publishing, Overland Park, KS, pp. 40-50, May 1996.*
2. *Goldman, James E., "Network Communications," in* The Electronics Handbook, *J. C. Whitaker ed., CRC Press, Boca Raton, FL, pp. 1,939-1,984, 1996.*
3. *Freed, Ken, "Understanding Digital Telecom Services,"* Broadcast Engineering, *Overland Park, KS, pp. 78-85, April 1997.*
4. *Paulson, C. Robert, "Fiber Optic Transmission Systems," in* NAB Engineering Handbook, *7th Ed., NAB, Washington, DC, pp. 717-730, 1992.*
5. *Wu, Tsong-Ho, "Network Switching Concepts," in* The Electronics Handbook, *J. C. Whitaker ed., CRC Press, Boca Raton, FL, pp. 1,513–1,152, 1996.*

"CLEARLY THE RESULT OF AN EARLY EXPERIMENT IN COMPRESSION..." MUSED WILCOX.



SNELL & WILCOX

Engineering with Vision

Circle (5) on Free Info Card

By Kare Anderson

Keeping cool while under fire

The No. 1 reason people get fired is anger, and the No. 1 problem people say they have at work is that they don't feel heard and respected. How do we let people feel heard when they are difficult to be around — and still stand up for ourselves?

If the only tool you have is a hammer, you treat everything like a nail. Here are some more tools to add to your toolbox for the next time someone is upset and taking it out on you. No tool will work all of the time and some tools will work better for you than others.


Kare Anderson

Lighten up

When others act "hot," we tend to escalate (get loud or more hostile) or withdraw (assume a poker face or get quiet). Both reactions are instinctively self-protective, but self-sabotaging because they are akin to saying, "I don't like your behavior, therefore, I'm going to give you more power." Instead, stay present and acknowledge that you heard with a pause or a nod and without taking sides or using blaming language. Take a few breaths and maintain eye contact. This will buy you time to think about what you want to do and to prove that you heard what was being said.

You can acknowledge by saying, "I understand there's a concern" (rather than "I understand you're upset," which is emotion-laden language). Your goal is to de-escalate conflict. Try to "warm up" to the part of the person you can respect. Focus on it mentally and refer to it verbally: "You are so 'dedicated' or 'knowledgeable' or whatever the person's self-image is, which leads the person toward rationalizing his or her behavior. Then say, "May I tell you my perspective?" This sets the person up to give you permission to state your view.

Presume innocence

Nobody likes to be told they are wrong. Whenever someone is not making sense or is lying, you will not build rapport by pointing it out. Let the person save face by asking questions. Say, for example, "How does that relate to the . . . (then state the conflicting information). You may find you were wrong and you "save face." Or, by continually asking non-threatening questions you can get the person to self-correct, which will protect your future relationship.

Look to the person's positive intent. In arguments, it is natural for us to mentally focus on the "right" things you are doing while obsessing about the "wrong" things they are doing. This makes us superior or righteous, and we get more rigid and listen less. Stay mindful of your worst side and his or her best side when you get into an escalating argument. You can increase the chances for reaching an agreement.

Dump it back in their lap

If someone is dumping on you, don't interrupt, counter or counter attack. When the person is done ask, "Is there anything else you want to add?" Then say, "What would make this situation better?" If he or she continues to complain, acknowledge that you heard them and, like a broken record, repeat yourself in brief language, for example, "What will make it better?" ■

Kare Anderson is a speaker and author. For more communication tips, visit www.sayitbetter.com. To set up a speaking engagement, contact her at 415-331-6336 or kareand@aol.com. (Photo courtesy of M. Christine Torrington.)

Did you know. . .

- People get along better when they stand side by side.
- If you argue for more than 10 minutes, you may not be discussing the real conflict.
- Someone will listen sooner, longer, remember more and like you better if you address his or her interests first, then how that relates to what you have in common and then back to your interests.
- When lying, most people can assume an innocent expression, yet few will respond with the right timing or duration. Ignore the expression and consider if the timing and duration seem natural. You'll increase the chances of knowing if they are lying.
- In a gathering, pay attention to the one who is getting the least attention. You'll change the dynamic in the group and may also gain an unlikely and loyal new ally.
- Praise individuals for thoughtful action, not just to them, but to those who are important to them, and you will reinforce the behavior you most admire.
- Don't embarrass someone while trying to reach an agreement, you may never have their full attention again.
- When you have the upper hand, don't make a victim of the underdog.
- Offering something free and valued unasked, often instills the desire to reciprocate.
- If you want more from another erson, don't ask for it until they have invested m , energy, money or reputation. ■

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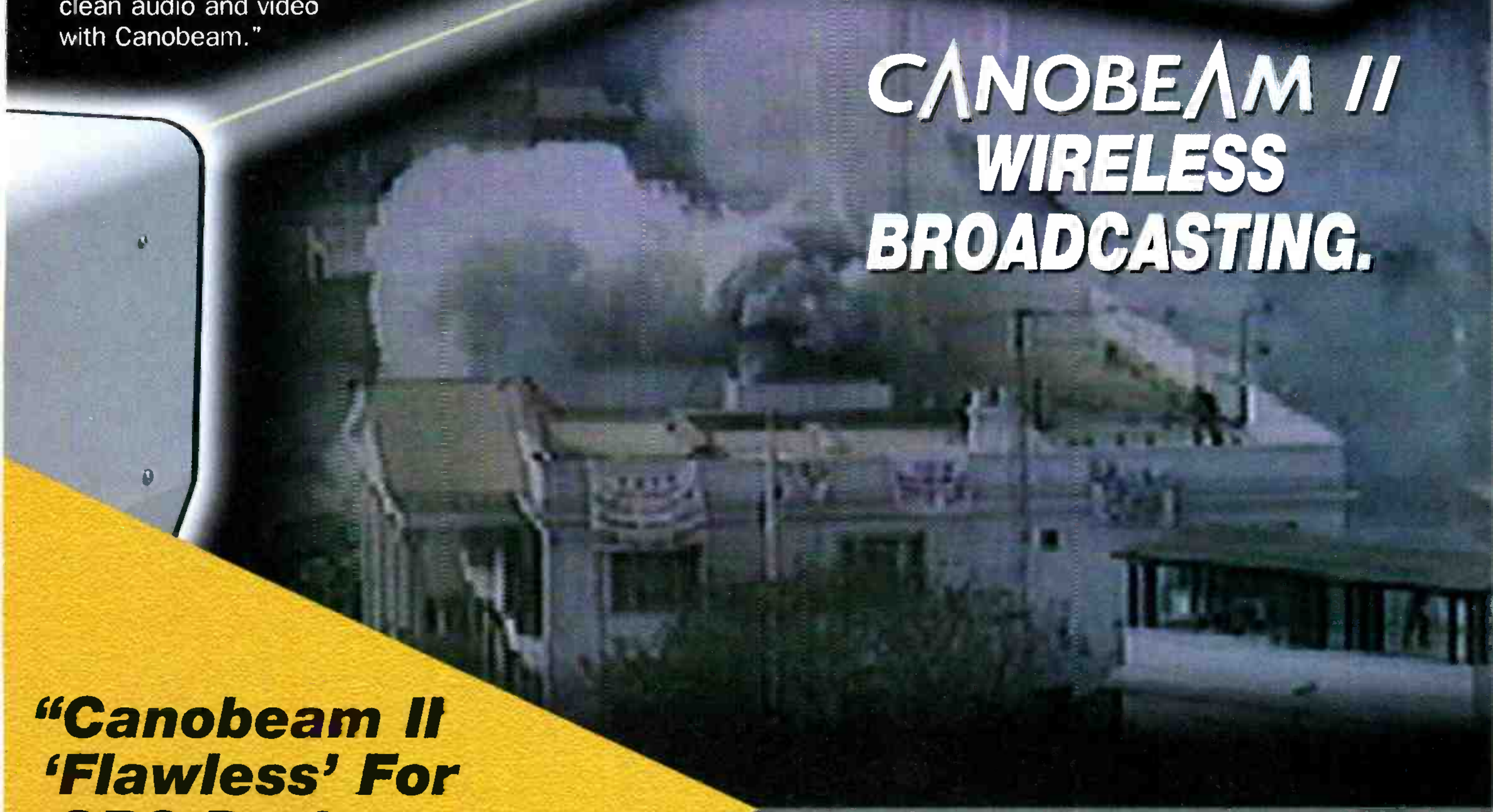

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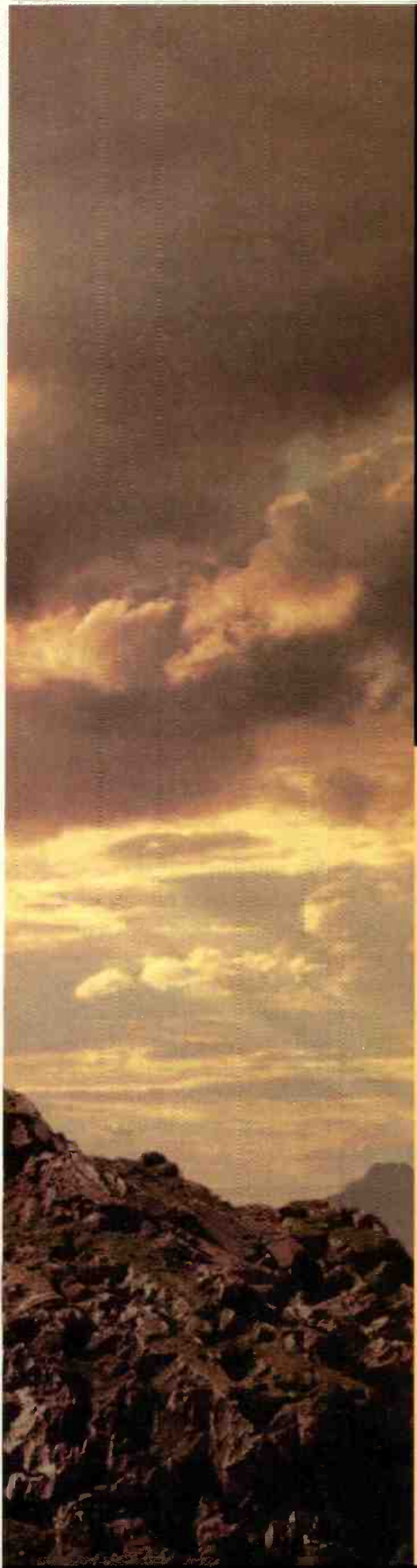

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By Brad Gilmer

From Mac to video

Macintoshes have always held the high ground in the graphics market and seem to be the system of choice for graphic artists in the broadcast design environment.

But why would someone choose to use a Macintosh over a dedicated paint box? The most common answer is money. You can buy three fully outfitted Macintoshes and tons of software for the price of one moderately equipped paint box.


Brad Gilmer

Let's focus on three tools you can use to get Macintosh graphics off the desktop and into the video domain. The first is to install the Video Explorer card made by Intelligent Resources. The second is to purchase a MultiBuffer DS-1 framestore and Envoy software from Ensemble Designs. The third is to use a feature of the Accom Axess still-store system. We used Adobe Photoshop to manipulate graphics in the Macintosh domain.

The Video Explorer

Although the Video Explorer is no longer manufactured, there are large numbers of them in use. The Video Explorer card plugs into your Macintosh. Our Video Explorer has two inputs — the first is a 601 digital video input and the second is a reference video input. Explorer has a 601 digital video output. The Video Explorer uses a Photoshop plug-in to import video. The process is simple. From Photoshop, use the file/import menu to access the Video Explorer settings dialog box; from there you can preview, freeze and then capture the frame you are viewing on the preview monitor into Photoshop. To export from Photoshop, drag the image to the preview monitor and it will be available as a video source on the card's digital output. Anything displayed on the Video Explorer's preview monitor will be output by the Video Explorer card.

A solution by Ensemble Designs

Ensemble has produced a rack-mount framestore and associated software that allows you to import and export up to four channels of digital video. Each input loops with an active reclocked output for use in feeding other devices. There is also a connection for reference video in. The framestore connects to your Macintosh via a LocalTalk interface or through a network using an Apple Attachment Unit Interface via a 15-pin connector.

Connecting the framestore to a network allows multiple desktops to access it, although not at the same time. There is no lockout, so multiple users can end up battling over control of the buffer.

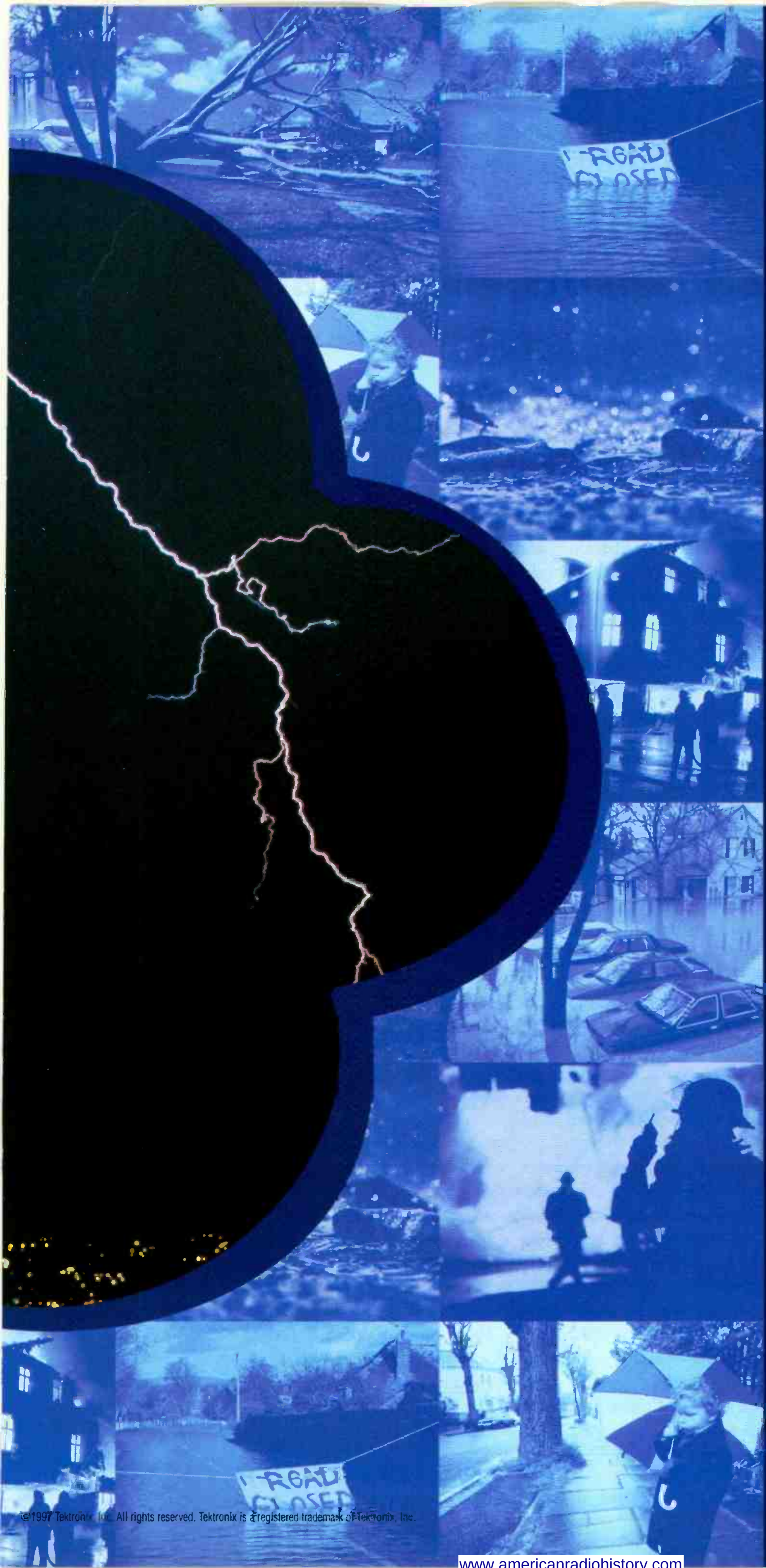
Envoy Digital Image Transporter software is used to communicate between the framestore and the Macintosh. Not only does this software enable export and import, but it also allows you to adjust video parameters, such as setup and hue over the network. The MultiBuffer will work with SGI and PC/NT platforms, as well as the Macintosh.

The Accom Axess — another solution

The Accom Axess is a large, multi-user, full-featured still-store. It can consist of multiple nodes with a mix of still and moving video, all managed over an Ethernet network. The system allows Macintosh users to read from or write directly to still-store locations. The process is simple and similar to that of the Envoy software. The Axess software on the Macintosh installs an import/export plug-in on Adobe Photoshop. Selecting import or export on this plug-in transfers the image. During the transfer process, you specify a location for the still on the Axess system. But be careful, if you use an active location, there is nothing to keep you from writing over a still that is currently in use.

There are two problems with transferring graphics from the desktop to the video domain: maintaining aspect ratio and generating NTSC legal colors. You should understand both of these problems if you are going to work in this area every day. Fortunately, there are two good sources of information available. The first is Charles Poynton's book, *A Technical Introduction to Digital Video*. The second is the Colourspace FAQ posted on the Internet. This document is posted routinely in the newsgroup SCI.ENGR.TELEVISION.ADVANCED and is also available at www.inforamp.net/~poynton/ColorFAQ.html. You can find more FAQ pages on graphic file formats and other topics at www.dcs.ed.ac.uk/%7Emxr/gfx/utils-hi.html. ■

Brad Gilmer is president of Gilmer & Associates, Inc., a technology and management consulting firm.



By Skip Pizzi

Audio levels and metering

It used to be simple: Keep the meter levels out of the red and everything was OK. Today, things are different. With the emergence of digital audio and a variety of new metering "standards," accurate and consistent monitoring of audio levels has become a challenge.

In those earlier times, the volume unit (VU) meter was ubiquitous, and its standard calibration and ballistics became quite familiar and reliable to audio professionals. This meter standard was developed in the days of narrower bandwidths and tube amplification, however, which made the VU meter's averaging characteristics acceptable.

Peak vs. average response

With the emergence of wider audio bandwidths and solid-state signal paths, more careful control of *peak* audio levels became necessary. This led to the development of the *peak program meter* (PPM). It accurately followed peaks as short as 10ms duration, and its slow release time made the mechanical display of such fast peaks easy to read.

This helped operators know more about audio peaks, which can be as high as 15dB to 20dB above the value indicated by the VU meter. You could never be sure about this, however, because each sound's peak-to-average ratio (or *crest factor*) was different. For example, typical speech might have peaks 10dB above the VU's reading, while a harpsichord or metallic sound effect could hit 20dB above, and a flute might only reach 5dB above. The PPM took away this guesswork, always displaying the maximum peak value of every sound.

Nevertheless, the PPM has its own confusing elements. For example, it is marked with different calibration scales in different countries. (The scale most commonly used in the United States has markings that are roughly analogous to those of the VU meter.) More confounding is the *lag* that the PPM exhibits when displaying steady-state tones. Because these are usually sine-wave signals having extremely low crest factors, the PPM will "under-respond" to them. This means the reference point on the meter that is used to align reference tones is lower (typically by 8dB) than the reference point used when actual program material is monitored.

Absolute vs. relative levels

While such divergence abounds on the dynamic characteristics of audio metering, there is also plenty of confusion on its static issues as well. In other words, how is the meter referenced or just what does the "0dB" mean in terms of electrical output? This question applies to all meters, regardless of type.

Traditionally, three basic "standards" evolved: the pro audio community usually set 0VU to +4dBu (1.23V), while the broadcast industry often used +8dBu (1.95V) and the semi-pro/industrial market sometimes employed 0dBu (0.775V).

This divergence continues today, and it's complicated by the addition of different kinds of meters on different equipment. This means that the interfacing of devices is not always as simple as lining up all the "0s" on all devices' meters.

Digital metering standards

Contemporary professional audio equipment is generally designed to allow 15dB to 20dB of headroom above the reference level before clipping occurs. The latest issue in metering complication is a new approach to the headroom concept that digital audio presents. Digital systems have an absolutely specified maximum level, which is defined when all bits of a sample are set to "on" or "high." This is referred to as a *full-scale level*, and the unit dBFS has been established to define it. The maximum level possible in any digital system is referenced as 0dBFS, with all other levels in the system defined as negative values below reference.

For this reason, meters on most digital audio devices are marked with a "0" at their maximum value, and all other markings are negative numbers. To accommodate peaks, an incoming reference-level tone is aligned to a level below "0." Throughout the industry, different users have selected -15, -18 or -20dBFS as their reference level, and this has made the exchange of digital recordings between facilities problematic.

All of these issues conspire to make proper audio level control difficult today. Your best hope of a solution includes the use of consistent meter types, the establishment of strict house-standard reference levels and alignment practices, and strong operator training. ■

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

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Circle (13) on Free Info Card

By Mark Dillon and Steven Blumenfeld

Who's paying you to do this?

A couple of months ago, we explained why webs will never form on your television. The reasons were based mostly on technical and creative considerations, such as image resolution, viewing distance, personal posture and control devices. However, none of these factors is as important as advertising.

Unfortunately, many ad execs just don't get the Internet paradigm. They still think in terms of eyeballs, impressions and CPM. So, why are so many bright, well-dressed New Yorkers on the wrong track? Well, lots of good news is coming from the Internet advertising scene masking underlying realities. As reported by the Internet Advertising Bureau, spending on web advertising for the second quarter of 1997 was 313% higher than a year ago, reaching $214 million.

Mark Dillon and Steven M. Blumenfeld

Unless you're selling products directly from a web site, advertising is almost the only way to generate revenues. Only 0.01% of all web sites generate enough dollars from advertising to support the site, though in absolute dollars, advertising revenues are increasing, they support an infinitesimal proportion of all web sites. If all advertising-supported web sites went down tonight, it might be weeks before the average web surfer noticed. But what if every ad-supported TV station went dark tonight?

Is it just a matter of time before advertising on the web truly catches on? Probably not. All TV programming, advertising included, is intended to reduce interactivity. The goal of the programming and advertising executives alike is to make you forget you have a remote control. To do this, most ads are low in information content, high in emotional content and rich in production values.

Current Internet bandwidth limitations prevent advertising from having high production values. As a consequence, the emotional content is low and is not extremely successful at motivating the "click-me" behavior. Most research registers click-through rates in the 1% range — the remaining 99% don't even bother to click and see what's behind the ad banner. (Our own experience suggests that click-through rates, as measured by departures from the ad itself, are exaggerated. Less than half of the users who clicked on our ads on the Internet landed on our site. We assume the no-shows stopped before downloading was complete.)

Buying ads on the Internet

Traditional mass media advertising sells impressions to defined audiences, such as women between 18 and 34 or middle-income males. Advertisers buy impressions that meet their target demographics. This can be done on the Internet with ad banners. However, equating the impact of the average ad banner with any 30-second spot on the lowest-rated cable channel is a hard sell.

Where a TV spot is intended to keep you from doing something (using the remote), an ad banner must motivate you to do something (use the mouse). To motivate a click-through, first the banner must suggest that there is something of value at the other end. It is at this "other end," the place we are clicking to, that we encounter difficulties. For the most part, the place at the other end of the click-through is a wasteland, with nothing of value to be found. Surveys show that to 99 out of 100 web surfers, most advertisers are clickless.

Thus, we confront the conundrum of the Internet ad buy. You do not advertise on the net in the sense that you "build awareness" or "protect the brand." With television, no action is expected or possible, so the objective is a lasting impression. Victory can be declared when the viewer's memory survives long enough to be recalled and take action on it.

By definition, people on the net are taking action. If they don't, they won't see your ad. Banners are not the ad, they are the doorway. And if a user clicks, he or she expects a payback — you have to deliver the goods — not just promises or pretty pictures. On the net, unfulfilled promises are offensive, and pretty pictures take too long to download. On the Internet, consumers can deal more easily with advertising's reputation for delivering images, not reality; they completely avoid the ad.

Commercial information on the Internet has to get back to basics. Instead of delivering "impressions" to the clients, agencies must begin delivering customers. Instead of delivering images to customers, it has to deliver products — or at least real information about them. ■

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

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Circle (14) on Free Info Card

By Louis Libin

Broadcast auxiliary spectrum: What is left for DTV?

Beginning in 1987, the FCC Advisory Committee on Advanced Television Services analyzed spectrum allocations that could potentially impact or be impacted by the non-broadcast services associated with the implementation of an advanced TV service. The committee recommended that new spectrum should be assigned for broadcast auxiliary and made specific recommendations on new spectrum locations. Since then, much of the broadcast auxiliary spectrum (BAS) has been lost or must now be shared with other users. In addition, many new broadcasters use this limited spectrum on a day-to-day basis.


Louis Libin

Broadcast auxiliary spectrum is used by TV stations to convey their signals on a point-to-point basis. It is primarily used for studio-to-transmitter links (STLs), intercity relays (ICRs) and electronic news-gathering (ENG). Non-broadcast video transport falls into two general categories. The first group of services provides *contribution* transport over the path from the source of the program signal to the studio. Examples of contribution transport services include temporary microwave pickup, ENG, network-to-studio feeds and fixed microwave repeaters. The second category involves *distribution* transport over the path from the studio to the viewer. Distribution networks include feeder services, such as STL and cable television service (CARS) and broadcast services, such as direct broadcast satellite (DBS) and multichannel distribution systems (MDS). For digital television, the FCC will limit additional terrestrial VHF/UHF broadcast allocations to the same NTSC bandwidth of 6MHz. For delivery methods other than terrestrial broadcast, other options are available to program providers.

Videotape, compact video disk, DBS, cable and fiber to the home all may have the capability of delivering to the viewer DTV signals that occupy significantly more than 6MHz of bandwidth.

In order for delivery systems to achieve their maximum potential, program providers will need to assemble their finished product in a format consistent with the highest-quality distribution system available. In addition, a single high-quality studio standard may be desirable to facilitate production.

Auxiliary spectrum status

On a regular basis, auxiliary spectrum is encroached on and is being removed piece by piece. For example, on Sept. 26, 1997, the FCC adopted an amendment to the commission's rules amending Parts 74, 78 and 101, regarding auxiliary broadcast services requiring permanent coordination criteria between this service and government operations in the 17.8-19.7GHz band. This is just the latest action potentially impacting broadcast auxiliary operations. Even if you know of a broadcast auxiliary band that has not yet been impacted, you can bet it's been targeted for downsizing or elimination.

There is even an amendment out to allocate the 455-456MHz band to the mobile satellite service on a primary basis for non-voice, non-geostationary mobile satellite services. Broadcasters do not need a reminder to understand the frequency congestion that approximately 80% of stations face on a daily basis, as news coverage intensifies nationwide. The job of the frequency coordinator, once an intermittent off-hour volunteer task, in many cities is now a stressful and intensive daily project.

New technologies have been developed, such as digital compression, IR and fiber-optic links, but it will be years before these techniques will be commonly available. In addition, these new technologies have their limitations. There are also implementation options, such as the split-channel plan, that can reduce interference. Even so, increased channel spectrum use requires tight coordination. Also, bear in mind that the electronic news-gathering operations are usually not performed under ideal conditions. It's important to recognize that further sharing of any of the existing broadcast auxiliary spectrum will be harmful to the broadcast industry because electronic news-gathering will be impacted.

It's obvious (at least to most broadcasters) that our industry cannot function without adequate BAS spectrum. And if today's crowding isn't enough, the addition of multichannel and HDTV operations will create further pressure for more BAS operations — and the need for additional spectrum or the coverage of news will suffer. ■

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


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Computer Systems

Circle (8) on Free Info Card

By Del Kunert

Selecting a video server

Engineers charged with selecting video servers are faced with dozens of choices ranging from generic systems offered by computer makers, to highly specialized systems developed by vendors targeting specific markets. That's why it's important to clarify your system's requirements by asking the tough questions:

- What type of video server is required (VOD, NVOD, TVOD, IVOD)?
- How many hours do you need to store?
- What type of encoding will be used?
- What type of network will be used?
- System architecture.

What type of video server is required?

Determining the type of video server you need depends upon what type of video-on-demand (VOD) defines your application. Understanding how video can be delivered can help you select the right video server.

In near video-on-demand (NVOD), a content title can be associated with multiple video streams — with each video stream started at fixed intervals.

True video-on-demand (TVOD) is an improvement. With TVOD, a content title can be associated with multiple video streams, with each video stream started immediately upon user request.

Interactive video-on-demand (IVOD) provides users with full access and interactive control of the video information whenever they desire. Users can also enjoy VCR-type control functions. Different types of VOD applications require different types of servers. A server suitable only for NVOD may be unable to respond quickly enough to user commands in an IVOD application.

How much capacity is enough?

The number of video streams that must be concurrently delivered is an obvious factor. An even more important factor is the type of encoding used. The type of encoding will affect the amount of storage required.

Consider the encoding

Your next challenge is determining content storage requirements. Storage capacity is the largest influencer of video server costs. How many titles are needed? What is the average length of each title? How many hours do you need to store?

The video encoding method also must be considered. Variable bit-rate encoding can significantly decrease content storage requirements, compared with constant bit-rate encoding. However, most video servers do not support variable bit-rate encoding.

What kind of network is required?

A video server must also be able to connect the network distribution system. If analog video streams are to be distributed, you'll need MPEG decoders on every output. If digital video streams are required, the video server must be able to properly interface with your distribution system.

The video server must be able to support communications with client devices, such as PCs or intelligent set-top boxes. Be sure your selected server supports the appropriate application binary interface (ABI), such as DAVIC's DSM-CC.

System architecture

Pay special attention to specific system architecture features. The tasks performed by a video server are input/output intensive. Accordingly, the ability to handle multiple and independent I/O channels is more important than the speed of the CPU.

VOD, particularly TVOD and IVOD, requires fast and predictable response to user requests. A real-time system that is optimized to respond quickly and deterministically to random and unpredictable real-world events is a superior platform for VOD.

Video data is large and is generally accessed sequentially. Video server operating systems that include video-specific enhancements to handle the unique characteristics of video data are preferable.

The addition of a video file system that optimizes access to video content is invaluable. A video server that includes direct input/output as a complement to buffered input/output optimizes video data throughput. Operating systems that include in-kernel buffer management to move video data directly from content storage to network buffers can also increase performance.

Know your goals

Establishing a clear picture of what your server must do and working with vendors to answer your questions will help you make an intelligent video server purchase. ■

Del Kunert is director, Interactive Video-on-Demand Business Area Team for Concurrent Computer Corp. in Ft. Lauderdale, FL. He can be reached at 732-870-4309 or del.kunert@mail.ccur.com.


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Circle (15) on Free Info Card

Selecting test equipment for digital systems

It takes more than a VOM to test today's digital systems.

By Kenneth Hunold

THE BOTTOM LINE:
As digital systems change from islands to oceans surrounding analog islands, test procedures also need to change. To properly test digital systems, engineers need knowledge and digital-ready test equipment. $

It has been said before that no matter what the VTR, HDTV or video server format of tomorrow will be, tomorrow's TV system will be digital. It has also been said, when referring to testing and measuring digital TV systems, "Don't worry . . . it's digital!" Although the first statement is probably true, the second could not be farther from the truth. Digital systems need to be tested just as much as analog systems (albeit for different responses). Also, brand-new, all-digital systems are rare, even today. New digital installations are most often built within existing analog infrastructures and must interface with the existing analog facility. It is important to test the facility as if it was an analog facility *and* also as a digital facility. Depending on the mix of analog and digital systems, the order in which to test for analog and digital compliance may vary. It is important to realize that both

Selecting test equipment for digital systems

tests must be carried out, effectively doubling your initial proof-of-performance test time.

What to test and why

Digital systems must be tested just as much as analog systems. Only the nature of the test and the equipment used to perform the tests is different. Digital television is only now entering the phase of development where most digital video equipment properly interfaces with equipment made by other vendors. However, this interoperability is not universal. In instances of finger-pointing between (or among) vendors, it is often left up to you — the customer — to determine digital blame and how to proceed toward compatibility. A good place to start is with standards developed by organizations with established standard-setting procedures, either national or international. These organizations include SMPTE, AES, ITU (formerly CCIR) and ANSI. Armed with these manufacturer-neutral and committee-balloted standards (and they can be quite an arm full!) you can begin to referee compatibility issues at your facility.

For standard-definition video systems, the document referred to most often is SMPTE 259M-1993, which covers the serial transmission of digital video signals. Serial transmission is the most popular digital video interconnection method. The SMPTE 259M standard covers multiple line rates and data rates including, but not limited to, 143Mb/s for composite digital systems (e.g., D-2 and D-3 VTRs), 270Mb/s component digital systems (D-1, D-5 and other VTRs) and 360Mb/s 18MHz-sampled component digital systems (D-5 VTRs). Test equipment capable of measuring SMPTE 259M signals is considered an absolute necessity in today's digital facilities.

Today's test equipment includes a variety of functions. Depending on how far your facility's transition to digital has progressed, different types of test equipment could be needed at different stages. If serial digital distribution is used throughout, then serial digital versions of most of the monitoring equipment will be required. At one end of the cost and sophistication spectrum, all that might be required is a simple continuity monitor. Often, this device serves as nothing more than a waveform monitor for the digital signal. It confirms signal presence and little else. At the other end of the cost and sophistication spectrum is the digital analyzer. In addition to waveform monitor capability, these devices can also analyze the signal at the interface level.

Routine monitoring of the signal for continuity and video content can be accomplished either with a purpose-built SDI monitor or, perhaps on a temporary basis, an appropriate quality D-to-A converter could feed your existing monitor system. This raises the question of whether implementation plans call for a composite digital or component digital facility. Although SMPTE 259M can be used for either composite or component digital systems, it is usually a good idea to keep the

Standards documents

Standards documents are necessary to define the details of complex systems and ensure stable and reliable operation. Listed below are standards documents from professional organizations that may be helpful in defining and describing TV audio and video systems.

AES standards:

- AES3-1992 (ANSI S4.40-1992). Transmission of two-channels periodically sampled and uniformly quantized audio signals on a single twisted pair cable. User and interface related data may also be transmitted. This is a revision of the original 1985 document.
- AES-3id-1995. This information document (id) describes transmission of AES3-formatted data over unbalanced coaxial cable.
- AES10-1991 (ANSI S4.43-1991). Serial Multichannel Audio Digital Interface (MADI). This standard is for transmitting multiple AES3 channels over a 75Ω coaxial cable or optical fiber. This interface is becoming popular with digital console and multitrack recorder systems. Up to 56 channels can be transmitted.
- AES14-1992 (ANSI S4.48-1991). XLR-type connector gender and polarity. This standard specifies a common scheme for wiring XLR connectors in audio systems.
- AES17-1991 (ANSI S4.50-1991). Measurement of digital audio equipment. This standard specifies methods for verifying the performance of digital equipment. Many tests are almost identical to those used when testing analog equipment. Because of the requirements of digital audio equipment, additional tests are included. This document is currently under revision.
- AES26-1995. Conservation of polarity of audio systems. This standard specifies the polarity of the signal at the different interface points in the audio chain, particularly for the acoustical, electrical and magnetic aspects.

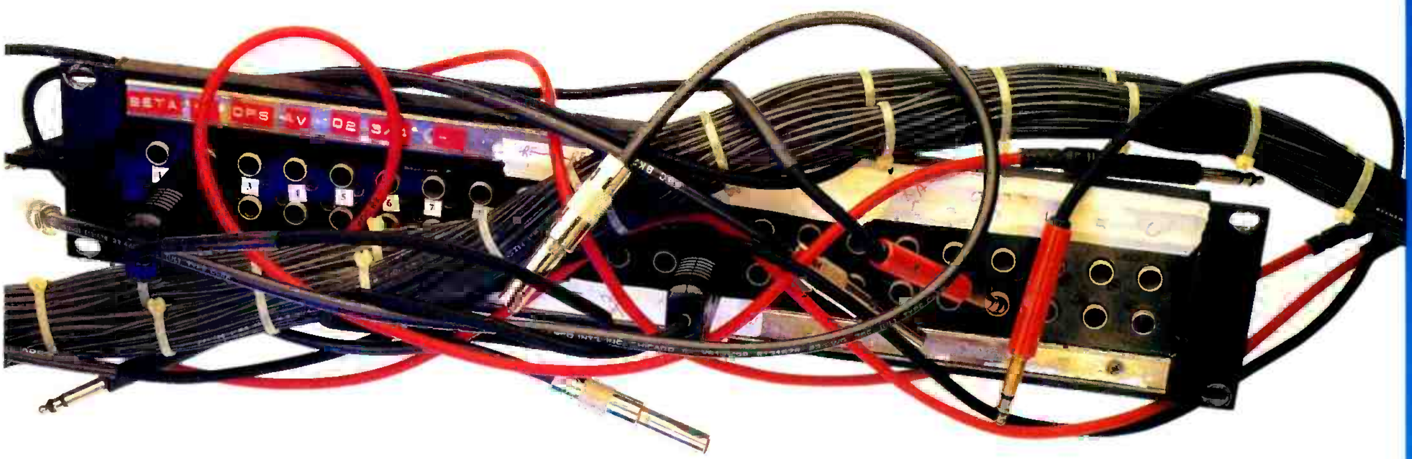
SMPTE issues different kinds of standards documents. These include "standards," "recommended practices" (RP) and "engineering guidelines" (EG). Some of the relevant documents for analog and digital systems include:

- SMPTE 170M-1994 NTSC for studio systems;
- EG 1-1990 alignment color-bar signal (SMPTE bars);
- SMPTE 259M-1993 bit-serial 4:2:2 interface;
- SMPTE 125M-1995 bit-parallel 4:2:2 interface;
- SMPTE 244M-1995 bit parallel NTSC composite interface;
- RP 165-1994 error detection check words and data flags (EDH);
- RP 184-1996 jitter specification;
- RP 192-1996 jitter measurement;
- EG-33 jitter characteristics and measurement;
- SMPTE 276M-1994 AES/EBU audio over coaxial cable (similar to AES-3id);
- EG 32-1996 AES/EBU emphasis and preferred sample rate;
- SMPTE 292M-1996 bit-serial 4:2:2 high-definition interface;
- SMPTE 240M-1995 analog HDTV production system 1125/60;
- SMPTE 260M-1992 digital HDTV production system 1125/60;
- SMPTE 274M-1994 1,920x1,080 HDTV scanning 60Hz; and
- SMPTE 296M 1,280x720 scanning 60Hz (this document has not been finalized);
- ANSI/EIA/TIA 250-C-1989 Electrical Performance Standard For Television Transmission Systems. This is the standard that all common carriers and most TV networks must comply with. Although there is no digital performance specification that is analogous to 250-C, this standard is often applied to the analog I/O of digital systems.

Standards documents are available from:

Society of Motion Picture & Television Engineers
Standards Department
595 W. Hartsdale Avenue
White Plains, NY 10607-1824
Phone: 914-761-1100
Fax: 914-761-3115
eng@smpte.org
http://www.smpte.org

Audio Engineering Society
Special Publications Department
60 E. 42 Street
New York, NY 10165-2520
Phone: 212-661-8528
Fax: 212-682-0477
HQ@aes.org
http://www.aes.org



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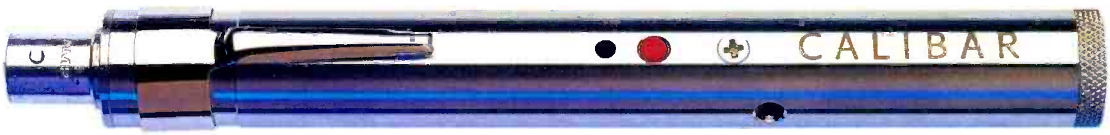

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Selecting test equipment for digital systems

big picture in mind and make a facility-wide choice whenever possible. This decision needs to be consistent with equipment depreciation and other economic and technical trade-offs.

At the interface level, the SMPTE 259M signal must be monitored for peak-to-peak amplitude, rise time, overshoot and jitter. These tests determine the quality of the hardware used to serialize the signal. They can also give a clue to the stability of the clock circuits in the originating hardware or any other signal reclocking or regeneration stages. Once the signal is passed through a transmission device (which could be a DA, coaxial cable or coast-to-coast fiber/satellite link), the signal needs to be checked at the receive end. A common indicator of digital signal health is the "eye pattern." It is used as an indicator of how well a device will be able to differentiate between the states of the interface. The more separation between the upper and lower states and the sharper the transition between the two states (which both determine how "open" the eye is), the better a serial receiver will be able to determine the difference between the two states of the signal. Most serial receiver chipsets include an automatic cable equalizer to correct for the high-frequency roll-off of the coaxial cable. It is this equalizer that allows the digital signal to be transmitted over cable distances varying from a few inches to a thousand feet.

Digital test equipment must also allow you to check the quality of the original A/D conversion. Because a signal, once digitized, is difficult to modify, it is imperative that the original conversion from analog to digital be done correctly. SMPTE 259M specifies how digital video signals are serialized into a single bitstream for transmission. In order to fully examine a digital signal, it is often necessary to examine the individual samples. ITU-R Recommendation 601 describes how an analog video signal is to be sampled. The continuously varying analog signal must first be broken down into a series of discreet samples. These samples are then quantized, resulting in a number that describes the signal amplitude at that point in time. This number can be expressed to a certain precision by using a certain number of bits, typically eight or 10 for video signals. This allows you to see exactly what the "video level" of the signal is, limited only by the number of bits used to describe the signal. For the luma portion of the component digital signal, "100%" is equivalent to a 10-bit sample value of 940 (decimal), and black level is equivalent to a sample value of 64 (decimal).

SMPTE 259M also defines certain non-video codes that are used in the system. In component digital systems, horizontal sync pulses are replaced by numeric codes reserved for synchronization signals. Test equipment should detect these codes and also indicate if they occur when they are not expected. The portion of the signal outside the active video portion (in what could be considered the horizontal and vertical blanking interval of an analog signal) can be used to transmit other digital data. This ancillary data can include audio, time code, CRC checksums for error detection and other data. This data should be available for inspection and possible analysis, depending on the intended use and location of the test equipment.

Don't forget the audio

Similar to digital video, digital audio signals must be monitored at the audio level and the interface level. The most common digital audio transmission standard used in broadcasting is AES3-1992. It describes the coding that digital audio signals should use for transmission. Again, just like the video signals, the signal must first be sampled and quantized into discrete values. Common sampling rates include 44.1kHz for CDs, 32kHz for some radio transmission systems and some consumer DV systems and 48kHz for almost all other professional applications. Common quantizing resolution values include 16-bits per sample for CDs, 18- and 20-bit converters for digital disk recording and digital VTRs and up to 24 bits for "audiophile" systems. The AES standard allows for a maximum of 24 bits of audio data to be transmitted. Once these samples are made, the analog values must be quantized into a discreet value. The number of bits used to describe the digital audio value is determined by the A-to-D converter. Currently, most audio systems use less than the full 24 bits allowed by the standard. Test equipment that shows the number of active bits is useful to tell if any processing equipment is truncating, or reducing, the number of databits describing the audio signal, thereby reducing the resolution of the system and adding distortion.

Many times, all that is desired is to do traditional analog audio testing on signals that exist in the digital domain, e.g., frequency response, THD+N, noise floor, etc. Typically, you are measuring the quality of an A-to-D conversion. Although not trivial, current DSP technology certainly makes such analysis feasible. In addition to testing the accuracy of the data used to convey audio, the actual interface itself must be checked, as in digital video systems.

Audio test equipment must be able to measure the AES interface for parameters similar to those parameters measured on the video interface. These parameters include p-p level, rise and fall time, overshoot and jitter. Beyond that, test equipment should be able to detect bit activity and decode status byte information. If the information contained in the status bytes does not agree with the actual condition of the interface, problems could occur. For example, compatibility problems can arise when a device receives a 48kHz-

For more information

For background information, read these related articles in *Broadcast Engineering*:

"Transition to Digital: Testing Serial Digital," Parts 1&2, August and September 1997.
"Testing Digital Systems," November 1996.
"Testing MPEG-Compressed Signals," February 1996.
"Transition to Digital: Testing Serial Video," November 1995.
"Testing Fiber Systems," November 1994.
"Production Clips: Production Test Equipment," Parts 1&2, August and September 1994.
"Automated Testing for Video," November 1993.
"Testing Audio — Automatically," November 1993.
"CCD Camera Testing," sidebar to "The Latest in CCD Camera Technology," July 1993.
"Performance Testing of Digital Audio Equipment," November 1992.
"Ruggedness Testing for Transmitters," November 1992.
"Multitone Audio Testing," July 199 .

Selecting test equipment for digital systems

sampled signal, but the status bytes indicate that the signal sample rate is 44.1kHz.

Audio monitoring moved beyond the VU meter a long time ago. Stereo introduced two channels (and meters), as well as phase and polarity concerns. "X-Y" monitors became popular for phase measurements and evolved into "sound-field" monitors. This type of monitor places the L and R axes at 45° either side of vertical to indicate stereo placement. DTV will bring an increase in the number of channels that can be transmitted. This increase to six-channel audio (used in the 5.1 channel ATSC transmission system) will raise many questions and concerns about how to monitor these audio channels for maintenance and production. Some designs that have not been used since the "quad" days may have to be dusted off. (That's "quad" as in quadraphonic sound, not quadruplex VTRs!) Apart from just an increase in the number of channels, operational, maintenance and transmission monitoring of this new format will be a challenge that has largely not been met by current products.

HDTV is right around the corner

What about the future? In addition to dealing with the operational needs of producing 5+ channel sound, the digital interface used tomorrow will be different from the digital interface used today. For HDTV signals, the data rate for the 1080I and 720P signals is approximately 1.5Gb/s. This is more than four times the highest data rate supported by SMPTE 259M. A new standard, SMPTE 292, has been developed to address serial HDTV transmission via coaxial and fiber-optic cable. There are many similarities between the two standards, and similar parameters will need to be checked, although at a much higher data rate. Test equipment for this interface is rare today, but it is hoped that interface tests and data analysis similar to what we currently perform on SMPTE 259M will also be able to be carried out on the new HDTV interface.

The trick to selecting test equipment for digital systems is to categorize the types of measurements that need to be made in each operating area. Not every operating area needs the detailed analysis tools that a maintenance area would require. Also, tools used in the construction and commissioning of digital facilities are different from the tools used in a day-to-day operating environment. Digital signals do not need to be checked for level and frequency response on a daily basis (although these tests can provide an operator with a comfort zone and a reality check). It is, however, important to make sure that analog levels are properly converted to digital. Many of the new pieces of test equipment include data analysis tools that are new to engineers who were formerly required to test analog facilities. We will need to test digital systems just as rigorously as their analog predecessors. Although we will be looking at different parameters with different tools, the end result, the best signal quality possible, remains the same. ■

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

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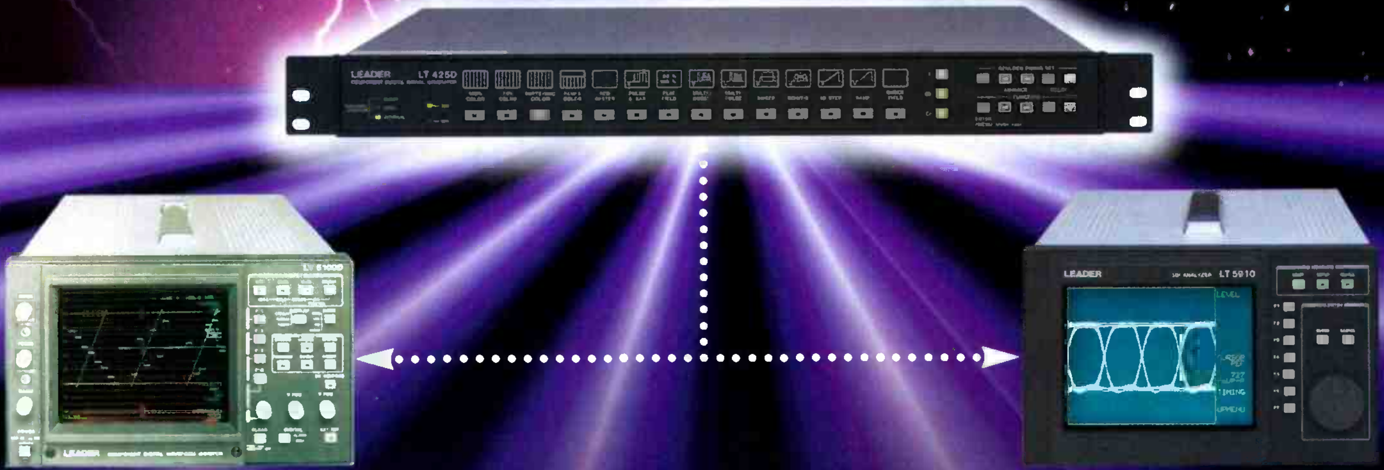

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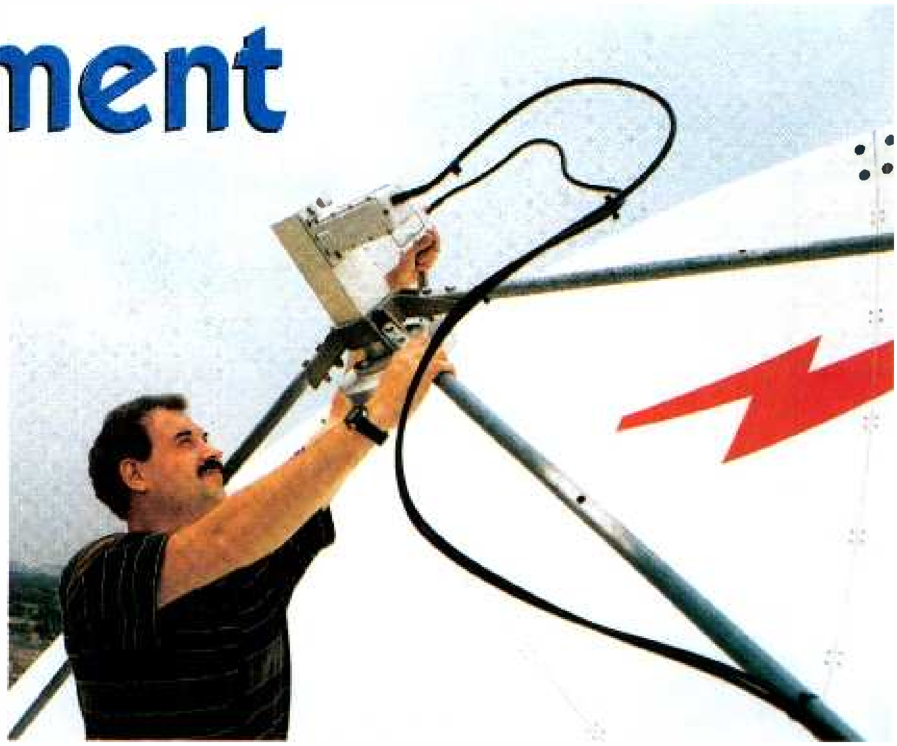
Maintaining satellite equipment



It's no fun fixing a dish when it's 10° below zero with 12 inches of snow on the ground.

By Philip Hejtmanek

THE BOTTOM LINE:
Over the last 20 years, satellite delivery of program and commercial material has virtually replaced land-line and package delivery. Although fiber-optic capabilities have changed that somewhat, satellite delivery remains critical. Loss of satellite equipment can cripple a facility, either directly through loss of primary programming or indirectly through loss of feeds intended for later broadcast. Proper maintenance can prevent failures and minimize downtime. $

Photo: Periodic inspection and tightening of components connections are critical to maintaining system reliability.

Satellites in geosynchronous orbit are extremely effective platforms for point-to-multipoint distribution of broadcast program material. Nearly all broadcast facilities in the United States have at least one satellite receive terminal. These terminals typically are used daily to acquire network feeds, syndicated programming, weather data or news. Some stations also have uplinking capability, allowing them to send program material or data to a satellite for reception by others. All too often, though, station operators install this mission-critical equipment and promptly forget about it — until the day it fails. Simple maintenance procedures done on a regular basis can easily prevent unexpected downtime.

Broadcast satellite facilities can be divided into two general types: *fixed* and *mobile*. Most stations have at least one example of a fixed receive system — the network or syndicated program downlink. Often, these systems feature a simple fixed-dish antenna locked down on a single satellite, but many facilities have motorized satellite antennas, capable of steering to multiple satellites. Fixed systems can be either receive-only or transmit/receive. Some receive-only systems feature antennas with spherical (rather than parabolic) reflectors, capable of receiving multiple satellites at the same time.

Many TV stations and networks also operate mobile satellite systems. One of the most common is the Ku-band satellite uplink truck for news operations. Additionally, a significant number of C-band mobile uplinks are used mainly for sports or network backhauls. In many cases, these large, full-bandwidth analog trucks are giving way to smaller systems that rely heavily on digital compression technology to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Maintaining satellite equipment

reduce bandwidth and power requirements. Naturally, the maintenance problems with all satellite trucks are compounded by the fact that the equipment is subjected to the rigors of the North American highway system, along with countless potholes. There are also flyaway Ku-band systems, which are uplinks in a shipping case, ready for deployment anywhere in the world.

Set a maintenance schedule

The best way to make sure that satellite equipment is properly maintained is to set a maintenance schedule and stick to it. Virtually all manufacturers of satellite equipment recommend that checks and maintenance steps, such as lubrication, be done at regular intervals. It is well worth the extra effort to log test point values and meter readings following the installation of new equipment. Then, changes in parameters from the nominal values can indicate potential trouble spots.

Because elements of a fixed satellite terminal are installed outside, it is best to perform outside work when the weather is favorable. Anyone who has done significant work on a satellite dish in the dead of winter understands this firsthand. One unavoidable task for those in northern locations is sweeping snow out of unheated satellite dishes. And, at any time of the year, high winds may move an antenna and necessitate repointing.

A fixed system consists of an antenna, an antenna controller (in the case of motorized dishes), a feed system, an interfacility link and receive-only or transmit/receive electronics. The electronics segment of a receive-only system could be a simple receiver/demodulator, an integrated receiver-decoder (IRD) or separate receiver and decoder components. A majority of satellite-borne communications systems feature encryption for security purposes, so the decoder is often a key element. Transmit/receive systems feature similar receiver elements, in addition to encryption encoders, RF exciters and high-power amplifiers. C-band transmit systems frequently use klystron amplifiers at 6GHz, with output power measured in kilowatts. Ku-band transmit systems generally have traveling wave tube amplifiers (TWTAs) with output power levels from 100W to 300W at 14GHz.

Mobile systems have an additional element to consider — the maintenance of the prime mover, as well as the electronics and antenna. Vehicle manufacturers have specific maintenance schedules established for their products, and it is wise to follow them.

For the safety of those involved, always remove power from the drive motors before starting any maintenance.

Maintaining fixed antenna systems

When it comes to maintenance, the simplest part of a satellite system is often forgotten. Once the satellite antenna is properly installed and aligned, it is frequently ignored. The antenna is often the most difficult element to service; freeing up a stuck 9m dish in a snowstorm can be tough. For that reason, this is the system element that probably deserves the most attention.

Non-motorized satellite antennas typically require little maintenance other than general cleanup. Sometimes, strong winds can move an antenna away from the correct positioning, so repointing is needed. Always try to repoint an antenna while the desired satellite is in the "center of box" (satellites drift around their nominal position slightly). Information about satellite drift and center-of-box timing is available over the phone from the satellite controllers.

The first step toward ensuring reliable operation of a motorized antenna is a periodic visual inspection, general cleaning and lubrication. The reflector, feed system, motor assemblies, jackscrews and base should be closely examined for loose or missing parts or bolts. Thermal cycling and normal motion can easily loosen up fasteners. Mechanical components can be cleaned with a stiff brush, cloth or compressed air. Corroded parts or hardware should be cleaned or replaced. Loose screws or bolts should be torqued to the manufacturer's specifications.

Maintenance is also important to the electrical components of a motorized reflector. Azimuth, elevation and polarization motor drive systems should be exercised periodically, and limit switches should be checked for proper operation. All AC wiring and control cables should be checked for cracked, discolored or burned insulation. These symptoms usually indicate overcurrent conditions or poor connections. Load center circuit breakers for the drive motors, as well as the ground fault protectors for accessory AC duplex outlets, should be checked for safe and positive operation. Tighten terminals and connections at the load center and electrical junction boxes associated with the motor drives.

It is a good idea to record the operating AC voltages and currents for each of the phases in a motor drive circuit upon installation and then at periodic intervals. Deviation of more than 5% from the installation values can indicate troubles to come. Electrical enclosures should be opened and the insides checked for watertight integrity and signs of arcing or discoloration.

Jackscrews, motors, gearboxes, bearings and pivot points should be lubricated to manufacturer's specifications at the specified interval. The rubber boots on jackscrews should be inspected for cracks or tears. In corrosive saltwater environments, exposed fas-

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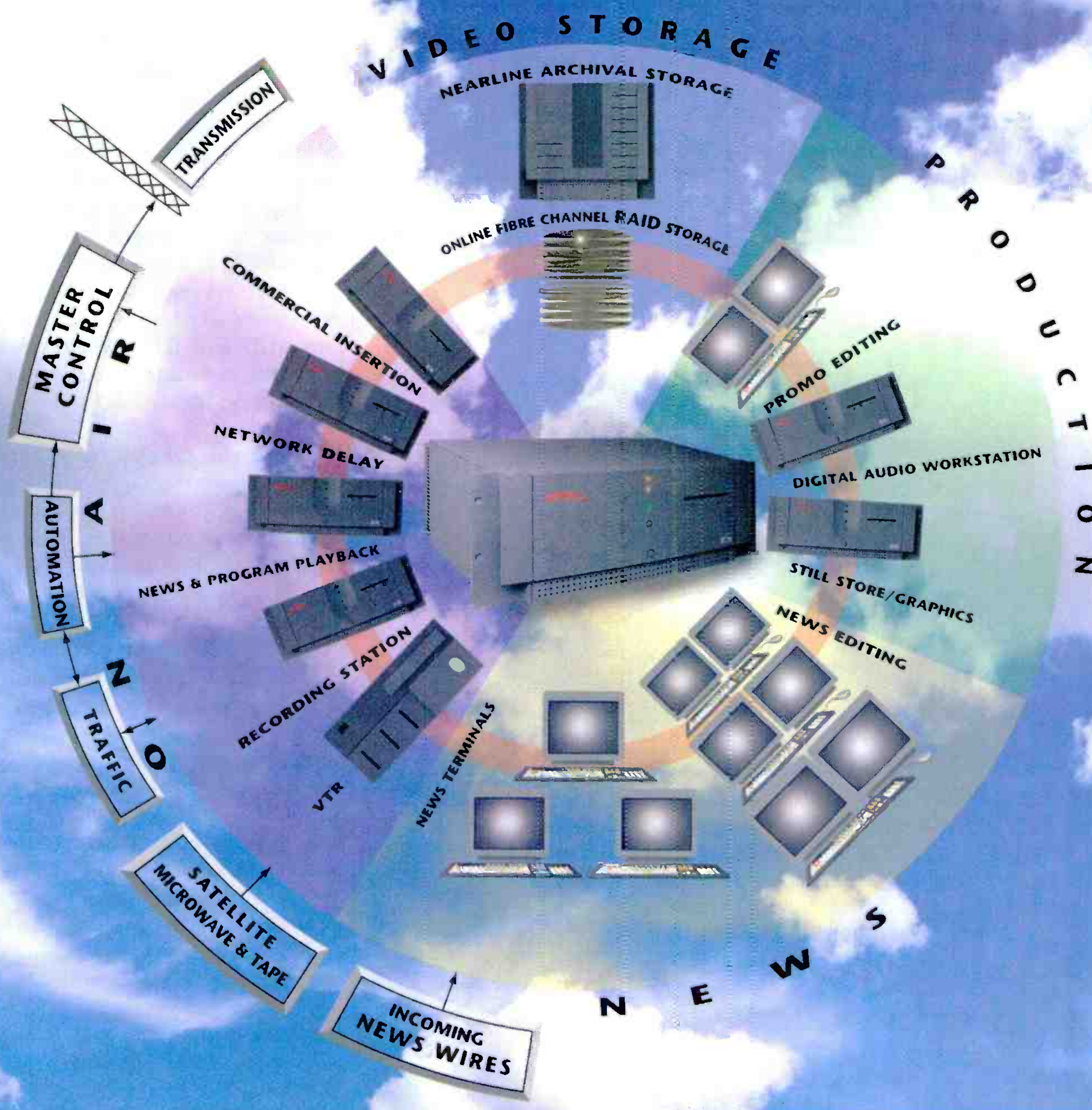

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Maintaining satellite equipment

teners and hardware should be treated with an anti-corrosive spray or compound to minimize long-term damage. Always remove electric power from motor drives before servicing them. Serious injury or damage could result if the antenna was inadvertently moved during maintenance.

Caring for feeds and interfacility links

Feed windows and horn assemblies should be closely inspected for dirt or foreign objects. Birds, wasps and bees have been known to nest in feed systems, resulting in poor receive system performance. Obstructions in transmit feed systems can result in excessive VSWR and possible amplifier damage. Low-noise amplifiers and downconverters should be checked for proper operation and weatherproofed.

Interfacility links (IFLs) are basically transmission lines that connect the antenna system to receivers or power amplifiers. Most receive systems use coaxial cable for this purpose, while transmit amplifiers are generally connected to the feed through the use of a waveguide. Waveguides are usually pressurized with dry air or nitrogen to prevent moisture from entering. A regulated positive pressure of about 0.5psi, even in the case of a small leak, will usually keep the water out. Loss of gas pressure in the nitrogen tank is a sure sign of a leak. Leaks most frequently occur at rotary joints or flexible waveguide sections, especially in the area of the feed. IFL connectors should be clean, tight and waterproofed to minimize VSWR losses.

Transmit and receive electronics

Maintaining satellite terminal electronics is much the same as for maintaining other equipment types. In general, if adequate airflow and cooling is available, the equipment should operate properly. It is important to change air filters associated with power amplifiers at regular intervals, typically on a quarterly basis, depending upon the environment. Air-conditioners and heat exchangers should be kept unclogged for maximum efficiency. High-voltage power supplies and amplifier assemblies need to be vacuumed (with the power turned off, of course) and all connections tightened at least twice a year. In general, most of the same procedures used in broadcast transmitter maintenance hold true for satellite equipment.

Modern RF exciters and solid-state amplifiers require little maintenance, but it is prudent to check carrier and subcarrier frequencies and RF power levels on a quarterly basis. A monthly log of amplifier meter readings is an invaluable resource when troubles crop up. A good spectrum analyzer, frequency counter and RF power meter are essential tools for maintaining satellite uplinks.

Satellite receivers and IRDs generally need nothing more than a cool place to operate. The same holds true for encryption encoders, decoders and digital satellite modems. If encryption/de-

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Maintaining satellite equipment

cryption equipment is mounted in a secure area, it is wise to affix a sign with key passwords and telephone numbers to the equipment; in the event an emergency re-authorization is needed, it can save time.

Keeping mobile satellite systems going

Packaging a complete satellite uplink/downlink system into a vehicle often results in airflow and cooling compromises. Equipment is typically closely packed in racks and supplemental air conditioning is a must. Many problems occur as a result of vibration caused by over-the-road travel. Close inspection of rack-mounted electronics is much more critical in the satellite truck. Coax connectors and AC plugs have an uncanny way of coming apart at the most inopportune times. Even the racks can become loose on a rough trip. Keep all air filters clean.

Vehicle maintenance is as important as electronic maintenance for a satellite truck. A good truck operator will make daily inspections of truck engine oil, brake fluid and tire pressure levels, as well as fuel system integrity. The motorized antenna systems used on uplink trucks are more complex than those used in fixed systems and should be frequently inspected for proper operation and loose or missing parts. Leveling jack systems require periodic lubrication, and the AC electric generators onboard most trucks require periodic oil changes, lubrication and tune-ups. Circuit breakers should be checked quarterly for positive operation and periodic maintenance checks can prevent lost news shots or lost revenue.

Sometimes, the air for amplifier cooling is drawn from the outside, so special care should be taken to prevent condensation from forming in high-voltage power supplies, amplifier cavities and TWTAs. Arcing in these areas can cause major damage to expensive amplifier tubes.

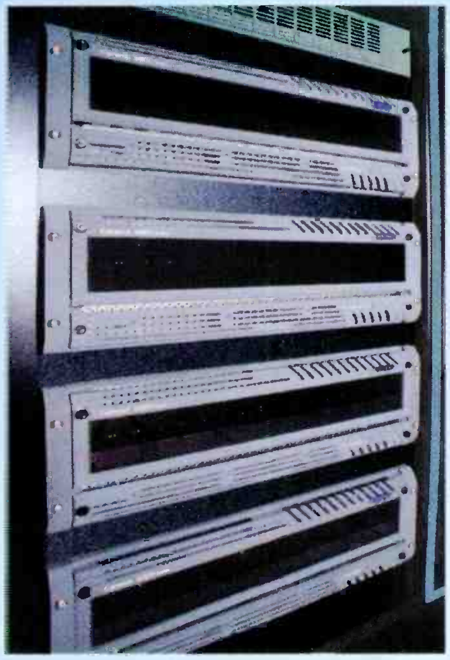
Flyaway systems take the worst abuse — bouncing around inside packing cases while being shipped to the far corners of the world. Again, periodic maintenance can spell the difference between success and disaster. In flyaway systems, mechanical elements of the antenna and equipment packs should be inspected for lost or missing parts before each shipment. A flyaway system should always be set up and tested before it goes on the road. Interconnect cables need to be tested and each case should be inspected for damage before the unit is shipped.

Due to increased stress from vibration and weather extremes, mobile uplinks require frequent inspection and lubrication of mechanical components. (Photo courtesy of Southern Illinois University Broadcasting Service, Carbondale, IL.)

Maintenance is mostly common sense. Time spent on careful inspection and care of satellite equipment is worthwhile. Most problems are found before they can affect the operation of the equipment. Ignoring the need for periodic maintenance is false economy, and the payback for skipping maintenance can be disastrous. ■

Philip Hejtmanek is director of technical operations for WWJ-TV, Detroit, MI.

MAKING THE CONNECTION FROM ANALOG TO DIGITAL



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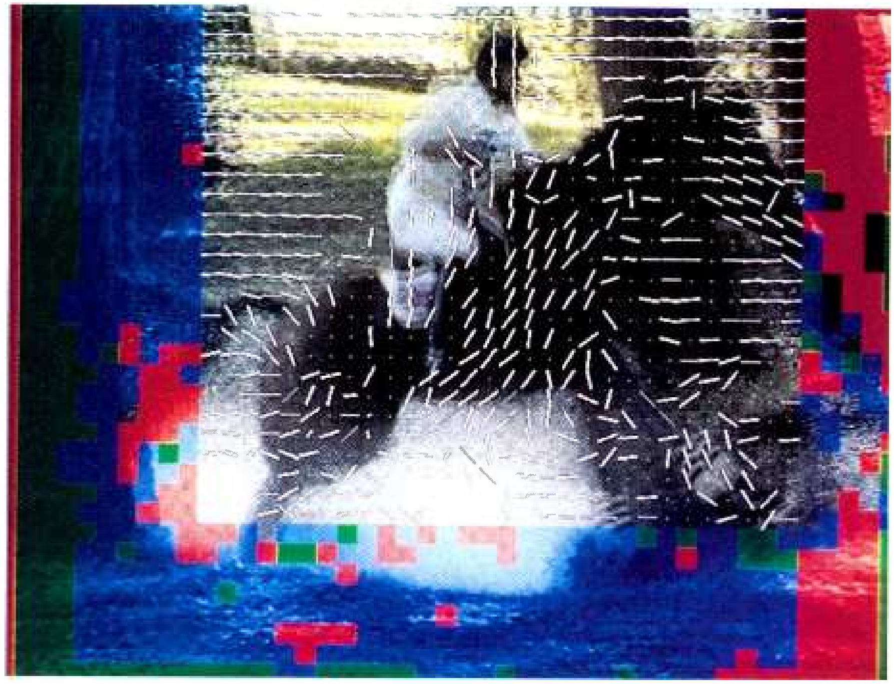
Circle (20) on Free Info Card

Lossless editing with the "MOLE"

Editing MPEG without a loss in picture quality is difficult, but not impossible.

By Mike Knee & Nick Wells



THE BOTTOM LINE:
Seamless concatenation can refer to the process of splicing an MPEG bitstream or the lossless concatenation of compression encoding and decoding operations. Within most MPEG-2 flavors, either operation is nearly impossible without restricting flexibility or increasing the bit rate beyond what would be considered efficient compression. However, the benefits are considerable and work toward this goal is ongoing. $

Photo: Motion-compensation parameters in the MPEG bitstream can be analyzed using equipment such as the Snell & Wilcox MVA100 MPEG video analyzer. The overlays are split into two windows. The inner window shows lines representing direction and length of the first motion vector for each macroblock. The outer window's color overlays indicate the direction of motion compensation for each macroblock. Green indicates a forward predicted macroblock, red for backward and blue for bidirectional. Parameters such as these are preserved by the MOLE.

For broadcasters, a wide variety of processing is performed on conventional signals including real-time cuts, crossfades and wipes. Additionally, captions and logos must be inserted into full-frame signals as necessary. Video production requires all of the above *and* frame-accurate editing. As MPEG-2 becomes widespread, users will expect to perform these same functions on MPEG-2 signals. Unfortunately, these "simple" tasks are far more difficult on compressed signals than on baseband signals. One of the difficulties is the absence of a "standard" MPEG-2 bitstream. There are different bit rates, levels and profiles. There are also different types of bitstreams, including: elementary, program and transport streams. Properly handling these signals will require transcoding between different bit rates, levels and profiles, as well as creating new transport streams from elements of old ones.

The MPEG-2 standards focused on moving compressed signals from the studio to the viewer, with little consideration toward signal handling at the network level. Because of this, switching MPEG-2 streams in real-time is problematic. Current switching solutions can be classified into three categories: naive cascading, restricted MPEG-2 and bitstream splicing.

Naive cascading fully decodes the MPEG-2 signal prior to processing and fully re-encodes it afterward. Once decoded to baseband video, the signal could be switched or sent through a DVE. Under some circumstances no processing would be done, but the signal would be re-encoded at a different bit rate or with a different flavor of MPEG-2. In this case, the processing involved constitutes a transcoder. Fully decoding the picture is usually required for complex effects, because the effects require access to the pixels. However, in a situation such as master control, a switch of this type simply passes the input to the output the majority of the time.

Lossless editing with the "MOLE"

The result is an additional cascade (generation) of the MPEG-2 decoding/recoding process. Within a typical broadcast chain, several cascades are likely. The loss in picture quality caused by multiple cascades is typically about 5dB. This loss can be reduced by using a milder compression, but at the expense of an increased bit rate. Because of this, naive cascading is not considered a real solution to the concatenation problem.

The restricted MPEG-2 approach avoids the concatenation problem by compressing to a limited subset of MPEG-2. This allows something like frame-accurate editing to be performed on the bitstream. An example is the Sony SX system that uses an IBIBIB . . . GOP structure. Simple edits can be performed with minimal intermediate processing around the edit point. Unfortunately, the IBIBIB . . . structure requires a higher bit rate for a given level of quality than an IBBPBBP . . . structure. One benefit of the higher bit rates is that naive cascading can be performed with reduced loss. The main benefit of the restricted approach is that it offers a genuine solution to the concatenation problem. The downside is its incompatibility with mainstream MPEG-2 coding. In a closed environment, this may be acceptable. However, MPEG-2 Main Profile's success suggests it will increasingly be used as the medium for contribution (e.g., from SNG equipment), primary and secondary distribution (e.g., in digital terrestrial TV systems) and archive storage (e.g., in the ACTS AURORA project). Using a restricted version of MPEG-2 for editing, followed by a transcoding to Main Profile is less than attractive. And, the higher bit rates undermine the benefits of using compression in the first place.

The bitstream splicing approach attempts to do a "cuts-only" bitstream switch. It does not work for the more complex functions, such as crossfades or caption insertion and does not address transcoding. The SMPTE has carried out significant work in this area. Its Working Group PT20.02 (Switching and Synchronization) set up an ad hoc group that has proposed a standard for bitstream splicing. Two splice types are proposed: 'seamless' and 'non-seamless,' depending on how a decoder behaves when it receives the spliced bitstream. Seamless splicing is suitable for certain types of switching, but imposes restrictions, such as when the switch can be performed. Non-seamless splicing imposes requirements on downstream decoder behavior. The disadvantages of bitstream splicing include a lack of flexibility and the required changes in encoder/decoder operations. Despite these disadvantages, bitstream splicing could be useful for a low-cost solution in some applications.

Work on the MOLE is under way at the Snell & Wilcox research laboratories in Hampshire, England.

The ATLANTIC project

The ATLANTIC project was undertaken by several companies, including Snell & Wilcox and the BBC. Among the goals was the development of equipment and products that allow for the switching and editing of MPEG bitstreams without impairments.

The ATLANTIC approach recognizes that most processing operations require access to decoded pictures. Because of this, there is an inevitable cascade of decoding/recoding operations. In naive cascading, the side information including motion vectors and coding mode decisions that relate to the decoded picture are thrown away. This forces the decisions to be re-made when the signal is re-encoded. In ATLANTIC cascading, the side information is transferred to the re-encoder where it can be reused. This side information is given a formal data structure known as the *information bus.* (See Figure 1.)

The ATLANTIC decoder is a standard MPEG-2 decoder with an information bus output synchronized to the video output. Later, in the Dim coder (encoder), all the coding decisions are taken from the information bus. This ensures the re-encoding process is nearly identical to the previous encoding. The only cascading impairments introduced are due to mismatches between the DCT and inverse DCT functions. These only amount to about 0.0002dB.

Decoding and re-encoding the bitstream as a permanent transparent process is useless. However, the benefits become apparent within the context of a larger process. The main processes that use the information bus are picture operations and transcoding. Picture operations process the picture and the information bus before re-encoding. In the transcoding process, no picture processing is required, but re-encoding is performed with some parameter changes, typically a change in bit rate.

Picture operations can be illustrated with the example of a bitstream switch. Using the information bus technique, an unrestricted switch can be performed and the technique can be extended to include crossfades and wipes. The block diagram of a bitstream switch using the information bus is shown in Figure 2.

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Lossless editing with the "MOLE"

In it, synchronized decoded video signals are switched using existing technology. In the steady state, when bitstream A is selected, the information bus is passed unchanged from decoder A to the Dim coder. The output bitstream is essentially identical to input bitstream A. The same thing occurs after the switching operation, when bitstream B is selected. Near the switch point, neither information bus is usable due to references made to picture information on the wrong side of the switching point. (See Figure 3.) During this switching period, the re-encoder is on its own and works as a full MPEG encoder. It is not possible to eliminate cascading impairments during this period by using the information bus. This is because, from an MPEG point of view, the majority of the pictures to be coded consist of new information.

The re-encoder must lock to the new information bus quickly, thereby once again eliminating any cascading impairments. For most coding decisions, a lock can be obtained as soon as the switching period is over. However, an additional recovery period may be needed to address buffer fullness issues. (For more information, see "Editing MPEG Bitstreams," October 1997.) During this recovery period, the re-encoder is essentially operating as a transcoder. Once the buffer issues have been accommodated, the re-encoder can be fully locked to the new information bus and the steady-state cascade is re-attained. At this point, it would be possible (though unnecessary) to switch the decoder-re-encoder unit out of the circuit and replace it with a compensating delay. In fact, the only calculations required to perform the switch take place near the switching period. This same switch could be implemented efficiently in an editing system using non-real-time software processing. There are no restrictions in the relative or absolute GOP structures of the two bitstreams. In the example, bitstream A has a regular, common, IBBPBBP…structure, but bitstream B has an almost random-looking, but perfectly legal structure.

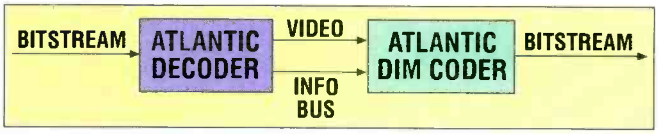

Figure 1. Cascading using the ATLANTIC technology includes the use of the information bus.

The MOLE

In principle, the switch could be replaced by a production switcher or DVE, enabling a full range of functions to be performed on the decoded pictures. The only problem is in the handling of the information bus signals. They would need to be passed around

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Lossless editing with the "MOLE"

the switcher and processed separately. However, some knowledge of the switcher's status would be needed. This requirement can be overcome by converting the information bus into a special format known as the "MOLE," which allows for the use of conventional digital studio equipment. Whenever the input signals are passed untouched, the MOLE associated with that signal is also passed automatically. In this manner, the MOLE "burrows through" the studio equipment and emerges at the other end, ready for use in re-encoding. Conversely, whenever the equipment affects the signal, such as during a crossfade, the MOLE is automatically destroyed and cannot be used for re-encoding.

The information bus is inserted into the video signal by the "MOLE composer" at the output of each ATLANTIC decoder and is decoded by the "MOLE interpreter" at the input to the ATLANTIC encoder. (See Figure 4.) For proper operation, the information bus must pass transparently through studio equipment. To do this, several conditions must be satisfied, including:

- the MOLE must be invisible on the video signal;
- the studio equipment must be capable of passing the MOLE signal without error; and
- the encoder must detect when the MOLE is no longer valid. When the MOLE is invalid, the encoder must make its own coding decisions.

The ATLANTIC technology imposes no special constraints either on upstream encoders or on downstream decoders. However, the quality of the first compression encoder in the chain needs to be as high as possible, because it defines the quality throughout the chain. Prototype ATLANTIC decoders and encoders, including MOLE processing, have been demonstrated.

Transcoding

In addition to picture operations, bitrate transcoding can be performed. In this scenario, the information bus is passed from the decoder to a Dim coder, but intermediate pixel-based processing is not used, eliminating the need for the MOLE. Two transcoder types are being investigated. The first is a 'drifty' transcoder.

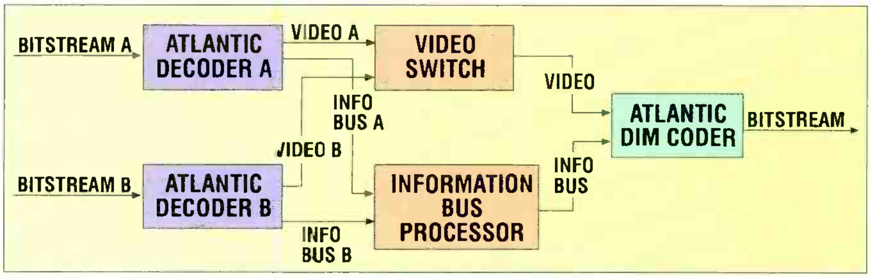

Figure 2. Bitstream switch using the information bus.

Lossless editing with the "MOLE"

In the drifty transcoder, the decoding pipeline stops at the generation of inverse-quantized DCT coefficients. These coefficients are then requantized under the control of a bit-rate control algorithm set to the new bit rate. The information bus is passed from the variable-length decoder to the variable-length encoder for insertion into the new bitstream. The transcoder is drifty because the predictions generated in the downstream decoder will not match those generated in the upstream coder, causing accumulated errors in successive P pictures through the GOP. This architecture only provides limited opportunities for changing coding parameters, such as prediction modes. However, under some circumstances, such as when transcoding to a slightly lower bit rate, these restrictions may be acceptable.

The second type is a "full" transcoder, in which the decoder and encoder prediction loops are implemented. Even here, some decoding and re-encoding steps can usually be left out, such as 4:2:0 to 4:2:2 conversion and picture re-ordering. With this architecture, no drift is introduced and it is possible to change some of the coding parameters. However, if prediction parameters are not changed, the architecture can be simplified, using only a single prediction generator.

SEQUENCE A:	I B B P B B P B B P B	B I B B P B B P B B P B B I
SEQUENCE B:	B P B P B P I B P B P	B P B P B B I B P B B P B P
SWITCH POINT:	→	
OUTPUT SEQUENCE:	I B B P B B P B B P ?	? ? ? ? ? ? I B P B B P B P

Figure 3. When a switch is done on two streams, the information bus can be used to reassemble the output stream. However, near the switch point, some frames must be re-encoded because needed information does not exist.

For both transcoder types, requantization is important. In all MPEG encoding, including the re-encoding in a transcoder, the inverse quantizer *reconstruction* levels are specified in the standard. However, the quantizer *decision* levels are not. The decision levels can be chosen to optimize picture quality at a given bit rate. For transcoding, decision level choices can be improved with knowledge of the previous quantization process. Requantizers such as these can provide significantly better picture quality at a given bit rate than the naive use of a commonly used quantizer.

Up to this point, the assumption has been a stand-alone transcoder. However, the full transcoder can be applied to any switching or processing equipment using the MOLE. In fact, transcoding is necessary during the recovery period following a switch. The transcoder's architecture makes it possible to specify an arbitrary bit rate at the switch output or to deliver arbitrary bit rates at the inputs so that transcoding is automatic whenever necessary.

Continued on page 77

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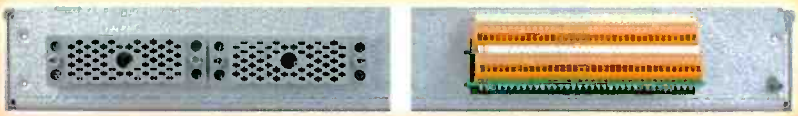

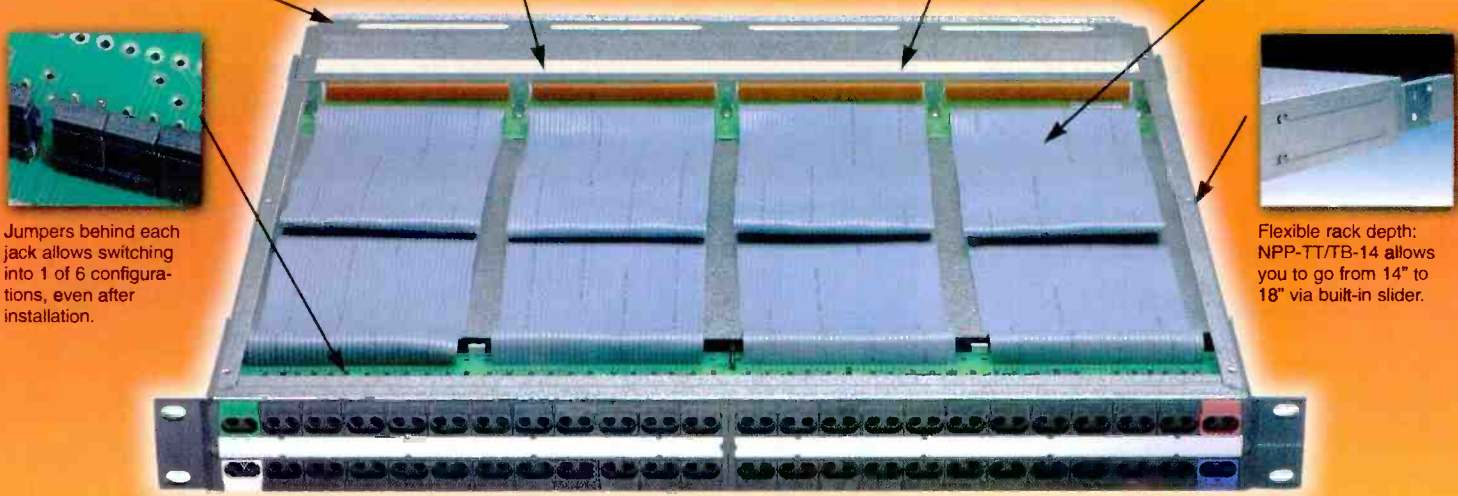

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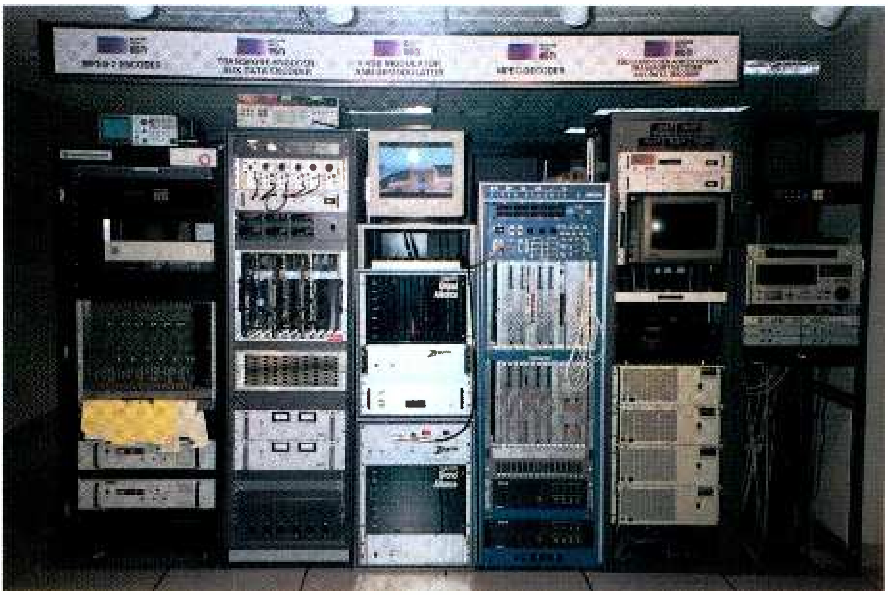
Circle (37) on Free Info Card

Understanding and testing the 8VSB signal

A basic understanding of the concepts used for 8VSB can be a powerful troubleshooting tool.

By Linc Reed-Nickerson



THE BOTTOM LINE:
DTV brings with it many new challenges, among them, the transmission of information using symbols rather than analog waves. Although maintaining digital transmission facilities requires many of the same procedures used in analog facilities, a variety of new tools and techniques will be required to ensure noise- and error-free information transmission. Engineers charged with the maintenance of these new systems need to become familiar with these new tools and techniques as soon as possible. $

Photo: A variety of equipment is required for 8VSB encoding and decoding. Pictured is the equipment used at the Model HDTV Station, WHD-TV, Washington, DC.

Modern high-definition television was born in the mid-'80s. Since then, we have seen the formation of the Grand Alliance and the adoption of 8VSB as the U.S. DTV transmission standard. Most likely, 8VSB will be adopted by many countries using 6MHz channel bandwidths, while many countries with 8MHz channel bandwidth are adopting the DVB-T standard, which recommends coded orthogonal frequency division multiplex (COFDM). COFDM uses thousands of orthogonaly spaced carriers, each of which carries a portion of the data at a low symbol rate.

The Grand Alliance bitstream

The 19.39Mb/s digital signal fed to an 8VSB transmitter is referred to as the Grand Alliance (GA) bitstream. It contains MPEG-2 encoded video, Dolby AC3 audio and data, all packaged into 188-byte data packets. Packets consist of a sync byte, followed by a byte packet header (information about the packet), an adaptation packet of varying length and the data payload. Packet length was chosen for optimum coding performance in the transmitter's exciter.

In the exciter (see Figure 1.), the data is randomized as required by the FCC. The goal of randomization is to guarantee a flat, noise-like spectrum. For instance, if the GA input stream is lost, resulting in long streams of "1s" or "0s" or if a number of high-power symbols occur in a row, the randomizer assures that the output signal will not cause interference with existing NTSC channels. Randomizing also improves performance in the receiver recovery loops.

After randomizing, the data is sent to a Reed-Solomon coder. Reed-Solomon

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At The Heart of Your Digital UHF TV Transmitter

Understanding and testing the 8VSB signal

coding is an error correction scheme operating as a byte-wise encoder. This type of encoding works well for short "bursty" errors. At the encoder, the sync byte is stripped from the GA packet and 20 parity bytes are added. This allows the decoder to identify and correct up to 10 byte errors per packet. In

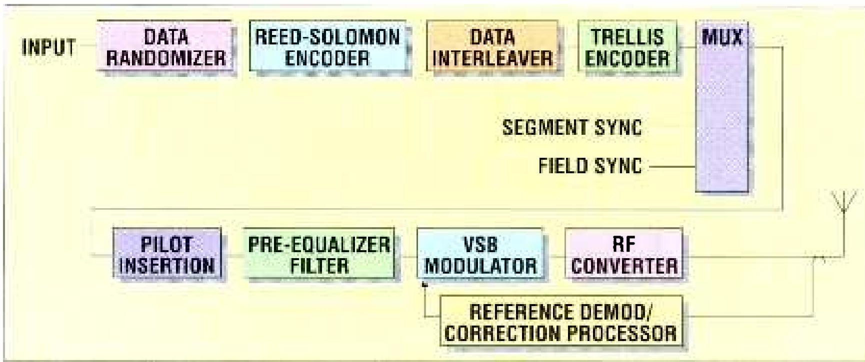

Figure 1. Block diagram of an 8VSB exciter.

terrestrial broadcasting, it is likely that noise burst durations will be longer than a Reed-Soloman error-correction scheme can handle. To protect the coding, the databytes are interleaved non-consecutively. (See Figure 2.) For 8VSB, the data is interleaved to a depth of 52, making it possible to correct for data lost due to noise bursts up to 193µs.

Next is convolution encoding, which uses a trellis coder. This complex coding scheme effectively handles white noise and results in signal gain (ex-

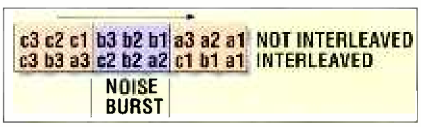

Figure 2. Simplified illustration of data interleaving. A noise burst that obliterates all three "B" bytes of a non-interleaved signal, covers only a single A, B and C byte of an interleaved signal. This leaves enough data for the Reed-Solomon decoder to determine the correct values of the missing bytes.

pressed in dB). Each bit at the coder's input produces two bits at the output. In 8VSB, there are eight possible states. However, in any one interval only four of the states are valid, depending on the previous interval. If the valid state changes are diagrammed, the results resemble a garden trellis, hence the name *Trellis Encoding* or *Trellis Coded Modulation*. (See Figure 3.)

After trellis encoding, supplementary sync signals are added in a data multiplexer to form the 8VSB baseband signal. Segment sync is sent after every 828 symbols. Segment sync is two-level binary data that is six data levels in amplitude and four symbols long, making each 8VSB data segment 832 symbols in length. (See Figure 4.) Segment sync replaces the sync byte removed prior to encoding. Because it is easily located by the decoder, even in the presence of noise, it adds to the signal's robustness.

A transmission data frame is 616 segments (48.4ms) in duration. (See Figure 5.) After every 312 segments, a frame synchronizing segment is sent. The frame sync segment carries the training reference signals for the receiver equalizer and consists of the four-byte segment sync, followed by 511 reference symbols. In the receiver, these are used for adjusting long equalizer taps. After the 511 reference symbols for long equalizer taps are three sets of 63 reference symbols for adjusting the short taps. Next are 24 symbols for VSB level ID, 82 reserved symbols and 12 symbols that are repeated from the previous segment.

(*Editor's note:* Given the "raster-like" nature of Figure 5, you might be tempted to liken the segment sync to horizontal sync and the frame sync to vertical sync. However, this would be incorrect. The process of digital compression leaves out redundant parts of the picture and sometimes only transmits the parts of the picture that have changed. The position of digital bits in this apparent "raster" are completely unrelated to their location on the screen. In fact, some of these bits are sound bits or databits. There may even be data packets from four completely separate standard-definition pictures mixed up, in no particular order, within the datastream. These packets are later sorted out in the receiver's MPEG decoder.)

Following the data mux, a constant value is added to the eight-level datastream. Much like adding a DC offset to a baseband signal, this constant offset generates the pilot signal. The 8VSB signal is transmitted as a single sideband suppressed signal and there is no carrier. The digital representation of the signal is split, passed through a root-raised cosine filter and converted to analog signals by high-speed D/A converters. The analog signals are input to two mixers, which are phase shifted by 90°. The output is a 44MHz IF signal, upper sideband only, with raised cosine response. At this point, the signal can be upconverted to the required channel frequency, sent to the power amplifier stages and broadcast.

Reception and decoding

Knowing how the 8VSB signal is generated, let's look at the receiver side. First, the receiver looks for the pilot to phase lock to the incoming signal. Once lock is achieved, the decoder locates segment sync to achieve an initial data lock. Even impaired signals can be phase

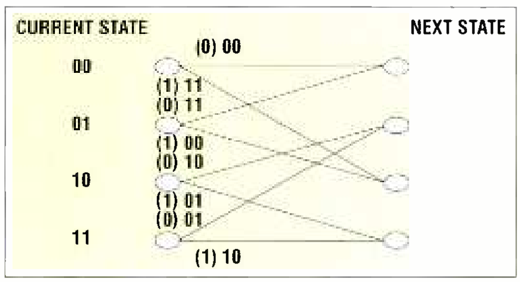

Figure 3. A simplified Trellis diagram showing the allowed state changes for a half-rate coder.

locked and the segment sync located. Next, the training sequence must be located because it provides the information needed to set the receiver's equalizer taps and correct unflatness in the incoming signal. At this point, the conditioned signal can be decoded into the 19.39MHz GA datastream. The pilot and sync signals not only help the receiver lock initially, but aid in maintaining

Understanding and testing the 8VSB signal

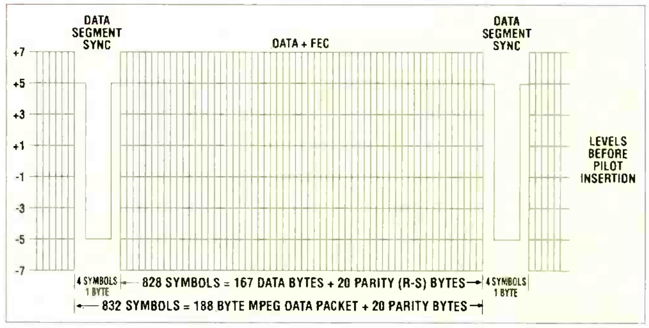

Figure 4. A single segment of the 8VSB digital baseband signal showing data levels and segment sync. Each segment is 77.3µs in duration and consists of 832 symbols.

lock should a disturbance occur. In many cases, the data lock may be lost, but pilot and sync lock are maintained, allowing for a quick signal recovery.

With digital reception, the picture and sound on a viewer's set are either nearly perfect or not there at all. Unlike analog signals that degrade gracefully, digital signals are subject to a cliff effect. Viewers who have been tolerating inadequate picture quality because of poor antennas, low signal level or noisy reception, may find they cannot receive a digital signal. Viewers living in the Grade B contour and fringe areas may find reception intermittent. Many of these viewers may require some education about steps they can take to ensure consistent, satisfactory reception. Work is currently under way to determine the benefits of circularly polarized antennas for DTV, which may significantly improve reception for those using indoor antennas, such as rabbit ears.

For analog signals, some picture impairments were tolerable, because the effect at the viewer's end was often negligible, even for some fairly severe faults. However, with digital, a transmitter with a linearity problem could mean the loss of viewers in the Grade B coverage area or worse. With digital, reception won't degrade gracefully, it will simply disappear.

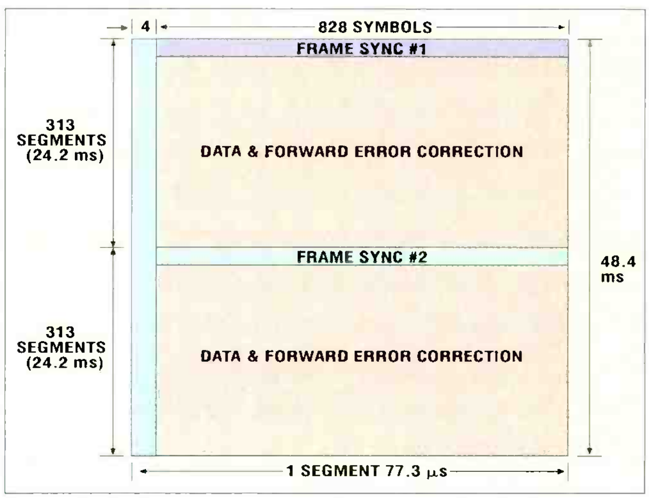

Figure 5. The transmission data frame showing the frame sync segment, which is repeated every 312 segments.

Understanding and testing the 8VSB signal

Measuring transmitter performance

Several parameters are required for satisfactory operation. First, there is the basic FCC requirement against creating interference with other over-the-air services. To verify that there is no leakage into adjacent channels, out-of-band emission testing is required. Second, with analog, there was concern with signal-to-noise measurements. However, with digital, the desired-to-undesired signal ratio is measured. *Desired* is the intended output of your transmitter, *undesired* is any signal or noise component that does not belong.

Comparable to analog transmitters, flat frequency response across the channel passband is required. A properly aligned DTV transmitter exhibits many of the same characteristics as a properly aligned analog unit, flat frequency response and group delay, with no leakage into adjacent channels. In the analog domain, the effects of group delay result in chroma/luma delay. Despite being degraded, pictures are still viewable. However, group delay problems in DTV transmitters result in intersymbol interference (ISI) and a rise in the bit error rate (BER), causing viewers' sets to drop in and out of lock. Even low levels of ISI may cause receivers operating near the edge of the cliff to lose the picture completely. Amplitude and phase errors may cause the same problem, again, resulting in reduced viewer coverage.

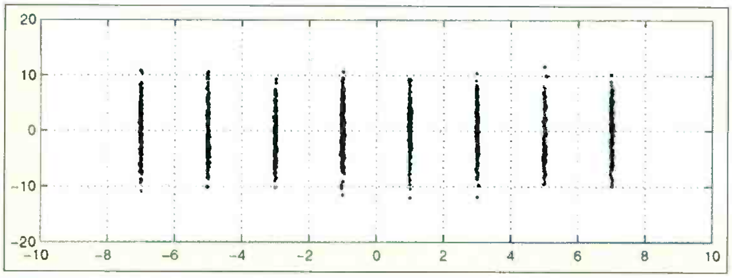

Figure 6. A near-perfect constellation diagram of an 8VSB signal.

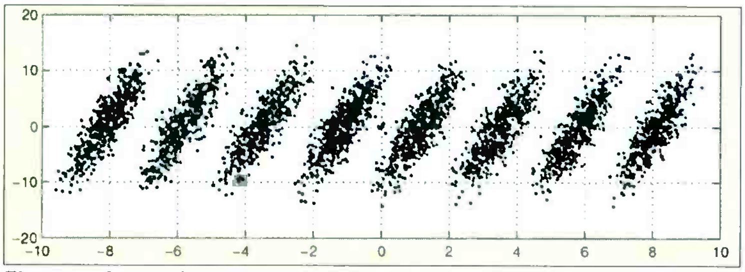

Figure 7. Constellation diagram of an 8VSB signal with noise and phase shift. Spreading of the dot pattern is caused by noise, while the slant is caused by phase shift.

Eye patterns and BER have become buzz phrases with digital signals, but they may not be the best parameters to monitor. The constellation diagram and modulation error ratio measurement provide insight into overall system health and allow you to identify problems before they affect viewers. RF constellations are displayed on the I (in-phase) and Q (quadrature) axes. Constellations of tight vertical dot patterns with no slanting or bending indicate proper operation. Figure 6 shows a near perfect constellation diagram. 8VSB levels are the in-phase signal so they are displayed left to right. An 8VSB signal is a single sideband signal with pilot carrier added. In a single sideband signal, phase does not remain constant. Therefore, the constellation points (dots) occur in a vertical pattern. As long as the dot pattern is vertical, and the points form narrow lines of equal height, the signal is considered good and can be decoded. Figure 7 shows an 8VSB signal that has noise and phase shift. Noise is indicated by the spreading of the dot pattern. Phase problems are indicated by the slant along the Q-axis.

BER is a good and valid measurement for 8VSB. Unfortunately, you are losing viewers by the time the degradation is apparent. Monitoring the modulation error ratio (MER) allows you to see an indication of degraded performance before BER is effected. In many cases, MER provides enough warning time to correct problems and prevent lost viewers. MER provides an indication of how far the points in the constellation have migrated from the ideal. There can be considerable migration before boundary limits are exceeded. Degradation in the BER is only apparent when those limits have been exceeded. Good 8VSB measurement sets allow MER and other transmitter parameters to be continually monitored and will alert operators when signal parameters are outside cautionary limits.

DTV brings opportunities and a new set of problems. Opportunities lie in the ability to transmit HDTV pictures or multiple standard-definition images. Additionally, picture and sound quality will be better than currently available signals. The problems come in helping your viewers get the most from their investment in DTV. Part of that job will be ensuring that your transmitter is providing the optimum signal. ■

Linc Reed-Nickerson is a product development manager for Tektronix Inc., Beaverton, OR.

SYSTEMS INTEGRATION

Budgeting for DTV

One way or the other, it all comes down to numbers. The technology is secondary.

By Jerry Whitaker

THE BOTTOM LINE: There's no doubt about it, DTV is coming and is already here at some stations around the country. While stations are dealing with the changes in technology, the question still comes down to "how much is it going to cost?" Here are some "take it to the bank" answers to these tough questions.$

Make no mistake about it, high-definition television via the Grand Alliance DTV system is coming to a station (or two) near you. Industry critics notwithstanding, HDTV will be to NTSC what FM was to AM. In both cases, there is a fundamental change in the competitive landscape. That's the good news.

The bad news is that there is no such thing as a free lunch, especially where the government is concerned. What is this "new viewing experience" going to cost broadcasters? Plenty. Some issues include:

• Reduced coverage, relative to the existing NTSC signal, in many cases. Replicating NTSC service with DTV is a laudable goal, but for most VHF NTSC stations that are assigned UHF DTV channels, the jury is still out.

• Fast-track implementation scenarios for major market stations that will strain the ability of equipment vendors to design, build and install the necessary systems.

• A licensing nightmare for stations in the unfortunate position of having to erect a new transmission tower. The problem is not so much from the FAA or the other federal agencies, but from local governments, some of which have built reputations on being difficult to deal with.

• A steep learning curve for everybody involved in the process. From the director of engineering to the news department set designer, widescreen operation in general, and DTV in particular, will require more than just a little reschooling.

It will also cost a boatload of cash. To summarize the overall implementation plan blessed by the FCC, "Please pay now. We'll let you know later if you're going to make any money at this."

I mentioned the FM radio experience. Many industry observers have characterized the move to DTV as something akin to the move from black-and-white to color, only raised to the second or third power. Perhaps.

Consider another familiar industry paradigm shift: the move from a dominant AM radio industry to the powerhouse that FM is today. Those of you who were around in the early days of FM will recall that it was decades before FM began to look like a profit center. It was, of course, the classic chicken-and-the-egg situation: expensive transmission systems broadcasting to non-existent receivers. And the few receivers that were in the field were temperamental in the extreme. It took a unique feature set — stereo, in this case — and affordable, stable receivers for FM broadcasting to blossom.

If we accept that DTV is coming and the TV industry will be participating in it sooner rather than later, the challenge becomes how do we get from here to there. The place to start is, of course, at the bank. The transition to DTV must fit into some type of business model (even if the model has more than a few uncertainties in it).

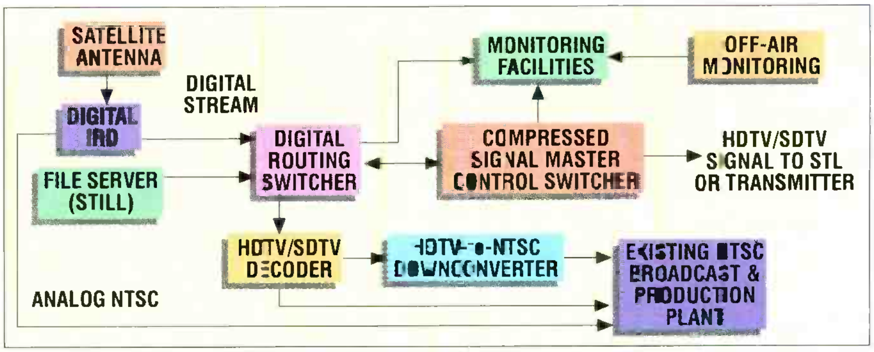

Figure 1. Block diagram of a minimal ATV implementation that provides for limited local insertion.

HDTV model vs. 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. The reality today, however, 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?

The flexible nature of the Grand Alliance system permits broadcasters to decide whether they would like to send to viewers one superquality HDTV program or several "NTSC-equivalent" SDTV programs. A significant component of the FCC decision on DTV was the timetable for implementation. Few industry observers believe that the timetable can be met. Fewer believe that the

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Budgeting for DTV

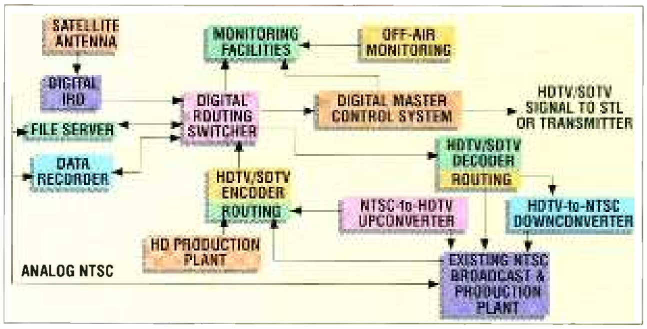

Figure 2. Block diagram of a transitional ATV model, which provides some local origination capabilities.

deadline will really stick. Be that as it may, the most basic question for TV stations 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, IRD 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.

Many possible implementation scenarios have been proposed. The plans quickly divide into two basic camps:

1. *Minimal DTV.* Under this plan, as illustrated in Figure 1,[1] local stations simply pass-through DTV signals and provide limited local insertion. Local insertion is one of the unresolved issues for DTV implementation. Considerable discussion has taken place over how the MPEG-2 signal can be made to support the logo supers and other effects that have become commonplace in television. Under the minimal DTV scenario, no local production of widescreen HDTV would be attempted.

2. *Transitional DTV.* This plan takes the minimal DTV scenario and adds some local origination capabilities. As illustrated in Figure 2,[1] this plan establishes a foundation

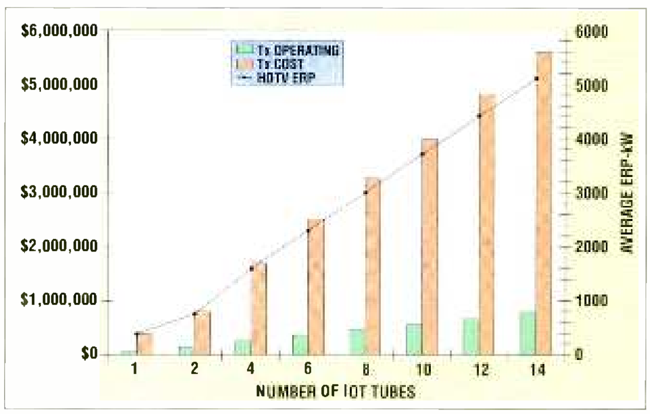

Figure 3. Cost of ownership and DTV system power vs. number of IOT tubes.

upon which additional local capabilities could be based.

Regardless of the route taken to DTV, every scenario will involve a transmission system upgrade. Depending upon the existing facilities, principally the tower, this element of the conversion to DTV will likely be the most costly.

	MINIMAL MODEL		TRANSITIONAL MODEL	
CATEGORY	LOW VHF	HIGH VHF	LOW VHF	HIGH VHF
TRANSMISSION EQUIPMENT	$183k	$260k	$183k	$260k
BROADCAST EQUIPMENT	$265k	$265k	$759k	$759k
DIGITAL STL SYSTEM	$173k (119k)	$173k (119k)	$173k (119k)	$173k (119k)
MONITORING/TESTING	$60k	$60k	$60k	$60k
TOTAL	$681k (627k)	$758k (704k)	$1.175m (1.121m)	$1.252m (1.198m)

Table 1. Cost of a VHF transmission facility with STL multiplexing. The numbers in parenthesis equal a site without STL multiplexing.

Implementation issues

The purchase of a new transmitter for DTV operation, or for NTSC use for that matter, is a complicated process that must take into consideration a number of variables:

- The actual cost of the transmitter, both the initial purchase price and the ongoing maintenance expenses for tubes and other supplies.
- The actual AC-to-RF efficiency, which relates directly to the operating costs. Efficiency numbers for transmitters can be rather confusing. The only number you really care about, however, is how much AC is required to achieve your licensed power output.
- Maintenance issues, the most important of which is the *mean time between failure* (MTBF). Also important is the *mean time to repair* (MTTR), which relates directly to the accessibility of transmitter components and the type of amplifying devices used in the unit.
- Environmental issues, not the least of which is the space needed for the transmitter. The cooling requirements are also important and may, for example, affect the ongoing maintenance costs.
- The availability of sufficient AC power and power of acceptable reliability and regulation at the site.

Each of these issues must be given careful consideration before any buying decision is made. It is possible, for example, that upon further examination, the transmitter costing the least to purchase winds up being more expensive than others in the long run because of higher annual operating expenses.

RF power requirements

Two parameters determine the basic design of any transmitter: the operating frequency and the power level. For DTV, the frequency has been clearly spelled out; the power parameter, however, deserves and indeed requires additional consideration.

The FCC allocation table for DTV lists ERP values that are

Budgeting for DTV

given in watts rms. Although sometimes referred to as *average power*, this is not always technically correct. The intent was to specify the true heating power or rms watts of the total DTV signal averaged over a long period of time.[2] The specification of transmitter power is further complicated by the DTV system characteristic peak-to-average ratio, which has an impact on the required power output rating of the transmitter. For example, assume a given FCC UHF DTV ERP allocation of 405kW rms, an antenna power gain of 24 and a transmission line efficiency of 70%. The required DTV transmitter power Tx will equal:

$$Tx = \frac{405}{24} \times 0.7 = 24.1\text{kW}$$

Because the DTV peak-to-average ratio is four (6dB), the actual DTV transmitter power rating must be 96.4kW (peak). This 4x factor is required to allow sufficient headroom for signal peaks.

The tower: the big question

The station's transmitting tower — long ignored and possibly forgotten — by most station managers, has taken center stage as one of the more important elements that must be addressed in any move to DTV operation. Adding a new antenna and transmission line to an existing tower first requires a structural analysis to determine if the existing tower can support the additional equipment loads.[3] Armed with the results of this analysis, a decision can then be made on the next course of action, generally by choosing from one of the following options:

- *Use what you have.* The tower's structural capacity will support the DTV transmission line(s) and antenna(s), allowing installation to proceed. In this situation, little or no alteration will be required to the existing tower.
- *Improve what you have.* One or more of the tower components will be overstressed by the transmission hardware, so the tower must be reinforced to accept the additional equipment loads. In this situation, structural modifications are necessary, requiring additional time and expense before installation of the additional DTV transmission line(s) and antenna(s) can proceed.
- *Lose what you have.* Addition of DTV transmission line(s) and antenna(s) will compromise the structural integrity of the tower to a point that reinforcement would be cost-prohibitive or beyond good engineering judgment. In this situation, the only alternative is to construct or lease a new transmitter site.

Regardless of which option you will be faced with, the costs associated with these changes will force all broadcasters to look toward maximizing their vertical real estate assets. The advent of cellular telephony and personal communication systems (PCS) has caused many municipalities nationwide to tighten their zoning restrictions, and in some cases, to deny the construction of new towers, regardless of the purpose.

CATEGORY	LOW-POWER	MEDIUM-POWER	HIGH-POWER
TRANSMISSION EQUIPMENT	$390k	$1.005m	$1.49m
BROADCAST EQUIPMENT	$265k	$265k	$265k
DIGITAL STL SYSTEM	$173k (119k)	$173k (119k)	$173k (119k)
MONITORING/TESTING	$60k	$60k	$60k
TOTAL	$888k (834k)	$1.503m (1.449m)	$1.988m (1.934m)

Table 2. Cost of a UHF transmission facility. The numbers in parenthesis equal sites without STL multiplexing.

CATEGORY	LOW-POWER	MEDIUM-POWER	HIGH-POWER
TRANSMISSION EQUIPMENT	$390k	$1.005m	$1.49m
BROADCAST EQUIPMENT	$759k	$759k	$759k
DIGITAL STL SYSTEM	$173k (119k)	$173k (119k)	$173k (119k)
MONITORING/TESTING	$60k	$60k	$60k
TOTAL	$1.382m (1.328m)	$1.997m (1.943m)	$2.482m (2.428m)

Table 3. Cost of UHF transmission facility. The numbers in parenthesis equal sites without STL multiplexing.

The cost of coverage

A fundamental question in the DTV planning process is, "What is 'full coverage' of the DTV signal really worth?" The first step in finding the answer to this question is to develop a "cost of ownership" table for varying transmitter sizes and the corresponding ERP produced. Engineering issues aside, it is possible to build a facility with equivalent DTV-NTSC coverage; whether it is *practical* to build one is quite another matter. The results of one case study[4] are summarized in Figure 3. The values given are only estimates and may vary depending on the specifics of the installation. The cost of electricity, a major element in the cost of ownership, is a parameter subject to local variations. The bottom line is that achieving equivalent coverage in many instances is not worth the cost. A point of diminishing returns is reached where twice the money does not buy you twice the viewers.

The issue in perspective

Several organizations have made concerted efforts to attach specific numbers to the various conversion scenarios. One of the better known efforts was conducted by the Public Broadcasting Service. Its basic conclusions are given in Tables 1-3.[5] The costs change greatly depending upon the DTV model that is embraced by the station.

One of the major problems facing stations that are planning for the conversion to DTV is that, for many issues, the answers are not yet known. Hardware vendors and consultants are scrambling to meet the demand for answers and equipment. Eventually, the issues will sort themselves out. Until then, uncertainty is the name of the game. If it's any consolation, you're not alone. ■

Jerry Whitaker is a contributing editor to Broadcast Engineering *magazine.*

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Lossless editing with the "MOLE"

Continued from page 60

Although it has been stated that this approach will handle any MPEG-2 signals without restriction, bad coding decisions and motion vectors cannot be made better by ATLANTIC technology alone. If a relatively high bit-rate bitstream does not make proper use of the MPEG-2 specification (e.g., has a small motion vector range) and is received for transcoding to a low bit rate, the re-encoder will essentially have to work as if it were encoding for the first time. It is possible that a range of transcoders with varying degrees of capability for remaking coding decisions could be developed, but the best approach is to generate good quality bitstreams the first time they are encoded. A prototype transcoder implementing the approaches outlined above is under construction.

Additional applications

The MPEG switching technology previously described makes it possible to develop a frame-accurate, non-linear editor in which the input and output interfaces, as well as the information stored on the server, are all in MPEG-2 form. Such an editor has two major advantages over other technologies:

1. Editing can be performed in the MPEG domain without fear of introducing cascading artifacts.
2. MPEG-2 is more efficient in bit-rate terms than other formats currently used in editors. This could lead to greatly reduced costs for servers and network connections.

Figure 5 shows a block diagram of a post-production editing system suitable for small studio applications. This system is being built in the ATLANTIC project. In it, control, video and audio sequences are transferred via an ATM network using standard TCP/IP file transfer protocols. The following is a brief description of the main elements of the editor:

• *Format converter:* Converts incoming MPEG-2 transport streams into separate video, audio and data PES streams for storage on the main server and generates an index file.

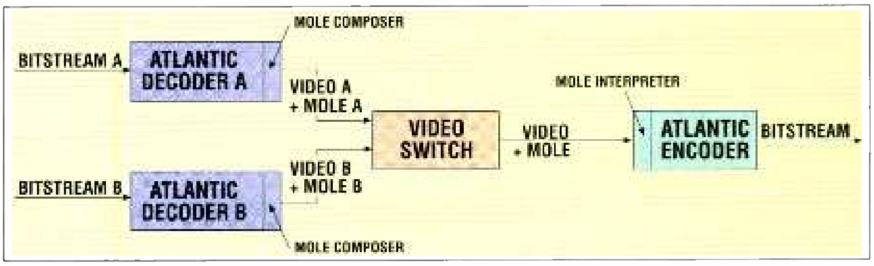

Figure 4. ATLANTIC switch using the MOLE.

• *Browse track generator:* Generates an MPEG I-frame-only reduced-resolution browse track corresponding to the video stored on the server, and possibly an audio browse track, and stores these on the browse server.

• *Journalist workstation:* Operates as a conventional edit workstation on the I-frame browse track and provides a graphical user interface to allow journalists to create an edit decision list.

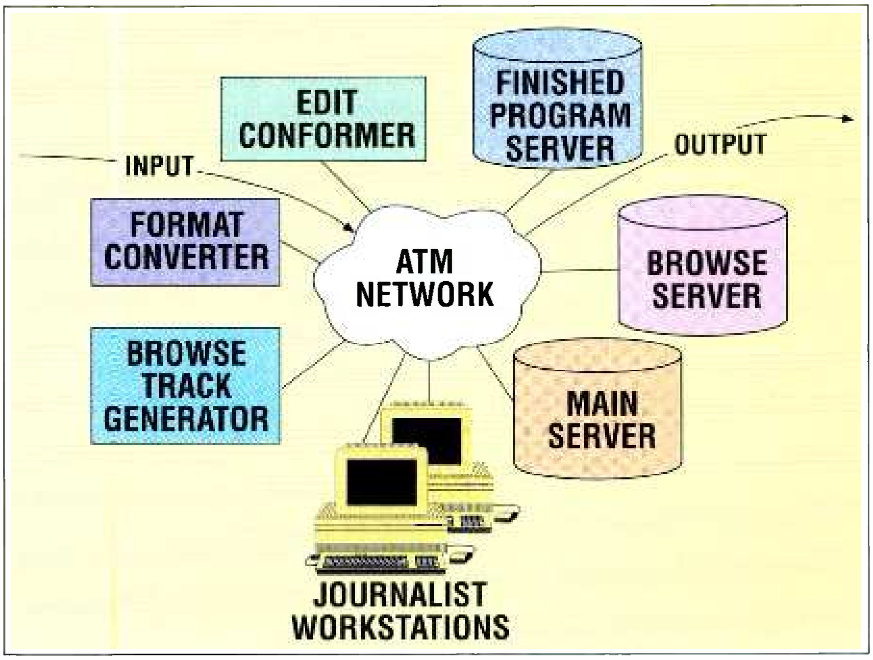

Figure 5. The ATLANTIC post-production system.

• *Edit conformer:* This is the real-time ATLANTIC switch, controlled by the edit decision list. Bitstreams are pulled from the main server, edits are conformed and the results are placed onto the finished program server.

Developing a true MPEG-based editor poses several design challenges including:

• audio/video synchronization;
• handling program-related data;
• audio editing; initially, a simple bitstream switch operating on audio frame boundaries will be used. For more refined operation, an audio MOLE has been developed enabling sophisticated processing and reducing the cascading impairments;
• designing a low-cost journalist workstation using off-the-shelf MPEG decoders; and
• system-wide control.

Although the challenges are significant, the potential advantages of an efficient MPEG-based editor and switcher are enormous. Seamless, unrestricted switching and mixing, together with high-quality transcoding on any MPEG-2 bitstreams, will make it easier to integrate these new signals into existing facilities. Components based on this technology will make possible a full range of processes on MPEG bitstreams while preserving quality throughout the complex broadcast chain. The cost benefits of compression need not be given up to buy flexibility in bitstream processing. ■

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By Don Markley

Tower lighting and you

The lights on your tower(s) are somewhat akin to the spare tire in your car. You know it's back there somewhere, but you really don't pay it much attention. You look at it now and then, but you really don't do anything with it. When the car is serviced, someone else checks it and you generally leave it alone.

Don Markley

In the opinion of the FAA

The regulations on tower lighting are well-known although most broadcasters don't really understand how their specific requirements are determined. The FAA doesn't assign the tower lighting requirements for broadcast facilities — the FCC does. The whole process for a new tower starts when a notification of proposed construction is filed with the FAA. The FAA assigns the notification a study number and starts the review process. After studying the impact on the airspace, the FAA determines whether the proposed construction is a hazard to air navigation.

This determination is handled as an opinion and forwarded to the FCC. Remember, this is not a definite ruling, but an opinion. One important distinction is that you can't fight an opinion in court. The FAA's position acts as a recommendation to the FCC, and is almost always accepted as the final word on the subject. If the FAA doesn't feel that a proposed structure would be a hazard, it suggests a lighting and marking scheme, adding the necessary enhancement to the tower to deter pilots from hitting it.

Usually, the FAA recommends an alternative; either painting and red lights or some type of strobe lighting. For shorter towers, medium-intensity strobes may be acceptable to the FAA. For the tallest structures, high-intensity strobe lighting may be the only acceptable system for daytime use. An alternative almost always acceptable to the FAA is a dual system in which the tower is marked with high- or medium-intensity lights during daytime hours and red lights at night. This is not accompanied by a painting requirement.

When either red lights and paint or strobes are suggested by the FAA, the commission usually requires the conventional lights and paint. Conventional lights and paint are considered to be more environmentally friendly, translating into fewer complaints received by either the commission or the congressmen from the affected area. Some zoning boards are now urging the use of either conventional lighting and marking or dual systems to reduce the visual impact of towers. If a strobe lighting system is preferred by the station, a request can be made to the FCC accompanied by a description of the area and an explanation of why such a system would not have an adverse environmental impact. Upon a satisfactory showing, the FCC may change the construction permit to allow the strobes.

The fact of the matter is that dual lighting or the conventional paint and red lights do result in fewer complaints. Many people find the flashing strobes bothersome at night. They certainly don't add beauty to a hilltop or to a residential area. Apparently, the cellular/PC industry has decided that strobes are the way to go. It is assumed that this is based strictly on cost, because strobes do eliminate the need for repainting the towers. Still, it isn't really being friendly to the neighbors. Perhaps there is a lesser need for good neighbors for giant cellular companies than for a broadcast station.

Observing the rules

Now for the spare tire part. The rules for tower light observation are clear and well-known to all broadcasters. Basically, the lights need to be checked daily to ensure that they are on. Fortunately, the current crop of remote-control and monitoring systems can handle that function and even make the required notifications if a problem exists. Still, it is highly recommended that someone — yes, a real person — keeps an eye on the lights. Contact a neighbor of the tower or a nearby authority with your request that they simply keep an eye on the tower and let you know if they notice a problem. Together with the automatic system, this should give you adequate notice of light failure.

When any portion of the lighting system fails, and this is important, you *must* promptly notify the FAA and make provisions to have the system repaired. If you don't know who to call at the FAA, try the nearest airport control tower. It will usually be listed in the phone book along with numbers for the nearest flight service station. Find this number and post it where it is easily found. Immediately upon finding part of the system has failed, notify the FAA. When you do this, get the name of the person you talk to and record it, along with the time of the notification, on your maintenance log.

This whole notification thing is hugely important. First, if you do not notify the FAA of the problem and an aircraft hits your tower, you may be liable for damages. When the lights are not functioning properly, the tower immediately becomes a hazard to air navigation. When you notify the FAA, it issues a Notice to Airmen of the unlit or improperly lighted structure. All pilots are required to check these notices (NOTAMs) before a flight for proper flight planning. If your tower is so listed and someone hits it anyway, you have a good chance of being in the clear on the liability issue.

Second, if you don't promptly notify the FAA and the FCC catches you, the fine may be eye watering. The base amount for "violation of tower obstruction marking and lighting requirements" is now $10,000. This is for a single violation or a single day of a continuing violation. The commission has the discretion to assess such an amount for each day of a continuing violation. By the way, don't try to lie your way out of such a mess. The base amount for "misrepresentation/lack of candor" is $27,000. Fess up and take your lumps with the assurance that the lumps would be bigger if you lied.

Take note, the violation is for marking *and* lighting. The marking bit is normally the condition of the tower's paint. The FCC inspectors have a card with paint chips to identify when the tower paint is faded to the point that repainting is necessary. Because you don't have such a card, paint when in doubt. Usually, the condition of the paint regarding peeling and flaking will alert you of the need to repaint before the fading is too severe. Your rigger will also advise you of the need for painting as part of routine inspections.

Towers used for a variety of communications purposes are subject to federal obstruction marking regulations, which include rules for paint and lighting. (Photo courtesy of Bob Mosher, CEE, consulting engineer.)

Finally, we come to the maintenance of the lighting system itself. This brings us back to the spare tire comparison. With the exception of the photocell and flasher, there isn't too much that the station engineer can do to the system. You really are at the mercy of your riggers or contractor. For strobe systems, there are several good companies who will maintain the strobes on a contract basis. For red lights, most stations simply rely on a good rigger to change the bulbs, either regularly or upon failure. Stations should have a contract with a reliable rigger to change the bulbs on a scheduled basis. This eliminates most of the burnout problems. When you do lose a bulb unexpectedly, try to get it replaced within a couple of weeks. Then, notify the FAA that your operation has returned to normal.

The secret to keeping your tower-lighting system legal is a reliable rigger or lighting service contractor. The secret to keeping your job is notifying the FAA immediately upon learning that the system is not functioning fully within the regulations. ■

Don Markley is president of D. L. Markley and Associates, Peoria, IL.

new products

By Deanna Rood

Lenses
Canon

• IFpro 18X lenses: these lenses incorporate internal focus (IF) technology that allows you to get closer to the image while capturing an even wider angle image; the YJ18X9B KRS and the YH18X6.7 KRS offer the longest zoom ratio in their class, 18X, the widest angular field of view (52.1° by 40.3°) and a short MOD (0.9m); the 18X IFpro lenses enhance user creativity by allowing the use of polarized and cross filters more effectively because with the IF technology, the front of the lens does not rotate.

Canon, One Canon Plaza, Lake Success, NY 11042; 800-321-4388; bctv@cusa.canon.com
Circle (255) on Free Info Card

Digital console
Solid State Logic

• Aysis Air: a 48-channel digital console designed for live broadcasters; it incorporates its own router for stand-alone operations, but can be extended to use SSL's Hub Router, providing control of more than 2,000 sources and destinations; complex wiring is reduced by the 95 channels of digital audio on a single coaxial cable; the dedicated control surface is optimized for real-time mixing operations and all console controls are fully automated dynamically or via snapshots; settings can be stored and instantly recalled, selectively and globally; superior sonic performance is provided by the SSL's advanced proprietary digital processing.

Solid State Logic, Begbroke, Oxford OX5 1RU England; +44(0) 1865 842300; fax +44 (0) 1865 842118
Circle (254) on Free Info Card

Video server
ASC Audio Video Corporation

• VR300: driven by a Pentium Pro processor, this disk-based on-air solution features Fibre Channel RAID storage and ASC's FibreDrive architecture; FibreDrive allows multiple servers to have instant, simultaneous random access to shared Fibre Channel RAID storage; the VR300 video server takes advantage of on-line Fibre Channel RAID digital storage, and ASC's RAIDsoft technology eliminates the need for a hardware RAID controller; RAIDsoft protects systems against double data drive errors and single, unknown location data driver errors; in addition, hot standby disk drives can be added to the array for an extra level of redundancy so that if a disk drive failure occurs, the lost information is rebuilt automatically in the background to a hot spare, and the failed drive can be removed at the next scheduled maintenance interval.

ASC, 4400 Vanowen St., Burbank, CA 91505; 818-843-7004; fax 818-842-8945
Circle (263) on Free Info Card

HDTV upconverters
Tekniche

• JUNO: a range of high-quality HDTV upconverters that offers features such as aspect ratio conversion and comprehensive noise reduction in a 2RU frame at a cost-effective price; other standard features include advanced conversion of SDTV to HDTV, analog and digital outputs, full 10-bit resolution with 16-bit internal processing and multilevel noise reduction; a flexible architecture allows a wide range of input and output standards; options include a high-quality digital comb-filter decoder, audio delay/resynchronization and advanced noise reduction.

Tekniche, 100 Stonehurst Court, Northvale, NJ 07647; 201-784-2288; fax 201-784-3860
Circle (256) on Free Info Card

Improve spot management
Columbine JDS

• Clip Vault: a software and hardware package designed to manage video servers and digital tape archives; as an add-on to CJDS's MCAS-III total master control automation package, Clip Vault improves spot management, while bringing total integration to the management of video material in a station; by streamlining station workflow, it can reduce your operation costs, while improving efficiency; new spots or promos are copied to the video server using MCAS-III software eliminating the need for dubs and bar coding — then Clip Vault moves a copy of the material from the video server to a robotic digital archive; there is no loss of quality even after repeated playing because the spots are stored as digital files; the digital tape archives store 100+ hours of video material.

Columbine JDS, 1707 Cole Blvd., Golden, CO 80401; 303-237-4000; fax 303-237-0085; www.cjds.com
Circle (257) on Free Info Card

Picture-quality measurement system

Tektronix

• PQA200: a picture-quality analysis system that can measure video image quality quickly, automatically and objectively; you can use the PQA200 for managing picture quality to meet the requirements of content providers and viewers, while using available bandwidth as effectively as possible; it can deliver practical, repeatable results in less than a minute independent of the types of impairment present, the compression system used or the video material itself; measurements can be used for system or algorithm tuning, production line testing and other tasks that require fast testing sequences and quick results; useful applications range from bit-rate optimization to end-to-end system testing.

Tektronix, U.K. Ltd., Fourth Ave., Globe Park, Marlow, Bucks. SL7 1YD; (01628) 403300; fax (01628) 403301
Circle (250) on Free Info Card

Compact disc recorder

HHB Communications

• CDR800: a low-cost professional audio CD recorder that features rack mounting, in addition to balanced XLR analog inputs and unbalanced phono analog inputs and outputs; other features include AES/EBU digital input and output and optical and coaxial digital I/Os; an onboard sample-rate converter makes direct digital copying from DAT machines and other digital formats simple; a unique stable platter mechanism supports the disc from below, minimizing vibration during recording, resulting in increased transparency and extended low frequency.

HHB Communications, 626 Santa Monica Blvd., Suite 110, Santa Monica, CA 90401; 310-319-1111; fax 310-319-1311
Circle (269) on Free Info Card

Non-linear video editing system

Discreet Logic

• SMOKE: an on-line non-linear video editing system that is available on the SGI OCTANE workstation; SMOKE is designed as a pure editor and combines the basic editing tools of an analog suite with the productivity of a non-linear system; optional modules can enhance the editing capabilities allowing the flexibility to grow on a modular basis; this finishing tool is ideal for post-production facilities offering commercials, infomercials, as well as broadcasters requiring versioning of promos or sports news where speed is necessary.

Discreet Logic, 5505 boul St Laurent #5200, Montreal, Quebec H2T 1S6 Canada; 800-869-3504 or 514-272-0525; fax 514-272-0585; info@discreet.com; www.discreet.com
Circle (253) on Free Info Card

Seamless connection to Avid's Media Composer system

SeaChange

• SPOT: this system connects directly to Avid Technology's Media Composer, a digital nonlinear video editing system, streamlining the production and delivery of commercials; new serial digital connectivity allows the production and delivery of commercials without the time and quality loss due to videotape transfer; the digital video server technology allows the scheduling and delivery of commercials on multiple channels and geographic zones; the easy-to-use SeaChange interface enables operators to control complex geographically specific commercial schedules on multiple channels.

SeaChange, 124 Acton St., Maynard, MA 01754; 508-897-0100; fax 508-897-0132; www.schange.com
Circle (258) on Free Info Card

LAN to WAN and LAN to LAN facilities for video file servers

Tektronix

• Profile VideoGateway: providing the first-time wide area networking (WAN) facility for the Tektronix Profile video file servers, the Profile Gateway allows facilities to move video content over telecommunications networks, for an alternative to existing courier, satellite and microwave services; it facilitates inter- and intrafacility operation between two Profile workgroups using, in the first version, ATM networks; the Profile VideoGateway is an information packet (IP) router and it allows Profile video file servers operating on an Ethernet/Fibre Channel network to be connected to distant facilities via WAN services.

Tektronix, P.O. Box 500, Beaverton, OR 97077-0001; 800-547-8949; fax 503-627-7275
Circle (262) on Free Info Card

Disk-based news playback system

Sony Electronics

• NCS-300: this cost-efficient stand-alone news playback system provides disk-based storage of edited material; it accepts rundowns from third-party systems, allowing the pieces to be sequenced automatically so they meet the requirements of the newscast; each item can be aired in order or the sequence can be changed with a keystroke; it can be configured to use up to eight filing positions, and using the 4:2:2 Profile of MPEG-2 compression to efficiently store material on RAID disk arrays, the system can be configured for three to 12 hours of storage.

Sony Electronics, 1 Sony Dr., Park Ridge, NJ 07656; 800-686-SONY; www.sony.com/professional
Circle (259) on Free Info Card

On-line editor

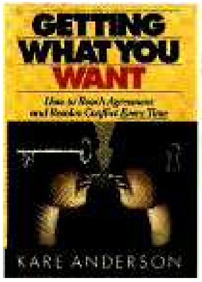
Accom

• Axial 3000: the latest addition to the Axial on-line editor family has all the features of the Axial 2010, but at a lower price and in a fully upgradeable system; the Axial 3000 has an expandable architecture that is based on a standard platform and supports "plug-in" system options; software options include Random Access Visual Editing (RAVE), a full-quality nonlinear editing environment and ShowCase software modules.

Accom, 1490 O'Brien Dr., Menlo Park, CA 94025; 650-328-3818; fax 650-327-2511; www.accom.com
Circle (260) on Free Info Card

new products

Book on resolving conflicts
The Compelling Communications Group



• **Getting What You Want: Resolving Conflict and Winning Agreement Every Time:** this book offers a three-step method to forge better agreements more easily in everyday life, plus 100 "yes" triggers of persuasion (now in 19 languages and 32 college and corporate courses); the author is Kare Anderson, a gut-instincts expert, former Wall Street Journal reporter and Emmy-winner; the book costs $22; a free on-line, monthly newsletter is available by E-mailing "SIB" to kareand@aol.com; you can also find over 300 tips at web site http://www.sayitbetter.com.

The Compelling Communications Group, 15 Sausalito Blvd., Sausalito, CA 94965; www.sayitbetter.com
Circle (290) on Free Info Card

Integrate and automate business operations
Columbine JDS

• **Paradigm:** a totally integrated management information system that electronically links all critical business processes of broadcast multichannel systems, cable network and DBS operations, including ad sales, programming, traffic, finance and master control automation; a number of modules are built around and integrated in a central relational database; the entire business operation of a facility is automated from the proposal generation and scheduling down to building the playlist that goes to the master control automation system.

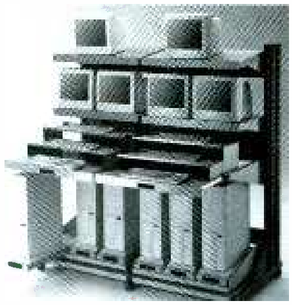
Columbine JDS, 1707 Cole Blvd., Golden, CO 80401-3296; 303-237-4000; fax 303-237-0085; www.cjds.com
Circle (264) on Free Info Card

Application package for spot insertion and program playback
Hewlett-Packard

• **MediaStream AirDirect:** a low-cost application package for MediaStream recorders that allows you to move to digital technology and go on-air with basic ad/spot insertion and program-playback capabilities from dub to air via a simple PC interface; offering entry-level functionality, including VTR-source dubbing, accurate playback, playlist editing, AsRun logs, remote playout control via GPI, database management and trimming.

Hewlett-Packard, Test & Measurement Organization, P.O. Box 50637, Palo Alto, CA 94303-95120; 800-452-4844 (ext. 5520); www.hp.com/go/tmdir
Circle (261) on Free Info Card

File server station
Winsted Corporation



• **LRx series:** these file server stations are designed for the file server and LAN markets and feature steel, L-frame architecture; you can mix and match the modular components and each system includes smooth rolling wheels; the basic L-frame comes with a stationary server shelf for multiple servers or a pullout server shelf for individual servers; the sliding server shelves have optional retractable cable lacing guides that help keep cables in place while the server shelf is pulled out, and the pull-out keyboard shelves come in flat or tiered versions.

Winsted, 10901 Hampshire Ave. South, Minneapolis, MN 55438-2385; 612-944-9050; fax 612-944-1546; www.winsted.com; racks@winsted.com
Circle (267) on Free Info Card

Comprehensive monitoring unit
Leader Instruments Corporation

• **Model LT 5910:** this comprehensive monitoring unit reports compliance with vital aspects of SMPTE 259M and 244M standards and reads out SDI signal conditions, including level in terms of equivalent cable length and an eye-pattern display; EDH errors are caught and logged with provision for remote alarms and printer drive; other monitoring functions include a 16-channel audio status readout and full EDH reporting that includes FFCRC and APCRC codes and readout of all EDH flags.

Leader, 380 Oser Ave., Hauppauge, NY 11788; 800-645-5104 or 516-231-6900; fax 516-231-5295
Circle (265) on Free Info Card

Circle (47) on Free Info Card

Circle (46) on Free Info Card

New software & smaller version of Oxford digital consoles
Sony

• **Oxford digital consoles:** model OXFR3 24C0 is an addition to the Oxford digital consoles that is more compact and lower in cost; Sony has also launched a software upgrade for the Oxford digital consoles, version 1.1; the software includes multiformat panning and monitoring of all standard surround-sound formats (including LCRS, 5.1 and SDDS), control linking, enhanced EQ algorithms, increased delay functionality, partial mix loads and greater automation capabilities; these advanced features will be used in the 24C24 version, as well as the new Oxford 24C0.

Sony, 1 Sony Dr., Park Ridge, NJ 07656; 800-686-SONY; www.sony.com/proaudio
Circle (252) on Free Info Card

Closed-captioning encoder
Evertz

• **8070:** a digital closed-captioning encoder that generates line 21 caption data directly into the digital bitstream; the 8070 features direct keying, internal modem and V-chip support; it allows data to be encoded into all caption and text channels in field 1 and 2 of video, and extended data services packets can be encoded into field 2 supporting services, such as station name and call letter identification, program name, classification and remaining air time. ■

Evertz, 3465 Mainway, Burlington, Ontario, Canada L7M 1A9; 905-335-3700; fax 905-335-3573; sales@evertz.com
Circle (268) on Free Info Card

Circle (48) on Free Info Card

letters to the editor

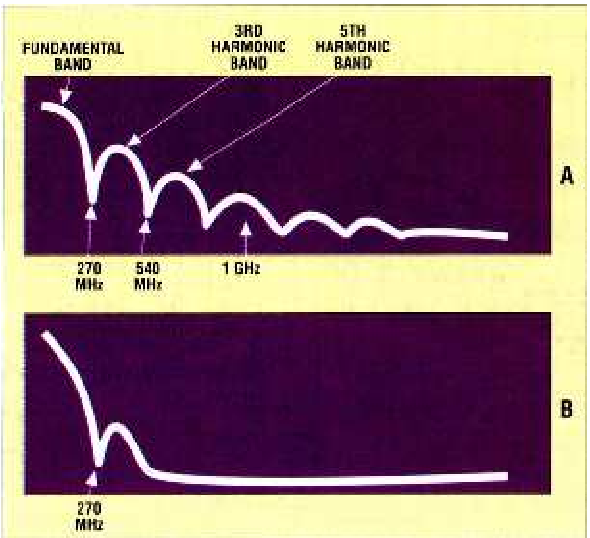
Continued from page 8

Correction:

*The diagram in Transition to Digital (*BE, *Aug. 1997, p.16) contained an error. The author of the figure explains how the waveform is developed.*

"Because of the bit-shuffling process described in SMPTE-259M, a digital video bitstream has many edges. A digital component signal has a bit rate of 270Mb/s. If successive "1s" are sent, each successive bit cell will alternate between high and low states. An alternate high and low state can be brought together and be thought of as one square wave.

This square wave would have a fundamental frequency of 135MHz. To create square waves, you need the odd harmonics of this 135MHz fundamental. Therefore, the band of frequencies extending from 0 to



Correct labeling of the SDI spectrum.

*270MHz is the fundamental band of energy in a digital bitstream. The second energy band is the third harmonic centered at 405MHz (3*135MHz). The third band is the fifth harmonic band, etc.*

Looking at the spectrum analyzer display, what strikes most first-time observers is that there is a null in energy at 270MHz. Even though the bit rate is at 270MHz, very little information is present at that frequency. The small spike seen at 270MHz is mostly clock crosstalk from the SDI driver circuitry.

JIM BOSTON

Send your thoughts to the editor at

CompuServe 74672,3124 or fax to 913-967-1905.

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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 levelling

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 camera 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

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 ONR 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 broadcast 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 flexiblity, 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 Stretch/Black Compression circuit is also included.

Panasonic

Broadcast & Television Systems

$500 Rebate thru 12-31-97

AG-DP800H SUPERCAM

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.

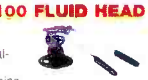
wDP-800H "LS" Package:
- DP-800H Supercam 3-CCD camera head with 1.5" electronic viewfinder and Anton Bauer Gold Mount battery plate
- Fujinon S14x7.5 BRM 14:1 servo zoom lens
- CC-S800 soft carrying case
- WV-QT700 tripod mounting plate

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

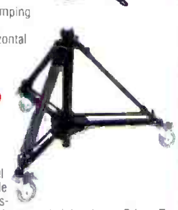
sachtler

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

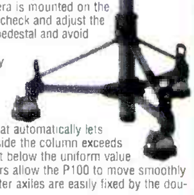
CAD 2A 2-Stage ENG Carbon Fiber System:
- CADDY Fluid Head • ENG 2-Stage Carbon Fiber Tripod
- SP 100 Lightweight Spreader • Soft padded ENG Bag

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.

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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 ruggedly constructed from black high density weatherized ballistic nylon and has an open-cut style that makes it comfortable to wear in a variety of climates. Also has a highly adjustable design to fit almost any physical proportion.

- 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 cigarette, dual XLR or mixed).
- 7-stage "fuel-guage" charge status indication and auto-reset short/overload protection.

The **Event** model is very similar 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 indistinguishable 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 simultaneously. 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 connectors or two of each.

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 various 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, composite 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 output 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 cameras, 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 professional 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 system 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 effectively adjusts the Systems Center of Gravity. The upper portion of the Sled's central support post includes gunde markings. These markings allow for accurate gimble positioning.

The Dyna-Elastic Arm

The Exoskeletal, Dyna-Elastic Support Arm is designed to counteract 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

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).

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

anton bauer

Logic Series DIGITAL Gold Mount Batteries

The Logic Series DIGITAL batteries are acknowledged to be the most advanced in the rechargeable battery industry. In addition to the comprehensive sensors integral to all Logic Series batteries, each DIGITAL battery has a built-in microprocessor that communicates directly with Anton/Bauer InterActive chargers, creating significant new benchmarks for reliability, performance, 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 cameramen: a reliable and accurate indicator 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

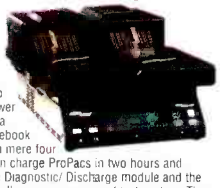
Extremely small and light weight, the Digital Trimpac still has more effective energy than two NP style slide-in batteries. High voltage design and Logic Series technology eliminate the problems that cripple conventional 12 volt slide-in type batteries. The professional choice for applications drawing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

- **DIGITAL TRIMPAC 14 LOGIC SERIES NICAD BATTERY**
  14.4v 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 QUAD 2401 becomes an all purpose power and test system. The 70 watt QUAD 2702 bundles all Power/Charger features in the ultimate professional power system.

Dual 2702/2401

Two-Position Power/Chargers

The DUAL 2701 (70 watt) and 2401 (40 watt) are sleek, rugged and economical 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 travel 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
PG-30 ... 2.39 · PG-60 ... 2.59 · PG-120 ... 2.79

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 ... 33.99
123L ... 43.99

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 ... 7.99
ST-126 BQ ... 8.39 · ST-182 BQ ... 17.49

Betacam SP
B5MSP ... 15.75 · B10MSP ... 17.75 · B20MSP ... 19.75
B30MSP ... 20.75 · B60MLSP ... 29.75 · B90MLSP ... 46.45

Panasonic

Mini DV Tape
AY DVM-30 ... 9.99 · AY DVM-60 ... 11.99

DVCPRO
AJ-P12M (Medium) ... 8.49 · AJ-P23M ... 9.99
AJ-P33M ... 13.49 · AJ-P63M ... 22.99
AJ-P64L (Large) ... 24.99 · AJ-P94L ... 34.99
AJ-P123L ... 44.99

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 Premler Grade Professional VHS
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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" ... 12.99 · DVM-60EX "No Chip" ... 14.99
DVM-30PR "No Chip" ... 9.99 · DVM-60PR "No Chip" ... 12.99

Full Size DV Tape with Memory Chip
DV-120MEM ... 29.95 · DV-180MEM ... 34.95

PVD Series Professional DVCAM Tape
PDVM-12ME (Mini) ... 24.95 · PDVM-22ME (Mini) ... 26.95
PDVM-32ME (Mini) ... 29.95 · 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

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QUICK DIAL 74

Panasonic

WJ-MX50 Digital A/V Mixer

- Four input switcher and any two sources can be routed to the program busses
- Two-channel digital frame synchronization permits special effects in each A/B bus.
- Combination of 7 basic patterns and other effects creates 287 wipe patterns.
- External edit control input for RS-232 or RS-422 serial controls. Also has GPI input.
- Wipe boundary effects: soft/border (bold, 8 background colors available)
- Digital effects: strobe, still, mosaic, negative/ positive, paint, monochrome, strobe, trail, and AV synchro
- Real-Time compression - entire source image is compressed inside a wipe pattern
- "Scene Grabber" – move a pattern while upholding the initially trimmed-in picture integrity
- Non Additive Mix (NAM): selects between A and B sources, passing only the signal with the highest luminance value.
- Fade-in and fade-out video, audio, titles individually or synchronously faded
- Down stream keyer with selectable sources from character generator or external camera.
- Eight separate memories enable instant recall of frequently used effects
- 8 preset effects including: Mosaic Mix, Position Stream, Corkscrew, Bounce, Flip, Shutter, Vibrate, and Satellite
- Audio mixing capability of 5 sources with 5 audio level adjustments.

BT-S1360Y

13" Color Video Production Monitor

The BT-S1360Y is a full-function, professional 13" production monitor with a wealth of features. They include: superb 420-line horizontal resolution, S-Video input and output, advanced automatic white balance circuitry, blue-only mode, underscan and pulse-cross. All this, housed in a rugged, rack mountable metal-hybrid cabinet. So, for long-term reliability in any professional application, the BT-S1360Y is the ideal choice.

- Incorporates advanced, proprietary white balance circuitry that stabilizes white balance to provide outstanding picture performance automatically.
- S-Video input and advanced video circuit technology provides a remarkably sharp picture with over 420 lines of horizontal res.
- External sync inputs and outputs provide for synchronization with other equipment fed with the same sync signal.
- Blue Only mode plus Chroma selection provide a monochrome image for fine adjustment of contrast, brightness, chrominance & hue.
- Pulse Cross – displays horizontal and vertical intervals at the center of the screen so you can examine data in the blanking area and also sync/burst timing.
- Two sets of video/audio inputs and outputs.
- Underscan – shrinks the scanned area of the picture tube approximately 5% enabling the entire active picture area to be displayed. Lets you detect intruding cameras and mike booms.
- Switchable color temperatures of 6500°K (broadcast standard) or 9300°K (for pleasing picture).
- Built-in speaker and headphone jack.
- Rack-mountable with optional BA-131 brackets.

BT-S 1360Y Olympic Demo Special!

We have a limited stock of BT-S1360Y monitors that were used by Panasonic exclusively at the 1996 Olympics in Atlanta. Used only by Panasonic engineers in broadcasting the summer games, these monitors are like new.

Demo Special $599

($400 less than our regular selling price on this monitor)

SONY

PVM-14N1U/14N2U & 20N1U/20N2U

13" & 19" Presentation Monitors

With high quality performance and flexibility, Sony's presentation monitors are ideal for any environment. They use Sony's legendary Trinitron CRT and Beam Current Feedback Circuit for high resolution of 500 lines as well as stable color reproduction. They also accept worldwide video signals, have a built-in speaker and are rack mountable. Four models, the PVM-14N1U/20N1U are designed for simple picture viewing; the PVM-14N2U and 20N2U add RGB input and switchable aspect ratio for more sophisticated applications.

They Feature:

- 500 lines of resolution to match DV, DVCAM and DVCPRO recording capabilities
- Beam Current Feedback for color temperature stability
- They handle four worldwide color systems: NTSC, NTSC 4.43, PAL, and SECAM
- On screen display in five languages. Picture adjustments (chrome, phase, contrast, brightness) and setup adjustments (volume, aspect ratio) are displayed as easy-to-read on screen menus.
- Built-in speaker for small audiences without the expense of an external sound system.
- Closed captioning is available with the optional BKM-104 Caption Vision Board
- Designed with a sturdy metal cabinet for stability, durability and rack mounting. The 13-inch series mount in a 19-inch rack with the MB-502B Rack Mount Bracket. The 19-inch monitors with the SLR-103A Slide Rail Kit.
- **PVM-14N2U/20N2U Only:**
- Remote Control (Last Input Switch) - Contact closure remote control allows you to wire a remote to an existing system so that the monitor's input can be remotely controlled to switch between the last previously selected input and the current input.
- With the PVM-14N2U and PVM-20N2U Series, the aspect ratio is switchable between 4:3 and 16:9 simply by pressing a button.

PVM-14M2U/14M4U & 20M2U/20M4U

13" & 19" Production Monitors

Sony's best production monitors ever, the PVM-M Series provide stunning picture quality, ease of use and a range of optional functions. They are identical except that the "M4" models incorporate Sony's state-of-the-art **HR Trinitron** CRT display technology and have SMPTE C phosphours instead of P22.

- HR Trinitron CRT enables the PVM-14M4U and 20M4U to display an incredible 800 lines of horizontal resolution. The PVM-14M2U and 20M2U use an aperture grille dot pitch of 0.25mm to offer 600 lines of resolution. M4 models also use SMPTE-C phosphours for the most critical evaluation of any color subject.
- Dark tint for a higher contrast ratio (black to white) and crisper, sharper looking edges.
- Beam Current Feedback Circuit • 4:3/16:9 switchable aspect ratio
- Each has two composite (BNC), one S-Video and component input (R-Y/B-Y, analog RGB) for flexibility. For more accurate color reproduction, the component level can be adjusted according to the input system. Optional serial digital interface kit BKM-101C (video) and BKM-102 (audio) for SMPTE 259M component serial digital input.
- True multi-system monitors they are equipped to handle four color system signals: NTSC, NTSC 4.43, PAL, and SECAM
- External sync input and output for synchronization with other equipment. Can be set so that it will automatically switch according to the input selected.
- Switchable color temp: 6500K (broadcast), 9300K (pleasing picture). User preset (3200K to 10000K)
- Underscan and H/V delay capability. In underscan mode the entire active picture area is displayed, allowing you to view the entire image and check the picture edges. H/V delay allows viewing of the blanking area and sync/burst timing.
- Using color bars as a reference, Chroma/Phase setup mode facilitates the complex, delicate procedure of monitor adjustment. Especially convenient when used with computer-based editing systems.
- On-screen menus for monitor adjustment/operation
- Parallel remote control and Tally via 20-pin connector
- Sub control mode allows fine, on-screen adjustment of the center "detent" value of the contrast, brightness, chroma and phase knobs
- PVM-14M2U/M4U mount in a 19-inch rack with the MB-502B Rack Mount Bracket. The 20M2U/M4U monitors mount with the SLR-103A Slide Rail Kit.

QUICK DIAL 8

SENNHEISER

Condenser Microphones

Unlike traditional condenser microphones, the capacitive transducer in Sennheiser condenser microphones is part of a tuned RF-discriminator circuit. Its output is a relatively low impedance audio signal which allows further processing by conventional bi-polar low noise solid state circuits. Sennheiser microphones achieve a balanced floating output without the need for audio transformers, and insures a fast, distortion-free response to audio transients over an extended frequency range. The RF-design yields exceptionally low noise levels and is virtually immune to humidity and moisture. The comparatively low RF-voltage across the elements of the transducer also eliminates arcing and DC-bias creeping currents. Sennheiser employs RF-technology to control residual microphone noise. Optimizing the transducer's acoustic impedance results in a further improvement in low noise performance. Sennheiser studio condenser microphones operating according to this RF-principle have proven their superior ruggedness and reliability in the past decades under every conceivable environmental condition.

MKH 40 P48U3

Cardioid

- Highly versatile, low distortion push-pull element
- Transformerless RF condenser, high output level
- Transparent response, switchable proximity EQ. Recommended for most situations, including digital recording, overdubbing vocals, percussive sound, acoustic guitars, piano, brass and string instruments, Mid-Side (M-S) stereo, and conventional X-Y stereo. Vocals when used with a pop-screen.

MKH 60 P48U3

Short Shotgun

- Short interference tube RF condenser
- Lightweight metal alloy, transformerless, low noise, symmetrical capsule design
- Smooth off-axis frequency response. Handles extremely high SPL (135 dB), ideal for broadcasting, film, video, sports recording, interviewing in crowded or noisy environments. Excellent for studio voiceovers.

Digital Multi-Track Recording

TASCAM DA-88

- ATF system ensures no tracking errors or loss of synchronization. All eight tracks of audio are perfectly synchronized. It also guarantees perfect tracking and synchronization between all audio tracks on all cascaded decks - whether you have one deck or sixteen (up to 128 tracks!)
- Incoming audio is digitized by the on-board 16-bit D/A at either 44.1 or 48KHz. The frequency response is flat from 20Hz to 20KHz while the dynamic range exceeds 92dB.
- Execute seamless Punch-ins and Punch- outs. This feature offers programmable digital crossfades, as well as the ability to insert new material accurately into tight spots. You can even delay individual tracks to generate special effects or compensate for poor timing.

SONY PCM-800

- Flawless sound quality, outstanding reliability and professional audio interfacing with AES/EBU digital I/O and XLR analog I/O connections.
- Combines audio functions such as precise auto punch in/out digital cross fade technology, external synchronization with SMPTE/EBU time code and selectable sampling frequencies of 44.1 and 48kHz.
- Shuttle dial for precise tape control, variable speed playback of 6% in 0.1% increments and a flat frequency response from 20Hz to 20kHz.
- Operate up to 16 PCM-800's in perfect sync with optional RCC-S1 sync cables for up to 128 channels of digital audio recording.
- Optional DABK-801 Sync Board provides SMPTE/EBU time code generation and chase sync. It locks to the incoming time code with subframe accurate offset— ideal for audio-follow-video applications. Also synchronizes to external video reference signal.
- Optional RM-D800 provides comprehensive remote control over all PCM-800 functions. The RM-D800 can control up to six units for up to 48 channels of digital audio.

ALESIS adat xt

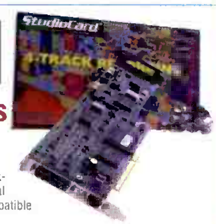
8-Track Digital Audio Recorder

An incredibly affordable tool, the ADAT-XT sets the standard in modular digital multi-track recording. With new features and enhanced capabilities, the ADAT-XT operates up to four times faster than the original ADAT, offers an intelligent software-controlled tape transport and provides onboard digital editing and flexible autolocation.

- Onboard 10-point autolocate system provides quick access to multiple tape locations. Four specialized locate points make your recording sessions quicker and easier.
- Includes remote control with transport and locate functions, offers a footswitch jack for hands-free punch-in.
- Advanced transport software continuously monitors autolocation performance and the head constantly reads ADAT's built-in sample-accurate time code—even in fast wind modes.
- Dynamic Braking software lets the transport quickly wind to locate points while gently treating the tape.
- Servo-balanced 56-pin ELCO connector operates at +4dB to interface with consoles with +4 dB bal/unbal inputs/outputs. Also unbalanced -10dB inputs/outputs (phono connectors).
- Has an electronic patch bay built-in so it can be used with stereo and 4-bus consoles.
- Make flawless copy/paste digital edits between machines or even within a single unit. Track Copy feature makes a digital clone of any track (or group of tracks) and copies it to any other track (or group) on the same recorder. This allows you to assemble composite tracks for digital editing.

QUICK DIAL 731

ANTEX StudioCard



4-Channel Digital Audio Card for Windows

The next generation in digital audio for the desktop, StudioCard is a premium-quality digital audio adapter with advanced features, studio-quality specs and professional connections. Unmatched in quality, flexibility and expandability, it features 4 tracks of audio sound and real-time digital mixing capability, making it the ideal board for musicians who want digital multitracking and mixing on their PC, or producers looking for a versatile board for post-production digital audio editing and uncompromised audio quality. StudioCard is Windows 95' plug and play compatible plus includes drivers for Windows NT as well.

- Key to StudioCard's amazing sound is the marriage of a low noise analog I/O section and high quality A/D and D/A converters. A PCI-based 32-bit memory mapped board, it delivers less than 0.003% total harmonic distortion and 92dB dynamic range. Plus, a PLL-based sample clock generator that can be locked to an assortment of clock sources.
- Incorporates a programmable 32-bit 40 MHz DSP and pro connections like 4 independent balanced analog I/Os (+4dBu or -10 dBV) and AES/EBU or S/PDIF digital I/O. It also offers a MIDI port with deep buffers and time stamping. No matter which type of equipment you have StudioCard will integrate into standard studio environments.
- Compatible with film, video or MIDI. StudioCard offers synchronization via SMPTE, MTC, word and pixel clocks, and composite video. Plus, the StudioCard not only reads SMPTE timecode, but generates it as well.
- Unique to the Antex design is StudioCard's multiple adapter capability. This means you can install multiple StudioCards in a single computer for up to 16-track recording. Start with one StudioCard today - add more StudioCards tomorrow. Also included is an on-board SPx expansion connector for plugging in optional daughtercards for compression or enhanced DSP operations.

Minimum Shipping USA (Except AK & HI) $7.00, up to 3 lbs. Add 60¢ for each additional lb. For ins. add 40¢ per $100. Prices are valid subject to supplier prices. Not responsible for typographical errors.

VIDEO and PRO AUDIO

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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 chasiss 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 intenal battery holds and restores current aptterns 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 RS16x8 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 DB (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 interlacing 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.

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

- processing, 8-bit D/A conversion
- insertion delay, frame of memory
- composite and one S-video output
- RGB (Sync on Green or all three), RGB/Sync and YUV (...) inputs. Also available with looping inputs
- luminance notch filter
- ...e-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

PowerScript™

Animated Postscript Character and Graphics Generator

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 DIF-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.

5100D Digital Waveform/Vectorscope

The 5100D can work in component digital as well as component analog facilities (and mixed operations). It provides comprehensive waveform, vector, timing and picture monitoring capabilities. Menu driven control functions extend familiar waveform observations into highly specialized areas and include local calibration control, the ability to show or blank SAV/EAV signals in both the waveform and picture, the ability to monitor digital signals in GBR or YCbCr form, line select (with an adjustable window), memory storage of test setups with the ability to provide on-screen labels, flexible cursor measurements, automatic 525/60 and 625/50 operation and much much more.

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.

CORPORATE ACCOUNTS WELCOME

Circle (55) on Free Info Card

The GALLERY

The GALLERY

STATEMENT OF OWNERSHIP

Statement of Ownership, Management and Circulation (Act of Aug. 12, 1970; Section 3685, Title 39, United States Code).

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	Average No. copies each issue during preceding 12 months	Single issue nearest to filing date
A. Total No. copies printed (Net press run)	36,786	36.275
B. Paid and/or requested circulation		
1. Sales through dealers and carriers, street vendors and counter sales	0	0
2. Mail subscriptions	32,426	32,378
C. Total paid and/or requested circulation	32,426	32,378
D. Free distribution by mail (samples, complimentary and other free)	2,642	2,626
E. Free distribution outside the mail (carriers or other means)	518	500
F. Total free distribution (Sum of D and E)	3,160	3,126
G. Total distribution (Sum of C and F)	35,586	35,504
H. Copies not distributed		
1. Office use, leftovers, spoiled	1,200	771
2. Returns from news agents	0	0
I. Total (Sum of G, H1 and H2)	36,786	36,275
Percent paid and/or requested circulation (C/G x 100)	91.1%	91.2%

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Dennis Triola,
Publisher

industry briefs

Business

Panasonic, Secaucus, NJ, is shipping the AJ-HD2000 digital high-definition (HD) recorder, a cost-effective approach to HDTV broadcasting using the D-5 format. The

AJ-HD2000 incorporates a D-5 VTR and HDTV processor in a single-piece HDTV VTR with full production features.

Panasonic also announced several sales, including the purchase of $8 million worth of DVCPRO equipment by Raycom Media Inc., Montgomery, AL. Raycom's purchase includes an initial $2 million DVCPRO investment to outfit 10 stations in applications ranging from a complete station conversion to DVCPRO editing-only and acquisition-only installations.

Fox Television Group, Los Angeles, and **Comark**, Southwick, MA, signed an agreement that offers DTV transmitters to the network's owned-and-operated stations. Under terms of the agreement, Comark will offer Fox's O&Os digital and NTSC transmitters through 2002, and will also extend a specially negotiated offer of DTV equipment and services to FOX affiliates.

ASC, Burbank, CA, announced that Canadian broadcaster CHBC-TV has purchased a six-channel VR300 video server system. The CHBC system will be configured with 30 hours of Fibre Channel storage to meet spot insertion and net delay requirements. The station plans to use one channel for ongoing recording, three channels for playback and two channels for network delay.

Canon, Lake Success, NY, announced the sale of its IFpro lenses to Spotlight Production Services, Dallas. Spotlight, which took delivery of three 18x IFpros, is building a three-camera mobile switching system that will incorporate them with three new Sony DVC-D30 digital cameras.

Hewlett-Packard, Santa Clara, CA, announced that British broadcaster Pearson Television Broadcasting has purchased and installed three MediaStream broadcast servers. The company, which chose H-P servers for their high storage and channel capacities and networking capabilities, will employ the new units to cache commercials and promotions for satellite channel transmissions.

Quantel, Darien, CT, and **Matsushita**, parent company of Panasonic, announced their intention to cooperate on the implementation of DVCPRO codec technology on Quantel products and systems. Final details of the alliance agreement are being defined.

CNN International will install a multichannel Profile system from **Tektronix**, Wilsonville, OR, at its Atlanta-based CNN Center. As part of the $1 million deal, the new installation will incorporate multiple Profile PDR200 video server file servers, Profile PRS200A RAID 3 arrays and Profile PLS200 datatape library systems.

PEOPLE

Tim Thorsteinson has been named president of Tektronix VND, Beaverton, OR.

Daniel Wright has been named president and CEO of Scitex Digital Video, Redwood City, CA. ■

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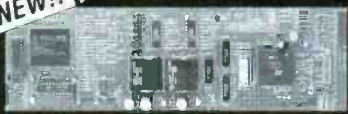

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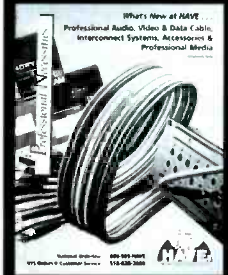

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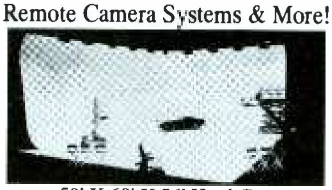

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MAINTENANCE TECHNICIAN Requires self starter having experience with Beta, VPR-3, PC's and other studio equipment maintenance. Experience with microwave, satellite, VHF & UHF transmitters, and FCC General Class license preferred. Contact Marty Peshka, Ass't Chief Engineer - Maintenance. WTNH-TV, 8 Elm Street, New Haven, CT 06510, or call (203) 784-8841. EOE

HANDS ON CHIEF ENGINEER OPERATOR for small market satellite television station. At least five years engineering management and budgetary experience in television. Thorough knowledge of analog, digital, transmitter, microwave operations, maintenance, studio operation and FCC regulations. Computer literacy a must. Send resume to: Dorrie Faubus, Station Manager, KOBR-TV, 124 E. 4th Street, Roswell, NM 88201. EOE/MF

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TELEVISION STATION IN LAS VEGAS is accepting applications for Broadcast Engineers. Please mail resumes to: KINC TV-15, Univision, 500 Pilot Rd., Suite D, Las Vegas, NV 89119. Attn: Gabriel Quiroz. Or fax to: (702) 434-0527 Attn: Gabriel Quiroz. Copy of SBE certificate is a plus. FCC license required. 3 years of experience in maintaining UHF transmitters. EOE

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CHRISTIAN TELEVISION NETWORK has opening at Corporate Office for Director of Engineering. Position requires experience in Transmitter and RF Systems, Production and Transmission video systems and knowledge of HDTV systems and regulations. Management and organizational skills are necessary. We seek individuals who are goal oriented and self-motivated. If you meet our criteria, please send your resume to: Tri-State Christian TV - Personnel, PO Box 1010, Marion, IL 62959. An Equal Opportunity Employer.

CHIEF ENGINEER Dallas Area Trinity Broadcasting station. Experienced in maintenance of UHF transmitter, studio systems as well as personnel supervision and training. SBE certification a plus. Send resumes to Ben Miller, Mail: P.O. Box C-11949, Santa Ana, CA 92711; E-mail: BMILLER@TBN.ORG; Fax: 714/665-2101. M/F EOE

OPERATING ENGINEER: Prefer minimum of two years experience in television broadcast. Good technical knowledge of basic audio & video & PC computers. Duties will include operation of studio cameras, microwave receive equipment, transmitter remote controls, light equipment maintenance as well as basic computer hardware & software maintenance. !!NO PHONE CALLS!! Resume Chuck Amy, Operating Engineer, KOAT-TV, 3801 Carlisle Blvd. NE, Albuquerque, NM 87107. Drug Free Workplace. *KOAT-TV is an Equal Opportunity Employer*

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TELEVISION ENGINEER Northern California broadcasting company is seeking support for its FOX 29, Eureka and FOX 30, Chico stations. Applicants must have experience in repair and maintenance of television transmitter and microwave equipment. Salary plus benefits. Send resume to: Job #4307-BE, P.O. Box 4159, Modesto, CA 95352. EOE

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A RADIO CHIEF ENGINEER is needed in Waterloo, IA with minimum three years radio broadcast experience in all areas of transmitter and studio facilities. Good communications skills, Computer knowledge, and open to continuing education. SBE certification is a plus. Contact: Gregory A. Dahl, Director of Engineering, Connoisseur Communications, 3901 Brendenwood Road, Rockford, IL 61107. (815) 399-8148 Fax; E-mail: 7441,3272@compuserve.com NO telephone calls.

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By Paul McGoldrick

MPEG-2 comes of age

To me, the most significant thing that emerged from the IBC convention in Amsterdam was entirely expected, but welcome. C-Cube gave the first public demonstration of one of its DVx chips simultaneously decoding two MPEG-2 streams. This is probably one of the last developments needed for MPEG-2-based non-linear editing systems. The result is likely to be major improvements in picture quality, higher compression ratios and improved end-to-end interoperability, compared to JPEG systems.


Paul McGoldrick

The flexible DVx architecture is based on a 32-bit RISC processor extended for MPEG's compression-specific instructions. Encoding and decoding can be 4:2:2 or 4:2:0, and an adaptive field/frame algorithm allows for either field- or frame-type data. From a professional/broadcasting viewpoint, a single chip that decodes two streams is a major breakthrough. Although the more important chip in the DVx family may be the one with an encoder and decoder on-board and both are real-time (at least within the limits of acceptability of the phrase!). The choice of Motion-JPEG in current non-linear editing systems is almost entirely driven by the availability of single-chip codecs. Having the same functionality in MPEG-2 is an essential part of a switch in standards. Of course, if there was to be a chip with two streams of encoding and decoding on board . . .

What will happen with existing streams using M-JPEG and the DV (DVS) standards of DV consumer (4:1:1, 25Mb/s) and DV prosumer (4:2:2, 50Mb/s)? Clearly, technology decisions and market decisions do not necessarily track well. With the higher compression rates — saving valuable storage space — and better picture quality, MPEG-2 systems should, if the prices are comparable, be the no-contest victors. In practice, the market forces associated with consumer-type standards are too intensive and too complicated to be called by average humans. It was staggering to read that after the debacles associated with the next generation of DVD, there is now a market alignment (i.e., war) set up for the next generation of audio compact discs. One side is the familiar Philips/Sony party and they are against everyone else.

The M-JPEG/DV systems will be usable with the MPEG systems as connection between the existing systems, and a transcoder can easily be accomplished on a Firewire (IEEE 1394) system. Unfortunately, this method would always involve decoding the M-JPEG/DV signals and re-encoding in MPEG.

Non-editing uses

The importance of these and future products are not limited to broadcast. Doors are opening into other areas. Take the case of recordable DVD. With encoders costing upward of $20,000, it is unlikely that the average household would have a recordable DVD. The average ratio of the number of MPEG-2 decoders to encoders sold is probably on the order of 10,000 to one, and that is before real adoption of the standard in the home. It has to be expected that, with the advent of the codec chip and with the inevitable price reductions that result from volume, the first mass-market implementation will be in high-end PCs. It should take only a couple of years for the usual trickle-down through medium- to low-cost PCs to take place. By the turn of the century, every machine will likely be fitted with an MPEG-2 codec. The multiple-to-one ratio of MPEG-2 decoders to encoders is going to be quickly replaced by a one-to-one ratio.

Even more than recordable DVD, and the authoring that goes with it (even I might be tempted), is the fact that we have reached the point that consumer digital VCRs and disc-based camcorders are really rather close. The quality of these devices is going to be limited only by the lens/microphone system and any deliberate degradation that might be introduced, allowing for future "improvements." In some cases, the acquisition of signals is going to be dramatically different, too: Texas Instruments and Motorola have made announcements that turn our current CCD detection systems on their heads. How professional the all-CMOS sensor from TI can be, for example, is not yet known, but the integration possibilities are staggering. ■

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

A blatant plug

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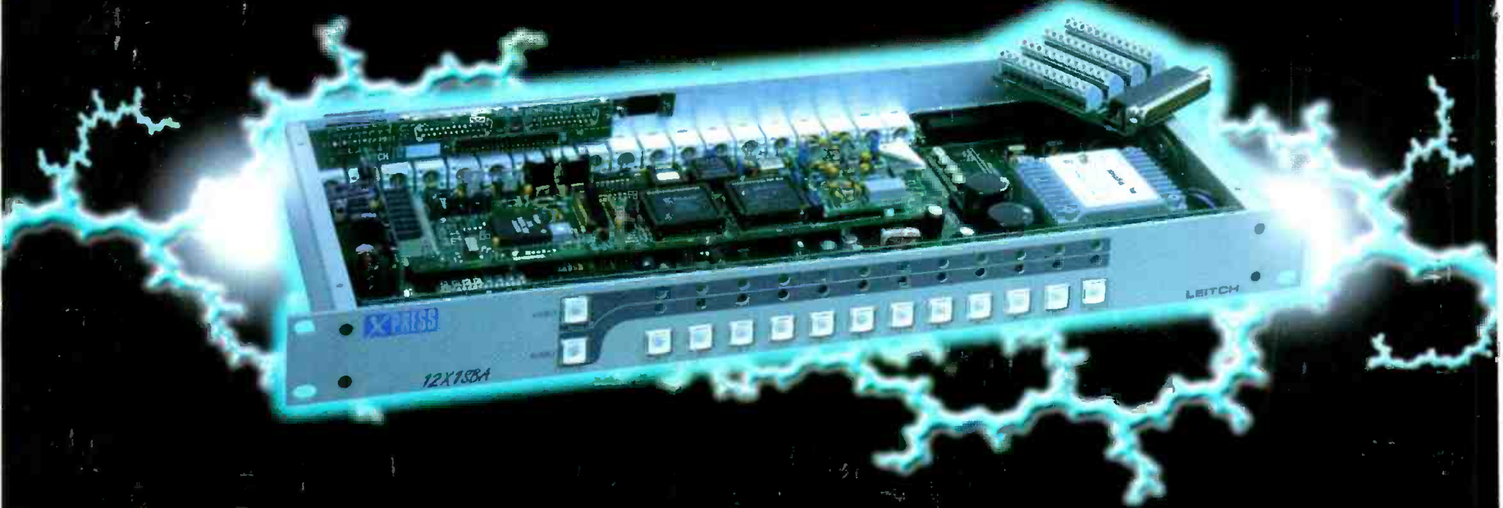

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