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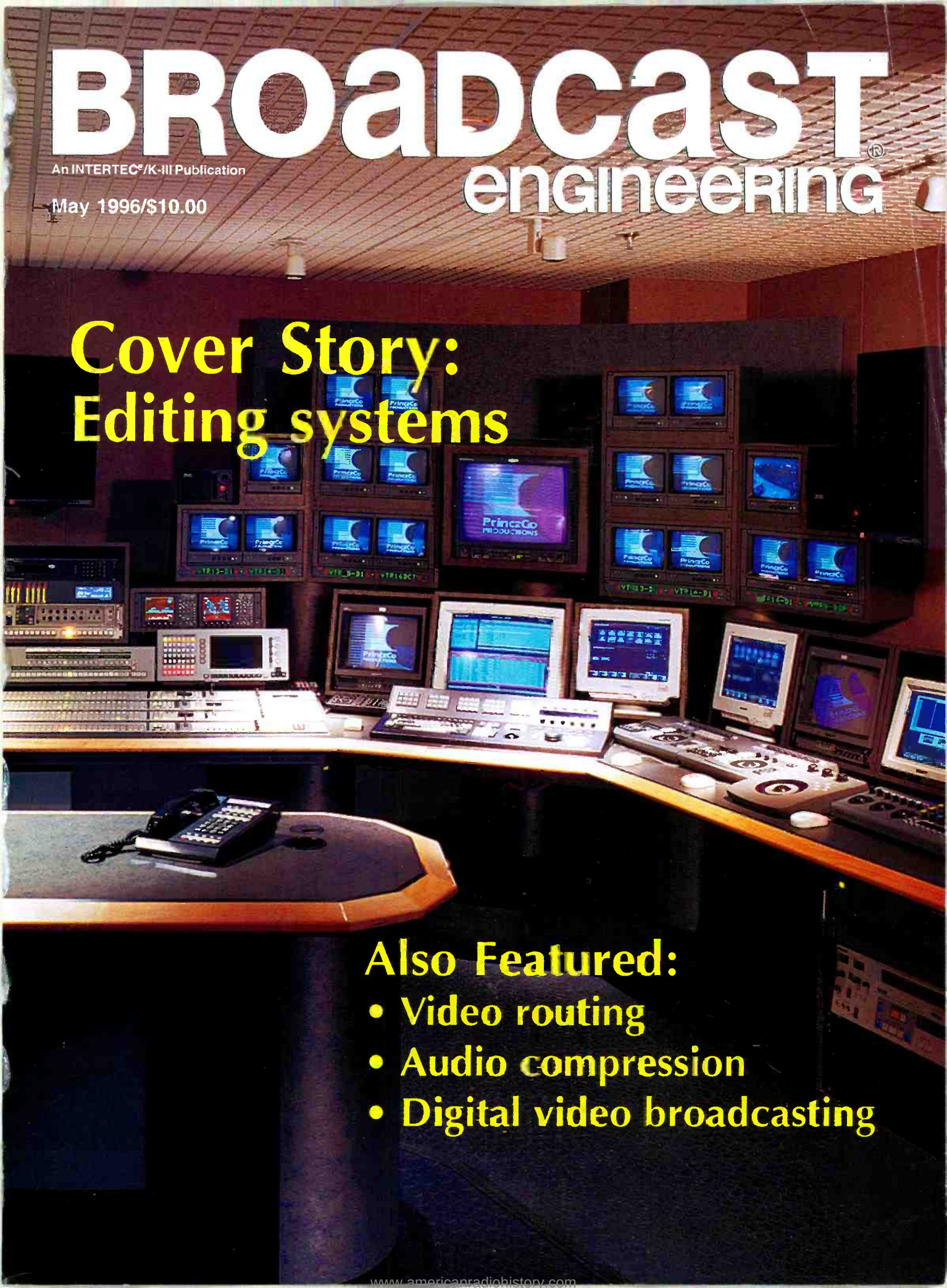
BROADCAST® engineering



Cover Story: Editing systems

Also Featured:

- Video routing
- Audio compression
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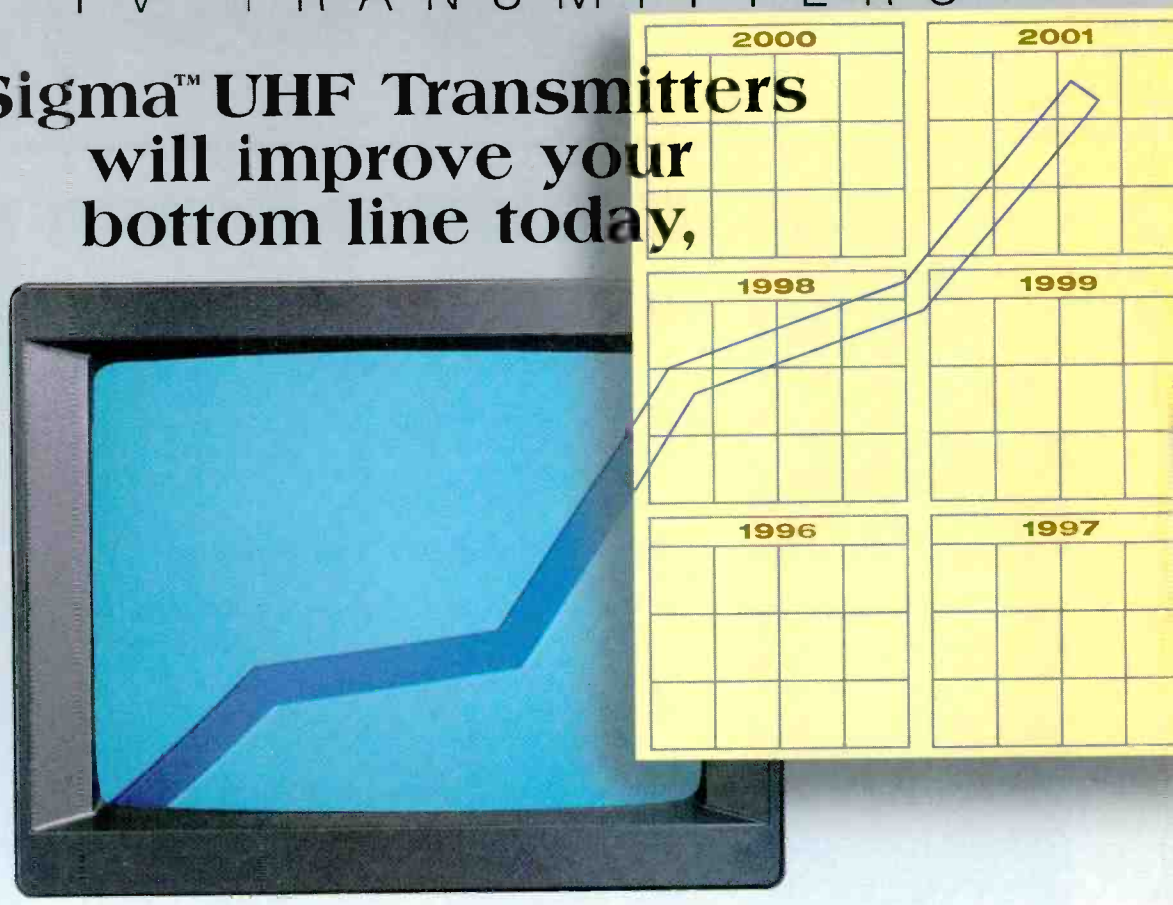

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May 1996 • Volume 38 • Number 5

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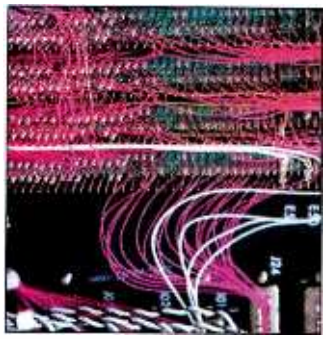

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ON THE COVER: The new PrinczCo digital editing suite designed and built by A.F. Associates Inc. of Northvale, NJ. Photo courtesy of A.F. Associates.

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By Dawn Hightower, senior associate editor

Model HDTV station project moves forward

Digital HDTV is moving toward reality. Broadcasters and equipment manufacturers are planning to establish the first operational HDTV station in the United States. The sponsors of the project are The Association for Maximum Service Television (MSTV) and the Consumer Electronics Manufacturers Association (CEMA). James C. McKinney is the project director.

A TV station in Washington, DC, will be chosen to be the host station. This project will benefit consumers and involved industries by demonstrating HDTV broadcasting with a fully equipped HDTV studio/transmission system; evaluation of auxiliary data transmission, interactive video services and satellite, optical fiber and microwave feeds; evaluation of equipment interface issues; information on prototype and commercial HDTV equipment; and employee training and educational material for station technical personnel.

This is a 3-year project and the implementation schedule will begin later this year with installation of an HDTV transmitter and compression encoder at the host station. HDTV production equipment and techniques should be scheduled for early 1997.

Fannon named chairman of citizens for HDTV

Peter M. Fannon is chairman of the Citizens for HDTV Coalition, which was formed in March to promote the rapid adoption and implementation of digital HDTV.

Prior to this position, Fannon was president of the Advanced Television Test Center (ATTC). Under his guidance, the coalition will urge the FCC to adopt the digital HDTV system standards recommended last November by the FCC Advisory Committee on Advanced Television Services (ACATS). An accelerated transition to HDTV will: revolutionize consumers' TV viewing experience; expand America's global load in digital TV technology; create and maintain thousands of high-tech American jobs; and preserve free over-the-air television.

For more information, Fannon can be reached at (703) 739-3851.

UCCE to sponsor course on error-correcting codes

The University Consortium for Continuing Education (UCCE) will sponsor a 4-day course entitled "Error Correcting Codes with Application to Digital Storage Systems" Aug. 19-22 in Boulder, CO. It will feature topics on PRML recording, Reed-Solomon Codes, error-correction for DVD disks and next-generation hard disks. The cost is $1,495 and includes a copy of "Error Correcting Codes." For more information, call Joleen Packman at (818) 995-6335.

NCTA president addresses SCTE Cable-Tec Expo '96

The National Cable Television Association (NCTA) president and chief executive officer Decker Anstrom will address the Society of Cable Telecommunications Engineers (SCTE) Cable-Tec Expo '96. The conference will run from June 10-13 in Nashville, TN.

Anstrom will address the opportunities the Telecom Act provides for the cable industry and will stress the importance of technical excellence in the industry's future.

Advanced TV Technology Center reaches membership goal

The Advanced Television Technology Center has new members. They are: Capital Cities/ABC, CBS, the Public Broadcasting Service, Pioneer Electronic Corporation, Sony and Mitsubishi.

The Technology Center will conduct tests essential to the transition to digital and high-definition transmission.

The Center is a cooperative effort of broadcasters and TV manufacturing industries to resolve radio-frequency issues and to develop systems engineering solutions to implement digital TV and HDTV service.

The FCC will consider standards for digital TV broadcasts and to allocate channels for advanced television later this summer.

The Center stems from an 8-year association of the broadcast and manufacturing industries in the Advanced TV Test Center.

The Center has two membership categories: one for regular members and one for nonprofit trade and scientific association members who may participate at a reduced rate. The Center also has launched an international membership campaign.

Membership inquiries should be directed to Howard Miller at PBS, (703) 739-5465.

WavePhore to launch satellite network and Newscast in Japan

On June 1, WavePhore will launch its satellite network and its Newscast services in Japan and the Pacific Rim. WavePhore will broadcast these services via satellite from the United States to Japan.

WavePhore has formed a wholly-owned subsidiary, WavePhore Japan K.K., to facilitate the licensing and distribution of these products and services. WavePhore Japan will also integrate Japanese-based content and infrastructure into this network.

WavePhore's Newscast, which provides real-time critical information to subscribers' PCs, will be available to Japanese businesses for the first time.

According to Glenn Williamson, executive VP and COO of WavePhore, WavePhore Japan will establish a foundation for network and Newscast offerings, and also will allow an aggressive rollout of other broadcast technologies for the distribution of content to Japanese markets.

Clarification

The March story, "CBS On (digital) Course" with Darcy Antonellis, CBS vice president of Technical and Olympic Operations, contained two editing errors that might have been confusing. In the story, Antonellis was incorrectly quoted as having said, "It seems silly for us to invest in an analog or, for that matter, *component* digital system knowing that the D-2 machines we have are aging." Her correct statement was, "It seems silly for us to invest in an analog or, for that matter, *composite* digital system knowing that the D-2 machines we have are aging."

Also, in her comment regarding the bandwidth needed for routers (in the pull-quote only), it should be noted that, by design, HDTV is a compressed format. A video router used for HDTV applications must have the bandwidth to support high-definition video in compressed form (emphasis added).

BE regrets these errors.

NAB endorses MegaWave's antenna design

The NAB and MegaWave of Boylston, MA, have reached an agreement where NAB will endorse products based on MegaWave's TV set-top antenna design.

About a year ago, NAB realized that a large percentage of TV sets in the United States depended upon set-top antennas to receive TV programming. NAB provided MegaWave with product performance requirements, and the company developed a compact set-top antenna that requires no tuning or length adjustment, while providing improved picture-quality performance when compared to "rabbit ears." The characteristics of the antenna will also make high-quality set-top reception of digital ATV transmission possible.

MegaWave's antenna's technology is a spin-off from work performed for the Advanced Research Projects Agency (ARPA) of the Department of Defense. These set-top antennas are expected to reach the market later this year.

1996 ITS annual Forum

Chicago will be the site for the International Teleproduction Society's (ITS) Annual Forum June 25-30. The program will encompass technology from the teleproduction, computer and communications industry. The Forum is an opportunity for manufacturers to provide one-on-one demonstrations and discuss product development and new applications with attendees. Those who wish to join ITS now can save $525 on the ITS Forum. For more information on ITS membership and to register for the Forum call (212) 629-3266.

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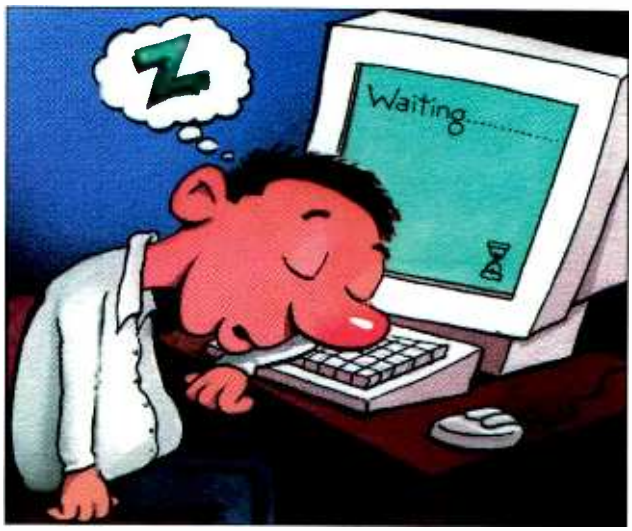
Circle (10) on Action Card

Morse code beats ISDN

I'm a man of speed. I drive fast and have the tickets to prove it. I want things done now, not later. I don't do lines. My goal is to cram into the next hour, the next day, the next week as many things as possible. When I finally die, it won't be because I was lounging around resting, it'll be while I'm rushing off to try to do three things at once and planning for what I'll do when those things are done. Maybe that's why I'm a runner. Running gives me the feeling of doing something "fast" even if I'm only doing a 7:30 pace.

The bottom line is I don't like waiting for anything — and that includes responses from places like CompuServe (CIS) and Internet resources. That damn hourglass in Windows may as well be a sundial because it moves about as fast. It's just another visual indication of how much time we computer users waste waiting and waiting and waiting for the drive, memory, CD-ROM and most often — our Internet service to *do something*!



The other night at about 1:30 in the morning, I finally got so mad at the slow service from the Internet (I was working it through CIS) that I decided that what I really needed was an ISDN line. Being the inquisitive type, I decided to use the Internet to research the availability of ISDN for my town, which is located just west of Kansas City.

Enter Microsoft. They maintain an excellent resource intended to help users get connected via ISDN. The address is:

www.Microsoft.com/windows/getisdn/order.htm

Once connected to their server, you are led through an interactive process to pinpoint your location and ISDN service providers. The first step shows a drawing of the entire globe where you click on your continent. I don't know whether they really support information for such a vast area, but at least it looks impressive.

Okay, I click on the North American continent. Up comes that portion of the globe, and I click on Kansas. The USA map is divided into regions controlled by the different regional bell operating companies (RBOCs).

The program then asks for your telephone number and whether the telephone number is a residence or business line. At this point, the program branches into two paths. The one path describes the ISDN service providers in your area, and if there are more than one, you then select which one you want. Based on your selection, you then see a display of costs, including installation, monthly usage and other innovative ways to bilk you for using ISDN.

After clicking on Kansas, I was greeted with the following message: *Unable to list an ISDN provider because, unfortunately, Microsoft has no information about ISDN service in [Kansas] or for area code [913] and exchange [832]. ISDN may or may not be available in your area, but the local service provider does not participate in this program.*

That wasn't much fun, so I decided to see if other RBOCs were "participating" in Microsoft's ISDN program. I then checked the New York and Washington, DC, areas, yep, ISDN service was available there. How about Colorado or California? Yes, service was available there too. In fact, in most cases, there were two service providers available, so a person could choose which one to contract with.

Not to be denied, the next morning I called Southwestern Bell Telephone (SWB) expecting them to never have heard of ISDN. Surprise, they not only knew of it, but promptly faxed me out a price sheet. Upon glancing at the prices, I think I know why SWB doesn't "participate" in Microsoft's program. SWB's costs for ISDN are from two to four times higher than those available from other providers! For instance, SWB charges a one-time installation fee of $457.40. In Florida, GTE charges $90.00 for installation. USWest charges $67 in Colorado. If you're in California, GTE will charge you $88.10, and PacificBell charges $70.75 for installation. If I were ripping off my customers, like it appears SWB is, I wouldn't want to publicize that fact either.

So, I'm back to a snail-pace Internet service because I refuse to be screwed to the tune of more than $400 when other service providers can do the same for about one-fourth as much. So much for competitive rates Mr. Hundt!

You know, I just thought of something. I still have my advanced-level ham license. To get that I had to pass a Morse code test of 13 words per minute. Come to think of it, that's probably faster than what I'm now getting from the Internet.

Brad Dick

Brad Dick, editor

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Circle (11) on Action Card

By Harry C. Martin and Andrew S. Kersting

Cable must-carry/retransmission consent deadline

Commercial TV broadcasters will soon have to notify every cable TV operator in their market of their station's election of must-carry or retransmission consent status. The deadline for notifying cable operators of the station's election is *Oct. 1, 1996.*

Notifications of a station's election can be sent to cable operators prior to the deadline. Any commercial TV station that fails to make an election by the deadline will be deemed, under the FCC's rules, to have elected must-carry. All elections *go into effect on Jan. 1, 1997,* and remain in effect through Dec. 31, 1999.

Noncommercial TV stations need not make elections since they have must-carry rights, but no retransmission consent rights. Of course, noncommercial stations, like commercial stations, should review their carriage status on local cable TV systems to ensure that they are obtaining the carriage to which they are entitled. The following are some points to consider when planning the election and carriage process.

• *What is my station's "local" market?* Commercial TV stations may demand carriage (must-carry) only on cable systems that are in the station's local TV market. For the purpose of the must-carry/retransmission consent rules, a commercial station's market is its Area of Dominant Influence (ADI), as defined in Arbitron's 1991-1992 TV ADI Market Guide.

The FCC has established a rulemaking proceeding to determine whether local cable markets should be defined in a different manner, perhaps with recent Nielsen Designated Market Areas. However, the commission has tentatively concluded that it should continue to use the Arbitron 1991-1992 ADIs to define such markets, at least for the current election period. The FCC has promised to issue a final decision on this issue prior to Oct. 1.

The local market for noncommercial stations is not defined by ADIs. Rather, such stations may demand carriage on systems that meet either of these criteria: the headend is within 50 miles of the station's community of license or the station places a Grade B signal over the cable system's headend.

Low-power TV stations may demand carriage on cable systems within a 35-mile radius of the station. However, there are many other limitations on LPTV must-carry rights.

• *How do I make elections?* Commercial TV stations must notify cable operators of their election of must-carry or retransmission consent by Oct. 1. Every station should put together a list of cable systems in their ADI. Such information can be obtained from industry reference books.

DATELINE: MAY 31

Annual employment reports (Form 395-B) are due to be filed by all stations on or before May 31.

Commercial stations in the following states must file their annual ownership reports or report certifications by June 3: Arizona, Washington, DC, Idaho, Maryland, Michigan, Nevada, New Mexico, Ohio, Utah, Virginia, West Virginia and Wyoming.

TV stations in the following states must file their license renewal applications by June 3: Washington, DC, Maryland, Virginia and West Virginia. LPTV renewals for Idaho are also due by June 3.

After obtaining information on all of the cable systems in a station's ADI, the licensee should then determine, for each system, whether it will demand must-carry or elect to negotiate a retransmission consent agreement. An election of retransmission consent should be made carefully, since systems are under no obligation to negotiate a retransmission agreement with stations they do not wish to carry. In such a circumstance, the station cannot go back and demand must-carry.

Accordingly, if a station is contemplating electing retransmission consent for a particular system, it would be wise to attempt to negotiate the retransmission agreement before making the formal election, so that if negotiations fail, the station can still elect must-carry.

Once a station has made its election for a system, it should send a letter to that system, via certified mail, notifying the system of the station's election. Even if the station has signed a long-term retransmission consent agreement with a particular system that extends beyond 1996, it should send the operator a letter electing retransmission consent, as a required formality. Copies of all election letters should be placed in the public file and kept until Oct. 1, 1999.

1996 tower registration reminder

Antenna filing dates

Window	States/ Territories
July 1-31	MI, MT
Aug. 1-31	AZ, HI, NC
Sept. 1-30	AK, NM, NY
Oct. 1-31	MA, MO
Nov. 1-30	IL, WY
Dec. 1-31	NV, OK, PR

FCC to prohibit restrictions on TV and MMDS antennas

The commission has adopted an NPRM to implement provisions of the Telecom Act of 1996, which prohibit restrictions that impair a viewer's ability to receive video programming services through devices designed for over-the-air reception of TV or MMDS signals. Such restrictions typically have taken the form of zoning prohibitions on outdoor antennas.

The FCC proposes to prohibit nongovernmental regulations, such as homeowners' association rules and restrictive covenants, as well as restrictive state or local regulations, such as zoning laws. The proposed rule relies on a presumptive approach, thereby preserving local authority to impose reasonably necessary health and safety regulations. In addition, the agency proposed that communities with special regulatory needs could apply for a full or partial waiver of the pre-emption rule. ■

TV station self-inspection checklist

For antenna structures

- **Overall height:** Does the overall height of the structure match that specified in the station authorizations? Y☐ P☐
- **Antenna:** Does the number and height of the antenna bays match that specified in the station authorization? Y☐ P☐
- **Location:** Does the street address and geographical coordinates of the station transmitter tower location match exactly with the information shown on the station authorization? Y☐ P☐

Y= YES
P=PENDING

Harry C. Martin and Andrew S. Kersting are attorneys with Fletcher, Heald & Hildreth, P.L.C., Rossyln, VA.

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Circle (12) on Action Card

EAS update

Purchasing EAS equipment

By Leonard Charles

Now that vendors' submitted equipment designs have been certified, the EAS implementation deadline of Jan. 1, 1997 for broadcasters looks like it will stick. The time has come for purchasing the necessary equipment to bring your facility into compliance.

Unlike the one-size-fits-all EBS equipment, the EAS equipment will be purchased by choosing from a list of many different features. Some of these features will be appropriate for your operation and some will not. So, before you call your distributor with PO in hand, make a list of what you need.

Equipment requirements

This article considers only over-the-air broadcast TV facility requirements (although most of this information also applies to cable systems). Here is a suggested basic EAS package for TV stations:

- Four monitoring inputs (two mandated, plus two for a local plan)
- An internal printer
- Internal digital audio recording
- Audio program loop-through interrupt
- Character generator (CG) interface

With these basic items, plus the appropriate receivers, you are ready for compliance of a single station having its EAS equipment installed at the control point. This package will also suffice for unattended or automated operation. What, if anything, you need to add to these basic features is dictated by your station's unique situation.

First, find out what your monitoring assignments will be from your State Emergency Communications Committee (SECC). The FCC's EAS office at 202-418-1220 has a list of SECC chairs or, for the Internet user, the SBE WWW site includes a complete list at www.sbe.org under the EAS Committee link.

Once you know your monitoring assignments, determine whether you have appropriate receivers on hand or whether you need to purchase new receiver modules with your EAS equipment. In the latter case, be sure to add the receivers to your EAS shopping list. Don't forget an adequate antennae, as well.

TV stations must determine whether an existing CG can be used to comply. Remember, no matter what that CG is doing when a national activation is received, it must switch duty immediately to broadcast that alert. If that is not possible, a separate CG must be purchased, so add it to your list. EAS equipment vendors can recommend reasonably priced units. Don't forget to specify the exact model of CG so that your EAS equipment will come ready to interface to it.

The specific hardware features you need will be included as standard equipment on some packages, and may be options on others. You will want to shop carefully to get the most for your EAS dollar.

Programming flexibility

Beyond the hardware issues, as you comparison shop for EAS equipment, spend some time discovering how each different model is programmed. If your station has a history of being proactive in local emergency alerting, consider additional monitoring inputs.

Also, find out if the equipment you are contemplating will allow the subsequent addition of custom header codes as they become available from your local officials. Remember, local systems will evolve and grow over many years. If your goal is to participate in that evolution, you will want to purchase equipment that accommodates expansion with a minimum of added cost. ■

Leonard Charles is an engineer at WISC-TV in Madison, WI, and chairs the SBE National EAS Committee.

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Circle (13) on Action Card

By Steve Epstein, technical editor

Switching MPEG datastreams

OK, slowly but surely, MPEG-compressed video is looking better. And, slowly but surely, it is beginning to make sense to look at moving MPEG throughout a facility. Typically, MPEG data is stored as files, but television and video are continuous streams. Unlike a continuous stream, files have a beginning and an end. Can these streams be routed and switched in a "TV" rather than a "data" environment?

What follows is a simplified overview of the task of switching MPEG data. For space and simplicity, much of the technical minutia has been left out. The purpose is to provoke some thoughts as to the problems that switching MPEG will present so that stations are ready when the time comes.

Video vs. compressed data

Television, at least from the viewer's perspective, appears as a continuous stream. However, that continuous stream is really composed of individual segments switched together by master control. The longest of these may be 20 minutes during commercial programming and an hour or more at other times. The shortest segments may only be a few frames of black inserted downstream by a proc-amp to cover a bad switch or poor lockup due to insufficient preroll. Long or short, all segments can be broken down into individual frames or even fields, and this is the level that is common to the video and data models.

Today, switching video is a trivial exercise. Facilities are gen-locked, and the use of active switches capable of sensing the vertical interval is nearly universal. With gen-locked signals, the vertical intervals of the sources to be switched are lined up and it is simply a matter of waiting for the next VBI to occur and making the switch. Channel surfers see near instantaneous channel changes. Rarely today do viewers see vertical sync, even when changing channels. Viewers have come to expect seamless switching of programs and commercials. Unfortunately, switching compressed datastreams is not quite that simple.

Many types of compression, including MPEG, are frame- and pixel-based. During the compression process, blocks of pixels are identified and the redundant information is discarded. (For more information, see "Video Compression 101" February 1996.) As the information in the frame varies, so too does the amount of redundancy and hence, the number of bits required to properly represent it. JPEG (and Motion JPEG) systems package each frame individually, but the size of each frame varies. Buffers are used to normalize the bitstream, but under/overflow conditions can still occur.

MPEG uses a combination of I-(intra), P-(predicted) and B-(bidirectional) frames. Each of these frame types differ considerably in size. I-frames are the largest and are essentially the equivalent of a JPEG-compressed frame. I-frames are independently coded and are used to start an MPEG compression sequence. P-frames are smaller than I-frames and are predicted from previous I- or P-frames. B-frames are the smallest, and

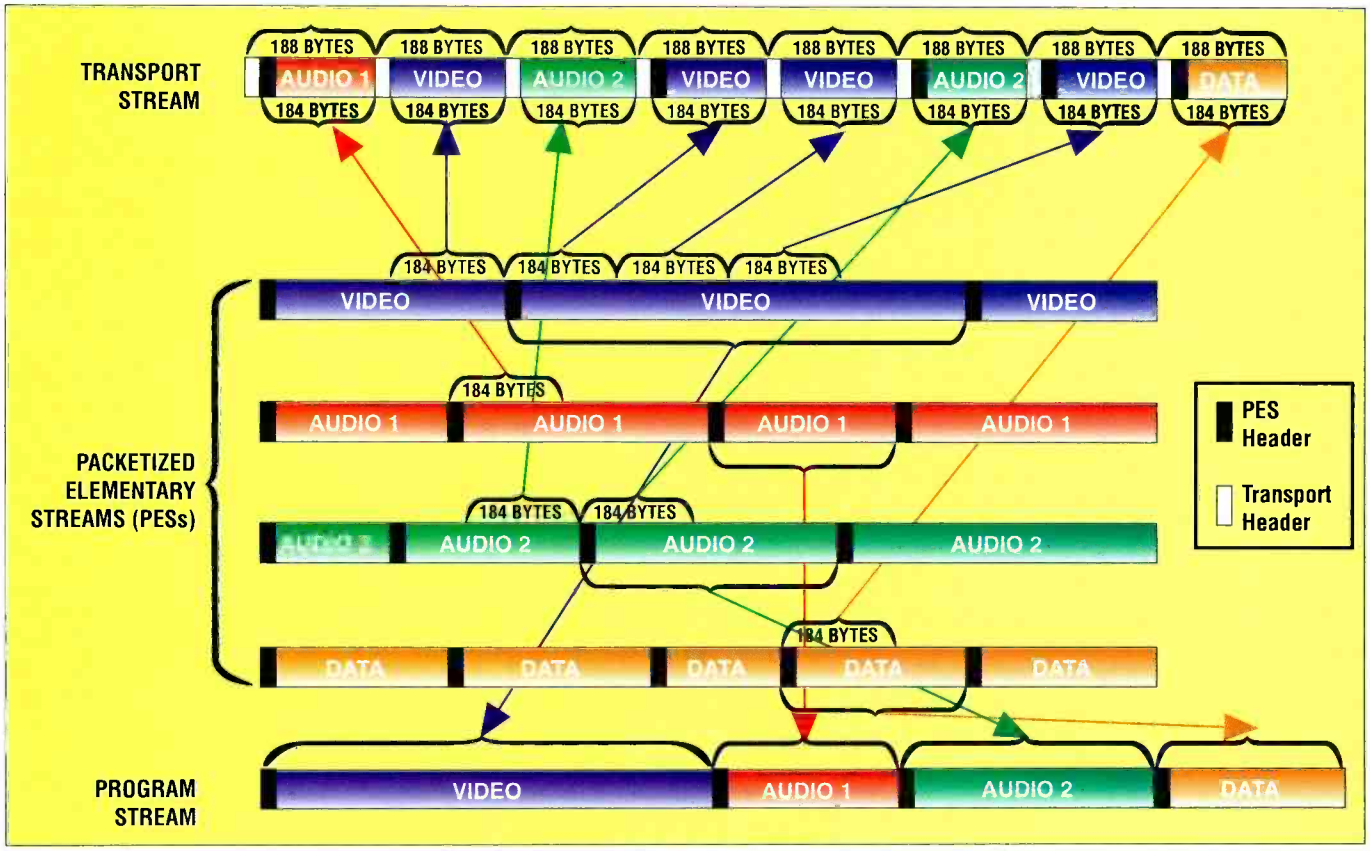


Figure 1. Relationship between the data and packets of PES, program and transport streams.

are bidirectionally predicted from earlier or later I- or P- frames. I-, P- and B- frames are arranged as needed to form a group of pictures (GOP). GOPs contain varying numbers of each type of frame, depending on the application. A typical GOP may contain 10 to 15 frames and begin and end with an I-frame, with B- and P- frames in between.

Once the compression is complete, the resultant data must be stored and ultimately delivered to the viewer. To do this, these almost randomly sized frames are packetized. Remember, for future extensibility, there are no rules for encoding. Decodable datastreams are all that is required. Packets carry headers that contain information about the payload data as well as additional information. Packet headers also provide the means for several things including: synchronization, identification and supporting information. Each header contains a sync word used to lock the decoder. Identification information would include packet contents or possibly routing information.

The C-Cube Microsystem's MPEG chipset will enable MPEG encoding in a variety of devices.

A packetized elementary stream (PES) carries a single source of information; this could be video, audio or data. Headers are placed within each PES to identify the data contents. Typically, several PESs are multiplexed together into a datastream that contains all of the necessary signal information. For MPEG-2, there are two basic types of packetized datastreams: the program stream and the transport stream.

Program streams contain one or more PESs that have a common time base. Typical program streams contain payloads of PES packets that are variable length. Because of their variable length, error-correction schemes are difficult to implement. Program streams are normally used when the devices are connected by a medium free from errors, for instance, buses within a computer.

Transport streams use fixed-length packets as well as error-correction schemes to provide robust transport of the MPEG-2 payload over error-prone media, such as over-the-air broadcast. Transport packets are each 188 bytes, including a 4-byte header. Figure 1 shows the relationship between PES, program and transport streams. Transport streams can be assem-

bled easily from a PES and program streams can be formed from a transport stream.

Changing streams

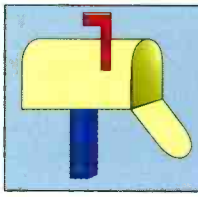
The task of switching MPEG-2 falls into two distinct areas: switching from one transport stream to another (a viewer changing channels) and *splicing* transport stream A or transport stream B into an output transport stream. In the first case, some amount of time will elapse between loss of the first channel and acquisition of the second channel. Today's channel-surfing viewers are not likely to tolerate much disruption during a channel change. This is one of the reasons behind the specification of two I-frames per second in the Grand Alliance HDTV scheme. A maximum of a half-second will elapse before the next I frame, with another following a half-second later. Once two I-frames have been acquired, a GOP can be properly decoded. Buffers may be used to smooth the change, but this will be up to set-top box/decoder manufacturers.

The second instance, switching one of several input transport streams into an output stream is difficult, but can be handled at a cuts-only level. Within the MPEG-2 systems layer is a provision for countdowns to splice points. The splice point is a point in the stream where a switch to another stream can be cleanly accomplished. However, without any equivalent to gen-lock, there is no guarantee that splice points in the two streams will occur simultaneously. Buffers will be required to align the splice points of two streams so that the switch can be made properly. Additionally, tables and headers within the outgoing stream will have to be updated to prevent the decoder from sensing the switch.

A packetized elementary stream (PES) carries a single source of information; this could be video, audio or data.

All of this overhead adds to the complexity of the switching mechanism. None of this, however, addresses one of the basic concepts that underlie MPEG-2 — the buffer. As stated, buffers are used to smooth the data rate. What happens when a buffer is nearly full and the datastream is switched to a stream that requires a nearly empty buffer? What about the simple act of patching around equipment at the transmitter? A discontinuity in the datastream could cause a momentary loss of picture, one much more noticeable than a single sync roll.

These problems are by no means unsolvable. Early NTSC had its problems, and in the last 40 years, many have been overcome. Keys, wipes, DVEs and complex layering were impossible in the early days, but are integrated into today's production process. Switching MPEG will be no different, as the problems present themselves, they will be solved, but that doesn't mean there won't be problems along the way. Familiarizing yourself with the basics of the MPEG standards will make dealing with these issues far easier in the future. ■



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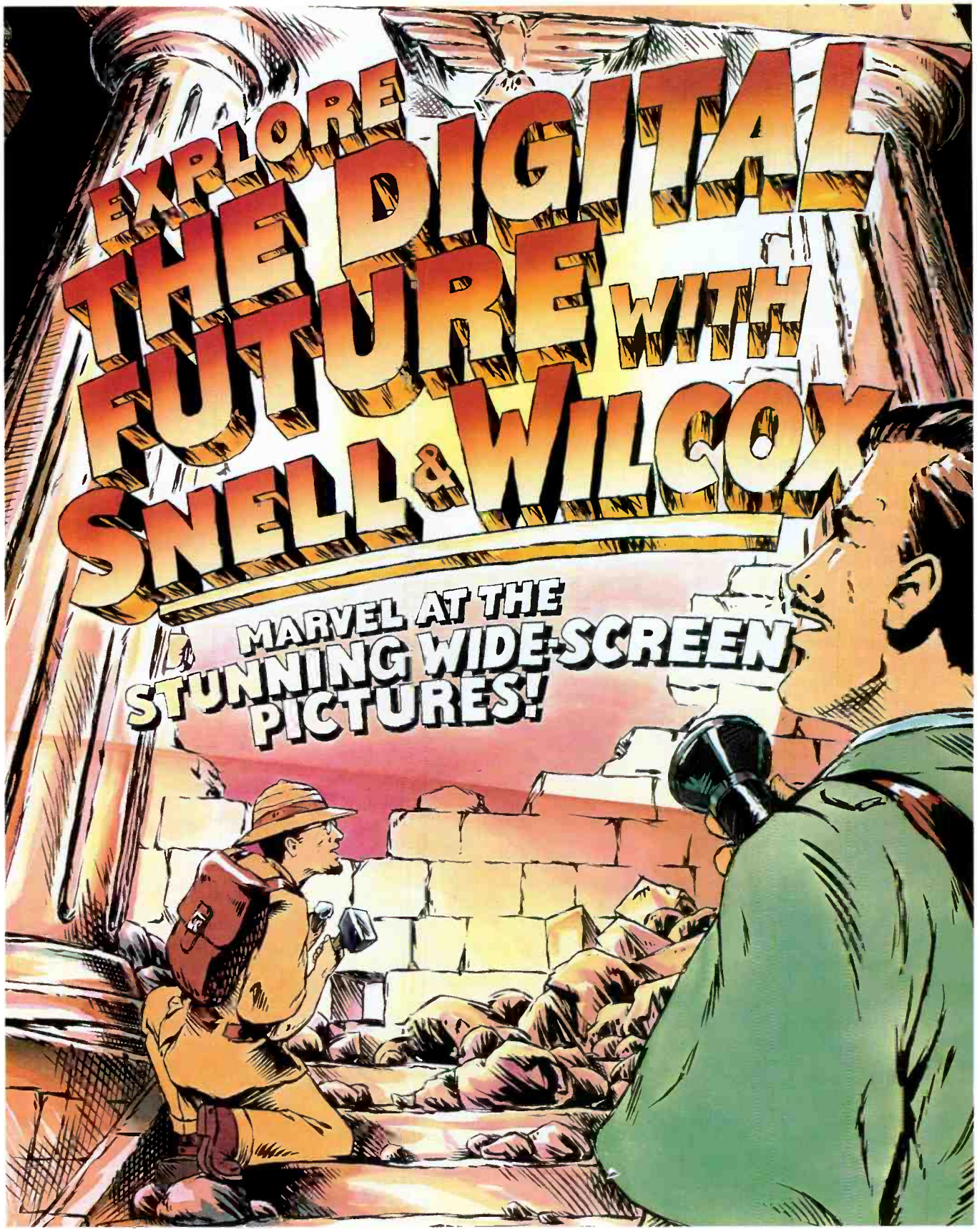


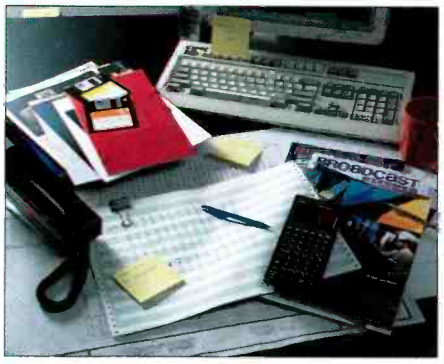
SNELL & WILCOX

Engineering with Vision

Circle (6) on Action Card

By Curtis Chan

Business strategies from the Far East



Asian rulers and commoners place great importance on the classical Chinese treatises on military strategy, the *Bing-Fa* (the art of war), because many believe that all elements of life are interconnected.

Today, insightful American and European executives have read many versions of the Bing-Fa as they have other management-oriented publications. The first written examples of Bing-Fa date back to 12th century B.C. One of the more famous texts is Sun Tzu's *Art of War* from fourth century B.C.

The harmony of the five elements

Sun Tzu asserts that five elements must be considered before finalizing a strategy. These elements deal with spiritual and psychological elements.

- *Element 1* is the moral cause. It rationalizes that a just cause creates the necessary unity of purpose among the leaders and those led. In America, the work force is more likely to follow a leader with just cause or a keen vision.
- *Element 2* describes temporal conditions. Roughly translated it means: To know Heaven is to understand the timing of nature, the timing of uncontrollable elements and this understanding is the knowledge of the soul. Bringing this down to earth, changes and unpredictable political situations dominate the economic landscape, and hence have impact on the dynamics of business culture, yet they operate within a cycle of natural timing. The business strategists try to figure out which cycle is coming or going in order to catch the "optimum wave."
- *Element 3* discusses geographical conditions because each locale has its advantages and disadvantages. Posturing to have an important negotiation take place in your home court gives you the advantage. Imagine having to go afar for an important negotiation and having to wait for the hosts during the final hour before concluding the transaction. Your hosts know that you are under pressure to sign a deal, so they play the waiting game in their home court.
- *Element 4* addresses leadership. The leader must be wise, trustful, benevolent, courageous and strict. In Asian countries, people believe that businessmen lacking these qualities will not receive full support of their people, and in turn, this will lead to low productivity and discontent.
- *Element 5* deals with organizations and disciplines that state that the delegation of authority and areas of responsibility must be made absolutely clear. Although sound in theory, different business cultures often clash with this. Many American businesses are less tightly managed than their Asian counterparts. On the other hand, order and discipline don't necessarily negate encouragement of creativity and individuality.

Sun Tzu's treatises

War is a game of deception, and the ability to mislead an adversary has always been viewed by Asian culture as admirable. Although Americans and Europeans prize openness and fair play, some deceptive chess is often played, so we must understand that ethical distinctions of the word *deception* are cultural.

One of Sun Tzu's first teachings says that *If one is able and strong, then one should disguise oneself in order to appear inept and weak.* In corporate life, making strong motions about your superiority is guaranteed to make you a target.

The next three strategies deal with temporal and spatial distance, as well as greed. They are: *When you are ready to attack, you must convey the impression that you will not attack. When you are close, pretend you are far, but when you are far, you must give the illusion that you are close.* And last, *One should bait the enemy with small gains.*

Sun Tzu teaches us the wisdom of not announcing our actions before they happen. The second strategy deals with keeping your adversary off balance in anticipation of an attack, thereby keeping him on guard and dissipating his resources. The third strategy deals with greed and teaches us to evaluate potential rewards other than the encouragement you get from your host.

You must think about how your products and services are compatible with your hosts' needs before giving away the farm. On the other hand, your adversary or potential partner may induce you into giving away many tangible or intangible assets by baiting you with small gains, all the while focusing on the bigger fish.

Sun Tzu's next four treatises focus on emotions: *If the enemy is well-prepared, strong, well-trained and secure in all areas, avoid a direct confrontation. Create opportunities for victory by arousing your opponent's anger and causing him to take foolish actions. Make your enemy grow proud and arrogant by expressing humility and weakness. And, when your opponent is inactive, give him no rest.*

If you have a small company with a consistent track record and you are bidding against a large conglomerate, you might want to emphasize your expertise and reputation rather than size and stability. In the second example, arouse emotion in your opponent to off-balance his or her logic and look for opportunities. The opposite is true for the next example where you might want to feign humility and weakness to give your adversary the feeling of being superior. In Asia, there's a famous saying that goes, "Silence is not cowardice, rather it's concentrated strength."

Five components to corporate victory

1. Know when to fight and when not to fight.
2. Obtain the support of your work force.
3. Be well-prepared to seize favorable opportunities.
4. Free yourself from interference from superiors.
5. When the time is right, act swiftly and decisively.

A favorite ploy referencing the fourth is to entertain your guests all day and night, or cause enough anxiety to frustrate and exhaust your adversary, then pounce on them, which gives you the upper hand.

The last excerpt is *Victory is determined before the battle begins.* A superior leader does not fight a battle that he has not already won in his mind because he has foreseen all of the possible mischances and calculated a plan for each one.

The last two strategies often get misunderstood. Attack when the opponent is least prepared and least expects it. This is so simple that it can't possibly be effective, but in reality, unrelieved vigilance is difficult to sustain and even the best companies become lax every once in awhile, which opens a door of opportunity.

The second verse, When the enemy speaks peace, he is plotting deception, often strikes a nerve. In Asia, humility is a weapon as well as a virtue, but in America, humility is not a common trait. So remember Sun Tzu's words of wisdom, *When your adversary's messenger is humble in manner and speech and his troops (work force) are simultaneously increasing in number, they are about to attack. When your adversary' messenger is arrogant in manner and speech and the troop's movements appear hasty, they are about to retreat. When the adversary speaks peace, he is plotting deception.* ■

Curtis Chan is president of Chan & Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA.

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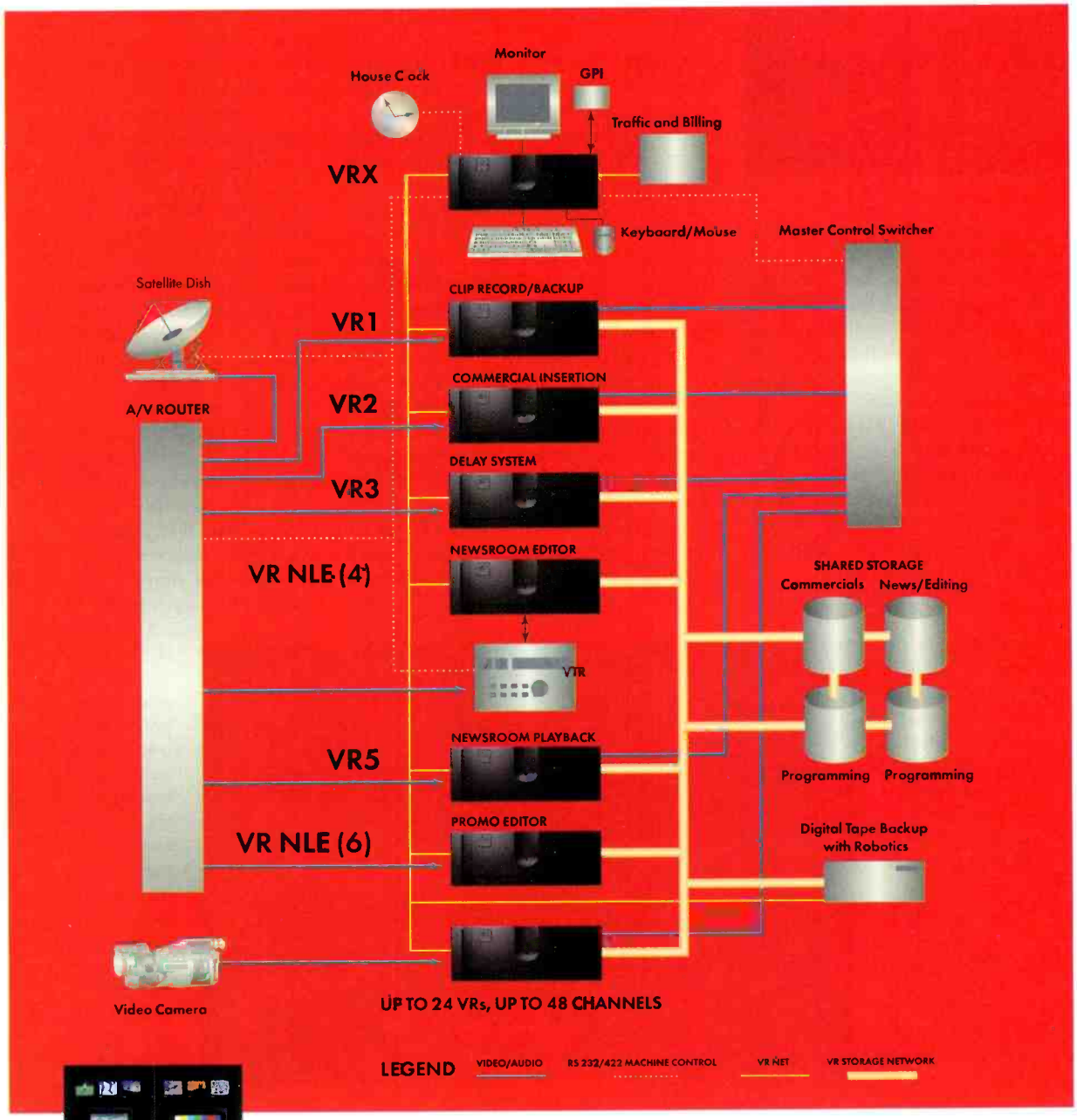
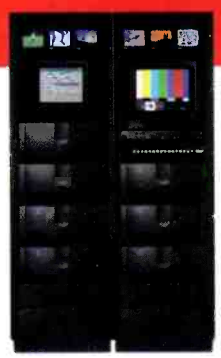
WHY TOTAL REDUNDANCY?





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Circle (7) on Action Card

By Bennett Liles

Field accessories

When you need something that you don't have in the studio, it's usually a case of "Let's put that on our wish list." On field shoots, you *must* have the right stuff with you. To make it even more interesting, there is no "usual" situation in the field. Exteriors become interiors, daylight becomes day-for-night and simple one-mic shoots can turn into panel discussions with PA feeds.

To start with, the most basic field rule is still good shooter-producer communication. Many modern producers have never held a camera or potted up a mic, so the shooter must ask "What is supposed to happen?" not "What should I bring?"

Video accessories

The right hardware for the camera is a fundamental need that is overlooked with amazing frequency during hasty loading. It's a good idea to lock the head to the tripod, lock the camera to the head and attach the pan handle. If it all stays together and upright, *then* disassemble and load.

When using rented gear, always make sure the tripod has all three pins and pads on the bottom and that all three legs lock securely. All too often, gear that was damaged on the last shoot is not caught and fixed by the rental house techs until the next user calls frantically from the location, having just unpacked and seen this equipment for the first time. One tripod leg that slowly lets go can cost you a $50,000 camera and lens.

Of all on-site conditions, lighting is the most fluid. On exteriors, a change in cloud conditions can mean reaching for fill light. Flags, scrims and color-correcting gels are also a must. Extra C-stands will be needed for all these widgets you didn't think you'd have to use. Sandbags for light stands will save lights *and* attorneys' fees.

Look at the power connectors on all lighting gear. Can you plug it in anywhere near the place you're going to use it? Make sure to have the right power adapters between stage plugs, Edison and pigtails. If there is no available power, batteries become a constant concern. Bring more than you'll possibly need and make sure they are fully charged. Of course, for the nickel-cadmium batteries in common EFP use, the term "fully charged" is relative, thanks to their memory effects. This is one reason to bring more than you think you'll need. When using batteries, a good field shooter will shepherd power carefully, cutting off batt-lights between takes and going to standby mode on the camera.

If a teleprompter is used, it will often be supplied by a separate vendor who specializes in prompter setup and operation. This means that the shooter on whose camera the prompter may be mounted will have to compensate for the front-end load by having counterweights handy. Be ready for the prompter vendor/operator to hand you a power plug expecting the shooter to know what to do with it.

The well-equipped field kit is heavy on accessories.

Audio accessories

On the audio side of the shoot, the vast number of forgettable trinkets make the video and lighting look like a snap. Microphones are a principal take-more-than-you-need item. For interviews, one mic per track is appreciated by many post people. Audio phase reversers can come in handy especially when using mics with PA feeds. Line-to-mic pads are often needed and the adjustable ones are the best idea for those situations where a "line-level" PA output turns out to actually be -20dBu or so.

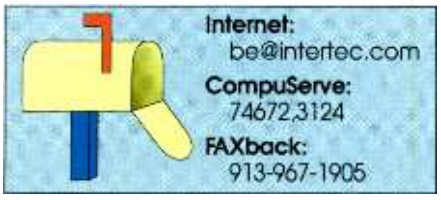
Impedance-matching transformers should also be a part of the audio gear. You may still come across an occasional 70V PA system with no other output available. For any type of PA feed, audio isolation transformers and ground lifters are necessary items. Every field shoot also should have a wide assortment of adapters, including RCA/XLR, XLR/quarter-inch, XLR/mini-phone, RCA/BNC, BNC barrels, RCA splitters, XLR splitters and XLR turnarounds (male and female). Even a power isolator, though bulky and heavy, can make you the envy of the press corps.

If you make audio adapters up in-house, take care to properly label them. Color-coding them is also a good idea. To keep any of these tiny widgets useful, however, it's critical to have a proper storage system for them. One cheap trick is to use a foam-filled case with a pattern of holes cut into the foam to fit each small accessory and microphone. These also serve as equipment lists, because the operator can tell at a glance if any items are missing. The foam protects and identifies each item.

The more luxuriously stocked field kits will also contain a battery-operated mic pre-amp and headphone amplifier. These can overcome long mic lines and help quickly trace audio trouble. By the way, don't try to save money on a mono mixer. There have been too many times that, in a complex mono situation, the left channel is used for one thing and the right for something else.

Finally, only Carl Sagan could tell you the number of things that gaffer's tape is used for on field shoots. Let's just say that if you show up with nothing but a roll of it in your hand, you'll be better equipped than having everything else and no gaffer's tape. ■

Bennett Liles is an audio engineer at Georgia Public TV, Atlanta.



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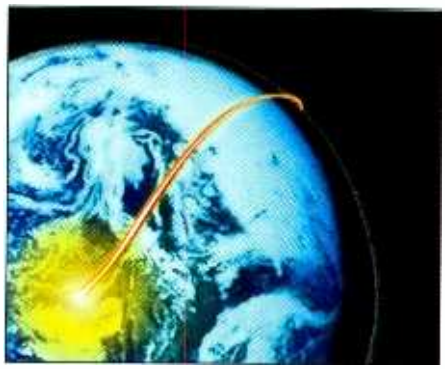
Circle (8) on Action Card

By Steven M. Blumenfeld and Mark Dillon

Security: An accident-proof car would be an armored tank



Physical security is a familiar issue to all broadcast engineers. We are constantly concerned with keeping people out and keeping hardware in our facilities. The level of physical security is based on the value of the items we are trying to protect. This is easy to do, we count up how much money we have spent on equipment and install a system appropriate to protect our investment. We use alarms, pass cards, sirens, window bars, cameras and even hire guards. Our management can easily understand this cost.

When your network was ramping up, its security was probably of little importance. You had relatively small amounts of data accessed by few users. Now, your systems have grown up and your data is mission critical — and you must protect it.

Protecting your data

Many new and vexing issues surface with data security — it is the nature of data networks to make it easy to move information. Yet many security measures attempt to block this flow.

A wide array of technologies promise to make your network secure, but unfortunately, they can also be a great inconvenience to those who are entitled to use the data. Remember, an accident-proof car would be an armored tank. Therefore, it will be your job to reach a compromise that allows the level of security you need, while at the same time allowing legitimate users to do their job with minimal inconvenience. And, it is often these same people who compromise your best laser-retinal-voice-recognition star-wars system; most data breaches are human problems, not technology deficiencies.

• **Rule No. 1:** Manage the expectations of management and staff. Try to secure as little data as possible from as few people as possible by determining what really needs to be protected, and from whom it needs to be protected. The less that needs to be secured, the easier it will be to provide protection. Conversely, the more data security you need, the harder it can be for legitimate users to access the information.

Define the kind of security you are trying to provide. The two basic types of security you will need are *privacy* and *integrity*. For privacy, some things are easy to define as needing security. For instance, your accounting systems need to be secure from unauthorized eyes. You do not want all of the employees in the company to have access to the payroll, do you? On the other hand, you might want everyone to have the ability to access common contracts, shipping data, vault/tape library data, schedules, etc.

On the other hand, billing records and videotape archives have little intrinsic value except that they must be accurate and not subject to loss. You don't care so much who sees them, but you do care if they get lost. This type of integrity depends upon an adequate backup policy. Backing up and rotating data off-site on a regular basis is critical to maintaining the integrity of your records and archives.

• **Rule No. 2:** Manage the behavior of staff and management. Employee E-mail is too numerous to secure or encrypt individually, so we rely upon secured systems. The systems are commonplace and not difficult to deploy — the leaks occur at the desktop by users who leave their systems open on the desktop when they're at lunch.

The key to every secured environment is knowing the identity of every user — the password. The lock to every secured environment is the rule-based system that permits or prevents access to specific information or areas.

Passwords are easily compromised. Individual users must be reminded of common password abuses: don't write them down or leave them in or on the desk, and don't use kids'/wife's/husband's names or birthdays — forward or backward. It is a good idea for you to require that passwords be changed on a frequent and regular basis.

• **Rule No. 3:** Pay particular attention to threats from the outside world. We all know how to physically secure our servers — you put them in a locked room, use lock-down cables, rack mount them and only issue a limited number of keys.

Until recently, your network was isolated from the outside world. Today, the Internet may make that hard drive on your desktop as accessible from Naples as from your keyboard. Increased work at home and traveling laptops demand that you open up your net to the outside world. When this occurs, physical security will not suffice and basic precautions can be taken.

A dial-back modem is a good idea. This device is a modem that has a rule set, so you call in and log-on, but you are immediately disconnected. The modem then looks at the numbers in its rule base and dials back only authorized numbers. This can be a bother if the user makes frequent dial-ups from home or is calling from yet another Holiday Inn.

Next, you can use SecureID cards. These devices are the size of a credit card and have a readout that changes every minute. You use this changing numerical sequence as your password. The changing password allows for a secure log-in and is only minimally inconvenient.

Once someone has logged on, allowing access to some data and not to others may be important. This is done with firewall software. Firewall software is a rule-based system that allows or disallows connections at the data packet level.

Tailor the system to fit your operation

Whatever combination of devices and systems you choose to deploy, they are not plug-and-play. They must be tweaked and tuned to meet the trade-offs of cost, convenience and security (pick two out of three) that your user environment demands. And like so much of what you do, when it's working right, nobody notices. But when it's not..... ■

Steven Blumenfeld is vice president of technology and studio operations, and Mark Dillon is vice president, on-line services, with GTE, Carlsbad, CA.

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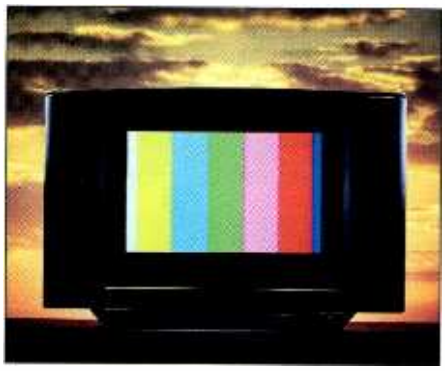
By Louis Libin

There goes our spectrum piece by piece



Station personnel who have been following the recent legislative initiatives regarding spectrum auctions, know that there is a real possibility that broadcasters may lose a portion of our broadcast spectrum. This may come at a time when we are desperately seeking to assign each existing broadcaster a second channel for digital ATV service.

Threat of losing spectrum

The threat of losing portions of the broadcast spectrum may come about in one of two ways. The first is a new bill introduced by the House Telecommunications Subcommittee chairman Jack Fields, which proposes to auction off all existing NTSC vacant noncommercial broadcast channels to other users.

The auction's proceeds would be used to fund public broadcasting. Marketplace implications aside, this bill would cause serious disruption in the ATV allotment/assignment process, resulting in a shortage of ATV channels in the major markets, and additional interference for NTSC and ATV stations. This initiative would seriously jeopardize the FCC ATV implementation timetable and could well disrupt implementation plans altogether.

The second area of concern is that spectrum repacking, in some form, will occur. The reason repacking may occur is due to the perceived value of spectrum, whatever and wherever it may be. Spectrum repacking will result in the addition of interference into our channels, especially ATV.

Repacking is defined as a sort of spectrum compression. It is a scenario where the use of certain TV channels will be eliminated, forcing existing and new spectrum users to relocate to a more crowded environment. Though there is a greater interference immunity of digital television compared to analog NTSC, with the second-channel implementation, the number of channels in the same spectrum is still doubled. There is a definite penalty when spectrum is repacked because of the likelihood of an increase in interference, regardless of the repacking scenario.

Many repacking plans will be submitted and studied. Each repacking plan needs to be analyzed for its local and global interference penalties to stations and markets. As in all interference scenarios, the major markets are hit the hardest.

Why would broadcasters support repacking?

There are some reasons why broadcasters could welcome the concept of repacking. The reality is that the extra channels aren't going to lie fallow, and the government is going to auction them off to the highest bidder at the time when broadcasters will be crawling out from under the cost of building their new digital stations. Either more TV stations are going to come on the air, or the channels will be used for other services.

More TV stations mean more competition for scarce advertising dollars. On the other hand, an intermixture of other, incompatible radio services within the TV broadcast channels, even with appropriate guard bands in place, could lead to massive interference problems. The worst thing that could happen would be a mixture of both scenarios, which is exactly what is likely under a spectrum auction of the recovered channels without repacking.

There are some reasons why broadcasters could welcome the concept of repacking.

Another reason why broadcasters may support repacking early in the game is to avert the possibility of the double disruption after NTSC is shut off or having to switch ATV channels once they are already on the air. However, it is true that repacking could mean a double disruption of TV service for some stations, but bear in mind that there will be a 5- to 15-year transition period between the two disruptions. The disruption due to repacking will have much less financial impact on broadcasters than the transition from NTSC to digital television, although it will happen over a much shorter time period.

Also keep in mind that if broadcasters are moving to allow a new service to occupy their spectrum, the new users in the industry may be forced to bear the financial brunt of the displaced user. The repacking will not require all stations to change channels, and it can be planned for in such a way as to minimize its impact.

The only equipment items that will be affected will be the transmitter and the antenna. In some cases, the transmission line system may also need to be changed or modified to ensure that flange reflections in waveguide or coaxial systems do not cause problems on the repacked channel. Both waveguide and coaxial systems can be properly designed if both channels are known before the initial ATV installation. By making the initial digital transmitter purchase with the eventuality of repacking in mind, the financial impact can be minimized. There is a trade-off for broadcasters: repacking may pacify the commission, but provide for more users with smaller coverage.

Repacking scenarios

The difference between the various repacking scenarios is determined by the amount of spectrum that needs to be recovered. For example, if no spectrum needs to be recovered, then VHF Channels 2 through UHF Channels 69 can be used. If the spectrum recovery target is 114MHz or, in other words, 19 6MHz channels, then the 12 VHF channels are an insufficient number. These scenarios are being evaluated for their potential toward accommodating ATV and NTSC channels.

Possible broadcasters position

Given that repacking may happen, the next issue is what block of channels will the TV stations be repacked into? Some believe that the loss of the low-band VHF channels to TV broadcasting is inevitable. Loss of the high-band VHF spectrum is also quite likely. My best guess is that the TV stations will ultimately be packed into the middle of the present UHF band, i.e., UHF channels 21-60, or something close to that.

The VHF channels, the lower UHF channels and the upper UHF channels all will be auctioned and reallotted to other services. I base this conclusion on the fact that Channels 14-20 are already used by land mobile services in some markets, while Channels 70-83 have already been taken over by land mobile services, and there is constant, tremendous pressure on Congress from land mobile interests, such as police departments, business radio users and others, for more UHF spectrum.

Aside from the added interference for broadcasters, there are some engineering

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advantages for repacking into the mid-UHF channels. First, if all TV stations are in a single band, there will be economy-of-scale benefits in the design and manufacture of receivers, transmitters and antennas.

The low-band VHF channels are troublesome for NTSC television. In fact, there are four main reasons why the FCC is planning to look carefully at specifically reallocating the lower VHF TV band:

1. Higher impulse noise power present at these frequencies, natural and man-made, especially near urban areas.
2. Co-channel interference from sporadic-E skip and inversions. Service reliability in terms of variability will most likely be impaired.
3. Availability of these channels for ATV allotments.
4. Cable converter boxes normally use Channels 3 and/or 4 for modulation to the receiver. This problem would not go away under digital broadcasting; it would simply manifest itself in a different way.

Some believe that the loss of the low-band VHF channels to TV broadcasting is inevitable.

The VHF channels cannot accommodate all of the digital stations, so the choice would be between repacking into two bands or one band. There is little doubt which makes more sense and which course the policy-makers in government are going to take.

We are attempting to redesign TV broadcasting with our eyes open. Broadcast television is presently scattered over four different bands across 750MHz of spectrum. The existing NTSC allotment plan was implemented in two stages as the demand for additional channels paralleled the development of transmitter technology, then readjusted under pressure from the land mobile interests. This time around there is the possibility for broadcasters to be forced into a cleaner TV allotment plan. But not at the expense of new interference to either our NTSC or ATV service. ■

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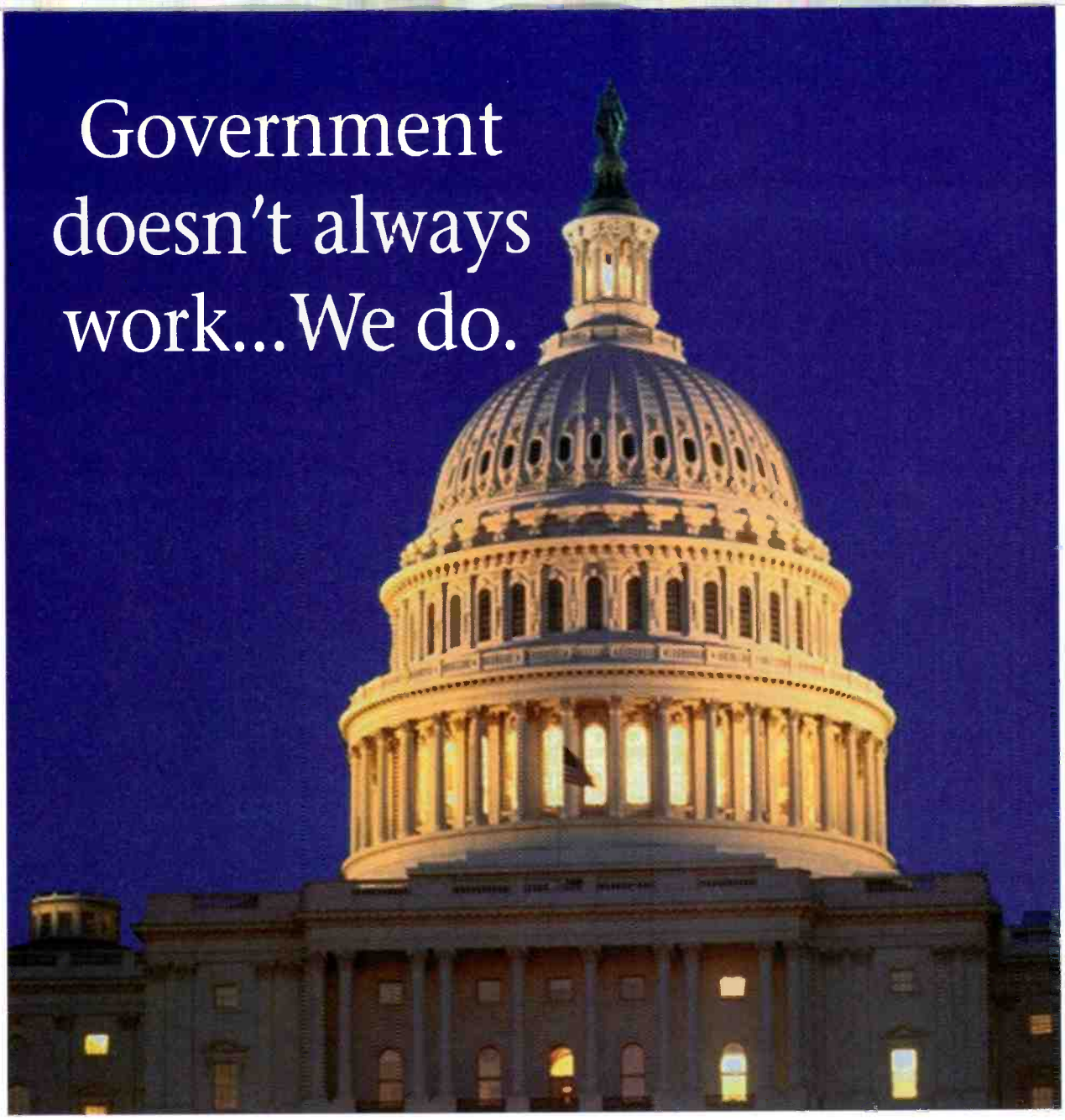

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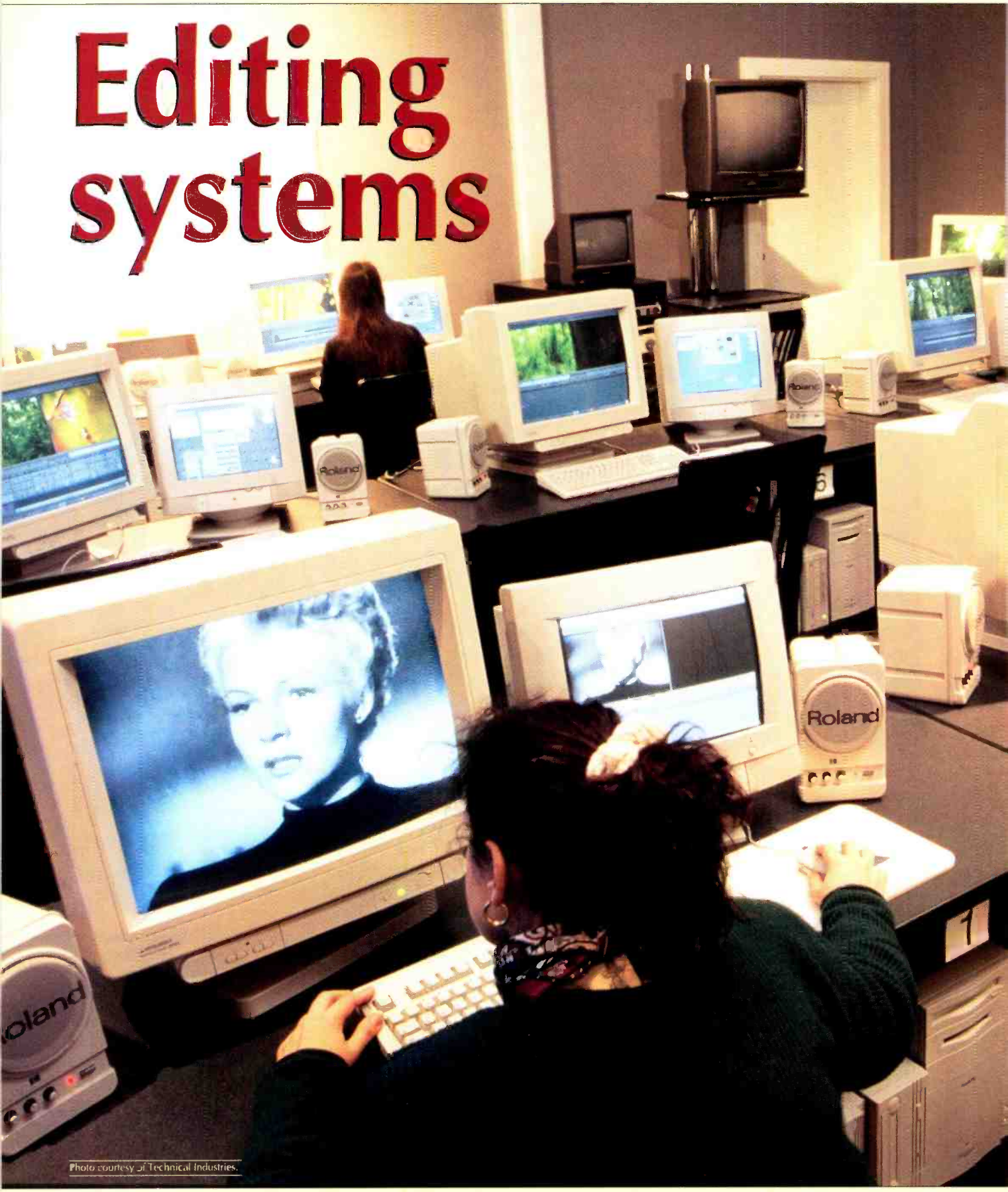

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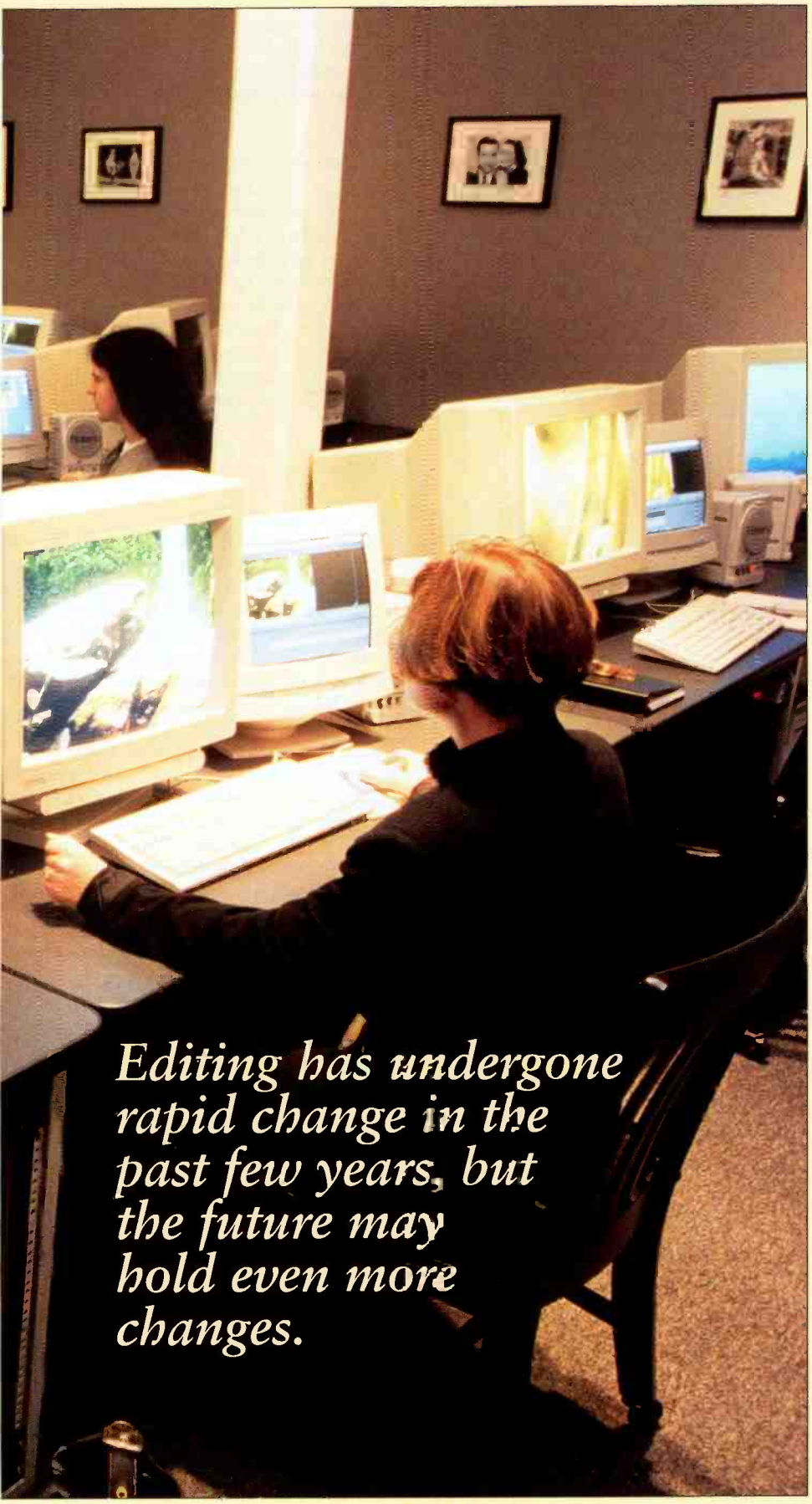
By Rick Lehtinen



The Bottom Line:

As technology continues to provide new editing tools, the choice of hardware capable of producing a finished product has grown. With so many system choices, storage space, features and possibly even price may be less important than how well the editing system fits the editor's style. The "best" system may be the one that fits the operator's personality. $

Editing technology was one of the hottest topics on the NAB convention floor this year. While desktop was certainly the most visible, traditional methods were also abundant.

There still remains strong controversy as to the "quality" issue when it comes to non-linear methodology. For some, the only way to edit video is on tape. I remember talking to an editor at Skyview Video in Chicago. Although she used a desktop system, it was only to prepare the EDL. The final product was always done from tape. From her perspective, tape was a long way from dead.

In addition to the quality issue, operator interfaces are always of concern. Desktop technology affords manufacturer and user the opportunity for new ways to do old tasks. In this month's Cover Story, we look at some of the ways editing has changed in recent years. More important, we examine what lies in store for that important, but often unappreciated, part of the creative process — editing.

Three great legs form the base on which editing science is built.

1. *Paradigm* is the overarching pattern, the work flow, the way we get things done.
2. *Machine control* is the means by which the tools talk to each other.
3. *User interface* is the means by which we direct the tools.

As the industry has progressed, each leg has become higher and more refined, but the nature of the work, and the fundamental ways in which it is done, have more or less stayed put.

The world, however, has not. Advances in compression, telephony, wireless communication and computers have shortened the distance between nodes on the video network. Recall that during the Gulf War, allied commanders had to request news correspondents not to be too specific regarding the locations of what they were seeing, because the enemy was using live reports to sight artillery fire.

It's a live-wired world we live in, but production systems are reminiscent of earlier eras. But there is hope. By studying the path editing has taken, we may gain insight into where it is bound. We will also be better able to size up which new systems are revolutionary, and which are just more of the same, with flashy edgings.

The paradigms

Video editing is cutting and pasting. The industry traveled a side track for awhile, taking elaborate means to accommodate the linear nature of videotape, but the path from image acquisition to image broadcast or distribution still centers on keeping what's good and taking out what's not. Contrast this with computer graphics, which, more like word processing, involves creating video, as well as excising it.

The means of editing are varied and change over time. In the early days, video editing was machine-to-machine. Editing by splicing was practiced for a while, but the difficulty of it, and the fact that the splicing tape kept gumming up the VTRs, quickly ended the practice.

In machine-to-machine editing, one VTR plays, the other records. The source deck is advanced between edits to the next desired segment. The trick is to start and stop the record deck precisely where you want the new material to take up and leave off. It's quite a trick unless the machines are perfectly synchronized, otherwise the in and out points will not align and the edit will pop and glitch. In the early days, when TV transmitters hiccuped for lack of stable sync signals, a bad edit could knock you off the air. Nevertheless, the machine-to-machine paradigm was perfected, and continues to this day.

As gen-lock science improved, system timing became easier. This opened the door to using more than one source machine at a time. With one machine as the A roll and another as the B roll, a switcher could cut, dissolve or mix between the signals. Generally, such multimachine edit setups were called A/B roll systems, and this became the paradigm on which much of CMX editing was based. It continues to this day, and a branch of it has evolved into desktop video. Several VTR manufacturers provide playback decks and edit recorders in each model/price grouping, to make it easy to assemble A/B roll systems in several price ranges.

Enter digital

The digital recorder enabled users to re-record the same video several times with minimal generation loss. (Generation loss occurs when a tape is recorded, then removed from the record deck and played back in the source deck over and over again, until the accumulated noise degrades the picture. Digital is not as susceptible as analog to such losses.)

Digital also offers the interesting ability to read-before-write. In certain situations, you can play back a signal, pass it through a switcher or mixer to add an effect and re-record it on the same pass. With tape, this requires judicious care, because the underlying video track is erased by the subsequent one. However, many disk-based systems, either optical or magnetic hard-disk drive, also offer this capability, but allow non-destructive read-out. Digital recording is widely deployed and growing fast, and is the root of most non-linear editing systems.

With digital disks comes a caveat, however. The acquisition material, or field tapes, must be converted from analog and transferred to the disk recorder. Even if the source material is digital, it must still be transferred to the disk. Both processes require time. In an increasingly fast-paced production environment, time is a precious resource.

There are at least three ways to deal with this transfer. The first, and worst, is to play back the source tapes through a digital encoder onto the disk recorder. This approach requires a lot of equipment, most of which is unused between transfers. And to make it worse, it takes considerable time. Operators must sit around while the transfer is under way.

The second way is to speed up the transfer. There are two current approaches. One is to use a digital tape, such as DV, in the camera,

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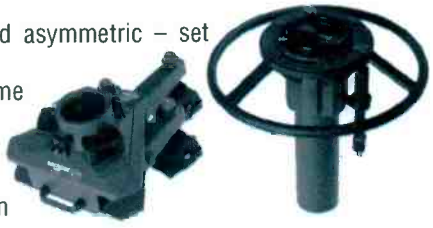

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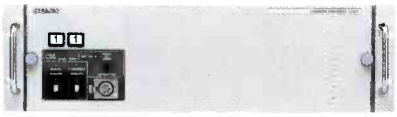

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One of several edit suites used for training at Savannah College of Art & Design. The system combines linear editing with traditional VTRs.

to eliminate the analog-to-digital step, and then to transfer the footage to the disk-editing system at greater-than-real-time speed. Another tack is to replace the tape in the camera with a removable disk subassembly, such as a Winchester drive. When the disk arrives in the newsroom, it plugs directly into the disk-editing system, where it can be accessed immediately without further transfer or encoding.

Both of these systems offer strong advantages over transferring and encoding field tapes, but both systems require substantial new capital investment. An emerging system offers much of the advantage of high-speed transfer, but allows a facility to use existing equipment. The trick is to save time in transfer, by avoiding it. Field tapes are copied onto the disk system as they are edited. In this way, only the material to be used is transferred to the disk. Several new desktop systems and news-editing systems offer this paradigm.

Server-based editing

Server-based editing resembles digital disk-based editing, except that files from one user can be instantly available to another. Facilities need only to endure the time penalty of transfer and digitizing once. Thereafter, all potential users can access the material simultaneously. For instance, assume an important piece for the five o'clock news is under construction in edit "A." Via the server, the producer in edit "B" can start putting together the same story for the six o'clock news, accessing the same digitized elements.

Not every facility puts out back-to-back newscasts. Many that do, reuse stories with minimal updating. There are, however, a number of facilities that not only produce multiple newscasts, but provide separate news programming to cable channels or that sell news to other stations. If Internet broadcasting increases in importance, it may begin to consume editing resources as well. With this many hands fighting for a field tape, conflict is inevitable. An economic advantage of the server-based facility may be that a multitude of users can cherry pick off the main storage system, without disrupting the work flow or cloning the primary news organization. This may help keep ancillary news services in the profit column, rather than allowing them to become cost centers. However, with all of this footage going into the server, storage space must be carefully sized and managed to ensure sufficient room on an ongoing basis.

Network editing

Of course, to eliminate transfer time altogether, you could simply expand the facility's remote production capability. This would, of course, require a geometric expansion of a microwave resource that is already overstretched or the development of a telephony resource that does not yet exist. Nevertheless, treating the question, "If we could do it, what would it look like?" may provide some insight.

In the first place, going live constantly provides a fine opportunity to make mistakes. Editing would become not so much a means of eliminating undesired shots, as it would a chance to clean up our image.

Second, we would begin to appreciate the value of stored footage. A 100-car pileup at 5:00 p.m. makes vivid live material at 6:05. It may still be worth going live at 9:00 p.m. or 10:00 p.m., when all that's left are street sweepers. Without referencing earlier footage, however, the later package would come up short.

Finally, the ability to go massively live may mean going live less. Some live shots today seem more designed to market a station's capabilities than to convey information — going live to the airport in Denver, for instance, because there is an airline-related story out of Salt Lake City. When any station, or for that matter, anybody, can easily obtain live imagery from distant cities, the value-added of the local news provider will shift back indoors.

User interface

When working with a tool, you deal with a user interface. Hammers have handles, buckets have bails, electric can openers have little levers or buttons. Over time, the interface evolves, especially when the underlying technology changes.

Film editing was performed directly on the medium. You cut, lifted, spliced and glued the film until you got it right or you ran out of time. As videotape entered the scene, however, it quickly became apparent that splicing would not suffice. Rather than working directly with their medium, editors became dependent on VTRs to transfer imagery from one device to another, and to determine the location of images on tape. (If you can decipher the images on a magnetic tape by visual inspection, you are an oddity.) Early VTRs had buttons for their control. Buttons, not gloves, became the new user interface.

Early VTRs were large, like washing machines. To do serious editing required a good pair of sneakers and above-average physical endurance. Because it was nearly impossible to see both monitors as you ran and stretched to push the buttons, it was greatly preferred to control the machines from a sitting position, where all of the monitors could be seen at once. A preferable location for this control center was near the switcher. Thus, the remote-control panel was born. Remote control was little more than a button extender, but it represented another change in the user interface in that control of several devices could be concentrated in one place.

Pushing buttons, however, required an accuracy in timing that was complicated by the machinery not starting instantly, but rather winding up to speed and achieving servo lock. The required preroll varied from machine to machine, and sometimes with the season. Even after preroll was functionalized with its own button, the VTR machinery would not always lock up in time,

One of several desktop linear/non-linear hybrid editors designed for use in professional editing applications. (Photo courtesy of FAST, Foster City, CA.)

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Deus Ex Machina

Early machine control systems mimicked the remote-control panels, save that a series of latches, gates and relays that pressed the buttons, not the operator. Because most early control panels consisted of numerous buttons wired in parallel with a common ground, computer interfaces that controlled these machines were called parallel interfaces. In a parallel interface world, modifying each VTR for computer control was often a labor of love. The wiring was intensively customized.

Later-generation tape machines operated over standard RS-232 and RS-422 interfaces. These so-called serial control tape machines communicated between the control panel and VTR using a series of proprietary command words. Decoded at each end, the words indicated status of controls ("I'm a button and I've just been pushed") and activated indicators ("servo-lock achieved, turn warning light off").

Today's machine control systems use not only primarily the RS-422 standard, but in many cases, they use a common language. The Sony command language, for instance, was designed for one brand of VTR, but has been widely adopted for a number of devices throughout the industry.

We have thus described the protocol of machine control. Now a few words on its hardware.

Machine control hardware

As stated, early video-editing systems made a home run from the remote-control port of the VTR to the controlling computer. The computer was rarely sophisticated, but rather was more of an elaborate state machine, which performed the operator's selected function when the time-code counter reached a certain number, plus or minus an offset. Much greater flexibility in editing came about as soon as manufacturers started using more powerful industrial mini-computers, such as the PDP-8 and PDP-11.

To ease the computational burden, the computer actually communicated with an intelligent control device located near each VTR. The computer ordered the controller; the controller interacted with the VTR. In this way, the editing system needed to track only activities related to the edit, and not attend to the minutiae of each machine. This system was the root of most sophisticated videotape editing systems for several years. Although costly, these powerful systems gave a speed and flexibility to multimachine editing that is still the standard to match today.

Enter the PC

PCs using 386 chips and higher have more than enough horsepower to control several videotape machines. The popular PC languages, however, are poorly adopted to the task. In addition, a lot of the traffic that travels down the serial remote-control bus is not critical to directing edits. One company, Videomedia, early on developed a simple ASCII language with which to command machines, and then interconnected machines on a simple local area network (V-LAN). Each machine was provided an intelligent interface module, which interpreted the simplistic ASCII codes to whatever the specific VTR required to perform its functions.

In the early days, each make and model of VTR required a specialized interface. This was later refined to a series of cards serving families of PCs, and later to a universal card, to which you could download appropriate software. The current V-LAN uses universal cards that automatically identify the connected tape machines, and then configure themselves to serve it. This keeps costs down, and provides manufacturers of many current and envisioned video tools a standard control interface to design to.

Is intuition right?

One advantage of computer-based editing is that it cuts down on the number of people in the loop. Fewer workers means tighter creative control. However, tightening the loop between the editor and the media too much may have an undesired effect. It impedes collaboration.

Consider that in the film days, an editor hunched over a splicing tool and cut and pasted. The finished product was screened, most likely in a small theater, and changes called out to the editor who sat in an annoyed funk in the back of the room as hotshots of lesser brilliance ripped apart his or her work. Collaboration was high, however, partly because the editing and its approval were separated from each other by time and distance.

The same could be said for the splice era of videotape, except that a producer could watch the tape as it played back, and suggest changes immediately. In today's post house or ENG editing bay, however, those empowered to approve footage or order changes can hover over the editor like kibitzers in a checkers match. Changes, if needed, can be requested immediately.

As the march to off-line pre-editing followed by on-line finishing progresses, the separation begins again. The off-line editor will likely be a creative person, one who works alone at an individual workstation, and likely at odd hours. The on-line editor, armed with the latest in high-speed equipment, will likely be a punctual perfectionist, with a technical streak, akin to the negative cutters in the cinema industry.

It was joked by one expert, that in the near future, the off-line editor may knit you a sweater that is wild in color, but that does not fit, while the on-line editor will knit a sweater with stitches of the greatest precision and accuracy, but it would all be of the same color. ■

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and the edit failed.

To prevent this error, supervisory systems evolved that ensured that "all systems were go" prior to committing an edit. If not, these systems could sense the impending error and abort. This represented an additional change to the interface, in that a degree of supervisory control was transferred to the equipment.

Of course, one remote-control panel per VTR made for a multitude of buttons. Soon, new user-control surfaces developed, in which buttons were delegated to controlled machines, not hard-wired. This button sharing, effectively a time-multiplexing of controls, was yet another change to the user interface.

Control of three or more VTRs, as well as the mathematical rigors of time code, soon made direct human control of editing VTRs impractical. Computers were well adapted to this work, however, and users quickly adopted them. Doing so, however, complicated the interface issue. There were now two branches, computer-to-VTR (machine control), and human-to-computer (human interface).

PC editing systems

Once people started editing via computer, everything changed. In the first place, the equipment was no longer specialized to the video industry, but was adapted from elsewhere. As a result, some of the fit was good, some uncomfortable. The immediate upshot to adopting computer control for editing was a tremendous flexibility in user interface. Today, there are editing systems that use CMX-style keyboards on which users type their commands. There are systems that

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capitalize on the graphical user-interface (GUI) environment. There are even hybrid solutions; keyboards that plug into a computer, but resemble an edit controller.

For each system, there are advocates. Typists claim that their systems are fast, in that commands can be learned by touch. Furthermore, keyboard macros allow users to quickly customize frequently repeated operations. Graphical interface proponents claim that their systems are intuitive, in that the clips can be sifted and sorted like strips of film. The hybrid systems, however, seem to capitalize on both. The newer control surfaces offer faster, more video-relevant movement, the screens show clips and timelines. Each camp has its advocates, some of them fanatics.

And within each camp, all is not quiet. Users of empirical interfaces, those on which you type or move buttons, seem to be content with learning the system as provided. Users of intuitive systems, however, quickly divide themselves according to work habits. One argument claimed that Lightworks was more natural because it allowed you to specify an operation, such as a lift, and then designate the in and out points. Avid, on the other hand, required in and out points first, then allowed users to specify the function, in this case, lift. In some future day, designers might realize that left brain/right brain functions, or personality styles, may have as much to do with selecting a system as price. For now, it's probably best to consult the people who will actually use it before you buy.

Interface of the future

As editing crawls into the computer to stay, designers will likely adopt, or at least experiment with, whatever user interface is thrilling the computer industry. Speech recognition, for instance, had a short debut in video editing a few years ago, but was retired without fanfare. As fuzzy logic software allows speech recognition to make strides in the computer market, expect to see voice control do a reprise. Still unanswered: How to keep the sounds on tape from triggering the editor? Imagine making a tape about news editing, where voices on tape falsely trigger the editing system making the tape. Wear headphones? Unlikely, for the same reason that they are not often used today. Rewinding VTRs are not fun to listen to.

Virtual reality (VR) holds some promise for the editing environment. The editor could immerse in virtual clips and images, which he or she could then assemble with a wave of the arms. The paradigm would be close to film, just require a lot in terms of hardware and computer resources. VR would hold particular appeal when creating content for stereoscopic video displays.

It's probably best to consult the people who will actually use it before you buy.

The strongest new technology for video editing might not be based in video at all. Integration and automation of adjunct elements could speed the editing process by hurrying along the things editing waits on. One new newsroom system stores pad footage on either side of desired footage, and then rolls in more or less of the pad, depending on changes that develop in the script.

Editing, the art and equipment of combining multiple images or streams of images into a unified whole, has been a part of this industry since Thomas Edison made his first bad take. The fix in that day was to cut away the bad and paste in the good. Most of electronic editing has been bent at the same task. The means have changed since then, but the process remains the same. In an Internet-connected, webbed-wired world, that may be comforting. ■

Rick Lehtinen is an analyst for In-Stat, a multimedia research firm in Scottsdale, AZ.

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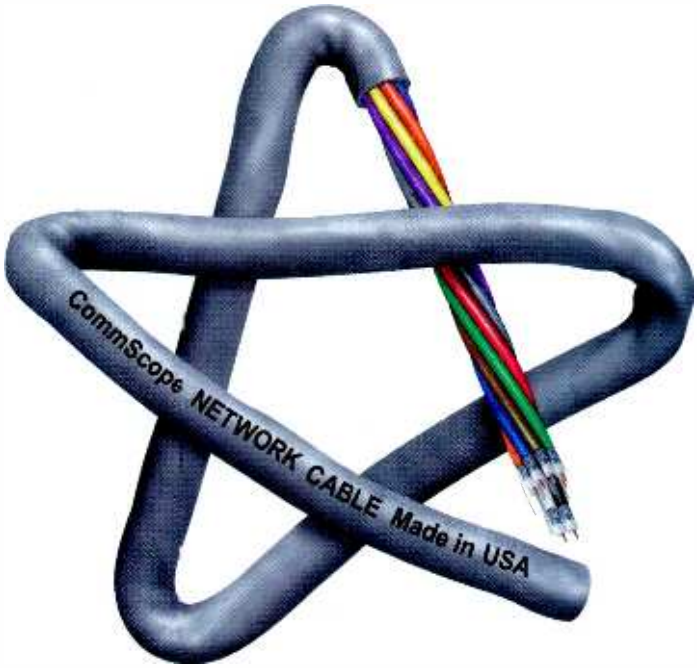

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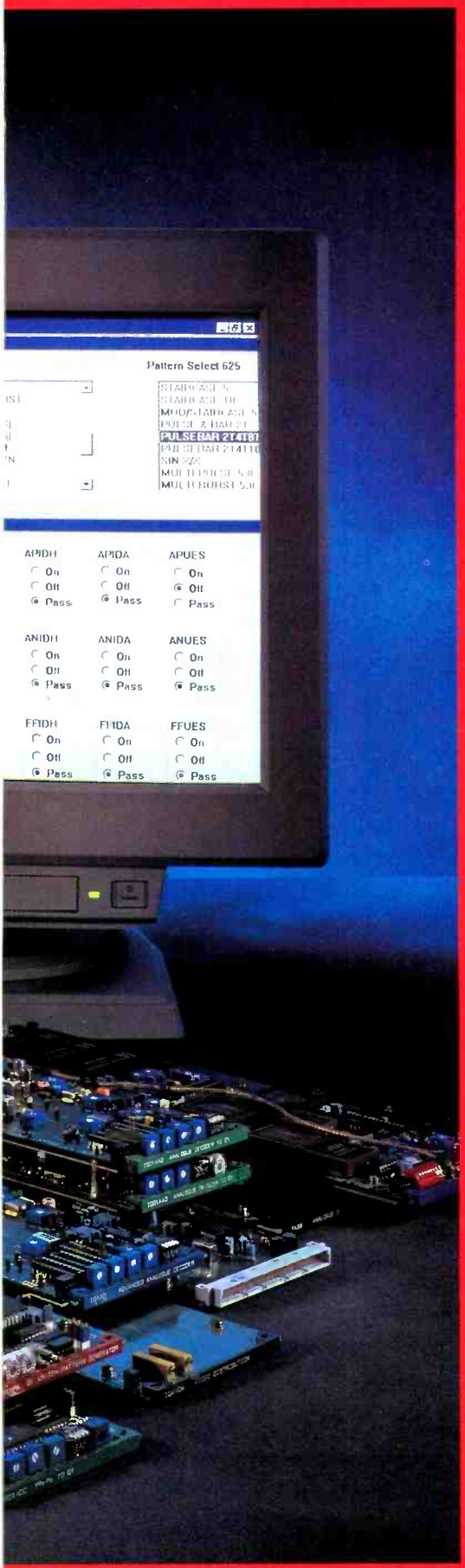

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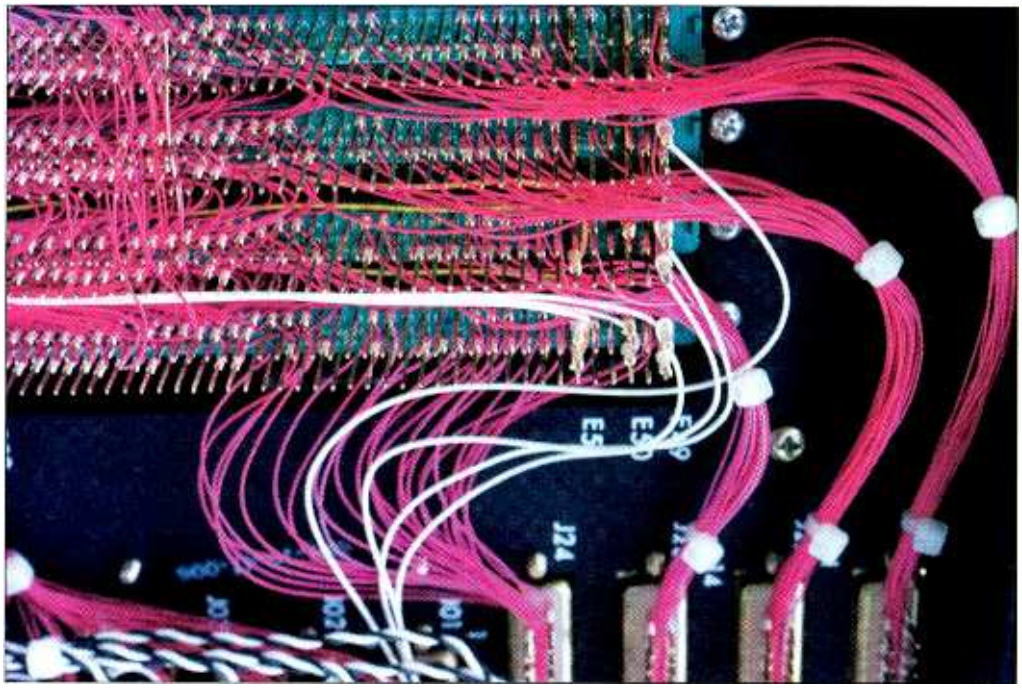
By Jerry Whitaker

Routing technology



Technologies borrowed from the telcos promise to reshape audio/video routing.

The Bottom Line:

Routing switchers, as mundane as they appear, are at the heart of a facility. By examining the purpose of the routing switcher, in the light of new technology, you could arrive at an entirely different set of equipment capable of performing the required task. Implementing the new model may not be possible yet, but in the near future it may not only be possible, but required, to future-proof facilities well into the next century. $

The routing system of a TV station or video production center is the hub of all activity at the facility. This central element, more than almost any other single piece of equipment, defines the operating paradigm of the facility. Because everything is built around the router in a large facility, changing the system is a major undertaking — one that no manager wants to do any more often than absolutely necessary. The requirements for flexibility in configuration and upgradability in design are important. Furthermore, in order to maximize the useful life of the system, the type of router technology used is a critical design element.

Much has been written in this magazine during the past few years on routing system technology. The push from the equipment standpoint has been multifaceted, including:

- Faster switching and more control over switching events through implementation of improved control systems;
- Redesigned, more intuitive user interfaces;
- Greater maximum signal-handling capacity;
- Expanded input/output format options;
- Analog/digital hybrid configurations; and
- Reduced physical size of the switching chassis.

These trends are important for end users and will accelerate as stations continue to demand better, faster, cheaper products.

As we look toward the beginning of the next century — now less than four years away — it is clear that the video center in general, and the routing system in particular, may be due for a complete rethinking. Most of this reassessment will be driven by free computing power.

Digital — the driving force

Microelectronics has played a fundamental role in shaping the entire communications industry. In a business where changes occur frequently and dramatically, the constant themes that have persisted are miniaturization, greater speed, reduced power consumption and reduced cost. These effects have increased the demand for microelectronics in all sectors of consumer, industrial and military products. Related advancements in manufacturing have enabled these devices to be produced in high volumes, significantly reducing the cost per device. In turn, the lower cost fuels future demand, which pushes the industry for further miniaturization, higher volume manufacturing and higher performance.

The combination of reduced size, increased speed and increased capacity of microelectronics devices was originally observed by Gordon Moore, chairman of Intel, when during the 1960s he commented that the feature size of semiconductor transistors re-

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duced by 10% per year. In fact, the reduction has been even more dramatic than that. The capacity of dynamic random-access memory integrated circuits has quadrupled approximately every three years. The increased density of transistors contained in devices today has resulted in the phenomenon of virtually "free" computing power. The end result of having such free power available is the drive by designers and customers to use it to the fullest extent possible.

Video + audio = data

Driven by forces enabled by free computing, the movement by video professionals from analog production, switching and storage systems to digital graphics, processing and hard-disk-based systems continues to accelerate. One of the significant by-products of this shift is what it has done to our notions of what is data. In the broad sense, data is any type of information. Does that include an audio track? Yes. Does it include a video segment or program? Well, yes.

In fact, as more audio and video are stored as files on a file server, the requirement for high-speed networking and database management has increased dramatically. The client-server model works quite efficiently for such office automation tasks as word processing, accounting and customer activity records. Those same tools are now being applied to the realm of audio and video information transfer and management. A 15-second video clip is, after all, just another file. An hour-long drama program is just another file too; a really big file, perhaps, but just a file. Really big files demand really fast networks to transport them. Progress in this area is demonstrated at each major video/computer trade show. Furthermore, the importance of crafting effective user interfaces for management of the resulting database are just now being realized.

Fortunately, the client-server paradigm seems to work well for this task. It also provides a starting point for vendors to refine existing techniques to new requirements, such as video and audio transportation, storage and manipulation. From the network standpoint, concepts and technologies borrowed from the telephone industry offer some interesting possibilities as well.

All of these concepts, of course, are predicated on the assumption that the information stream in the facility of the near-term future will be digital. All digital.

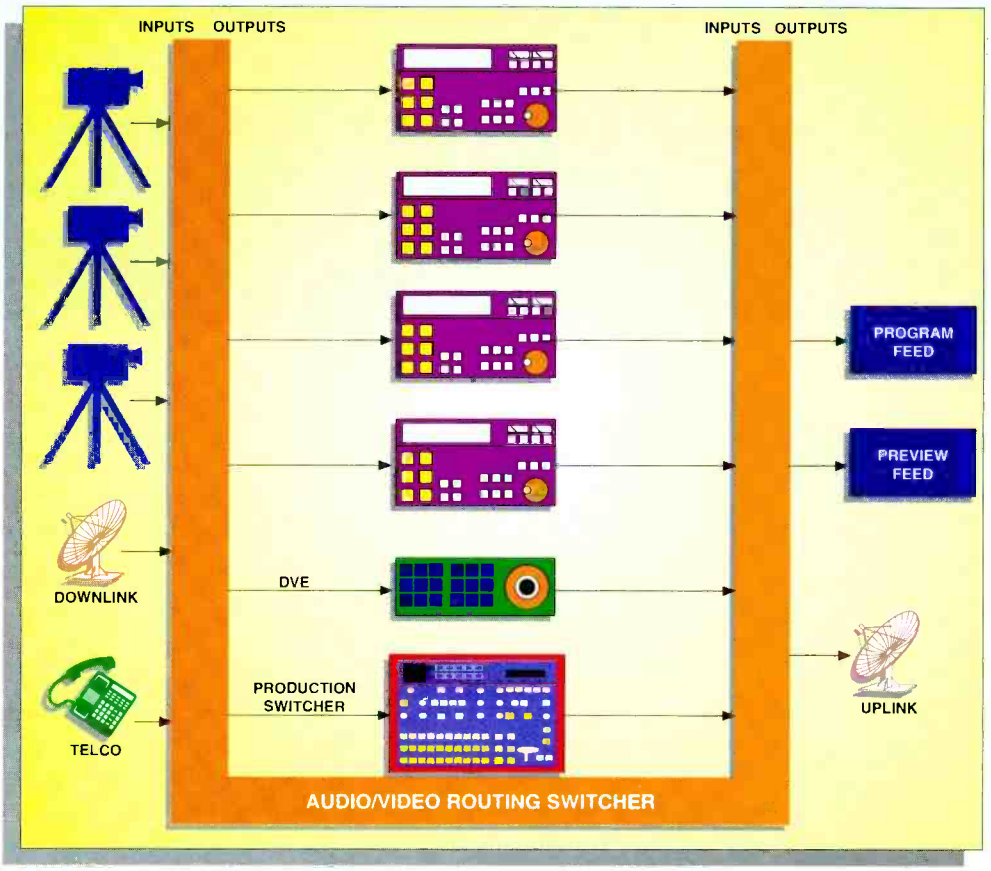

Figure 1. Classical approach to audio/video routing. Machine room devices and other resources are managed by a central switching system.

Moving video: the big picture

Serial digital means different things to different people. To video types, such as ourselves, when we talk about serial digital we mean SMPTE 259M. When computer types talk about serial digital, they mean networks. By definition, every computer network is a serial digital system, "serial digital" being the transmission of data in a serial fashion, one byte after the next. There are no "parallel digital" networks running out there. So, with this broader perspective in mind, what's in store for video professionals?

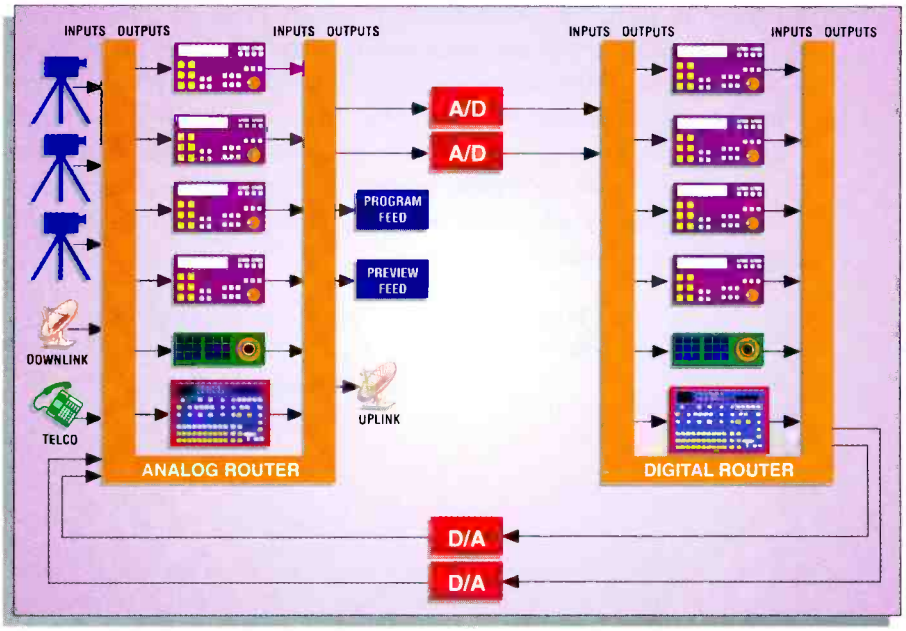

Figure 2. Hybrid analog/digital routing system, operating in parallel, with one or more bridge points.

"Our truck had a total makeover, but our cameras remained Ikegami."

Jim Moriarty, General Manager, YES Productions, New Orleans, LA., commenting on the purchase of new HK-366 and HL-57 cameras.

"When we decided to make our fifteen-year-old truck brand new, we reviewed all the cameras available and decided to stay with an old friend. Ikegami's HK-366 was a camera we've had our eyes on for some time.

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Our operators liked the PIP return video in the viewfinder, the 2-way trunking (which allows us to feed sources through the triax, i.e., a clock camera to the trunk and iso feeds out of the side of the camera), and the extra intercom features.

We also purchased a new HL-57 to add to the three we bought last year.

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The big picture insofar as video is concerned is broadcasting. Not broadcasting in the sense of call letters and transmitters, but broadcasting in the sense of point-to-multipoint distribution. That distribution could be over-the-air, via cable, via Internet, via satellite; you name it. The key is a single (or relatively small number) of origination points and many receiving points — ideally receiving points that can access the information without specifically ordering the service. The Internet is a prime example of this type of broadcasting. After you have access to the net, you can tune into anything offered on it.

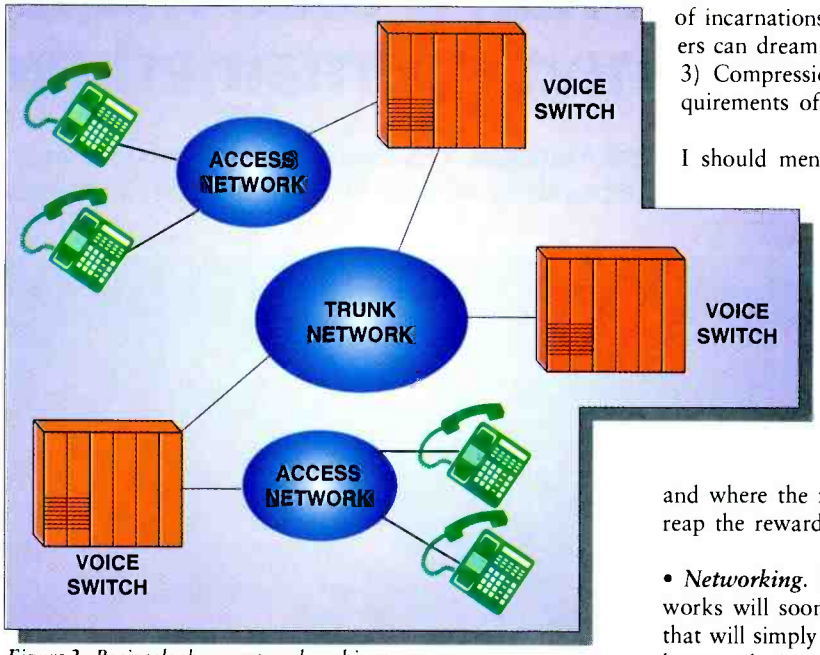


Figure 3. Basic telephony network architecture.

What everybody wants for broadcasting, as broadly defined here, is real-time on-line delivery of real video. Not those jittery, jumpy pictures that pass for "video" on computer networks today, but real video that professionals are accustomed to. The bottleneck in getting from what we've got to what we want is the pipe used to deliver the data. Within a video facility, the pipe is wide and flexible, passing 270Mb/s D-1 quality video, or even 360Mb/s widescreen component video, without working up a sweat. Such an environment, however, does not exist outside of a video facility. In the realm of common carriers, where virtually all of the nonTV broadcasting will take place, there are several options, some better than others. While not directly applicable to TV stations and video production centers today, the technologies being developed to solve these challenges will have a direct impact on how a facility will operate by the next century.

The requirements for flexibility in configuration and upgradability in design are important.

A key distinction must be made at this point between applications that require real-time video delivery and those that do not. Most video transfers within a station require real-time delivery. There are, however, a significant percentage that could accept something less. Such store-and-forward applications trade time for bandwidth of the interconnecting pipe.

A clean sheet

With these basic principles addressed, let us look at routing technology as it could work in the year 2000 and beyond, beginning with a clean sheet of paper. In order to put our system together, we will rely on a number of nonvideo-specific technologies, including:

• *Format processing.* This technology group includes the following:
1) Conversion of analog signals to digital (yes, we're sure to still have some analog machines sitting around);
2) Format conversion (bit rates of 143Mb/s, 177Mb/s, 270Mb/s, 360Mb/s, ATV signals in their variety of incarnations and whatever else designers can dream up); and
3) Compression, scaled to meet the requirements of the application.

I should mention here that all of these technologies are currently being used in video today. However, the major advancements and breakthroughs are likely to come not from video applications per se, but from computer communications (read: Internet) applications. That's where the production volume is, and where the money is. Broadcasters will reap the rewards of that development.

• *Networking.* High-speed, fiber-optic networks will soon be emerging from the lab that will simply kill off copper for any new large-scale installation. The challenges of switching optical signals are being addressed, with new progress reported in the literature each year. This area of development — clearly the domain of the telcos — holds the promise of an entirely new way of thinking about routing systems for video.

• *Database/resource management.* Having the technology available is of limited use if you can't efficiently control it. Software adapted from the business product offerings of such companies as Microsoft, IBM/Lotus and Novell, hold the promise of cost-effective development and easy integration with other office products and systems.

The classical approach to video/audio routing is illustrated in Figure 1. A large, centrally located switcher interfaces one or more machine rooms with the application points (usually production suites) that need various resources. As facilities became larger, the routing switcher also grew. Much of the development in routing technology during the 1980s focused on increasing the switch-point capacities of routers and reducing the physical size of those growing machines.

The era of the massive router, however, has given way to smaller serial digital systems integrated with modest analog routers. This parallel arrangement is the result of the logical progression from an all-analog facility to a hybrid analog/digital facility. (See Figure 2.)

A parallel here can be drawn to the computer industry. The huge mainframe computers

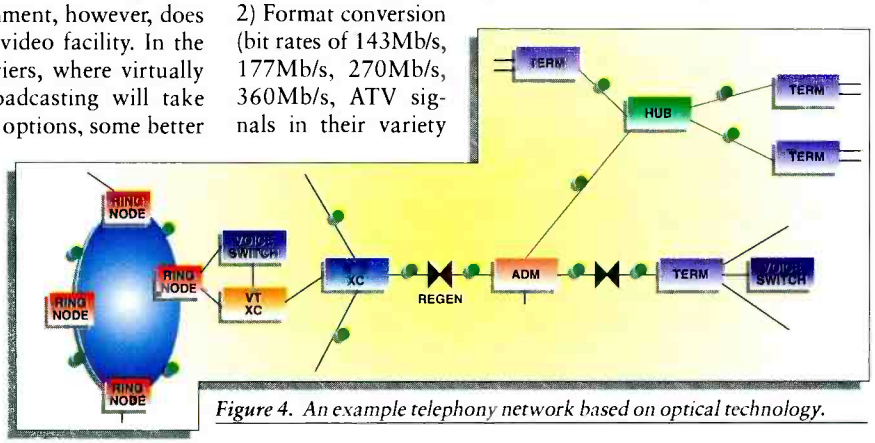
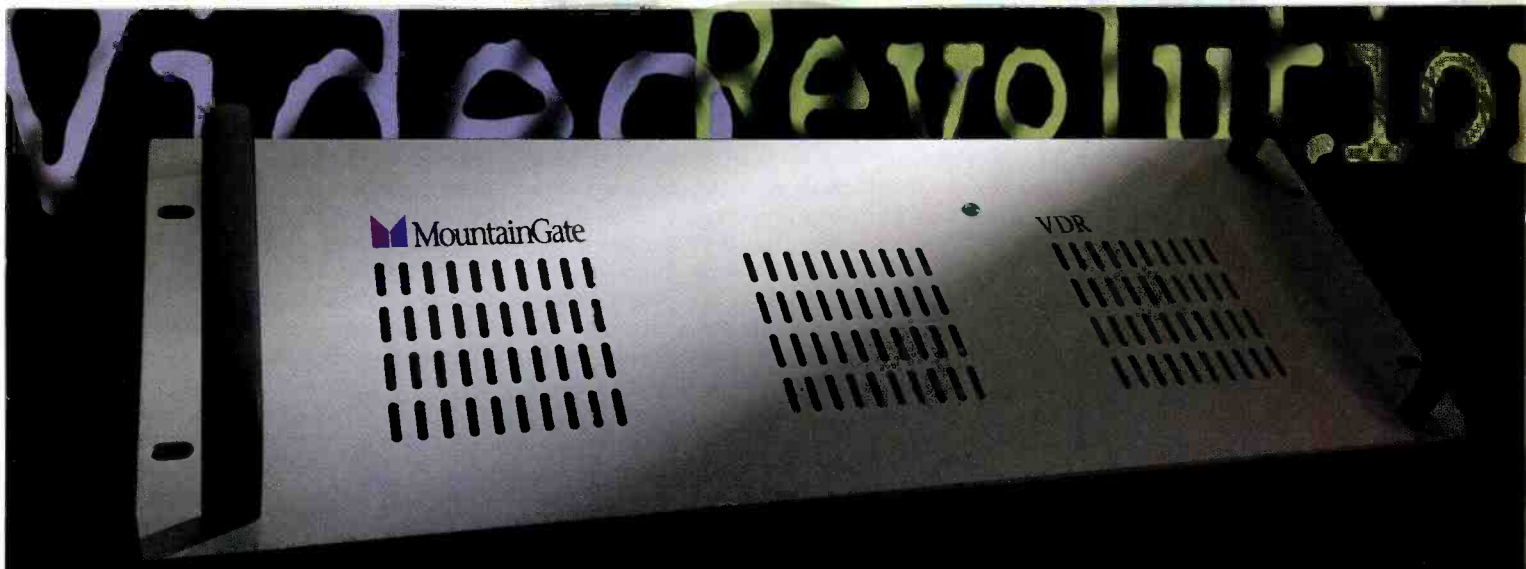


Figure 4. An example telephony network based on optical technology.



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of the 1970s began to be replaced in the '80s by smaller, smarter, more capable networked workstations and desktop computers. Today, there are still applications that can best be handled, and sometimes can only be handled, by mainframe computers. The same holds true for massive video routers. However, the technology that required big, centralized systems to operate efficiently has largely been replaced by a technology of distributed operating environments.

The telco example

While nearly as old as electronic communications itself, the telco paradigm holds valuable concepts for the video routing system of the future. As illustrated in Figure 3, 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.

Today, the majority of connectivity in the trunk network, and much of the connectivity in the access network, is provided using fiber-optic transmission. This is 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 on the application and topology of the network and the degree of survivability required. Consider the example network shown in Figure 4. Ring nodes, which by definition offer redundancy, are interconnected with stepped, linear elements. Automatic protection switching provides the ability to detect a network failure and 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), illustrated in Figure 5. The system shown differs from the ring system in that switching is required to restore service.

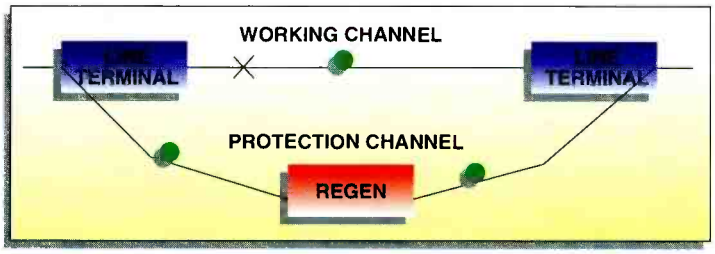

Figure 5. The 1 + 1 linear protection scheme.

A proposed system

If we integrate the principal technologies outlined previously into the domain of a major market TV station or video production center, we come up with an environment much different from what we're used to. It is an environment built around the telco concepts of access and trunk networks, managed by the computer industry client-server database model, and made practical by the enormous advancements in microelectronics and fiber-optic capacity.

Consider the proposal shown in Figure 6. As shown, the telco paradigm has been reduced to the facility level and integrated with local area network (LAN) features. The design goals include the following:

- Establish a fully-digital system;
- Permit maximum flexibility of resources;
- Reduce wiring and related interconnection expenses; and
- Allow for easy expandability.

The primary elements that make up the proposed system are commonly available today, some albeit in early stages of development. None, however, are particularly esoteric. The elements shown in the diagram include:

- *Source devices:* Typically storage devices (cassette- and hard-disk-based machines), graphics systems, character generators and effects devices, cameras and other common video production hardware.

High-speed, fiber-optic networks will soon be emerging from the lab that will simply kill off copper for any new large-scale installation.

- *Translator/concentrator (Trans/Con) hubs:* The interface element between source devices and the network. The Trans/Con would accept any variety of digital and even analog inputs and connect them to the network. Ideally, a Trans/Con would be located in each equipment rack, reducing the cabling demand significantly. The Trans/Con would perform all signal conditioning, reclocking (as necessary) and switching functions for the devices that it controls.
- *The network:* Depending on the resources and requirements of the system, one or more fibers in a ring would provide for transport of data (images, sounds and control signals) from one device to another. A reasonable implementation might be to install a 5-fiber cable for a medium-sized installation. The goal would be to overbuild the fiber infrastructure to ensure future upgrade capability. It is no more ex-

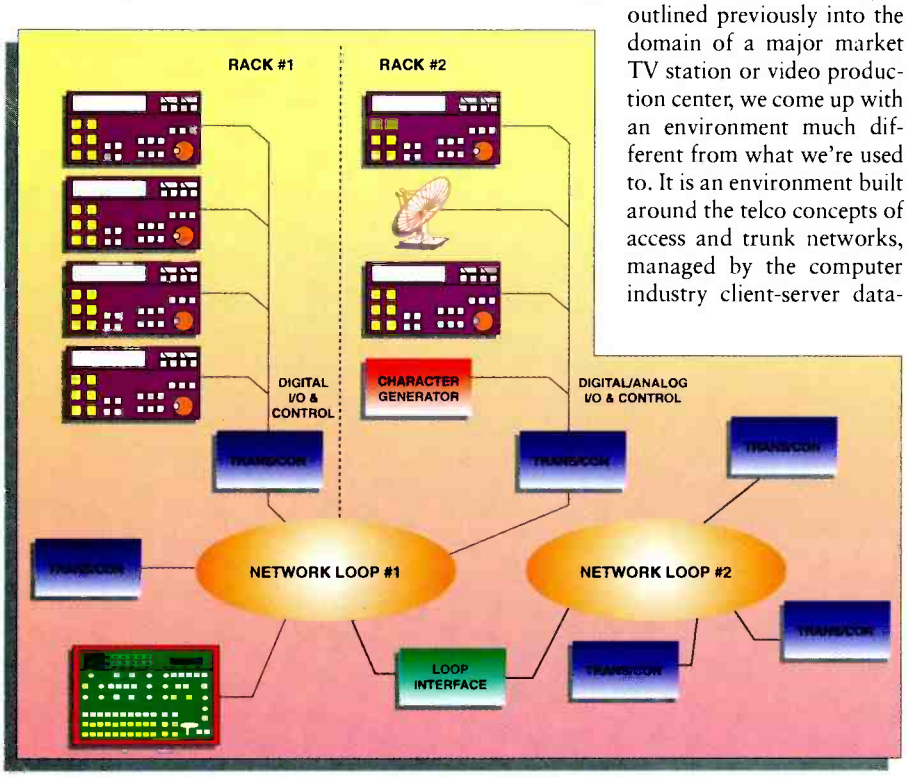

Figure 6. Networked data routing system using telco and LAN concepts.

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pensive to pull a multifiber cable than it is to pull a single-fiber cable. Certainly, the cost of the cable is a consideration, but it usually pales in comparison to the labor costs, especially if additional cable is installed after primary construction has been completed.

• *Control system:* The network and resources tied to it would be managed by any variety of common schemes, from a dedicated manual switching panel to an automated time- or condition-dependent switching system. The video switcher for a given production suite would simply become another control point for the network.

Like the telco model, this arrangement would permit production suites to be configured as, in telco parlance, an access network. Individual access networks could then be tied together by trunk networks. Although the physical implementation of such a system would be hierarchical, the logical implementation (from the user standpoint) would appear flat; that is, any machine anywhere on the system would be available to anyone anywhere who wants it (lockout controls notwithstanding, of course).

The multifiber network approach provides a number of operational benefits, including the ability to segment the network dynamically. For example, suppose an editing session has a couple of machines tied up more-or-less continuously. A particular cable could be assigned to that specific application, and thereby essentially remove that traffic from the network. Because the fiber lines would be dynamically configurable, the editing session traffic on its dedicated fiber could be confined to the physical area requiring the service. The corresponding fiber in another part of the facility would not carry that traffic, and could transport its own dedicated signals. This assignment and segmentation would occur without operator intervention. When the resources were no longer required, the configuration would simply go away and the resources would then be available for the next session. This scenario is how the telco access and trunk networks operate.

The multifiber network approach provides a number of operational benefits, including the ability to segment the network dynamically.

Ver. 1.0

The ideas presented in this article are intended to be a starting point for examination of how a new or renovated facility could be configured. As mentioned previously, none of the concepts are particularly radical; all have been used in one form or fashion before. The barriers of practical technology, however, have kept them apart until recently.

Because the router is such an essential part of a facility (technical centers are quite literally built around them), it is a good place to start planning for a future that will come sooner than we expect. ■

Jerry Whitaker is a *Broadcast Engineering* consulting editor.

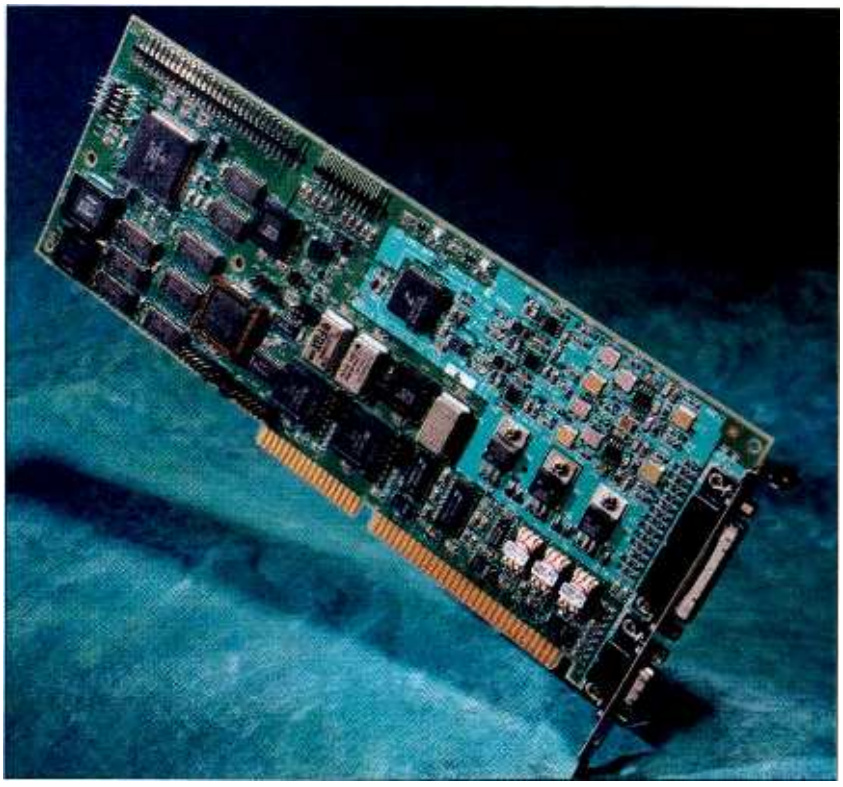
By Skip Pizzi, technical editor

Understanding audio data compression

The squeeze is on for high-quality audio at low data rates.

The Bottom Line:

In the TV world, video is always considered the spectrum hog, and audio is its tidy little partner. But in digital multichannel form, audio can occupy significant bandwidth and storage space on its own. With the trend toward improved TV sound, data-compression techniques that reduce these growing bandwidth requirements — while keeping sound quality high — are timely and useful. ***$***



The Capella from Digital Courier International is an example of an audio-compression codec available on a PC card.

When viewed from the perspective of digital video, even the highest-quality digital *audio* signals have fairly low data-rate and storage requirements. Relative to serial digital video's 270Mb/s fire hose, the 1.5Mb/s data rate of CD-quality stereo audio is hardly more than a trickle; and while one minute of digital video takes up to 2GB of storage space, one minute of digital audio (monaural) requires only 5MB. (See "A Digital TV Audio Primer," September 1995.)

Nevertheless, efficiencies always add up, so any factor of improvement in data management is of value. As TV broadcasters move toward a *multichannel* sound environment, these savings can pay even greater dividends. So TV broadcasters can take a cue from the radio industry, where much of the work in reducing the data requirements for digital audio has taken place.

Reduction of digital audio data rates by a factor of four or more is common today, with minimal audible degradation incurred. This takes the one-minute storage requirement down to around 1MB per audio channel. Data-compression ratios of 8:1, 10:1 or even higher are now possible with only subtle losses, allowing a relatively high-quality mono audio channel to be reduced to a 64kb/s data rate. This is particularly helpful when interfacing to digital telecom paths, such as ISDN (as many broadcasters are currently doing),

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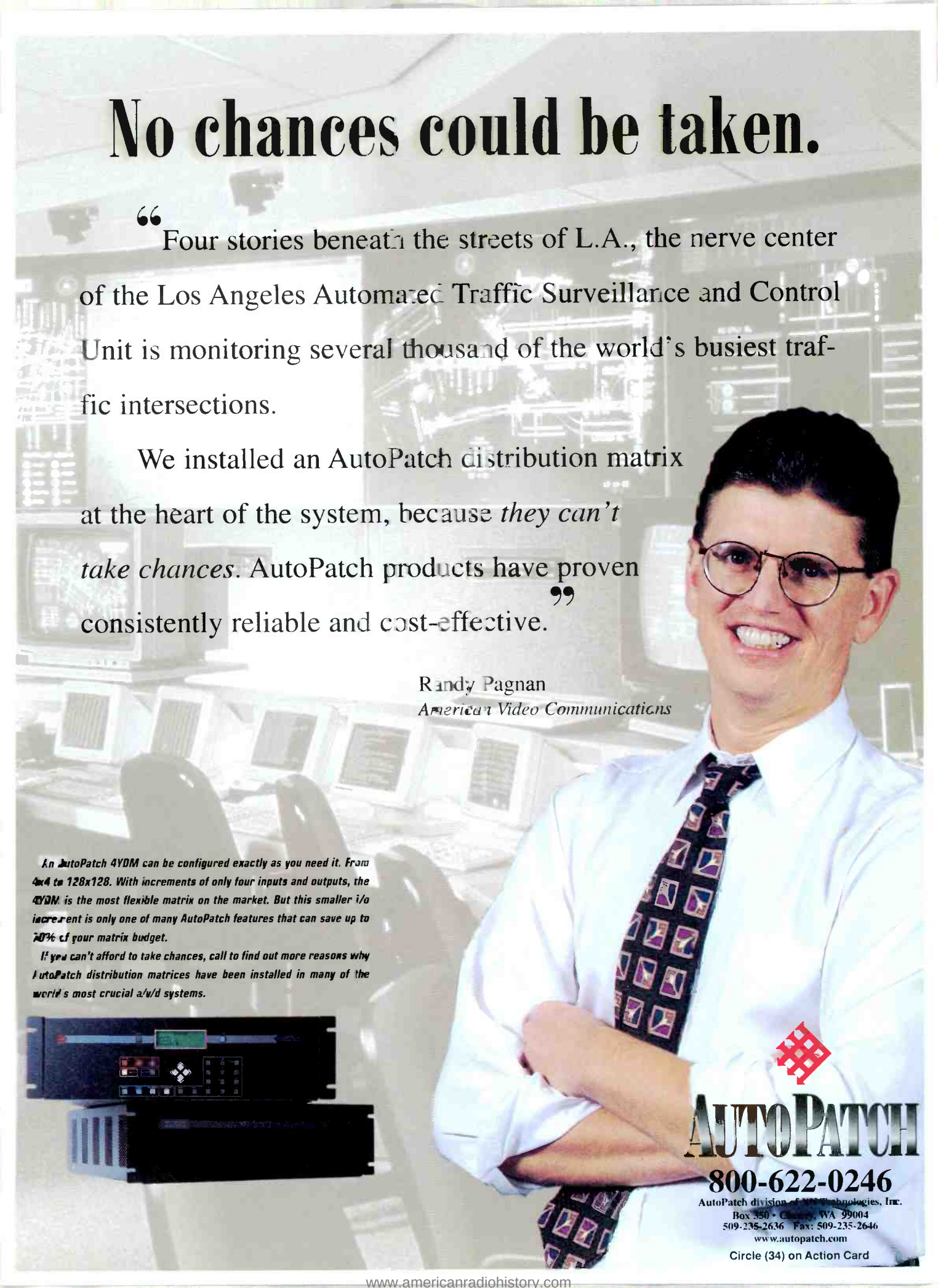
American Video Communications



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4:2:2
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(* Pre-read is only available on the BR-D85.)

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The Dolby DP561 is a PC-based encoder for the AC-3 multichannel digital audio data-compression algorithm.

because 64kb/s is the basic building block of these services. (A soon-to-be-released codec will offer 18:1 compression, allowing 15kHz stereo audio on a 64kb/s circuit.

Bit-rate reduction techniques

The technology for reducing audio data rates first appeared in the 1960s, when it was used by early digital telephone systems. Since that time, various approaches to curbing the appetite of digital audio systems have included floating-point systems, differential algorithms and entropy coders.

Floating-point systems analyze a block of data for its overall dynamic range, then apply a lower-resolution algorithm to it, adjusting the dynamic range of the algorithm to that of the audio in each block. Differential algorithms encode only the *difference* between samples. Entropy coders reduce frequently encountered data patterns to shorter streams. (A good example of the latter is Morse code, where the most commonly used letters of the alphabet in English language words are denoted by the shortest codings.)

Originally, these systems were only of the *lossless* variety, meaning that the decoded datastream was bit-for-bit identical to the input prior to encoding. This allowed only small savings in data rate — generally around 2:1 at best. More recently, however, *lossy* algorithms have been developed, which permit greater amounts of data reduction by producing outputs with recovered datastreams that differ from the original when analyzed bit-for-bit, but that *sound* essentially the same as the original to most listeners.

Lossless systems analyzed the datastream from a statistical perspective, reducing data rate purely "by the numbers." Today's lossy algorithms reduce data rate based on how the signal will be heard, and are thus referred to as *perceptual coders*. They exploit the human hearing sense's inability to detect certain kinds of signal losses, thereby reducing the data rate of digital audio signals substantially.

The process usually is performed in two distinct steps. First, analog audio is converted to 16-bit linear data, typically using one of the standard sampling rates of 32kHz, 44.1kHz or 48kHz. This produces a digital signal with a data rate in the 500kb/s to 750kb/s range per audio channel. The compression algorithm is then applied in the digital domain, reducing the data rate by a ratio of 4:1 or more. This produces data rates in the neighborhood of 128kb/s or less per channel.

Perceptual coding

The programming for perceptual coders comes from a body of knowledge known as *psychoacoustics*, the study of human aural perception. The primary element of psychoacoustics that these algorithms use is the phenomenon of *spectral masking*, whereby the presence of one audio signal overshadows (or "masks") a listener's perception of other lower-level signals at nearby frequencies. (See Figure 1.) A related function is *temporal masking*, in which a loud signal masks a quieter one that occurs just after (or even just *before*) it.

Once an audio signal is digitized, it can be processed in ways that are not easily performed in the analog domain. This includes manipulation of the signal while its data is represented in the frequency domain, which is necessary for comprehensive processing based on spectral masking. Such processing allows a perceptual coder to ignore and eliminate "unnecessary" parts of the signal (because they would go unnoticed by the listener), thus reducing data-rate requirements. More important, the perceptual coder can also selectively reduce the *resolution* used to encode the remaining (unmasked) audio signals, further reducing data rate. Reducing resolution will cause noise and distortion to rise, but as long as these degrading byproducts are kept below the masking threshold, they remain inaudible.

Note that data rate is the product of a digital audio signal's sampling rate multiplied by its sampling resolution (e.g., 48kHz sampling times 16-bit resolution produces a 768kb/s data rate). To reduce this rate, either or both of its component parameters must be lowered. Reducing a signal's sampling rate will have the unavoidable effect of dropping its high-frequency cutoff, so any significant change in this parameter will affect audio bandwidth. It is in the resolution area that more flexibility is available, however. Adaptive coding based on perceptual algorithms can reduce the resolution to an average of four bits or fewer per sample.

Therefore, most data-compression algorithms retain the sampling rates of the original A-to-D conversion, and reduce data rate by lowering resolution only. In this way, the frequency response and the time-domain accuracy (i.e., low wow-and-flutter, good phase response) of the original digital conversion are largely retained. Only amplitude-domain losses are introduced in the form of increased quantization noise and distortion. A well-designed algorithm will keep these degradations inaudible to most listeners, most of the time.

A final element of rate reduction in these systems exploits the redundancy in *multichannel* audio signals. In the typical stereo audio signal, for example, a substantial amount of data is identical in both channels. (The so-called "phantom center" image is a result of this duplicated audio in the

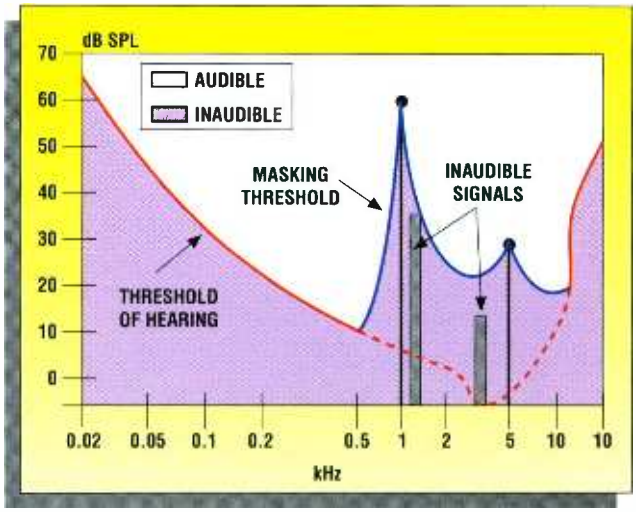

Figure 1. An approximation of the masking spectrum produced by 1kHz and 5kHz tones. The masking spectrum indicates how the threshold of hearing is temporarily altered by the presence of these tones. Actual program audio typically exhibits many more predominant tones, producing more "tentpoles" for masking spectrum and thus a greater inaudible area under the curve.

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left and right stereo channels.) A form of data compression called *joint coding* reduces the requirement to repeat this identical data for both channels, coding it only once instead and noting that it should be "copied" to the other channel upon decoding. This allows further data-rate savings to be accomplished. The more audio channels a program signal includes, the greater the likelihood of redundancy among the channels. Therefore, multichannel "surround-sound" TV audio is a good candidate for successful data-rate reduction through joint coding.

An example of this process is the AC-3 algorithm from Dolby Laboratories, which has been selected as the audio format for the Grand Alliance ATV system. It provides five full-bandwidth audio channels for left, center, right, left-surround and right-surround, plus a narrowband channel for a subwoofer feed. This *5.1-channel* format might produce a data rate of some 4Mb/s in uncompressed form, while perceptual coding applied to individual channels could reduce this to around 600kb/s. Yet, AC-3 allows the full 5.1 channel audio signal to be represented by a 384kb/s datastream, in part by applying the added efficiencies of joint coding.

Formats in use

A number of different audio data-compression systems are in use today. They have been applied to satellite transmission, microwave links, digital telephone lines (T-1 and ISDN) and non-linear storage systems.

The most popular algorithms for audio data compression today are listed in Table 1. The devices used to apply audio data compression are called *codecs* (coder-decoders) and they are typically packaged as rack-mount units or small portable boxes. Some codecs are also available in PC peripheral card form. Many codecs include the capability of encoding or decoding more than one algorithm type. Note that some of the algorithms in Table 1 are proprietary to a specific manufacturer, while others are established as industry standards.

Today's algorithms exploit the hearing sense's inability to detect certain kinds of signal losses.

There is occasionally some confusion among TV broadcasters between the ISO/MPEG Layer II audio algorithm and MPEG-2 video compression. All of the MPEG audio algorithm standards in use today for mono and stereo signals (Layers I, II and III) are actually part of the *MPEG-1* standard. Therefore, the full name of the Layer II algorithm, for example, is *ISO/MPEG-1 Audio Layer II*. This is often erroneously shortened by some users to "MPEG-II," which may not be much problem in the audio-only world, but it can be interpreted as something completely unintended in a video environment.

Most codecs and algorithms can also accommodate a range of output data rates. Audio quality typically varies in direct proportion to the data rate, so it is advisable to select the highest practical rate when encoding. Decoding is usually automatically detected and set by a codec to match the incoming signal's data rate.

The codec is always paired with another device that actually transmits, receives, records or plays back the compressed signal. These devices include T-1 CSU/DSUs, ISDN terminal adapters, STL transmitters and receivers, satellite or other communication modems, hard-disk recorders or PC-based automation systems. The data interface between the codec and these devices is critical. Often, telecom-type standards, such as V.35 or X.21 interfaces are used, but proprietary interfaces are also employed. In some cases, the codec and its associated device are integrated into a single chassis, so this data interface is not directly encountered by the user. For example, several recent units intended for remote-backhaul incorporate an ISDN terminal adapter and a codec in the same portable box.

Control data can also be encoded into the output signal on some codecs. This can be used to control devices at the receiving end of an ISDN audio feed, for example. It is usually interfaced to the codecs via RS-232 or RS-485.

Another feature that maximizes the flexibility of codecs and algorithms capable of supporting multiple data rates is the *inverse multiplex* (IMUX) process. This allows a wideband data signal to travel between codecs via multiple narrowband transmission channels. For example, a high-quality, multichannel-compressed digital audio signal of 384kb/s data rate can be sent between codecs on six ISDN "B-channels" of 64kb/s each, using an inverse multiplexer at each end of the path. (See Figure 2.) Several different protocols for inverse multiplexing are available, and a few new approaches have been recently proposed. The most commonly encountered format at present is called BONDING (an acronym derived from the name of the industry association that developed the protocol, the *Bandwidth-On-Demand INteroperability Group*).

Some audio practitioners have a philosophical problem with data compression.

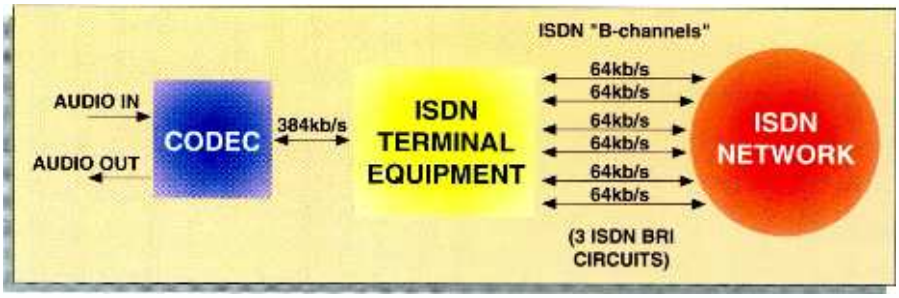

Figure 2. Block diagram of a typical inverse multiplexing application using three basic-rate ISDN circuits (six "B-channels") to carry a 384kb/s compressed digital audio signal. IMUX may be handled either by the codec or a by multiline ISDN terminal adapter. Similar equipment is required at the other end of the circuit.

A recent twist on the flexibility issue is the development of so-called *POTS* ("Plain Old Telephone Service") *codecs*, which are designed to provide "mid-fi"-quality audio over standard analog telephone circuits. These devices compress a mono audio signal of about 7kHz audio bandwidth down to an output rate of 28.8kb/s or lower. Using an internal V.34 modem, this data is then transmitted via the standard dial-up phone network. The inability of some phone lines to maintain a solid 28.8kb/s interconnection caused some reliability problems with early units. Subsequent devices require only 24kb/s, and/or accommodate "downshifting" to lower bit rates (at slightly lower fidelity) if the line should be unable to successfully pass their highest-rate signal.

Problems encountered

Some audio practitioners have a philosophical problem with data compression. They are troubled by perceptual coding's

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Understanding audio data compression

ALGORITHM	MAX. AUDIO BANDWIDTH	MAX. AUDIO CHANNELS	TYPICAL DATA RATE RANGE (kb/s)	SOURCE
Layer II	20kHz	2	56 - 384	ISO/MPEG-1
Layer III	20kHz	2	56 - 128	ISO/MPEG-1
G.722	7kHz	1	56 - 64	CCITT
G.722 Turbo	15kHz	1	56 - 128	Comrex Corp.
apt X-100	20kHz	2	56 - 384	Audio Processing Technology
AC-2	20kHz	2	56 - 384	Dolby Laboratories
AC-3	20kHz	5.1	384 - 640	Dolby Laboratories (ATV std.)

Table 1. A list of popular digital audio data-compression algorithms.

irrecoverable loss of 75% or more of a digital audio signal's original data. This issue persists even though proper listening tests have shown some algorithms to be quite transparent.

Nevertheless, while such an ideological basis for concern about perceptual coding may be unwarranted, there is some empirical basis for caution in certain applications of the technology. One is the degradation that can occur when a given signal is exposed to repeated applications of perceptual encoding and decoding cycles. Given the labyrinthine nature of signal paths in broadcasting, it is quite possible for an audio program to encounter independent stages of data compression during initial recording, remote backhaul, subsequent post-production, satellite distribution, station time-shift recording, studio-to-transmitter linking and perhaps even consumer recording. (Eventual ATV broadcasting will add one or more additional generations.)

It really doesn't matter if the same algorithm or different ones are used at each stage. (In fact, a variety is often preferred over repeated application of the same algorithm, so at least any audible artifacts are distributed rather than compounded.) The fact that the signal is repeatedly frequency-domain processed, rate-reduced, then returned to the time domain, takes its toll with whatever algorithm is applied. Noise and distortion can be added to the signal, along with varying frequency-domain errors that can sound like a runaway "flanging" effect.

Some algorithms are more resistant to such degradations than others, however, and can tolerate a greater number of cascaded generations before audible problems occur. The use of higher-output data rates (i.e., a lower data-compression ratio) is also recommended when subsequent compression generations are expected downstream. Of course, the preferred solution is to compress the signal *once* and keep it that way (without repeated decoding and re-encoding cycles) through as many segments of the signal path as possible.

Another reported artifact of audio data compression with some conclusive evidence behind it is the loss of stereo separation when using the joint-coding feature of some algorithms. This problem may also be compounded with repeated coding generations on such systems.

A separate class of difficulties comes up in post-production when compressed digital audio signals are involved. At present, many non-linear storage systems support various audio data-compression algorithms, but few systems are available that can edit the compressed files in their native form. Often the compressed files must be recovered to full bandwidth before any post-production can be applied, after which they can be recompressed. But this risks the buildup of artifacts from repeated generations of compression. Therefore, until your post-production systems are fully capable of working in the compressed domain, you may want to avoid data compression of audio materials until programs are in their final form.

Similar difficulties may arise in the ATV environment. If stations receive ATV programs from networks and other providers with multichannel audio signals already in AC-3 form, how will stations perform processes like voice-overs on outro themes for local promos? Either AC-3 decoding and re-encoding will be required or devices that edit and mix audio in the AC-3 domain will have to be developed. (See "Audio for Widescreen," February 1996.) This remains an unsettled issue at present.

Digital audio data compression is just one more proof of the "no free lunch" axiom. Even its developers recommend against using it unless absolutely necessary. But in those cases of necessity, it is an immensely enabling technology, allowing high audio fidelity to be achieved with great spectral efficiency. As in all of life's pleasures, moderation in the use of data compression is the key to healthy audio. ■

For more information on digital audio data compression, circle (200) on Action Card. See also "Digital Audio Encoders, Decoders" and "Digital Terminal Equipment, Modems, Codecs" pp. 65-66 of the 1996 BE Buyers Guide.

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By Richard Majestic

Digital video broadcasting

The Bottom Line:

Digital video broadcasting (DVB) is a new delivery medium that engineers will be involved with sooner or later. DVB is already making its appearance in Europe. And in order for it to succeed, it must encompass present and future digital TV standards. $

Europe has already adopted this hot new format for delivery of digital video.

As a TV engineer, you will be involved with this new digital delivery medium sooner or later. The European digital video broadcasting (DVB) project is still a fast-moving venture that includes more than 170 organizations from 21 countries. The DVB Office, in cooperation with worldwide equipment manufacturers and research organizations, set down the framework for a digital delivery system that can grow, mature and adapt over the years to come.

For the system to succeed, it must encompass present and on-the-drawing-board digital TV standards. It must take advantage of all special characteristics of every range of delivery media, including satellite, cable and terrestrial, including (S)MATV and MMDS. DVB includes standards common to all delivery environments to use the economy of scale in system design, component development and manufacturing and user acceptance.

To make this system work in tomorrow's TV systems, the DVB members have adopted a satellite system that can adapt to current and future satellite transponder designs. The matching cable system takes advantage of cable network characteristics. The digital terrestrial standard has been drafted and is undergoing testing prior to publication. A common scrambling and conditional access interface is part of the DVB system, but at this time remains incomplete.

The DVB system provides a range of picture qualities up to the RS-250C standard, together with multichannel digital audio, up to four stereo pairs (eight independent) audio, which can be configured to meet the demands of feed delivery service providers or the end-user.

The DVB core system

The following general technical solution discussion is valid for all mediums, including satellite, cable and terrestrial.

- The system is designed around digital blocks that carry flexible combinations of MPEG-2 video and MPEG-2 (Musicam Layer II) audio and other user data.
- The system uses common MPEG-2 Transport Stream (TS) multiplex.
- The system uses a common Service Information (SI) system that provides program details and other information.
- The system uses a common first-level Reed-Solomon (RS) forward error-correction (FEC) system.

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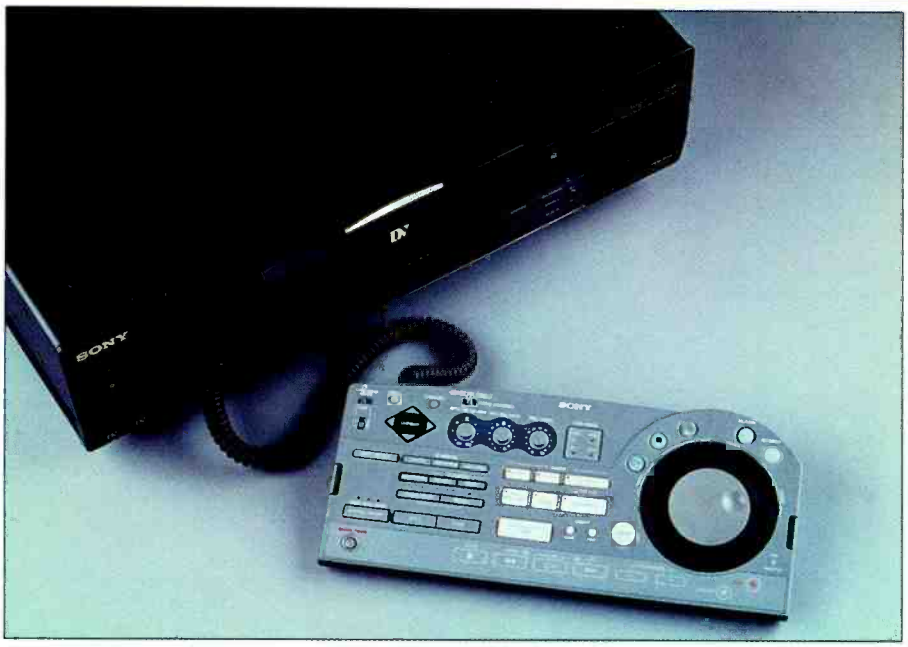


Sophisticated edit and play features will be available even in consumer devices like this Sony DV recorder.

• The modulation and additional channel-coding systems, if any, are selected dependent on the requirements of the transmission medium.
• A common scrambling system is available, but other proprietary systems can be used, as well as newly developed systems.
• A common conditional access interface is available, but other proprietary systems can be used.

The DVB family of system standards

DVB-S. The satellite delivery system for use in the 11/12GHz band; configurable to meet a range of transponder bandwidths and power.

DVB-C. The cable delivery system is compatible with DVB-S and would normally be used with 7MHz to 8MHz cable channels.

DVB-CS. The (S)MATV system is compatible with DVB-S and is normally used with 8MHz cable channels.

DVB-T. The digital terrestrial TV system designed for terrestrial 7MHz to 8MHz channels.

DVB-SI. The service information system for use by the DVB decoder to configure itself and to help the user select the virtual channel DVB bitstream.

DVB-TXT. The DVB fixed-format teletext transport specification, independent of the vertical interval.

DVB-CI. The DVB common interface for use in conditional access and other origination-controlled applications.

The DVB office has also developed DVB receiver guidelines that include suggestions for the interface for domestic receivers and a common interface specification intended for conditional access applications.

The DVB-S has been accepted as an ITU Recommendation (BT.601-4) for the broadcast transmission on 11/12GHz satellite transponders.

DVB service start-ups

In Europe, Philips of the Netherlands and NTL of England, are major contributors to the system design and engineering of DVB. Scientific Atlanta U.S. and Canadian operations are active in the DVB marketplace and have provided and made operational 1:1 redundant uplink encoder equipment to the TeleSat Corporation in Montreal, Canada. The system is 6-video channels of varying data rates that satisfy the picture resolution and FEC requirements. The delivery of a 6-video channel system occupies a 36MHz transponder.

Philips, NTL and other European manufacturers have installed fully operational systems running on satellite transponders and cable systems in Europe.

The DVB technical system

From the beginning, audio and video coding were to be ISO/IEC MPEG-2. The DVB system added the MPEG transport stream multiplexer and the necessary elements to include cable, satellite and terrestrial broadcast systems requirements. The system designers used the MPEG standard "toolbox" to tailor this system to be as sophisticated as the system designer wishes.

MPEG-2 audio coding

The sound-coding system specified for all DVB systems uses the MPEG audio standard. The current standard is MPEG Layer II (MUSICAM), which is a digital compression system that takes advantage of the psychoacoustic elements of human hearing, which mask nearby frequency lower-level sounds (or noise) and eliminates them from the coding process. Even if all sound elements are present and reproduced faithfully, they would not be heard, so they are eliminated from the datastream. This facilitates coding of the audio at lower data rates, while maintaining sound quality that is close to CD quality. The system can be used for monaural, stereo or multilingual sound and will include discrete surround-sound channels in the future.

MPEG-2 visual coding

MPEG-2 video is a group of coding systems that carry commonality and compatibility. Four source formats or levels range from a limited definition (similar to VHS VCRs, 240-line resolution) to full HDTV quality, each at varying data bit rates. Each of the four source formats can have different *profiles*, which are a collection of compression tools that when put together with a source format make up the coding system. A new profile means a different set of compression tools is available.

MPEG-2 conformance points

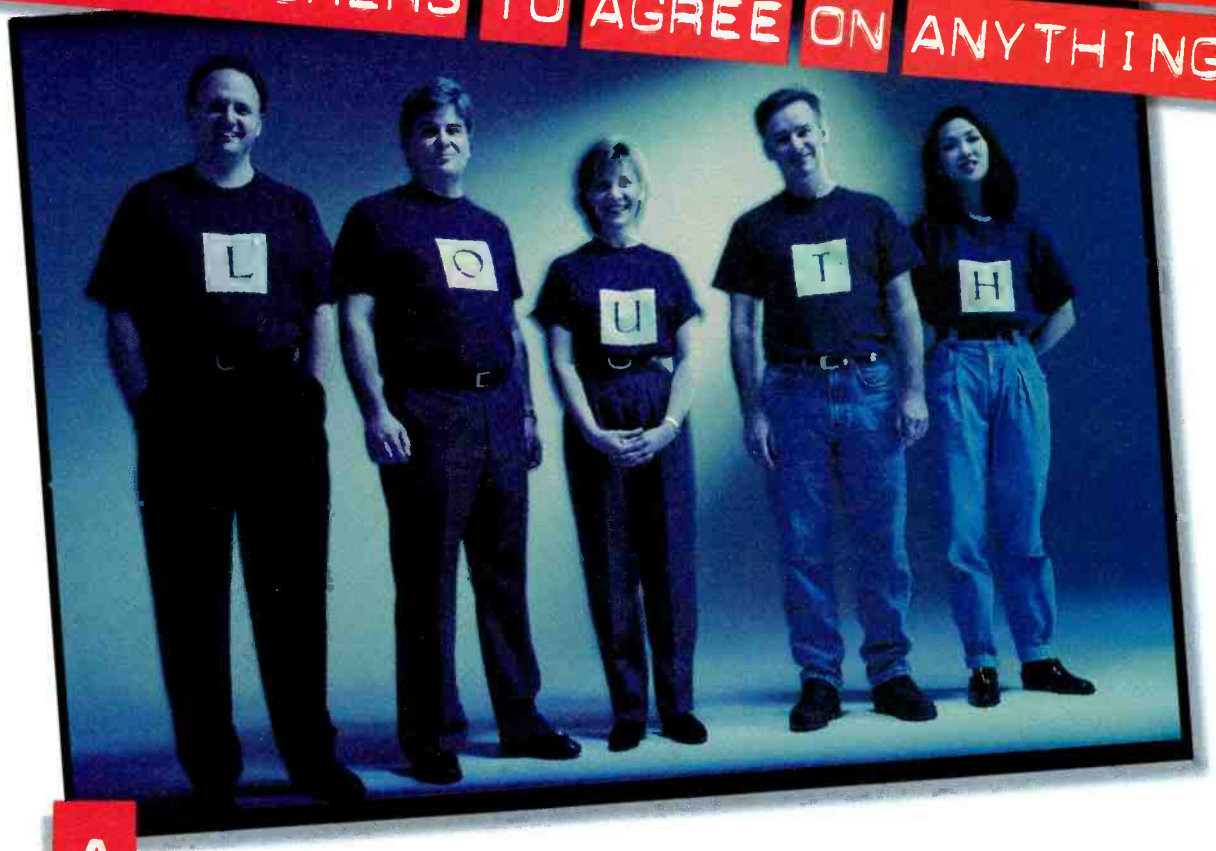
To date, 11 of the 20 level and profile combinations have been approved. (See Table 1 for the level/profile table.) Most users of the digital satellite and cable services intend to use the main profile at the

LEVELS	SIMPLE	MAIN	SNR SCALEABLE	SPATIALLY SCALEABLE	HIGH
HIGH	NOT AVAILABLE	⇐⇐⇑	NOT AVAILABLE	NOT AVAILABLE	⇐⇐⇑
HIGH-1440	NOT AVAILABLE	⇐⇐⇑	NOT AVAILABLE	⇐⇐⇑	⇐⇐⇑
MAIN	⇐⇐⇑	⇐⇐⇑	⇐⇐⇑	NOT AVAILABLE	⇐⇐⇑
LOW	NOT AVAILABLE	⇐⇐⇑	⇐⇐⇑	NOT AVAILABLE	NOT AVAILABLE

MAIN PROFILE AT MAIN LEVEL (4:2:0) GENERATES 15 Mb/s MAX. DATA

Table 1. The DVB level/profile table. Currently, there are five different profiles in the MPEG-2 system. There are also four levels associated with the source format of the video signal.

HOW DO YOU GET FIVE DISK SYSTEM MANUFACTURERS TO AGREE ON ANYTHING?



Actually, when it came time to standardize on one disk interface protocol, it wasn't that hard. The top ten manufacturers of disk systems overwhelmingly chose The Louth Protocol.

We'd like to tell you it was our impressive track record in broadcast automation that did it. Or our reputation for pioneering object oriented programming to make automation faster, easier and more flexible. But the truth is, disk manufacturers chose the Louth Protocol because it works. It's open. And it's free. 100% public domain.

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It has not only simplified applications such as Ad Insertion, Caching, Program Acquisition, Time Delay and Multi-Channel Managment, it has made the future easier for everyone. By opening a pathway that is free of gatekeepers, toll takers, and proprietary potholes. That's why we agreed to make the protocol available to *our* competitors in automation, as well.

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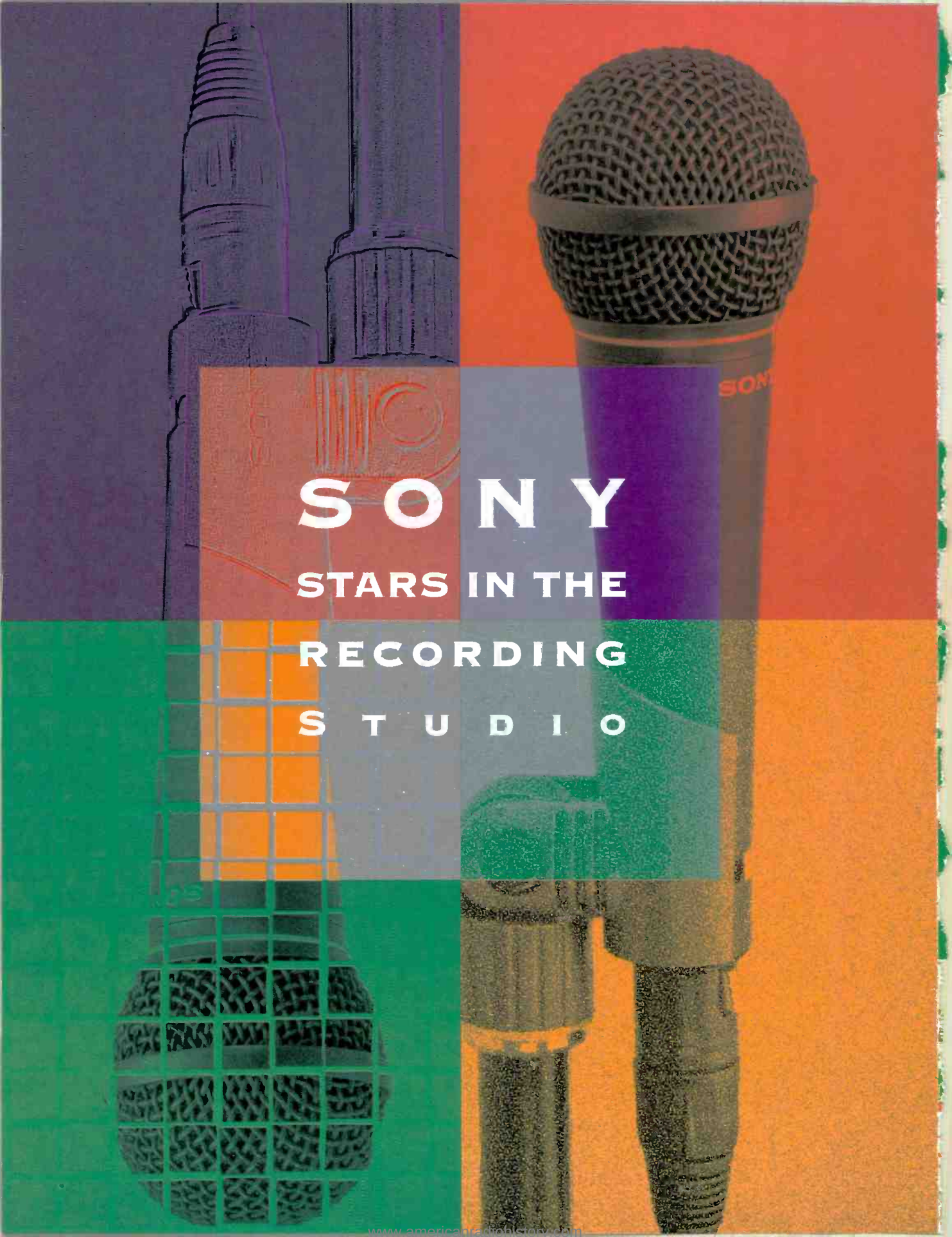

SONY
STARS IN THE
RECORDING
STUDIO

If it isn't captured by the microphone, it isn't present on the CD. That's why the first step in producing a CD is to choose the microphones. And when the engineers at DMP Records reach for a mic, they often choose the Sony C-800.

This Sony mic is the product of five years of research, development, listening and testing with both acoustic and electric music. It's a condenser mic with superb capabilities, including a maximum input of 150 dB SPL, a hand-selected 6AU6A vacuum tube and a dynamic range of more than 126 dB. But the specifications alone can only hint at the sound.

***Tom Jung-**
Engineer/producer at DMP

"When I compared the C-800s to my reference mics, there was no contest."

"The C-800 has a very smooth frequency response and is very natural sounding," says Tom Jung*, engineer/producer at DMP. "It's the most versatile microphone I have used in the studio. It works well on just about any instrument. When I compared the C-800s to my reference mics, there was no contest. The Sony mics sounded more like what was happening on the studio floor. As it turned out, I ended up selling my reference mics."

The Sony C-800 and the C-800G, which is equipped with a Peltier-Effect cooling system, are the latest and best in Sony's line of condenser microphones. They're joined by other condenser and dynamic mics that reflect one simple fact — Sony engineers are just as fanatical about sound as you are.

C-800G. A vacuum tube condenser mic with Peltier-Effect cooling for lustrous vocals.

C-800. Vacuum tube condenser mic for high quality instrumental and vocal recording.

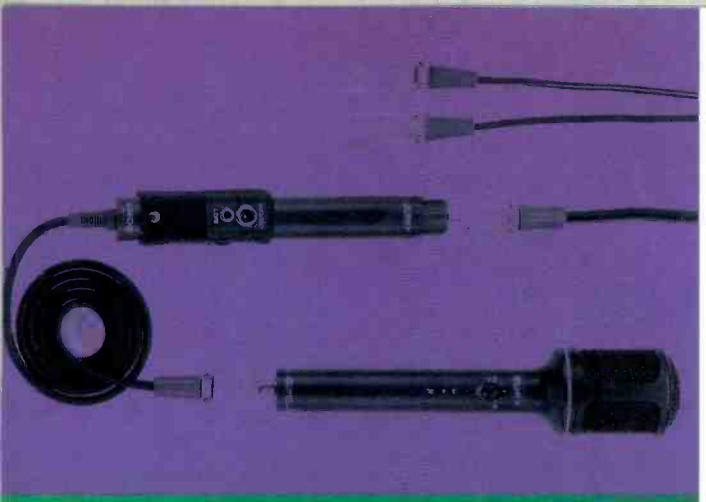
C-48. Condenser mic with large gold-coated diaphragm, and Uni/Bi/Omni-directionality.

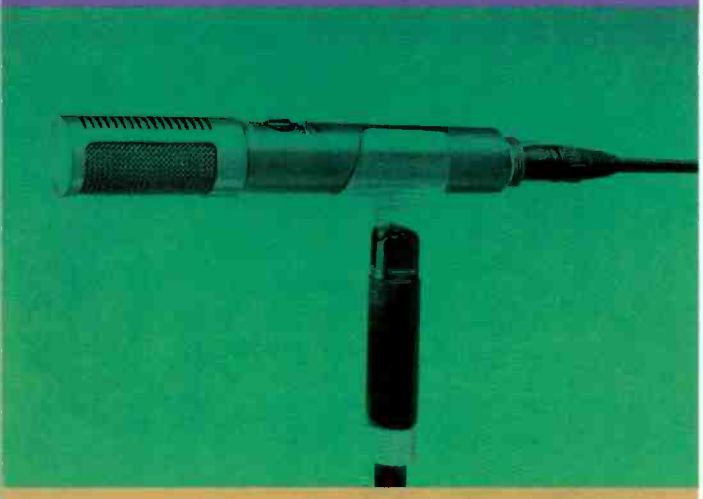
C-536P. Sony's most affordable condenser mic. For instruments.

ECM-999. Mid/side stereo electret condenser mic with frequency response 20-20,000 Hz, 104 dB dynamic range.

F-780. Dynamic vocal mic with high-efficiency alnico magnet, flat-wound CCAW voice coil.

F-740. Dynamic mic for vocals or instruments with high-efficiency alnico magnet.





=SONY MAKES=

TV NEWS.

AND

TALK.

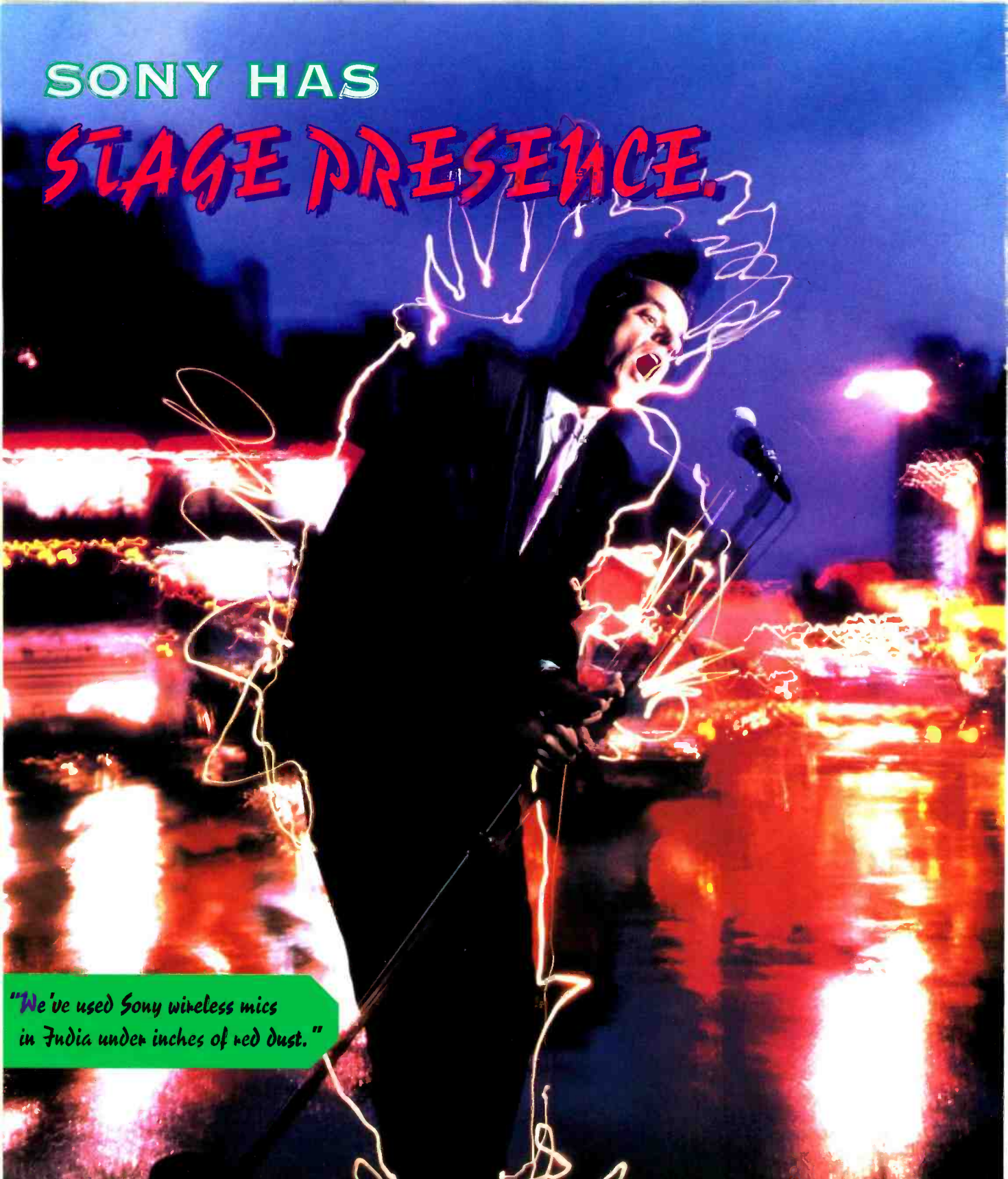
AND

SPORTS.

You hear them on the network news, the local news and the tabloid news. You hear them on late night talk shows and daytime talk shows. And you hear them on soap operas and live TV events. They're the Sony 800 Series Wireless Microphones and TV is their medium.

Because broadcast environments are thick with RF interference, every 800 Series mic was designed to operate on any of 94 frequencies. In the event that one frequency is a problem, you can instantly switch to another. Sony's Space Diversity Reception uses two physically separate antennas to keep the signal strong, even when the talent moves around. And Tone Squelch helps assure that you get just the signal — not the noise.

SONY HAS STAGE PRESENCE.



"We've used Sony wireless mics in India under inches of red dust."

ECM-MS5. Mid/side stereo mic with three capsules, adjustable directivity.

ECM-530. Table-top conference/lecture mic with stand and gooseneck.

ECM-77BC. Our most highly-acclaimed lavalier. 1/4" diameter.

ECM-55BC. Omni lavalier head, 7/16" diameter with response 30 - 18,000 Hz.

ECM-166BC. Sony's most affordable professional lavalier for wireless.

F-740. Dyn for vocals ments wit ciency aln

ECM-999. Mid/side stereo electret condenser mic with frequency response 20-20,000 Hz, 104 dB dynamic range.

ECM-531. Telescoping table-top mic with gooseneck. Plugs into lectern XLR connector.

ECM-66BC. Unidirectional lavalier head, 7/16" diameter.

ECM-44BC. Omni lava lier head, 11/32" diam eter with response 40 - 15,000 Hz.

F-780. Dynamic vocal mic with high-efficiency alnico magnet, flat-wound CCAW voice coil.

"They're frequency agile," says Greg O'Connor, technical equipment supervisor for CBS TV in New York. "So we simply change frequencies if RF interference ever pops up. We've got seven studios in this building, all with wireless equipment. And for sound quality, we mate Sony bodypacks with Sony lavaliers."

Scott Bartlett is an award-winning videographer at Montage, Inc., a Washington DC stringer firm that shoots for TV magazine shows and political events. "I'm convinced there's no more dependable mic on the market," he says. "We shot a Latin American president's conference in Argentina where there were camera crews from all over, plus police and secret service guys all talking on the radio. A single-frequency wireless mic could be useless. With two frequencies, you might be OK. Sony gives me 94 frequencies."

Broadcasters also pick Sony for interview mics, camera-mounted shotgun mics and mid/side stereo mics of exceptional durability and sound quality. Which gives Sony one of the broadest lines in broadcasting.

"I'M CONVINCED THERE'S NO MORE DEPENDABLE MIC ON THE MARKET."


ECM-MS5. Mid/side stereo mic with three capsules, adjustable directivity.


ECM-999. Mid/side stereo electret condenser mic with frequency response 20-20,000 Hz, 104 dB dynamic range.


ECM-672. Battery-powered short shotgun for video cameras, 101 dB dynamic range.


ECM-670. Short shotgun for video cameras, 92 dB dynamic range.


ECM-510. 14" long interview mic with large, comfortable grip, small capsule.


ECM-77BC. Our most highly-acclaimed lavalier. 1/4" diameter.


ECM-66BC. Unidirectional lavalier head, 7/16" diameter.


ECM-55BC. Omni lavalier head, 7/16" diameter with response 30 - 18,000 Hz.


ECM-44BC. Omni lavalier head, 11/32" diameter with response 40 - 15,000 Hz.


ECM-166BC. Sony's most affordable professional lavalier for wireless.


WRT-860A. Sony's high-power wireless bodypack, 20 mW transmitting power. 94 frequencies.


WRT-820A. An all-time favorite. Sony's standard wireless bodypack. 94 frequencies.


WRT-830A. Electret handheld wireless mic/transmitter. 94 frequencies.


WRT-810A. Dynamic handheld wireless mic/transmitter. 94 frequencies.


WRR-860A. Advanced diversity portable receiver, battery-powered for camcorder use.


WRR-810A. Non-diversity battery-powered portable receiver for camcorder use.


WRR-855A. Plug-in portable receiver for next-generation Sony digital camcorders.


WRR-850A. New dual-diversity receiver with battery power display for WRT-860A Transmitter.


WRR-840A. Dual diversity receiver for use with two microphones. Rack mountable.


WRR-820A. Single diversity receiver for all 800 Series wireless microphones. Rack mountable.

New York City makes for strange neighbors. Every year one of the city's most popular musicals takes up residence above one of its busiest train stations.

"They're right on top of the station," says Lew Mead of Pro Mix, the supplier of microphones for the show. "They've got RF signals from the radios for the inter-city trains, plus New Jersey suburban trains, plus Long Island suburban trains, plus radios for the police on the subways. Sony wireless mics cut through the clutter."

Time after time, Sony's 800 Series Wireless Microphones have proven themselves in tough situations like this on Broadway and in concert. One reason is Sony's range of 94 radio frequencies. If one frequency doesn't work, you can always switch to another. And Sony's new WD-880A Channel Multiplier lets you operate 42 wireless channels simultaneously — for even greater flexibility.

Capabilities like these earn Sony wireless mics a place on the road with chart-busting rock and rollers. "We've used Sony wireless mics in India under inches of red dust," says Rocky Holman, veteran monitor engineer at Desk Job Audio. "We've used them in Spain where we have to cart them over cobblestone streets. I want stuff that works every day without being massaged. That's Sony."

Sony's commitment to sound reinforcement extends to rugged dynamic mics, our legendary lavaliers and lectern mics. All are the work of engineers who are just as comfortable backstage as they are back in the lab.

Until recently, you could operate a maximum of 19 Sony wireless microphones in one location at one time. Now Sony ups the ante with the remarkable WD-880A Channel Multiplier. This new system expansion component lets you run 42 channels simultaneously!

What makes Sony microphones so good?

A glossary of Sony technical highlights.

42 Simultaneous Channels. Sony's new WD-880A is a boon to sound reinforcement. This Channel Multiplier enables you to assemble a system with up to 42 Sony wireless mics on one site, at one time.

Alnico Magnets. An alloy of Aluminum, Nickel and Cobalt, alnico may well be the most precious magnetic material used in microphones. Its high energy increases a microphone's sensitivity, to help deliver high output, high dynamic range and low noise.

CCAW Voice Coil. At the heart of every microphone is the magnetic circuit that generates voltage. Sony optimizes every aspect of the circuit – even the choice of voice coil wire. We often select Copper Clad Aluminum Wire – and wind it flat – for higher efficiency and increased output.

Channel Plans. A boon to producers using multiple Sony wireless mics in one location, Sony channel plans map out the optimum channels for minimum mutual interference. If interference does occur, you can change any channel on the spot.

Frequency-Agile. Also referred to as "frequency synthesis." It's the ability of wireless microphones to switch to alternate radio frequencies in the field. In today's RF environment, cellular phones, police radios and A/V electronics can all interfere with wireless mics. Being able to switch — at a moment's notice — to alternate channels is your only protection. Sony offers 94 channels.

Heritage. We were making microphones and mic mixers long before our first TV set and our first transistor radio. We've been in pro audio for almost 50 years. And it you can hear it.

Lavalier. A Sony specialty. Sony mics are the "house lavs" at countless TV stations across the country.

Mid-Side Stereo. A microphone with two capsules at a 90° angle, for matrixed stereo sound. The directivity pattern can be varied electronically from wide to narrow just by changing the matrix.

Neodymium Magnets. Used in Sony's more affordable dynamic microphones, Neodymium delivers high energy in a small size. (See also "Alnico Magnets.")

Peltier Effect. Heat is the enemy of all electronics, but tubes are especially vulnerable. Sony cools the top-of-the-line C-800G Studio Condenser Tube Microphone with a distinctive Peltier-Effect semiconductor heat pump. It carries thermal energy to a pipe filled with heat-conductive liquid, which whisks the energy into a heat sink located a safe distance away.

Plug-In Receiver. All Sony portable wireless receivers are designed to clip onto your video camcorder. The new WRR-855A actually plugs into a dedicated slot on new Sony digital camcorders. A water resistant seal keeps the slot safe from the elements.

Space Diversity Reception. RF reception varies according to small changes in the position of the transmitter and the receiver antennas. Sony's Space Diversity Reception maintains consistent performance by always giving you the better of two receiver antenna signals.

Vacuum Tube. Tubes are active circuit components sometimes preferable to solid-state transistors and diodes. Tubes impart a smoother, rounder sound to studio microphones that many producers prefer.

For more information on Sony Microphones, call: 1-800-635-SONY (Ext. Mics)

* Tom Jung quote excerpted with permission from the January/February 1996 issue of Pro Audio Review.

SONY

Sony Electronics Inc.
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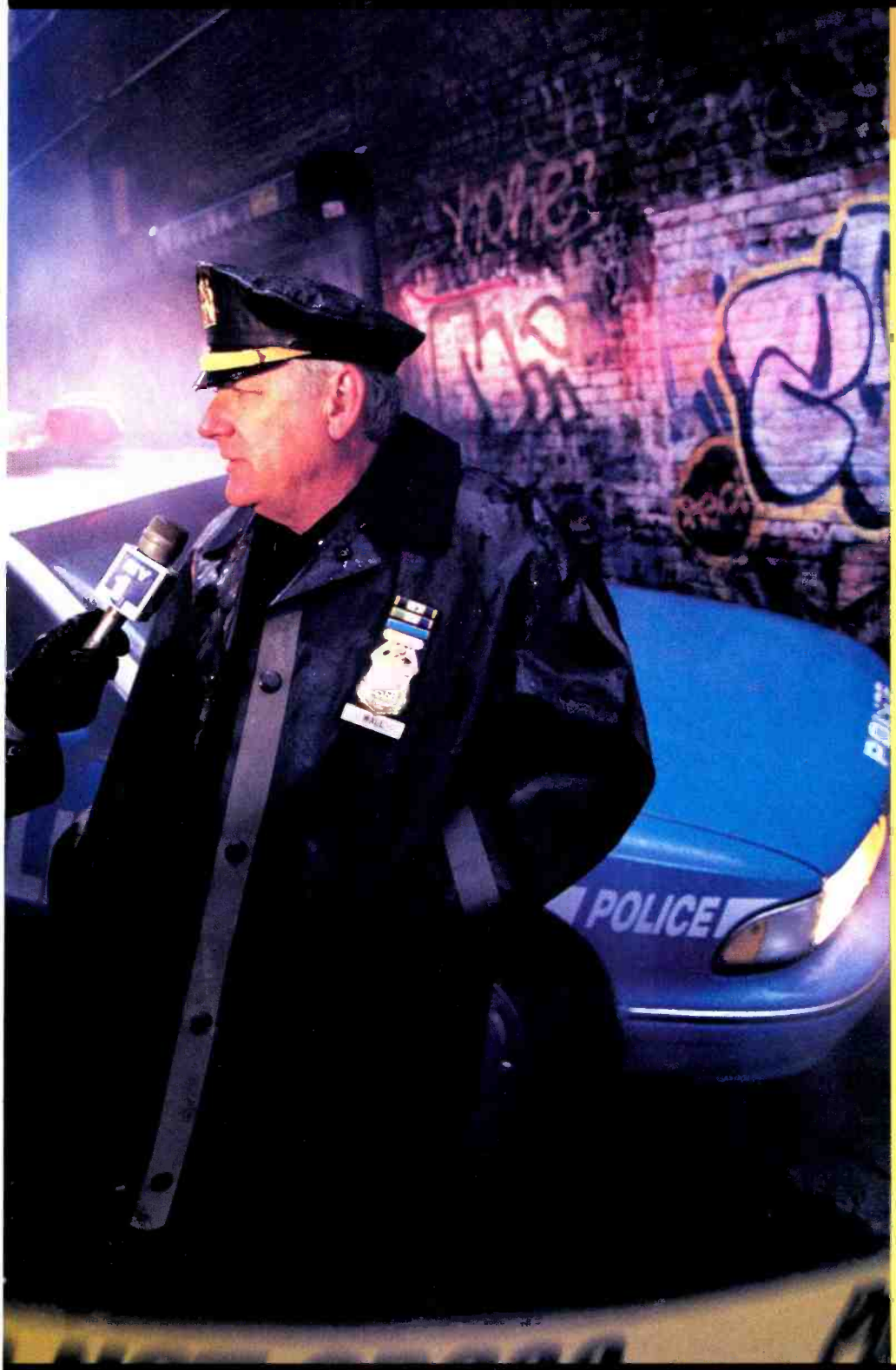


DVCPRO

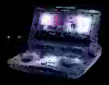
April 9th, 1996. News is made as Panasonic's DVCPRO hits the streets. Time Warner's revolutionary 24-hour news channel, NY1, converts its entire operation to DVCPRO. By equipping its 26 news correspondents with DVCPRO digital camcorders, NY1 has changed the face of newsgathering forever.

Lightweight Panasonic DVCPRO camcorders are perfectly suited for the station's pioneering videojournalist concept, which helps NY1 deliver its round-the-clock coverage of New York news, politics and sports.

DVCPRO camcorders and VTRs enable NY1 "to achieve the highest quality acquisition while significantly lowering operating costs." (NY1's own words)

For fast and first coverage of what's breaking in New York, viewers turn to NY1.

For their breakthrough to broadcast digital technology, NY1 turns to Panasonic.



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main level. This first generation of digital video equipment will allow service providers to offer TV programming that meets the full ITU-R Recommendation BT.601-4 for studio-quality pictures with 4:3, 16:9 or 20:9 aspect ratios.

A service provider will need to decide on operational bit rates or variable bit rates. Generally, the higher bit rates will transport a greater amount of the original picture, with fewer coding artifacts. However, the law of diminishing returns applies here, so look for trade-offs in picture quality for reduced bit-rate density, because transmission costs move upward as bit rate increases.

Tests have been conducted to establish the relationship between bit rate and picture quality for the main profile with main level. Based on today's encoding technology the following recommendations are achieved:

- To comply with the ITU-R Recommendation BT.601-4 or *studio-quality* pictures on all material, the system will have to operate at about 9Mb/s.
- To match the current *NTSC or PAL/SECAM quality* on all material, the system will have to operate at about 5Mb/s to 6Mb/s. A DVB document, "Implementation Guidelines for Use of MPEG-2 Systems, Video and Audio in Satellite and Cable Broadcasting Applications in Europe," describes the subset of MPEG-2 elements to be used by DVB.
- Film material that has been shot at 24fps or 25fps is easier to code than a studio TV camera, and will be fine at lower bit rates, even less than 4Mb/s.

DV players, such as this Toshiba unit, will provide users with superior audio and video quality from CD-sized disks.

DVB system performance cross reference

Table 2 will be useful in comparing anticipated audio and video compressed data rates for a given RF bandwidth and FEC. The figures given are based on back-to-back system performance and not for an end-to-end satellite system.

The MPEG-2 multiplex scheme and the DVB-SI

The MPEG-2 data packets are fixed-length packets containing 188 bytes of data. MPEG includes program specific information (PSI) that lets the MPEG-2 decoder capture and decode the packet structure. This data is transmitted with the picture and audio data packets and automatically configures the decoder and provides synchronization to the decoder for regeneration of the video signal. MPEG-2 also allows separate service information that can complement the program specific information.

DVB has prepared an open service information system to accompany the DVB signal. It's to be used by the decoder to provide services, as chosen by the system user. The MPEG-2 PSI data allows the integrated receiver decoder (IRD) to automatically configure itself, and the DVB-SI information enables the IRD to tune to a particular service(s), as grouped into categories with relevant schedule information.

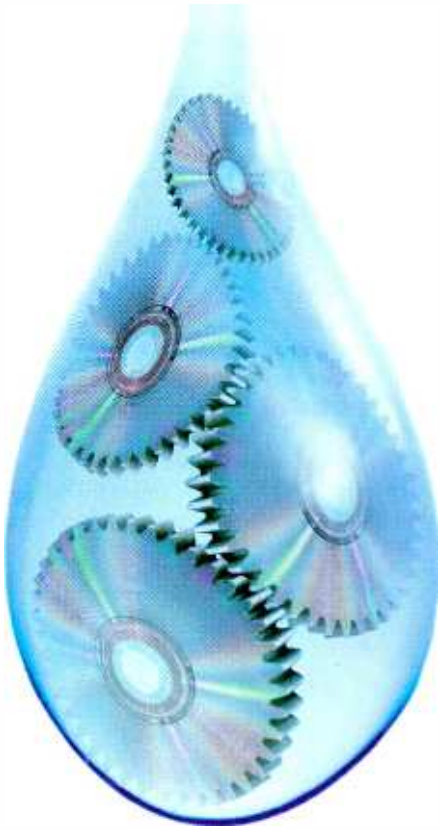
The DVB-SI also provides the elements needed to produce an electronic program guide. Current DSS service includes a similar service via SI data and the receiver interface. The individual DVB broadcaster's SI data would include such information as start time, name of service provider and program classification. The DVB-SI tables are provided in order to provide a seamless transition (or connection) between satellite and cable networks.

The DVB-SI is based on four tables, plus other optional tables. They contain descriptors that outline the characteristics of the service or event. The four tables are:

1. NIT --- Network Information Table: This

FEC	1/2	2/3	3/4	5/6	7/8
Threshold Eb/No (IF Loop)	4.5 dB	5.0 dB	5.5 dB	6.0 dB	6.4 dB
Occupied BW	6 MHz	6 MHz	6 MHz	6 MHz	6 MHz
Information rate	4.35 Mb/s	5.81 Mb/s	6.53 Mb/s	7.26 Mb/s	7.62 Mb/s
Transmission rate	9.45 Mb/s	9.45 Mb/s	9.45 Mb/s	9.45 Mb/s	9.45 Mb/s
Occupied BW	9 MHz	9 MHz	9 MHz	9 MHz	9 MHz
Information rate	6.53 Mb/s	8.71 Mb/s	9.80 Mb/s	10.88 Mb/s	11.43 Mb/s
Transmission rate	14.17 Mb/s	14.17 Mb/s	14.17 Mb/s	14.17 Mb/s	14.17 Mb/s
Occupied BW	18 MHz	18 MHz	18 MHz	18 MHz	18 MHz
Information rate	13.06 Mb/s	17.42 Mb/s	19.59 Mb/s	21.77 Mb/s	22.86 Mb/s
Transmission rate	28.35 Mb/s	28.35 Mb/s	28.35 Mb/s	28.35 Mb/s	28.35 Mb/s
Occupied BW	27 MHz	27 MHz	27 MHz	27 MHz	27 MHz
Information rate	19.59 Mb/s	26.16 Mb/s	29.39 Mb/s	32.65 Mb/s	34.29 Mb/s
Transmission rate	42.52 Mb/s	42.52 Mb/s	42.52 Mb/s	42.52 Mb/s	42.52 Mb/s
Occupied BW	36 MHz	36 MHz	36 MHz	36 MHz	36 MHz
Information rate	26.12 Mb/s	34.83 Mb/s	39.18 Mb/s	43.54 Mb/s	45.72 Mb/s
Transmission rate	56.69 Mb/s	56.69 Mb/s	56.69 Mb/s	56.69 Mb/s	56.69 Mb/s
Occupied BW	54 MHz	54 MHz	54 MHz	54 MHz	54 MHz
Information rate	39.18 Mb/s	52.25 Mb/s	58.78 Mb/s	65.31 Mb/s	68.57 Mb/s
Transmission rate	85.04 Mb/s	85.04 Mb/s	85.04 Mb/s	85.04 Mb/s	85.04 Mb/s

Table 2. Comparing anticipated audio and video compressed data.



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Circle (49) on Action Card

groups together services belonging to a network provider. It contains tuning information to be used during IRD setup and also signals a change in tuning information.
2. *SDT --- Service Descriptor Table:* This lists the names and parameters associated with each service in a MPEG multiplex.
3. *Event Information Table (EIT):* This is used to transmit MPEG multiplex event information. It contains information about the current transport and optionally covers other transport streams that the IRD can receive.
4. *Time and Date Table (TDT):* This data updates the IRD's internal calendar and clock.

Currently available, additional optional SI tables are:

- *Bouquet Association Table (BAT):* This provides a means of grouping services that might be used as a method the IRD could present services available to the end user. A particular service can belong to more than one bouquet.
- *Running Status Table (RST):* This is used to update the running status of one or more events. Its sections are transmitted only once at the time the status of the event changes. Unlike other SI tables, the RST is transmitted only once, while the others are transmitted repeatedly.
- *Stuffing Table (ST):* This may be used to replace or invalidate other SI or optional SI tables.

The DVB-S satellite system

DVB-S is designed to use a range of transponder bandwidths (26MHz to 72MHz - 1dB). It is a single-carrier system that has video, audio and data inserted into the fixed-length MPEG transport stream packets. The packetized data includes a number of stages of processing as follows:

- First the data is formed into a regular structure by inverting synchronization bytes every eight packet headers;
- The data content is then randomized;
- Reed-Solomon FEC is added to the data packet overhead. Being efficient, the FEC only adds 12% overhead to the datastream signal. This is commonly called the Outer Code or FEC for all delivery systems;
- Convolution interleaving is then applied to the packet data to further reduce data errors;
- Another convolution code is added to further reduce decoded errors and is called the inner code. This can be adjusted to suit the service provider's needs; and
- Finally, the data signal modulates the RF carrier using quadrature phase shift keying (QPSK).

The system is tailored to specific transmission channel properties. Burst errors are randomized between the two layers of error correction, e.g., the inner code can be adjusted to adapt to the system user's link budget.

The DVB-T terrestrial transmission mode

DVB-T system specifications are in the early stages of development, with an extended trial period expected to start by the end of the year. As with the other DVB standards, MPEG-2 audio and video coding is the basis of the DVB-T work. Other elements in the draft specification are:

- The outer running status coding and outer convolution interleaving coding are common with other DVB standards;
- The inner punctured convolution coding and interleaving are the same as DVB-S; and
- The modulation/channel coding has two elements: QPSK/QAM and OFDM (orthogonal frequency division multiplexing) with selectable guard interval.

DVB-S is designed to use a range of transponder bandwidths (26MHz to 72MHz-1dB.)

The draft DVB-T specification allows for the 2-level hierarchical modulation. With a low-level QPSK/QAM, a robust signal with less error protection is available, while the QAM would be less robust, a better quality signal is provided.

The *modulation system* combines OFDM with the QPSK/QAM. OFDM uses a large number of carriers that spread out the digital data content. OFDM has been used successfully in the Eureka-147 digital audio broadcasting (DAB) system to help eliminate the problems caused by multipath signals. However, the multipath immunity reduces the transmission capacity. Increasing the number of OFDM carriers improves the data transmission capacity, but increases the receiver's complexity, and therefore, the cost. Trade-offs come into play again. OFDM potentially allows overlapping frequencies in a same-frequency transmitting network for greater area coverage.

The DVB-C cable transmission mode

The cable transmission mode is essentially the same as the satellite system with the exception of the QAM modulation scheme replacing the QPSK modulation. The cable system uses no inner code FEC, because it's not needed. The typical system will use 64-QAM, but lower 32-QAM, and 16-QAM systems can be used in a trade-off of data capacity for system data robustness. In terms of capacity, a European 8MHz channel using 64-QAM has a payload of 38.5Mb/s, without adjacent-channel interference.

The DVB interface and scrambling issue

Conditional access is a big point with the DVB design. The conditional access package contains the common scrambling algorithm. Each integrated receiver decoder (IRD) must process the digital data for decryption and descrambling. The decryption translates the coded keys into a form that the descrambler can process, in turn producing a picture and sound.

The DVB common interface (DVB-CI) supports the MPEG-2 transport stream. The flexibility of the scrambling and unscrambling system allows the CA modules almost unlimited control over the IRD's access to authorized digital signals or its inability to decode unauthorized access. The first common interface is the MPEG transport stream, and the second is the control information between the plug-in module and the IRD.

The physical interface is the common PCMCIA II (personal computer memory card international association) connector. A smart card could be added to the module for additional security. The interface was designed to include such functions as electronic program guides. ■

Richard Majestic is a broadcast systems engineer with the United States Information Agency in Washington, DC. He can be reached via the Internet at rmajestic@aol.com.

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Editor's note: For more information on video compression, refer to "Video Compression," p. 24, February 1995, and "Video Compression," p. 42, October 1995 issues of *Broadcast Engineering* magazine.

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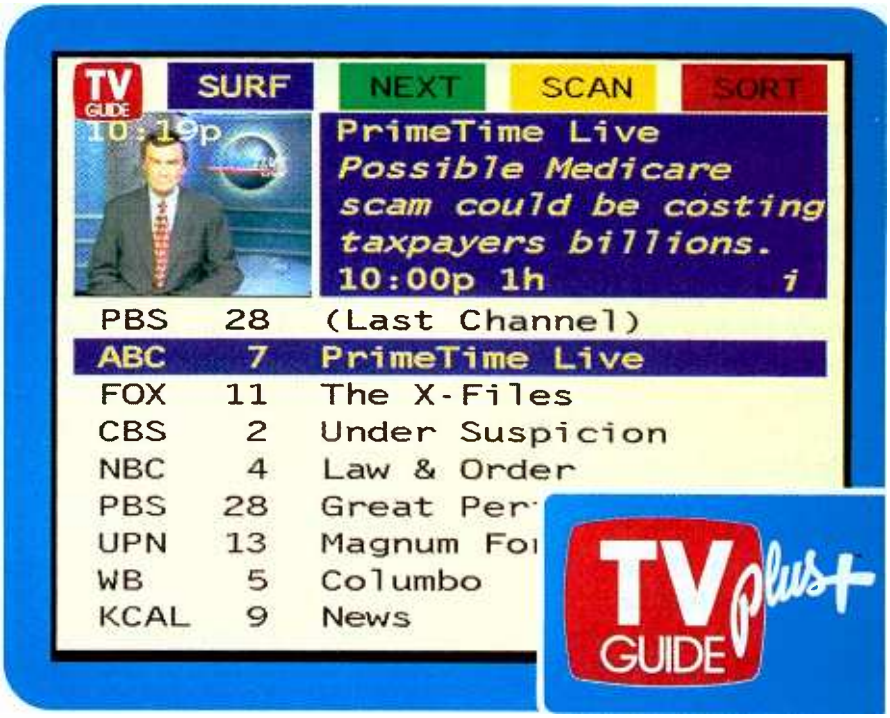
The EPG battle heats up

Everybody wants in on telling what's on television.

By Marjorie Costello



Since March 1995, when this column reported on VBI-delivered on-screen consumer services, electronic programming guides (EPG) have become one of the hottest features in consumer electronics. Interactive EPGs have also been at the center of a flurry of announcements involving major CE manufacturers, broadcasters, cable companies, computer software giants and online services.

StarSight, the first interactive EPG, has been joined by a host of new systems, including VideoGuide and TV Guide Plus+. And EPGs — originally launched in TV sets, VCRs and set-top boxes — are moving into cable converter boxes and DSS receivers. With times being what they are, a sophisticated interactive TV listing guide, TV1, can be accessed by modem-equipped computers from the World Wide Web.

Introducing new ways to tell viewers as much as possible about what broadcasters are transmitting has become one of the major trends in new media. And it's no wonder: As indicated by industry research reflecting frequently expressed consumer complaints, 90% of TV viewers have difficulty finding programs on cable, and 70% cannot tape a program on their VCR.

Above photo: Gemstar's TV Guide Plus + system is a no-frills interactive electronic programming guide (EPG). The service is free, but Gemstar charges manufacturers a fee for licensing its technology into televisions, VCRs and other equipment.

StarSight update

As reported last year, StarSight — based in Fremont, CA — was launched in 1994 as a full-blown 7-day grid guide delivered on the VBI to home equipment. Unlike the passive scrolling guides available on many cable systems, StarSight and its newer competitors are interactive. Among other interactive features, these EPGs let TV viewers instantly tune to a show from the guide with the press of a button.

During 1995, StarSight was added to TV, VCR and TVCR models sold by Sony, Samsung, Sharp, GoldStar and Magnavox — among others. These companies joined Zenith and Mitsubishi, the first companies to feature the EPG in some TV sets. Magnavox is also selling a stand-alone StarSight box, and StarSight elements have been incorporated into the Digital Satellite System (DSS) marketed by Sony and Thomson. Also, Toshiba, Panasonic and Hughes Network Systems (HNS) have licensed StarSight features for their upcoming DSS hardware. And Toshiba and Panasonic will offer StarSight in several TV models.

At the end of 1995, Thomson Consumer Electronics' (TCE) French parent company, Thomson Multimedia, announced plans to invest $25 million in StarSight, giving the company 13% ownership, with options to increase its stake to nearly 20%. TCE plans to aggressively incorporate the EPG in selected product lines, which include GE, ProScan and RCA — the leading TV and VCR brands. RCA will use a version of StarSight in the company's upcoming Genius Theatre TV/PC system.

Paging all VideoGuides

During 1995, a second interactive EPG called VideoGuide entered the market. Based in Bedford, MA, VideoGuide was developed by veterans of the video game industry. Like StarSight, VideoGuide is a fee-based EPG, but it is delivered using the BellSouth paging network and is only available in a set-top box. The paging information is received by a small antenna attached to the set-top box, which sells for $99. Consumers pay a monthly fee that is about the same as what StarSight charges, averaging $4.

Both VideoGuide and StarSight display their information on a 7-day grid guide. VideoGuide — reflecting its developer's video game background — features snazzier graphics, more distinctive fonts and even colorful network logos. However, StarSight offers more selection and sorting features.

VideoGuide also offers two additional ser-

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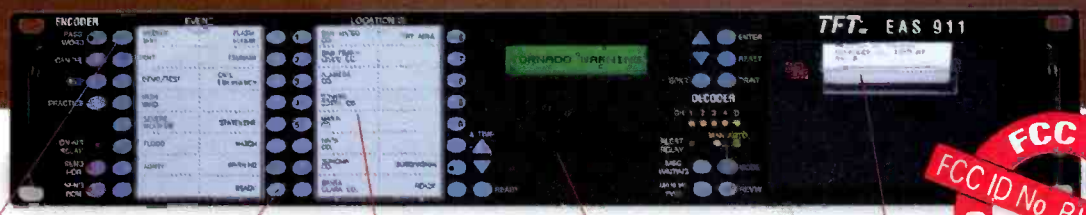

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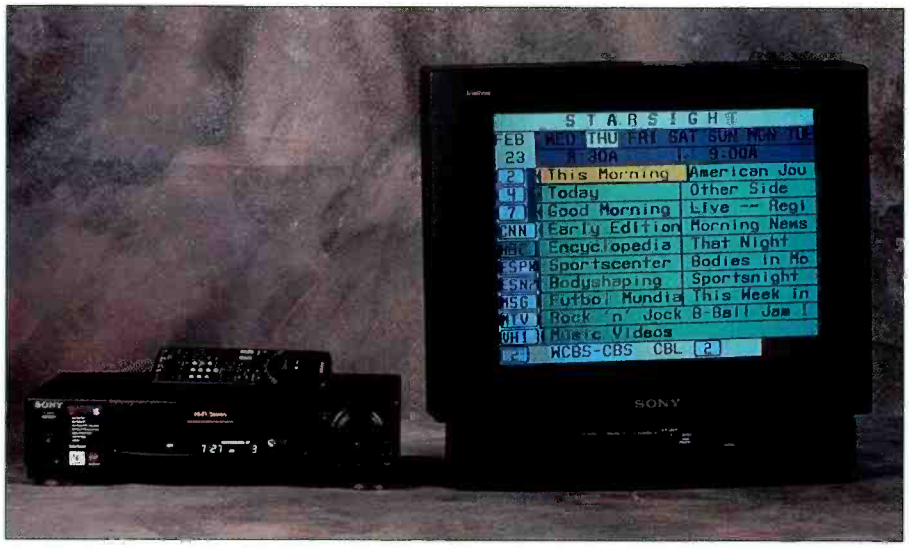


StarSight has been added to TV, VCR and TVCR models, such as the Sony SLV-98 0HF VCR shown above.

vices that will appeal to news and sports fans: "NewsGuide" and "SportsGuide." Sold as separate add-on services, but available free for the first month, NewsGuide includes a real-time electronic newspaper, updated regularly with UPI and AP newswire stories. Local weather is provided for the current day, as well as several days ahead, and the Dow Jones Industrial Average is updated throughout the day.

As yet, neither VideoGuide or StarSight has signed on networks, stations or consumer products companies as advertisers on their guides. However, this could change in the future.

At the 1996 Winter Consumer Electronics Show, VideoGuide announced plans to offer an add-on cartridge for its set-top box that would integrate DSS and other satellite channels with the EPG's broadcast and cable listings. The $50 cartridge will arrive sometime this summer.

Gemstar's new plus

Last year, Gemstar — the company that invented the VCR Plus+ for easy VCR programming — announced Guide Plus+. Like StarSight, Guide Plus+ is delivered on the VBI, but in contrast to VideoGuide and StarSight, Guide Plus+ is free. The company charges manufacturers a fee for licensing its technology into televisions, VCRs and other equipment.

However, Gemstar's system is a no-frills interactive EPG with TV program information confined to the next two days. Also, Guide Plus+ presents only a single column of information, while the other two EPGs can display data on up to three half-hour time periods. Guide Plus+ also lacks the program sorting options of VideoGuide and StarSight, but like the other two, offers what is commonly called "one-touch recording" for VCR programming.

Besides being free, Guide Plus+ offers another advantage that will be of special interest to broadcasters — a "live" video window of the current channel, fully integrated into the text and listings.

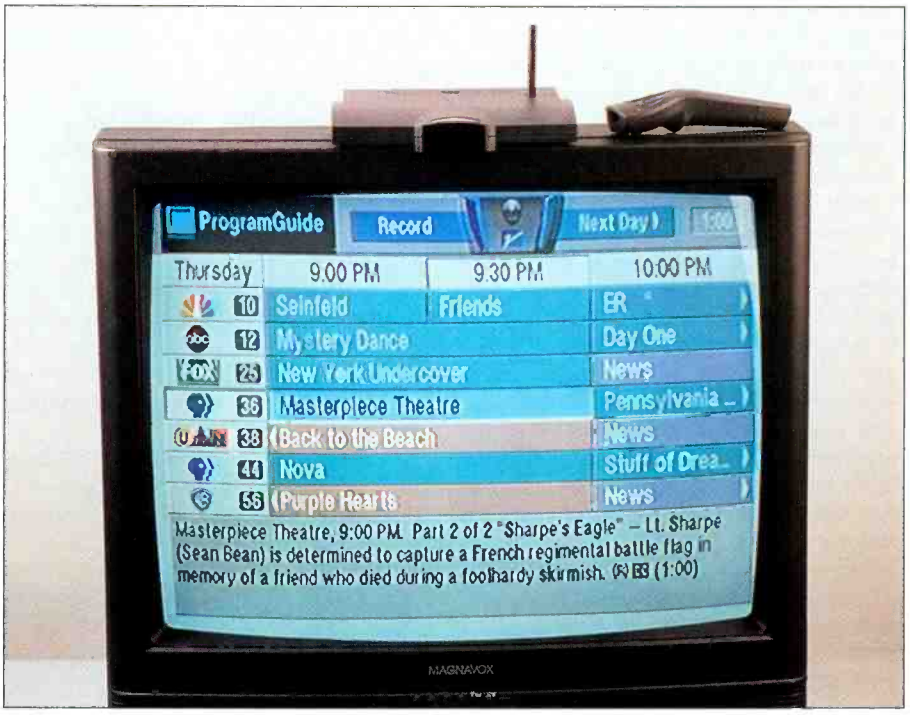
Pasadena, CA-based Gemstar announced in May 1995 that its EPG would be carried by ABC's VBI, the same network that was

then transmitting tests for Gemstar's other new system, Index Plus+. As reported last year, Index Plus+ provides some on-screen display information, but it is primarily geared toward creating an on-screen directory of all programs contained on a tape. This can be a cassette with off-air recording or a prerecorded tape.

However, in November, Guide Plus+ became TV Guide Plus+ after Gemstar formed a joint venture with Rupert Murdoch's News Corporation. As part of the deal, additional TV Guide-related information will be incorporated into the EPG and the Fox network will also be carrying TV Guide Plus+ data on its VBI. (News Corporation will continue development of TV Guide On Screen for cable boxes, as well as its on-line version for computers.)

Gemstar's alliance with TV Guide is also expected to lead to more relationships with stations — so they can provide last-minute scheduling changes — and an advertising marketing effort.

The first televisions featuring TV Guide Plus+ are slated to arrive this spring from Magnavox and JVC, with Gemstar reporting it has licensed most of the major TV and VCR brands to feature its EPG. The first VCRs offering Index Plus+ are either available or expected from Panasonic, JVC and Hitachi.



VideoGuide offers a fee-based EPG delivered using the BellSouth paging network and is only available in a set-top box. The paging information is received by a small antenna attached to the set-top box.

Guides get together

Because we are in the era of strategic alliances, Gemstar and VideoGuide decided to form one. Gemstar made a $3 million investment in VideoGuide, with Gemstar becoming VideoGuide's exclusive technolo-

gy licensing agent worldwide. This includes making deals here and abroad with consumer electronics companies for incorporating the VideoGuide technology into products, such as VCRs and televisions. Gemstar could also license and market VideoGuide's set-top box and service in foreign markets.

Because TV Guide Plus+ is a free service providing a no-frills EPG, and VideoGuide charges a fee for its graphically rich, full-blown grid guide, the companies are positioning their services as complementary. The aim is to leverage the systems to target different types of customers, pocketbooks and product-line segments, similar to the approach used in cable television to market basic and premium services. It's possible that Gemstar will incorporate VideoGuide features — such as news and sports — in future versions of TV Guide Plus+.

From all reports, it appears that the alliance was formed to counter the growing clout of StarSight, with its new infusion of French francs and RCA's American marketing clout. Thomson's investment in StarSight is not confined to buying into the company and sharing in revenues. According to TCE's executive vice president, Joseph Clayton, his company will be spending a total of $100 million to incorporate the EPG in its products, with the intention of "making StarSight an industry standard."

Cable converts to EPGs

Cable is beginning to catch EPG fever, with the first StarSight-compatible converters now deployed in several systems. And major MSOs have more than a passing interest in StarSight's success; besides Thomson, StarSight's major backers are drawn from cable, including Viacom International, Cox Communications, Tribune Company and Time-Warner.

New advanced analog boxes are now being deployed in systems throughout the country, with some models supporting other EPGs — such as TV Guide On Screen — as well as StarSight. At the end of 1995, Scientific Atlanta delivered its new 8600X HCT converter supporting StarSight. StarSight-compatible converter boxes, such as General Instrument's (GI) CFT 2200 and Zenith's MM 2500, were introduced earlier this year. TKR, in New Jersey, has rolled out GI's CFT 2200 and is conducting a StarSight test, with Time-Warner offering the StarSight-equipped Zenith MM 2500 converters in San Antonio.

StarSight offers MSOs an unregulated source of revenue without requiring them to make a major capital investment to offer the service. StarSight is now being marketed in tiers — like basic and premium channels — offering different feature packages. And the company is planning to deliver new services in the future, including MSO branding, local insertion, electronic messaging and advertising.

The on-line connection

The other wire to the home connected to another popular electronics device is also delivering information to consumers about what's on television. TV programming listing guides are now available on the major on-line services and the web. And Gateway, the computer direct marketer, is offering an interactive EPG to customers who buy its new Destination PC/TV. Destination's EPG is being supplied by Harman Interactive.

The most sophisticated on-line TV listing guide is available on the site operated by TV1 (http://www.tv1.com), an interactive service that first debuted on the web in January as "What's On Tonite." After a redesign, the site officially became TV1, and following a beta test, went "live" in February 1996.

Visitors to the site can see free listings for the day. This is the same information that the Microsoft Network is offering on its web start page (http://www.msn.com) by clicking on the "Show Tonight's TV Listings" button. Microsoft, impressed by TV1's service, includes a link to TV1's program grid as one of the user-customizable options on MSN's Internet home page. The MSN page — as well as TV1's site — is accessible by all Internet users, at no charge, using most web browsers.

If you become a registered member of TV1 — which requires providing name, address, E-mail and computer information, as well as selecting a user name and password — free customizable listings are available for the next six days.

As part of the TV1 customization, members provide information about their preferences by program category, time and channel. Members can also use a search feature to locate TV programs they specify, and print their own personal viewing schedules. TV1 is already going one step beyond the CE-delivered EPGs by offering hyperlinks to web sites operated by participating advertisers.

For example, participating TV and cable networks and channels can benefit from special hyperlinks in TV1's detailed description area for individual shows on their channel. These links can take TV1 web cruisers to special graphics, chat or newsgroups, as well as audio and/or video previews for a selected TV show. Another feature that TV1 is offering to participating Internet service providers, on-line newspapers, broadcast and cable programmers is co-branded listings. TV1 will customize listings to the co-branding partner, with advertising links and the resulting revenue shared by TV1 and the co-branding partner.

Cable is beginning to catch EPG fever with the arrival of StarSight-compatible converter boxes, such as General Instrument's CFT 2200.

A scaled-down version of TV1 is also offered on CompuServe, but without many of the features that make the service unique. And, the HouseNet section of America Online includes prepackaged TV1 listings of home repair shows called "How to TV."

TV1's benefits for broadcasters

The possible benefits to networks and channels for supporting the TV1 Internet site include: showcasing coming attractions, promoting their presence on the web, expanding the reach and impact of on-air promotions, and integrating relevant TV1 listings into their web site. Another opportunity is to tie in affiliates for increased local market penetration.

Explains Terry Schedeler, of Schedeler &

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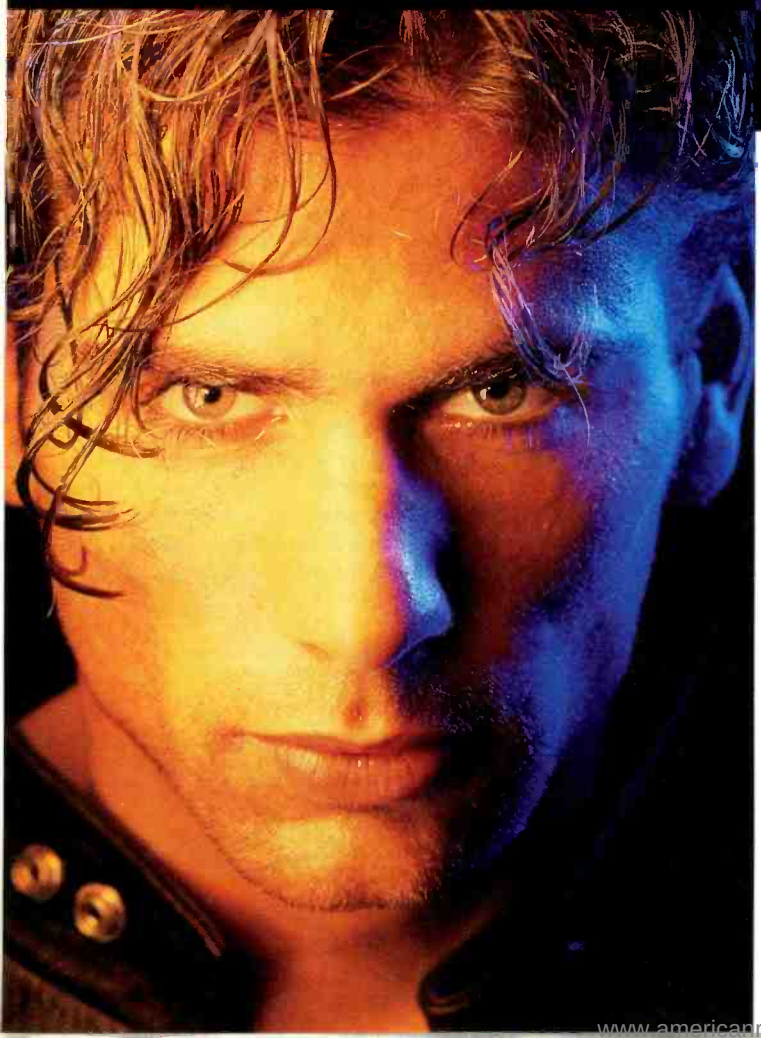

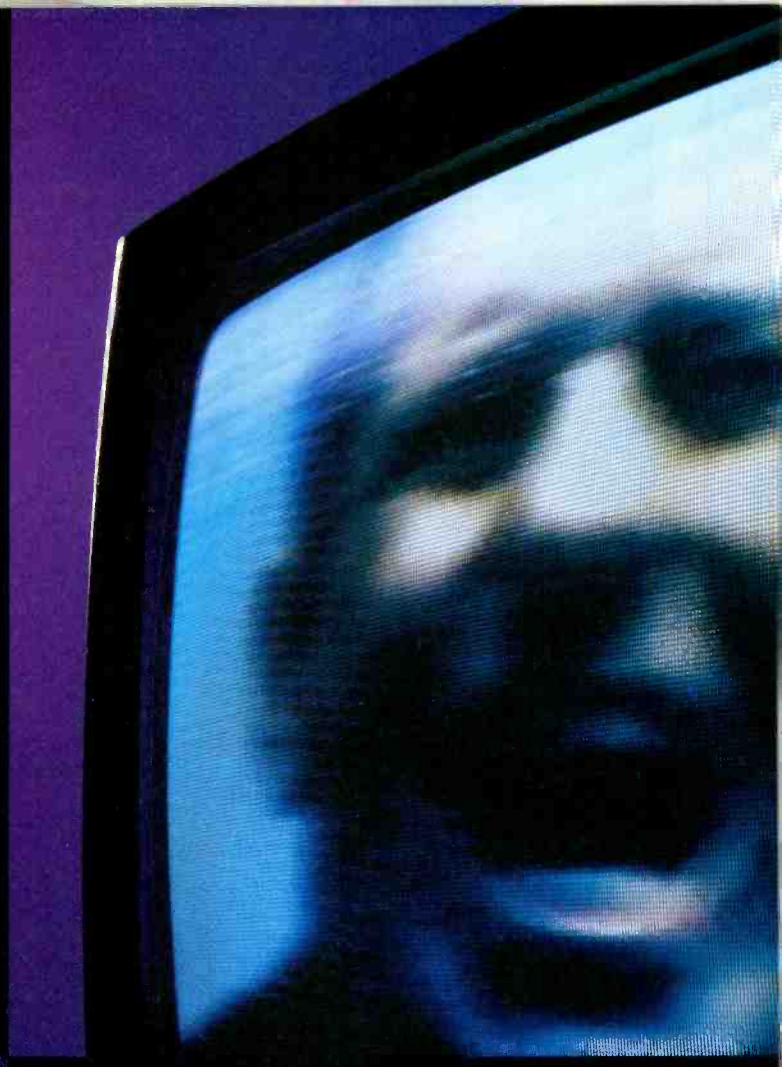

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Company, one of the partners in TV1, "We have architected an environment whereby [networks and channels] can either provide us with graphics and links to things or they can come on the site as an advertiser, within the listings, to promote a specific program." Schedeler — based in Chapel Hill, NC, and specializing in on-line marketing communications — notes that TV1 can "co-brand the site down to their local markets," which can be viewed by a member in an individual TV market, since members provide zip-code information when they join.

Stations could also use TV1's E-mail to send viewers information about an upcoming program. These station-generated messages would tap TV1's database containing information on its members' program preferences. That way, stations could target TV1 members in their markets with appropriate information. (As Schedeler points out, TV1 also gives members the option to decline these messages and other solicitations.)

The sophisticated software, search engines and customizable features used by TV1 are the work of another partner, New Century Productions. Based in Saratoga Springs, NY, New Century is a software development company with a specialty in Internet applications, whose principals are Art and Craig Gravina.

Although neither Terry Schedeler nor Craig Gravina were prepared to provide details, they admitted that TV1 is developing a system that would let members program their home VCR from the listings. Currently, members can print out a list of programs they plan to record off the air. TV1 is also developing unique capabilities related to the "neural networks" research conducted by TV1's third partner, Dr. Martin Block, a professor at Northwestern University's Medill School and principal in Block Research.

Stay tuned for the neural network

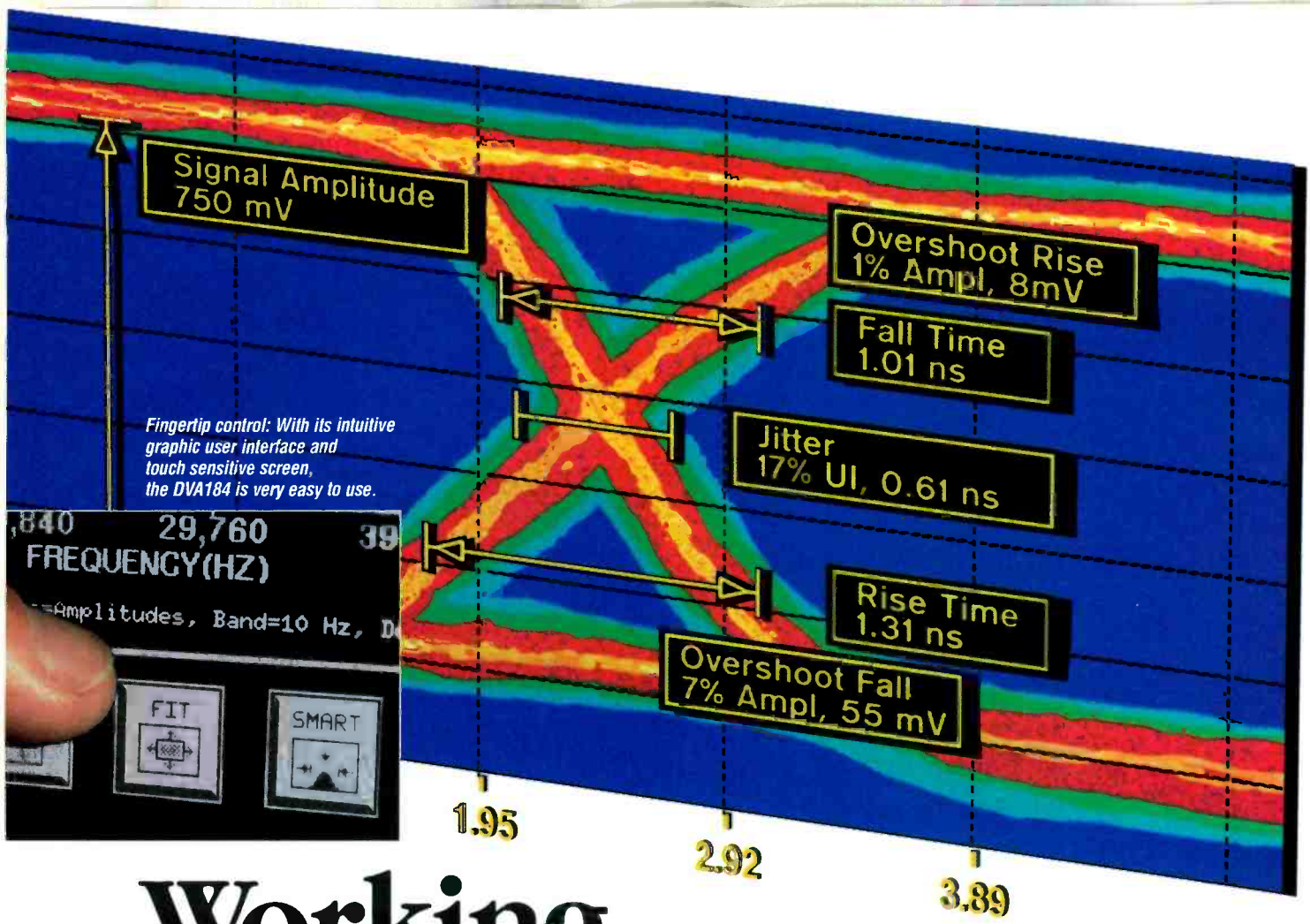
What is a neural network? Relax, it's not another cable channel. Instead, it is a market research method that Block has already applied to determine how consumer preferences for one type of product can be used to predict what else they might also like. Block used neural networks in evaluating supermarket scanning data to find out how people consume products. Through Block's work for packaged-goods companies, marketers found out that the common thread among shoppers who bought Company A's spaghetti sauce was that they were cat owners, while shoppers who bought Company B's spaghetti sauce owned dogs.

TV1 will use neural networks to examine people and television: TV1 will gather data on what people tend to watch on television, compare a member's preferences with other people who are like them and then recommend programs and messages that are likely to be of interest. States Scheduler, "That helps you find out how people consume information, and why we are integrating it into our site."

As Scheduler explains it, the benefits of neural networks are twofold: "For TV1's members, we will be able to suggest programming that would be of interest to them. For advertisers, [neural networks] will help them place more appropriate messages in front of the right kind of people."

This being the age of customization and competition being what it is, it's just a matter of time before the TV-based EPGs develop the technology for targeting your viewers through their own networks. ■

Marjorie Costello is a broadcast and video industry consultant and *Broadcast Engineering* contributing editor based in New York. Respond via E-mail: MACostello@aol.com



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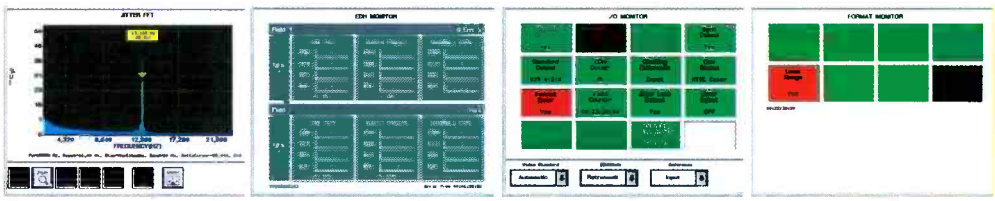

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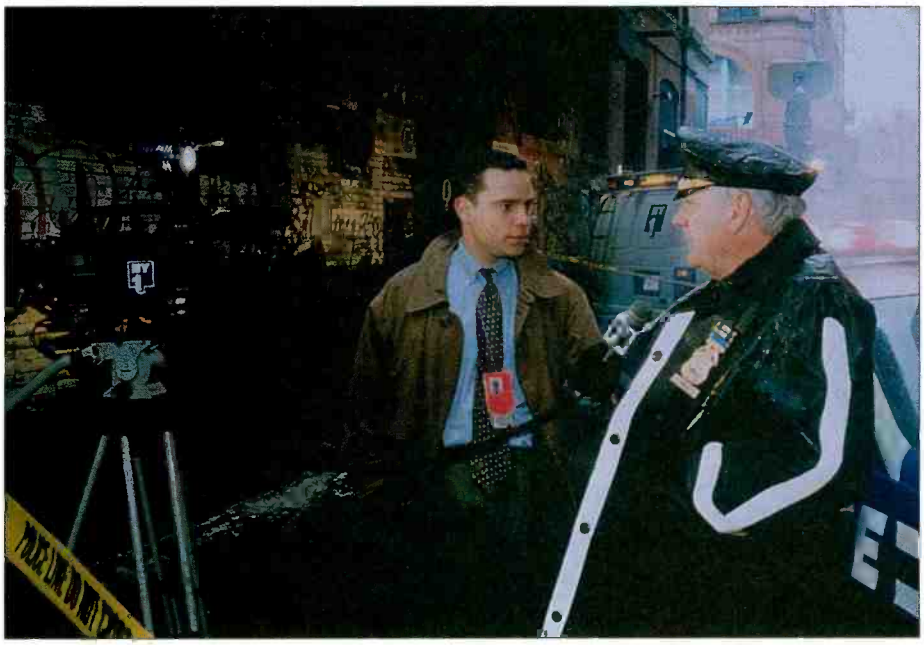
By Steve Epstein, technical editor

Special Report: DVCPRO



DVCPRO debuted at last year's NAB as balsa-wood models in a glass case. Despite this, the promise of high-quality digital acquisition on compact cassettes was apparent, but could Panasonic deliver? It's now a year later, and based on reports from those fortunate enough to get their hands on early production models, it appears that they have.

Format basics

For those who are not familiar with the basics of the format, here's a quick rundown of the specs. DVCPRO is a professional format based on the consumer DV format. The DV format was assembled by a consortium of more than 10 manufacturers, including: Sony, Philips, Thomson and Matsushita. This group produced a digital video system that included four components: a compression standard, a family of cassettes, a transport mechanism and format and a chipset that encapsulated the technology. Today, more than 50 companies are involved in the development of the DV standard. Table 1 summarizes some basic DVCPRO vs. the DV differences.

The compression standard involves first subsampling the 4:2:2 signal to 4:1:1, which reduces the overall data rate. Then, a 5:1 DCT-based intraframe compression is applied to the signal leaving a payload data rate of approximately 25Mb/s. The compression/decompression process is performed by a standard chipset that can be integrated into a wide range of equipment.

Photo: NY 1 has standardized on Panasonic's DVCPRO for all field acquisition. The new digital format provides one-person crews with lightweight portability and high-quality images.

Independent of the compression process is the storage process. The beauty of this is that it allows the compressed signals to be stored on a wide range of media, including tape, disk and even large RAM buffers.

The family of cassettes comprise three cassette shells --- small medium and large. Within the shells is 6.35mm (1/4-inch) metal-evaporated tape. DVCPRO uses the larger two of the three shells and metal particle tape. (See the sidebar "The Tape Behind DVCPRO," on p. 82.) The medium shell (about the size of an audio cassette) provides 63 minutes of recording time, and the large shell provides 123 minutes.

The DV transport mechanism is about the size of a full-height 5.25-inch disk drive. Power and size requirements are such that it could be installed in a computer drive bay. The DVCPRO transport is designed to withstand the rigors of field use and can be replaced easily with a new unit. The head assembly is about the size of a quarter, and can be replaced in less than three hours or the unit can be returned to Panasonic for replacement. Panasonic states that it will guarantee repair of a DVCPRO in 72 hours or provide the customer with a loaner. At 6,000 hours of operation (about two years of operation), Panasonic recommends a more extensive maintenance overhaul. For $3,123, Panasonic will install a new factory-aligned mechanical chassis with heads. The

extensive overhaul takes only three hours to complete --- there's no rebuilding of gears, springs, bearing or rollers.

Finally, the DV chipset, which consists of three chips, allows DV technology to be easily integrated into computers, disk and even set-top boxes if the market desires. Currently, both Tektronix and Truevision are involved in integrating DV codecs into their product line.

DVCPRO

There are several significant differences between DVCPRO and consumer DV products. The DVCPRO format has two longitudinal tracks: one for control and one for a cue track. The pro format uses a wider helical track and a higher tape speed. The DVCPRO format specifies a track pitch of 18 microns, and the DV's track pitch is 10 microns. DVCPRO tape moves at 33.8mm/s, while DV tape moves at 18.8mm/s. The pro format uses L and M cassettes, while the consumer format uses L and S cassettes.

At NAB, the talk of the show was the obvious differences between the DV format as implemented by Sony and the DVCPRO format from Panasonic. Sony announced that its products will rely on a 15μ track pitch. Will tape between the two companies' products be interchangeable? Current machines can playback Sony DVCAM tapes. However, future machines will be optimized for improved playback.

The central part of Panasonic's DVCPRO line is the AJ-D700 camera. Providing full ENG capability in a lightweight and economical package, it's a good fit for those applications where one-person crews are a must.

Perhaps the most eagerly awaited piece of DVCPRO equipment is the laptop editor. With two player/recorders, complete pieces can be edited in the field. The editor requires only 12VDC for operation.

The obvious question then becomes, will there be another format war like we saw on the consumer front with Beta and VHS? It's hard to say, but Panasonic has applied to the SMPTE for the D-7 designation for DVCPRO. Also, other vendors have lined up behind DVCPRO. Sony has not yet announced similar alliances.

A wide range of DVCPRO equipment is already available, with an even greater range expected in the next year. Currently, studio decks, a cassette library automation system, full-size camcorders and a hand-held DV camcorder are available. A laptop field editor will be available in the coming months. Proposed equipment includes a computer transport, as well as a newsroom server that uses Mercury computers on a multiplexed PCI bus combined with DVCPRO libraries and high-speed playback decks.

For Panasonic, DVCPRO is far more than just a tape format; it is a new way of looking at professional video acquisition and archiving. DVCPRO tools enable operators to complete their tasks quickly and efficiently, without the hardware getting in the way. One of the early DVCPRO adopters agrees. The cable broadcaster NY 1 has chosen to move its entire newsgathering operations to DVCPRO.

DVCPRO plays back Sony DVCAM tapes.

The AJ-D750 digital studio VTR provides complete versatility for editing applications. Tapes can be dubbed into the unit's HDD at four times speed, thereby shortening editing time.

NY 1

According to NY 1's Harlan Neugeboren, director of operations and engineering, NY 1 was looking for an acquisition medium that met the following criteria:

A. Digital recording
B. Robust format that could withstand several passes on a cassette
C. Competitive price point between $10K and $20K
D. Rugged product designed for broadcast operation
E. Easy operation and training
F. Easy maintenance
G. IC card setup
H. Availability of consumer/prosumer handycam equivalent equipment
I. Full product line within the format

These criteria were based on the cable system's news operations where the reporters and assignment desk personnel shoot their own material. At NY 1, everyone is a one-person crew. Because of this, the new format had to be reliable, rugged and easy to use and maintain; the IC card setup was extremely important.

According to Neugeboren, NY 1 chose DVCPRO for several reasons. The 4:1:1 recording format was not viewed as a quality limitation because of the limited number of generations required in a newsgathering operation. The quality of the serial digital output was quite adequate from a quality standpoint. Additionally, the AJ-D700 full-size camcorder was built as a broadcast product, but because the format is based on DV, it provided some level of interchange with consumer DV tapes. The metal-particle tape has proven to be durable; tape wear tests performed with the AJ-EZ1 handycam revealed no dropouts, even after 15 passes.

When fully outfitted, NY 1's complement of DVCPRO equipment will include 22 AJ-D700s, 34 AJ-D750s and 20 AJ-EZ1s.

Overall, Neugeboren says he's pleased with the performance of his DVCPRO equipment and satisfied with the breadth of options available in the format. Beta versions of the laptop editor received high marks from NY 1 editors, and they are eagerly awaiting production versions. ■

For more information on the DVCPRO, circle (202) on the Action Card.

NO.	ITEM	DVCPRO	DV (Tentative)
1	Cassette	L, M	L, S
2	Tape	MP	ME
3	Tape speed	33.8 mm/s	18.8mm/s
4	Track pitch	18 µm	10µm
5	Mechanical	Narrow tolerance	-
6	Control track	Lower track	None
7	Cue track	Upper track	None
8	Digital audio I/F	AES/EBU	-
9	Digital video I/F	Serial (259M)	-
10	Time code	Full support	-
11	Machine control	RS-232C/422A	-

Table 1. The differences between DV and DVCPRO equipment are significant. However, Panasonic claims that DV-compliant tapes will be usable on it's equipment, which affords users valuable in-the-field options.

The tape behind DVCPRO

DVCPRO requires tape performance levels that are much higher than those obtainable through conventional tape-manufacturing processes. Fujifilm has developed a process called ATOMM (Advanced super Thin layer and high Output Metal Media) that uses a double layer of particles. The base layer is a nonmagnetic layer of ultrafine particles. The top layer is composed of high-energy metal particles at a submicron order of thinness. This two-layer process results in reduced self-demagnetization and provides increased high-frequency output.

ATOMM-II, which is used for DVCPRO tapes, offers two main advances over the original technique: smaller particle size and a thinner coating. These improvements, combined with other advancements, provided a 5dB boost in tape output over the ATOMM technology. DVCPRO tape uses a 0.2µm ultrathin magnetic layer, which is the thinnest ever achieved for broadcast-use metal tape. A new high-polymer binder system ensures transport stability over repeated passes. A lubricant is incorporated on both layers and is calibrated for a wide range of temperature and humidity, providing tape stability and durability, even after long periods of storage. ■

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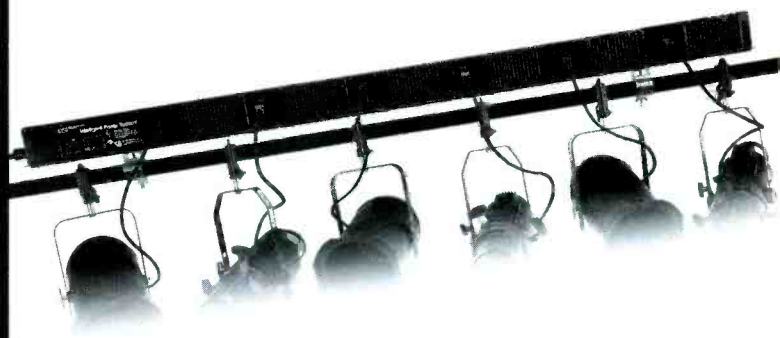

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Circle (46) on Action Card

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By Leonard Charles

The EAS Committee

Ready or not, here it comes. The new Emergency Alert System (EAS) must be up and running by Jan. 1. Two manufacturers, TFT and SAGE Alerting, have received certification from the FCC for their equipment designs. Both companies say there will be plenty of products in ample time to allow broadcasters to comply with the deadline. Now, it's up to you to make it happen.

If you've been reading the "EAS Update" column in this magazine, much of this article will be a review. If you have not read the column, this will serve as a crash course of what you need to be doing between now and the first of the year.

Creating a State Plan

If you are a State Emergency Communications Committee (SECC) chair, your first duty is to create a State Plan. First, you will need to solicit an SECC co-chair from the cable TV community. You will need to revise your state map book to list all broadcasters in the state; list all cable systems in the state; and define new operational area borders if necessary. You will need to define all stations and cable systems with the new EAS designations found in the rules. Each entity in the state must be given two monitoring assignments including the assignment of receivable Primary Entry Point (PEP) sources to the state relay system thus enabling entry of national messages.

The FCC has an outline to assist you in doing this while maintaining a web architecture within each operational area. See Figure 1 for an example of how an operational area could be drawn up subject to the adequate reception of each source by each participant. The State Plan must also list EAS header codes and scripts to be used by the state system in tests and actual activations, as well as a schedule for the required monthly tests. When the time comes, you must provide training guidance for participants of your state. SBE chapters should be able to help you with some of these responsibilities. Don't be afraid to ask.

The equipment

All participants in the EAS should begin by accumulating the information necessary to wisely purchase EAS equipment. It was fairly easy to buy equipment for the Emergency Broadcast System (EBS). This is not the case with the EAS. Today, there is unattended, automated, remotely controlled, manually operated, combo, duopoly, radio, television, cable or any combination of these types of properties. There are many options to choose from to purchase equipment specific to your operation. This month's EAS Update column on p. 10 lists factors to be considered before making a purchase.

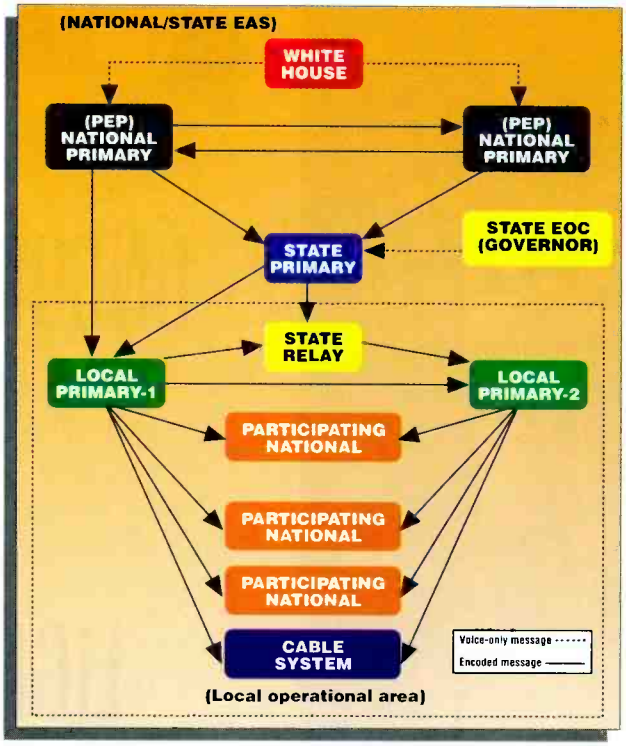

Figure 1. An example of how an operational area could be drawn up subject to the adequate reception of each source by each participant.

Once you have your equipment, you will need to make some operational and programming decisions. The new digital technology of the EAS enables automatic operation. You must decide if you will operate automatically all of the time, some of the time, only on specific received codes or never. Then, using the information in your State Plan, you can program your equipment to react the way you intend on the codes you expect to receive.

Now you are ready to install your equipment. If you and everyone in your operational area are ready to go with the new EAS before the Jan. 1 deadline, you can petition the FCC to do so. Don't forget about operator training. EAS equipment operation is much more involved than was the EBS equipment and will vary depending on which manufacturer you choose and what options you buy. You may consider more than simple operating instructions and give your operators a complete overview of the system.

EAS on-line

Once the EAS is on-line, you cannot remove your EBS equipment because there will be a one-year shakedown period. Between Jan. 1 of 1997 and Jan. 1 of 1998, all emergency and test activations will occur on the new EAS equipment while the decoding will be done simultaneously on the new EAS and the old EBS equipment. After Jan. 1, 1998, you may discard your old EBS equipment with the exception of any EBS receiver modules you may re-use if appropriate for a new EAS-assigned monitoring source.

Everything described to this point is clear and mandated as part of the rules and your State Plan. Believe it or not, that was the easy part. The EAS protocol and equipment is also available to your local area to develop and use an effective local plan in conjunction with all broadcasters, cable operators and emergency government agencies within its boundaries.

Working together, a plan can be written whereby a link can be established from each emergency source to each broadcaster and cable system in your local area. It is here where the use of background channels will be invaluable because, by their definition, background channels are available 24 hours a day year around. There are no mandates in the rules to help develop this local plan as each local area is unique and not prone to a one-size-fits-all blueprint.

No one knows best the makeup of your local area than those located in it. The SBE EAS Committee has written many articles and published an EAS Primer with suggestions on how to go about this task. To purchase a copy of the Primer, call the SBE National Office at 317-253-1640. ■

Leonard Charles is engineer at WISC-TV in Madison, WI, and chairs the SBE National EAS Committee.

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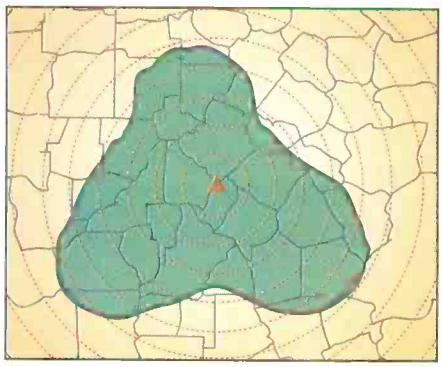
Circle (53) on Action Card

By Don Markley



UHF primer for VHF engineers, part 2

As a review, part 1 of this series discussed the various features of UHF transmitters up to the output of the diplexer/combiner equipment. Obviously, everything in the transmitter facility up to the transmitter is the same for VHF and UHF. The same holds true for monitoring equipment and test equipment, with the possible exception of the need to be able to check distilled water for purity. If the water has a funny metallic taste when mixed with bourbon, a test developed by the author, it is probably bad. If in doubt, inexpensive test equipment is available to test the resistivity of the water.

Transmission line

Now for the transmission line and antenna system. Most VHF technicians are used to dealing with rigid coaxial cable. When using bat-wing-type antennas, and in some other cases, two lines were used that provided equal signals to the transmitting antenna with a 90° phase difference. That type of transmission line system is rarely found in UHF antennas. With the possible exception of panel arrays, UHF systems will always use a single line, with three inches being the minimum practical size.

The transmission line design must deal with two significant problems: the average power-handling capability and the transmission line efficiency. The average power rating of 3-inch line at UHF Channel 50 is 21.8kW. This would handle a 10kW to 15kW ATV transmitter with reasonable margin. The next smaller line, $1^{5}/_{8}$ inches would only be capable of 5.4kW, which would take it out of the usable class for what appears to be the vast majority of ATV systems. Peak power is not really a problem as has been the case for VHF systems.

The second problem, efficiency, is a little more difficult to deal with. If the line length is relatively short, 3-inch line may be quite satisfactory. For a 300-foot run, the efficiency of 3-inch line at Channel 50 would be 82.7%. Increasing line size would not make a significant improvement in such a short run. However, if the station is on a tall tower, the line run can exceed 2,000 feet. For that length, the efficiency drops to 28%, which would probably be considered unacceptable. Remember, the line is not burning up dirty old 60Hz power, which can be had at a reasonable price. The heating of this cable is being done by UHF RF, which is being generated at a considerable cost. Simple arithmetic will allow you to calculate whether it is advisable to increase cable size to improve efficiency based on the cost of such line vs. the monthly expense of generating more RF energy.

Unfortunately, attempting to improve efficiency by increasing transmission line size runs into more problems. First, changing to larger coaxial cable adds more weight and windloading to the tower. Second, even the larger coaxial cables are still lossy at the upper UHF channels. It is of questionable value to go to 9-inch cable for the purpose of efficiency because of weight and cost. Even if those factors are not a problem, the largest coaxial cables are not usable at the highest channels because of their frequency range.

An elliptically polarized UHF antenna used by WJYS Channel 62, Hammond, IN. (Photo courtesy of Andrew Corporation.)

At the highest channels, *moding* enters into the overall equation. That is, the coaxial cable tends to look like a waveguide with a copper conductor hanging in the middle. The result is that the propagation in the cable is not suitable for coaxial cable and the cable is not suitable as waveguide. The solution is to change to waveguide. While power handling has been a primary consideration in many existing systems, the biggest reason for waveguide has been efficiency, which is also the reason why waveguide will be popular in the largest ATV systems.

Before discussing waveguide, it should be noted that it is not a necessity to stay with rigid coaxial cable. Outside of the United States, semiflexible coaxial cables are often used for television including high-power UHF. Some stations in the United States are using semiflexible cables, but their numbers are limited. Good arguments can be made in either direction. Careful thought should be given to the choice of rigid coaxial cable, semiflexible coaxial cable or one of the waveguide configurations. This decision can best be made by discussions of the particular aspects of each station between the station staff, the station's consulting engineer and the manufacturer's representatives.

Waveguide is available in rectangular, round or truncated elliptical types. Choosing between those types will be the subject of a future article. At this time, let it simply be said that waveguide is the most efficient type of transmission line at UHF frequencies. Power handling is not a problem in any of the waveguide types although windloading does differ significantly.

Antennas

The final item in the UHF system is the transmitting antenna. As mentioned earlier, the bat-wing isn't a practical antenna at UHF channels. The primary problem is that higher gain is needed to achieve the higher ERP values without running huge transmitters. Historically, many different antenna types have been used at UHF including some that have fallen into disfavor. The helical antenna was popular for a while as were various

dipole arrays. The zigzag had some popularity and is still available. Although this design provides good gain and bandwidth, it does so only with significant weight and windload. The most popular antenna types now seem to be slot types or pure waveguide antennas.

As is the case with the transmission line choice, picking a UHF transmitting antenna needs to be done with the station's consulting engineer and with manufacturers' representatives. For the purposes of ATV, it is probable that most antennas will be slot types. That design has a good bandwidth over UHF channels and maintains a fairly constant pattern over the full 6MHz. Remember, the problem is not simply to maintain the same azimuth pattern for all frequencies over a channel. The beam tilt must be essentially the same from one end of the channel to the other. With regard to impedance match, most manufacturers now believe that a return loss of at least 30dB over the entire channel will provide adequate performance for ATV.

The transmission line design must deal with two significant problems: the average power-handling capability and the transmission line efficiency.

Other than the input connections and hardware, there is little that can be done to the antennas while on the tower. Most slot antennas are either completely enclosed in a radome or have the slot protected by smaller radomes. The final impedance matching between the transmission line and the antenna is usually made with a matching section, which uses probes or slugs to correct for any mismatch. This is true for either coaxial inputs or waveguide. The theory is simple in either case — introduce a minor mismatch that creates a reflection equal in magnitude but opposite in phase to the existing reflections. When done properly, the reflections cancel out and the antenna looks like an honest 50Ω resistive load. It has been said that achieving a perfect match is as difficult as finding a beautiful, rich nymphomaniac who owns a liquor store. However, with patience, it is possible to come close.

The pure waveguide antennas are something new to the VHF technician. It is the most simple of antennas and can be considered a lossy waveguide section. The signal is applied to a circular waveguide section with slots cut into the waveguide itself. By appropriate placement and sizing of the slots, the energy is coupled out of the waveguide into the desired radiation pattern. It's really not that simple, but it can be considered in that fashion. The problem is that you can't really move the slots to tune the antenna, although the slots can be tuned slightly in other ways. Perhaps more than any other design, the construction of the waveguide antenna with regard to slot location is critical.

Circular polarization has not become as popular in UHF as in VHF. Part of the reason is the cost of producing twice the transmitter power. Another part may be that pure circular polarization is not as beneficial at the higher frequencies. The late Andrew Alford believed that circular polarization was not as effective as moving the receiving antenna a few inches. While that may be the case, moving the antenna a few inches is difficult when channel surfing if the antenna is on the roof.

It has become increasingly popular to use elliptical polarization. That is, some energy is transmitted with vertical polarization but not the full horizontal value. Any amount does seem to help with 15% to 20% seemingly giving the most bang per buck. Remember, UHF antennas with high gain have much narrower patterns in the vertical plane than the lower-gain VHF antennas. Therefore, the shape of the pattern in the vertical plane becomes critical. Careful shaping of the bottom side of the main lobe, which includes null fill, coupled with some vertically polarized signal, has been shown to result in greatly improved coverage from UHF stations.

In summary, the UHF transmission line and antenna system differ from VHF systems in that everything is significantly more critical. Adapters between cable sizes or from cable to waveguide must be optimized on channel. The cable or waveguide must be carefully selected based on necessary power handling and, more critical, efficiency. Finally, the antenna vertical beamwidths are much tighter, which means that their performance and physical alignment is more critical. But look at it this way, it you want everything to stay simple, just work in audio. ■

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

By Tom Waschura

SyntheSys Research DVA184 analyzer

The advent of digital video has created many changes in the TV industry. This includes innovative instruments to help with design, qualification, installation and maintenance. The spread of serial digital video has brought with it similar testing requirements focused on the critical parameters surrounding this format. As a result, a few instruments have been created specially for this purpose.

SyntheSys Research's Video BitAlyzer error analyzer, model DVA184, integrates high-performance analysis aimed at making the serial digital video testing job easier and more complete.

Serial digital video testing

Serial digital video testing includes checking the signaling layer for sending 1s and 0s from one point to another over a single coaxial cable. It also includes checking the format of the data that is being sent. In this case, the format must meet SMPTE or EBU standards for component or composite digital video formats.

The signaling layer for serial digital video transmits a serialized version of the 10-bit parallel format. This is done for 525- and 625-line systems in composite, component and 16:9 widescreen component formats. Bits of the datastream are randomized to assure a maximum amount of data transitions during transmission. This is a requirement to extract timing, as well as data information, from the received stream.

Serial data waveform and jitter

The serial digital video link transfers data at rates as high as 360Mb/s; this translates to 2.7ns per bit. At these rates, poor attention to the analog parameters of the digital data waveshape can limit the ability to send error-free video over a 300-meter link as specified. Parameters, such as signal amplitude, rise/fall times, overshoot and undershoot, must all be characterized with high analog bandwidth.

Much interest has centered on other error characteristics of the serial link, including jitter insertion, susceptibility and propagation through multiple devices in a serial facility. Recommendations have come out of standards committees to help specify jitter. Manufacturers, integrators and studio engineers will have to become more familiar with specifying and measuring these parameters.

Bit errors

Bit error statistics in digital video systems are another tool for studying the quality of systems, as well as a diagnostic tool. Simple bit error rates have marginal usefulness in real-world applications; however, more complex error analysis based on error position information can transform this test from a go/no go measurement into a diagnostic tool in identifying interference and error corrections.

Bit error rate testers of the past, designed primarily for the telecommunications industry, are inappropriate for digital video systems. The limitations for testing with pseudo-random test sequences virtually exclude them from use in the video application. New bit error analysis interfaces are now available on high-performance digital channel error analyzers to allow bit-for-bit error analysis of the serial digital video system while using standard video test patterns. Also, new technology for live error analysis at the pixel-by-pixel level offers the ability to do in-service error rate testing in live motion video.

Format checking

Format checking is another vital measurement of digital video quality. Testing must be done to check that inserted timing signals, pixel values and embedded ancillary data are properly formatted according to standards. Format checking ensures that the video information inside the datastream can be used by downstream equipment.

Testing toolbox

Instruments used in digital video testing applications vary from project to project. Different instruments are used at different phases of the product cycle, including design, debug, validation, manufacturing, repair and in-field maintenance. Instrument requirements, such as size, cost, performance and level of integration, also vary depending on these phases.

Oscilloscopes

The oscilloscopes typically found in video facilities are relatively low-bandwidth analog or digital ones. They are used to look at horizontal and vertical timing of video signals and for general debugging. In serial digital video applications, oscilloscopes with analog bandwidths in excess of 500MHz and high-quality 75Ω terminations are needed to measure the waveform parameters of the 143Mb/s, 270Mb/s or 360Mb/s interface. Digital scopes with sophisticated internal measurements offer semi-automatic ways to measure waveform parameters.

Jitter analyzer

Jitter in a digital signal is defined by the amount of deviation of the data transition edges from their ideal location. Looking at the data transitions is relatively easy with a high-bandwidth oscilloscope, but knowing the ideal locations of the edges is difficult.

One thought might be to try to trigger an oscilloscope on one edge of the signal and look at the variation in another edge using an infinite persistence display mode. The flaw in this approach is that jitter can be at low frequencies causing the variation on any one bit cell to go unnoticed.

The next approach might be to trigger the oscilloscope off of a clocking signal recovered from the data and view the same data edges. This creates an "eye" diagram. This would work up to the bandwidth of the phase lock loop (PLL) in the clock recovery circuit. These bandwidths are typically quite high to allow for the clock recovery circuit to track to incoming frequency variations, making it unusable as a triggering source to study jitter.

A highly stable clock that is recovered from the incoming data, but limited to slow variations must be synthesized to study jitter. This clock can be used as the triggering device to view an eye diagram. Variations in the timing location of the data edges with respect to the highly stable reference clock will show up as a closing of the "eye" in the eye diagram.

A jitter analyzer for digital video must include this kind of clock reference mechanism along with a way to measure the distribution of timing edge variations to determine the peak-to-peak or rms jitter. The creation of this clock reference based on the nondivided down serial data rate assures the highest accuracy and fastest jitter measurement. A histogram of edge placement is the best way to understand this jitter measurement.

Spectrum or FFT analyzer

Jitter measurements are grossly stated in terms of closing down an "eye" diagram to a certain percentage of the total bit period. This type of measurement is independent of the rate of frequency variation that causes the jitter.

The frequency of jitter is important because different jitter frequencies can cause different system problems. High-frequency jitter may

create difficulty in deciding if databits are 1 or 0 and ultimately increase the bit error rate. Low-frequency jitter (or wander) might cause downstream video and audio to include this frequency variation. Worst of all, the transfer characteristics of jitter for a given device, which relates output jitter spectrum as a function of input jitter spectrum, may cause the total system jitter of a few cascaded devices to exceed the jitter tolerance of an entire system. The jitter frequency is also important as a diagnostic tool to isolate the cause.

Studying the frequency domain of jitter can be done by using a spectrum analyzer to study a phase error signal that varies according to the difference between the ideal and actual data edges. Understanding and specifying the spectrum of jitter is important for knowing the jitter susceptibility and jitter transfer characteristics of a device and system.

A spectrum analyzer could be used to study the purity of the serial digital video carrier. However, by demodulating the edge-placement error signal, the bandwidth of the analyzer can be greatly limited. In fact, with this type of demodulator, a modest FFT analyzer can make these measurements accurately.

EDH monitor and bit error rate tester

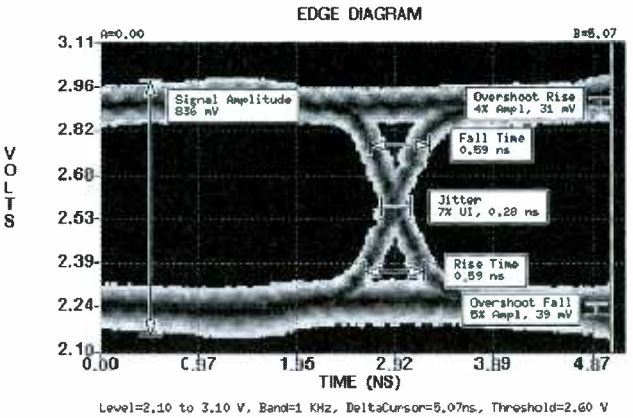
An error detection and handling (EDH) monitor allows checking the serial digital video link, as well as any instruments along the video path, for bit errors. EDH monitors calculate field-by-field cyclic redundancy code (CRC) error-detection codes and compare them to ones embedded within the digital video stream as EDH packets.

A bit error rate tester that can identify error locations to pixel or bit precision can be used to study digital error correlation to horizontal or vertical timing, error spectrum to isolate interference and more. Interfacing commercial bit error rate testers to digital video can be difficult, so instruments designed specifically for video purposes must be used.

Logic analyzer

A logic analyzer is a useful device to look at parallel digital video streams. The built-in capture memory allows an engineer to grab an event and look at the actual video data before and after the trigger point. The difficulty with using a logic analyzer in digital video is that the timing signals needed to identify the location of the data within the video frame or line are embedded inside the data. This makes triggering difficult. A real-time trigger signal is needed to indicate the presence of the type of error where a data grab is desired, and this can be difficult to create.

For this purpose, a video-specific logic analyzer must be used that has capture memory for an entire frame and can be triggered by external trigger or by internally identified format error violations. The grabbed memory must be viewable in many ways including hex dumps, horizontal waveform displays and as an output video still frame.

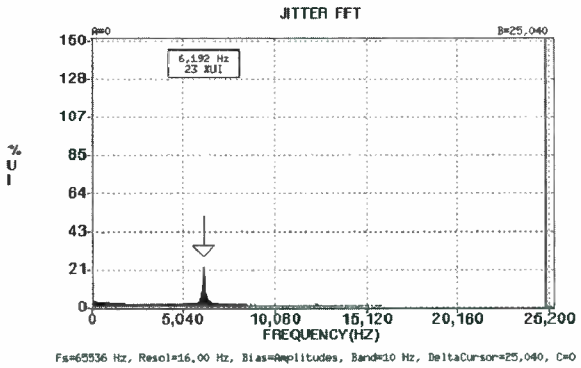


Display of edge diagram with automatic measurements.

Format checking

Format errors can include fields of incorrect size, pixels out of range, invalid timing signal values, incorrect blanking, nonstandard ancillary data and more. Because of the long-term tests required, format checking must be accompanied by a logging feature to allow unattended error monitoring for hours or days at a time. The resolution of this kind of log should be down to the pixel and frame level.

Coupling the isolation of data format errors with the grabbing mechanism of a framestore is vital when trying to isolate rate events.



Display of FFT analyzer.

Still-store and test pattern generator

Test pattern generators are output devices that can generate a variety of commonly used test patterns. A test pattern generator for the digital video engineer must include the ability to create custom test patterns, putting any type of standard or nonstandard data at any active or blanked location in the test frame. This flexibility provides the ability to create worst-case test data and stress devices. This stress can include the ability to insert a programmed bit error rate and jitter component.

Inserting jitter into test patterns and sending them through devices is the best way to measure device jitter transfer functions and jitter tolerance.

An ideal generator will include the still-store ability to grab, save and regenerate a stream from live input video. These grabbed frames must be editable and previewed in a normal still-store-type application.

Waveform monitor

Finally, the digital version of an analog waveform monitor is a useful instrument for the digital video engineer. Ultimately, the product of all the digital electronics comes down to a final analog representation of different color spaces and horizontal lines. A digital waveform monitor translates the pixel values into the more familiar analog values and plots them. In the digital domain, a tabular read-out is also helpful. The units of the read-out can be direct binary, hex or decimal numbers, as well as IRE units.

Automated testing

Serial digital video quality measurement is laborious. Features that allow for automatic and unattended analysis are welcome. Logging of error events and error frames, as well as complete testing of all available measurements with a single command, make analyzers of this type even more useful in the manufacturing and system monitoring functions. Print-outs with all results summarized and compared to specifications make excellent documentation of equipment compliance.

A better understanding

Finally, testing all aspects of a serial digital video link is an exhaustive process, and typically is not done by today's manufacturers. A complete test suite covering serial link and format needs to be simple, cost-effective and automatic, with comprehensive results available in a hard-copy printout for documentation. The general availability of this type of tester allows manufacturers and users to better understand their serial digital video systems. ■

Tom Waschura is a principal engineer with SyntheSys Research Inc., Menlo Park, CA.

By Eric Dausman

Videssence lighting lowers power bills

If your GM is like mine, he or she is constantly asking if there are any other ways to cut costs. After installation of robotics cameras, automation of master control and similar cost-saving measures, what else can be done? It's time to get creative and look at your budget for the big expenses that hit every month. Electricity costs are one example, and it may be easy for you to take advantage of new technology lighting that uses less power. One example is the Videssence studio lighting system.

Videssence lighting uses less power than conventional incandescent lighting, because it uses fluorescent-type technology. Therefore, it is more efficient. Most of the energy input is converted to light rather than heat, as in conventional incandescent studio lights.

The Videssence approach is similar to fluorescent lighting, except that it uses a special high-frequency ballast and special tubes that emit a light spectrum closely matching the color temperature of tungsten lamps. Our anchors love the flattering look of the soft light and the much more comfortable environment, which results from the lack of heat-producing fixtures.

The news studio for KGW Northwest NewsChannel 8 in Portland, OR, is a typical 40' x 50' stage. It uses one dimmer per circuit lighting system, and was installed in the early 1980s. The lighting grid provides 40kW of stage lighting for the news set, which was designed for two news anchors, plus a sports and weather person. News production begins at 5:30 a.m. with a 90-minute show and continues with cut-ins and a noon show until 1 p.m. At 5 p.m. we start a 90-minute news block and eventually finish with an 11 p.m. newscast. The weekend schedule remains the same, except that the morning news block starts at 7 a.m.

System design

Our set dimensions and lighting plan were sent to Videssence for the company's input. The resulting system completely replaced all of the other lighting fixtures. The total power input to the new lighting system is about 4kW. What a reduction!

Our electric company, Portland General Electric, calculated that our original load was reduced by 115,000kWh per year. The studio lighting ran for 59.5 hours per week, 52 weeks per year, with a power reduction of 37kW. In the Northwest, we have inexpensive power rates. Right now, commercial power is around $.05 per kilowatt-hour. The lower power requirements mean a cash savings of approximately $5,750 per year.

Videssence lighting uses less power than conventional incandescent lighting, because it uses fluorescent-type technology. Therefore, it is more efficient.

Also, the heat generated by the lights had to be removed by our air-conditioning system. The power that was being plowed into the HVAC system to remove these BTUs of heat from the studio is also being saved. Portland General Electric estimated that we saved another 26,500kWh per year in air-conditioning costs. This translates to an annual savings of an additional $1,325. The first year, we went through a normal summer with only one chiller coming on-line. Normal operation would have required both chillers on-line during typical summer days. We are saving energy just by the amount of air conditioning needed.

The electric utility offers a cash incentive to customers who install energy-efficient equipment. Therefore, we were able to get a cash rebate to partially offset the costs of the new fixtures. With an installed cost of approximately $28,000 for Videssence lighting, and a cash rebate of $7,000 from Portland General Electric, our out-of-pocket cost was around $21,000 for the project. The payback is around three years at current electrical rates.

Other power savings

Portland General Electric also offered a rebate toward the cost of installing new energy-efficient T-8 fluorescent lamps and electronic ballasts. The economics were simple. The power company would rebate us $20 for each new ballast and lamp set, and we would pay for installation and get the 30% energy savings. We chose to install the lamps and ballasts ourselves rath-

The Videssence lighting system in use at the news studio at KGW Northwest NewsChannel 8, in Portland, OR.

er than paying a contractor, which further reduced the cost of the project. We replaced more than 919 ballasts and tube sets.

There was a dramatic reduction in power use the first month. We had no idea how much energy goes into office lighting. Each new electronic ballast and T-8 lamp uses 30% less energy than the old systems. Our total cost was around $31,000. The utility rebate was $18,000. Our final cost was around $13,000. The estimated energy savings with the new ballasts and lamps is 94,000kWh per year. This represents $4,700 in annual savings. Again, payback was less than three years.

With these energy saving measures in place, our costs will be lower in the future. One thing may be for certain, power rates in the great Northwest will not always be $.05 per kilowatthour. If these projects made sense for our operation, they will probably make sense for many facilities with higher utility rates.

VIDESSENCE SAVINGS

Annual kWh savings	$141,500kWh
Annual power savings	$ 7,075
Installed cost	$28,000
Utility company rebate	$ 7,000
Total out of pocket	$21,000
Payback	**2.96 years**

T-8 LAMP AND BALLAST SAVINGS

Annual kWh savings	$94,000 kWh
Annual power savings	$ 4,700
Installed cost	$31,000
Utility company rebate	$18,000
Total out of pocket	$13,000
Payback	**2.76 years**

Table 1. The cost savings for KGW-TV with the Videssence lighting system.

More savings to be had

What efficiency project is next? Those old chillers in our HVAC system are at the end of their useful life. The refrigerant has even been banned by the federal government. But, there is good news. The utility company is offering rebates for HVAC replacement that improves power efficiency! We're planning now for the next energy-efficient upgrade.

Check with your local utility. You may be surprised how many rebate programs are available for such projects — and how much you can save through lower energy costs.

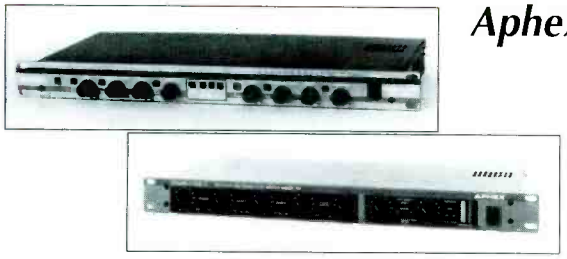
Eric Dausman is director of broadcast operations and engineering, KGW-TV Northwest NewsChannel 8, Portland, OR.

For more information on Videssence lighting systems, circle (201) on Action Card.

Internet: be@intertec.com
CompuServe: 74672,3124
FAXback: 913-967-1905

By Norm Scott

Aphex supplies solution to audio level problems



Performance at a glance

Aphex model 320A Compellor

- *2-channel frequency-discriminating leveler that varies attack time;*
- *Dynamic verification gate that prevents pumping or breathing during short program pauses;*
- *Dynamic recover computer accelerates compressor recovery under complex program to preserve natural sound on transients;*
- *Servo-balanced XLR inputs and outputs.*

Aphex model 722 Dominator II

- *Automatic limit threshold varies ratio of bandlimiting to clipping;*
- *Switchable pre- and de-emphasis, 50µs or 75µs or flat;*
- *Switchable low-to-mid and mid-to-high crossover frequencies;*
- *Peak ceiling adjustable in 0.2dB steps over 34dB range;*
- *104dB dynamic range.*

Several years ago, the engineering staff at Cox Communications, a cable TV supplier serving more than 350,000 residents in greater San Diego, became aware of the problem of drastic variances in the audio levels on satellite-supplied channels.

At the time, about 25 channels were supplied to subscribers equipped with decoder boxes. These boxes were simplistic in design, providing only the ability to manually change stations. Thus, subscribers could adjust the volume while already out of their chair changing the channel.

Audio-level problem solving

We used a simple method to attempt to provide consistent audio levels from channel to channel. A technician would listen to an adjacent channel and adjust the audio out of the satellite receiver, trying to match the two as closely as possible. This approach was less than ideal, and we found that it was detracting to dynamic range, in some cases, rather severely.

Cox gradually added more satellite channels, and cable boxes were upgraded to include an I/R remote control for channel changing only — no volume control. At this point, we started to receive a sizable number of customer complaints about level variances between channels. Further complicating things was our move to add more local commercial insertions on some of the satellite channels. The levels of the commercials didn't come close to matching that of the programming. More complaints resulted.

In seeking a solution to these problems, we added 10 inexpensive audio limiters. They corrected the problem as far as loudness, but on the downside, they added "breathing" during quiet passages of programs. This was quite audible (and annoying), so it was back to the drawing board.

The Aphex solution

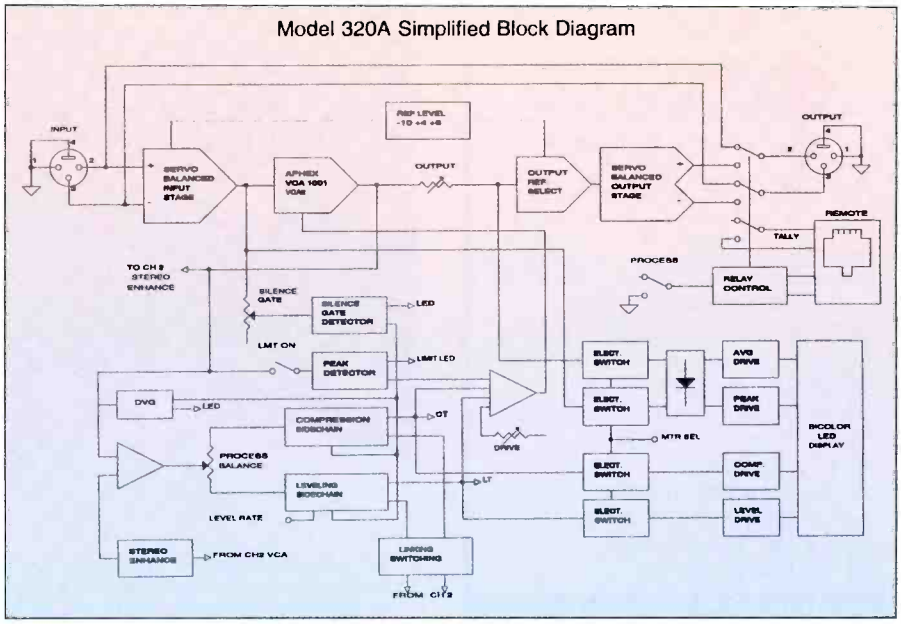
New World Audio of San Diego demonstrated two Aphex Systems products, the model 320A Compellor and the model 722 Dominator II. The 320A Compellor is a dual mono/stereo compressor, leveler and limiter, while the 722 Dominator II is a precision multiband peak limiter.

In our initial evaluation, the first thing that we noticed was the transparency of these products — we couldn't tell that they were being used except that the levels stayed constant without destroying dynamic range. Another thing we immediately liked was that the units would automatically go into bypass mode in case of problems like power supply failure. Audio signal would still be supplied.

We installed the Aphex products for each satellite channel at our downlink facility in El Cajon, CA, dedicating a Compellor and Dominator II to each satellite channel. In the chain, they're located just after the satellite receivers, providing limiting of the audio signal before it's sent to stereo generators, then to an FM modulator, and then out on fiber-optic lines to one of four headends. At this point, audio is never demodulated — we have complete control of it from the audio all of the way through.

The Compellor for each channel is used as a preprocessor. It provides compression and leveling, slowing riding signal up and back and adjusting it to meet the reference point. The Compellor also offers some peak limiting. One of its best attributes, however, is its Silence Gate, preventing audio level "breathing" or "swells" during momentary program gaps. This is especially handy for movies and for more delicate symphony programming on PBS. Older movies, in particular, often include quiet passages used for effect, and the lack of a sophisticated, intuitive gate can create the sound of a forest fire where there should be silence.

The Dominator II, implemented on each channel immediately after the Compellor, provides peak limiting that's as solid as a brick wall. It simply won't allow anything above 100% modulation to get through.



The model 320A Compellor is a dual mono/stereo compressor, leveler and limiter.

The peak ceiling is adjustable in 0.2dB steps over a 34dB range.

A frequent pre-emphasis problem crops up when trying to control modulation on an FM system, with gain increasing by about 15dB in the 1kHz to 15kHz range. Many limiters don't take this problem into account, and the result is overmodulation of higher-frequency, dynamic sounds (like cymbals). Other limiters attempting to address this problem either "breathe" or shut down any time dynamic high-frequency comes through. It ends up overshadowing the entire audio spectrum and washes out the lower frequencies.

The Dominator II addresses this problem well by incorporating multiband limiting. Individual limiters for highs, mids and lows maintain the full bandwidth and transparency of the signal. In setting up the combination for each channel, we look for the "sweet spot" of the Dominator — the point where the unit sounds best and is most transparent — and keep it there.

We use a TFT TV modulation monitor that allows us to set the level of each channel individually. We're under the same regulations of broadcast TV stations as far as percentage of modulation — basically +25kHz. This current level of adjustment is certainly more sophisticated than trying to draw an audible comparison from adjacent channels.

Almost maintenance-free audio processing

In the time since we began implementing the compressor and the peak limiter, the cable boxes supplied to subscribers were further upgraded to include a volume control, and we're now offering up to 77 channels. At least 70 of these channels are satellite-supplied and thus include signal processing to maintain consistent levels.

In addition, we now drop local commercials on 16 channels, which are divided into three regional zones. Each of these zones has its own dedicated set of limiters. The only channels not receiving the "Aphex treatment" are local broadcasts, which are subject to regulations.

Our audio signal processing is virtually maintenance-free. Each week, we monitor each channel's audio level, as well as video level and signal-to-noise ratio, and keep a running log of any changes that need to be made. I've noticed that the times are few and far between when we've had to adjust any part of the audio level.

The biggest beneficiaries of these efforts have been our customers. Complaints about audio levels have virtually stopped since we took the corrective measure of adding the Aphex Compellor and Dominator II. These two products have produced excellent results. You might say that not only has the Aphex combination solved our problem, but they have also been quite effective in "silencing" customer complaints.

Norm Scott is chief engineer for Cox Communications, San Diego.

Editor's note: Field Reports are an exclusive *Broadcast Engineering* feature for broadcasters. Each report is prepared by well-qualified staff at a station, production facility or consulting company.

The reports are performed by the industry, for the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author if requested.

It is the responsibility of *Broadcast Engineering* to publish the result of any device tested, positive or negative. No report should be considered an endorsement or disapproval by *Broadcast Engineering* magazine.

INDUSTRY BRIEFS

BUSINESS

Hitachi, Woodbury, NY, sold five Z-2000 digital cameras to Communications Concepts Inc., Cape Canaveral, FL.

Chyron, Melville, NY announced the election of S. James Coppersmith and Isaac Hersly to the board of directors.

Also, Chyron announced an agreement to acquire 19% of RT-SET, Ltd., Tel Aviv, Israel.

WavePhore, Tempe, AZ, completed the acquisition of Mainstream Data, Salt Lake City, UT for a total price of $31 million. The purchase price consists of $20 million in cash and $11 million in restricted stock.

Leitch, Chesapeake, VA, has been selected by CBS Television Network to produce its next generation of affiliate logo generation systems, CBS LIDIA III. Leitch is now accepting orders from affiliate stations.

Also, racks of DigiBus frame synchronizers designed and manufactured by Leitch Technology are being installed in NBC's New York City facility as part of the network's GEnesis project.

Solid State Logic, Oxford, England, installed an 80-input Sl 9000 J Series console in Larrabee North's, North Hollywood, CA, Studio 1. The facility, which already has an SL 9000 J in its Studio 2, is the first all SL 9000 J Series studio in the United States.

Scitex Digital Video, Redwood City, CA announced that NBC purchased 25 of its Abekas Dveous digital effects systems for use in the upcoming Summer Olympics in Atlanta.

Mountaingate acquired Recognition Concepts, Inc. (RCI) an industry leader in video and real-time disk recording technologies. Mountaingate will take over manufacturing and marketing of RCI's line of video disk recorders and real-time disk recorders.

Quantel, Darien, CT, delivered a HENRY system to Pinnacle Post, Seattle, WA. This is the only HENRY system in operation in Seattle.

Euphonix, Studio City, CA, installed its CS2000 console at Sony Music Studios, New York, NY.

Panasonic, Secaucus, NJ, announced that Tele-Communications Inc., Denver, CO, installed Panasonic's Postbox nonlinear editing system for use in its National Digital Television Center. The system is used to perform on-line editing of promotional spots for five channels of pay-per-view services.

The Television Corporation of the Catholic University in Chile (UCTV), Chile's largest broadcaster, purchased 24 Hitachi, Woodbury, NY, SK-2600 digital cameras, as well as a wideband triax transmission system. Nine cameras are installed in a large, fully digital OB van, while each of UCTV's three digital studios have three of the units. The remaining six cameras will be housed in two smaller OB vans currently under construction.

ABC Radio Network is using Wegener, Duluth, GA, digital audio products to upgrade its analog formats to digital. More than 400 networks have been converted to date.

Channelmatic, Alpine, CA, announced that Daniels Cablevision, Carlsbad, CA will employ Channelmatic's Digital Lite for its move into the digital insertion arena. The digital video servers will be installed at Daniels' Carlsbad (16 channels) and Desert Hot Springs (five channels) with a central encoder to support both systems.

DiviCom, was selected by Star Choice Television Network to equip the company's broadcast center.

Radamec EPO Ltd., England, has changed its name to Radamac Broadcast Systems. There will be two main divisions of the new

company, one dealing with the traditional robotics product line and the other dealing with the virtual studio products.

Telex, Minneapolis, was granted a patent for its RTS ADAM technology. The ADAM system has been purchased by NBC, ABC, CBS, Sony, TNN and SFP, France, and a multiple frame ADAM system has been purchased by NBC for the Summer Olympics in Atlanta.

Graham-Patten, Grass Valley, has supplied Encore Video, Santa Monica, CA, with D/ESAM 400 and D/ESAM 200 series digital edit suite audio mixers.

Broadcast Video Systems, Ontario, Canada, has sold 43 digital and analog linear keyers for use at the Summer Olympics in Atlanta.

Gepco, Chicago, received an order from NEP Supershooters for more than 100 miles of cable for use at the Summer Olympics in Atlanta. NEP will provide the NBC and world TV feed for the event.

Silicon Graphics, New York, has entered a merger agreement with Cray Research. Pursuant to the agreement, Silicon Graphics will acquire the outstanding shares of Cray Research.

HiRes1440 Group, Burbank, CA, delivered the world's first 8:4:4 HR1440 telecine system to Consolidated Film Industries (CFI), Los Angeles.

Thomson Broadcast Systems, a subsidiary of Thomson Multimedia, was awarded a contract by TDF Cable to build the cable network for Aulnoye-Aymeries, France.

A.F. Associates, Northvale, NJ, has completed an upgrade and facility move for Southwestern Cable Television, a Time Warner Cable company located in San Diego. The new network operation was built so that the transition from the existing tape-based system was seamless and achieved without interruption of service.

TimeLine, Vista, CA, sold four Studioframe workstations equipped with Pentium processing power and Studioframe version 6.20 software to Skywalker Sound, Nicasio, CA.

PEOPLE

Kent W. Ewing was named president of Leitch, Chesapeake, Va.

Kent W. Ewing

Mark Pinkel joined Scitex Digital Video as Southwest regional sales manager covering Southern California, Nevada and Arizona.

Andy Johnston was appointed vice president, Strategic Systems Group for Discreet Logic, Montreal, Quebec.

Philip Clement was promoted to managing director, film and television division, for The Rank Organisation, London, England.

Steven Rosenblum captured the American Cinema Editors (ACE) Eddie award for his work on Braveheart using Lightworks digital editing system from Tektronix.

Willie Scullion

Willie Scullion joined Sony Broadcast & Professional Europe, Hampshire, UK, as deputy marketing manager.

Mike Flint was appointed deputy managing director of Sony Broadcast & Professional Europe.

Maurits van Tol was named general manager of Philips TV Test Equipment, Copenhagen, Denmark.

Mark Durenberger was appointed to the newly created position of general manager, Teleport Minnesota for Group W Network Services, Stamford, CT.

William J. Miller was named chairman and chief executive officer of Avid Technology, Tewksbury, MA.

Guy Walsingham was appointed director of marketing for Quantel USA, Darien, CT.

Guy Walsingham

Chris Ishoy was named technical support for the professional products division of Denon Electronics, Parsippany, NJ.

Mark R. Evans was promoted to president of Wiltron Company, a member of the Anritsu Wiltron Measurement Group, Morgan Hill, CA.

Peter Marshall was appointed vice chairman of the board of directors for Keystone Communications, Culver City, CA.

Eloy Chairez was appointed manager of Accom's Western United States sales region.

Jack Lewis, chairman of Amdahl Corporation, was elected to the board of Pinnacle Systems, Sunnyvale, CA.

Steve Cooper was named as the new director of engineering for Switchcraft, Inc., Chicago. ■

NEW PRODUCTS

By Deanna Rood

Automated console

QSC Audio Products

• **Cantus:** a digital automated console the uses the latest in DSP technology and offers the flexibility and power of digital control combined with an ergonomic interface; the console's control surface provides easy and intuitive configuration of all parameters through conventional tactile devices like buttons, knobs and faders; in addition, a built-in computer system also provides control of all parameters through a keyboard, monitor screen and pointing device; a single-channel strip can control up to 10 separate audio channels simultaneously and offers parametric EQ, filter, delay, expansion and dynamic processing; up to 480 channels can be controlled with a single console that is seven feet long; user channel configurations can be saved and downloaded in seconds, providing quick reconfiguration for each session; other features include 24-bit audio processing and a 1.5Gb/s internal bus speed, eliminating internal dynamic limits; the console connects to the processing rack via a bidirectional fiber-optic link.

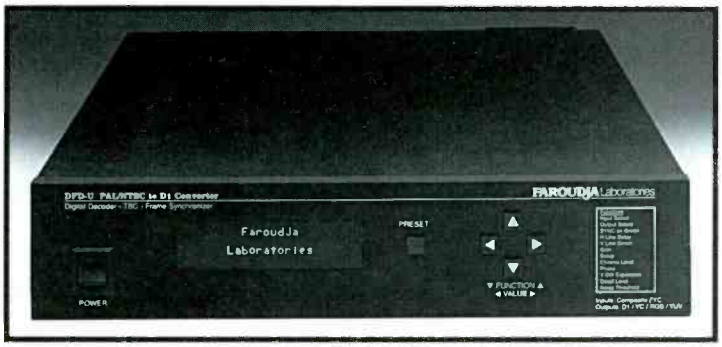
Circle (350) on Action Card

Image stabilizer adapter

Canon Broadcast

• **IS-20B:** an image stabilizer adapter designed to be front mounted on Canon's J20aX8B and H20aX6 ENG zoom lenses; the adapter incorporates Canon's Vari-Angle Prism technology to virtually eliminate shaking and vibration commonly associated with shooting from a moving vehicle, shooting on the run, handshaking or high-wind conditions; features include 8mm wide angle to 160mm telephoto with the J20aX8B (320mm with 2X extender) and maximum relative aperture of 1:1.7, specifications not previously available on Canon's Vari-Angle Prism lenses; other benefits include a panning switch to minimize image fluctuation at the end of panning, a vibration characteristic selector to select between low- and high-frequency mode and an auto-lock mechanism to automatically lock the Vari-Angle Prism when the IS-20B is removed from the lens (preventing damage during transport).

Circle (351) on Action Card



PAL/NTSC digital decoders

Faroudja Laboratories

• **DFD-U:** a series of PAL/NTSC decoders that make use of digital adaptive comb filter technology to convert PAL, NTSC or Y/C inputs into RGB, component or D-1 serial and parallel outputs; different options are available, including a frame synchronizer with full time-base correction; remote control via an RS-232 terminal is also available; all models make use of 10-bit processing, ACC and APC, and digital chroma enhancements; the DFD-U is especially suited for use as a first stage for video compression encoding (MPEG and others) when the input is under NTSC or PAL form.

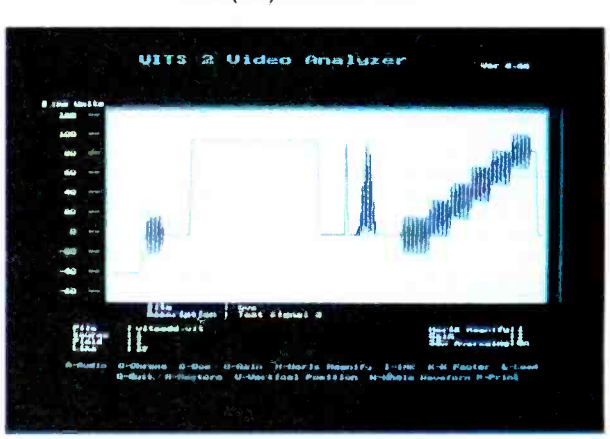
Circle (352) on Action Card

Video analyzer

Broadcast Video Systems

• **VITS 2:** a video analyzer designed to monitor video quality remotely; any line of the video field, including the VBI, can be sampled, digitized and sent by modem to a PC with VGA display capability; once received at the PC, the signal can be displayed on the computer monitor; to facilitate measurement, the display can be filtered, amplified or expanded; K factor or IRE measurements can be performed with internally generated graticules; a signal-to-noise measurement readout is also included.

Circle (353) on Action Card



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Circle (67) on Action Card

Broadcast video fiber-optic system
Multidyne

• Model FTX-95/FRX-95: a fiber-optic video and digital stereo audio transmission system that offers industry specifications that exceed RS-250C short-haul requirements; the signal-to-noise ratio exceeds 72dB and the differential gain and phase are less than 0.5% and 0.5°, respectively; at an optical budget exceeding 30dB, the signal-to-noise ratio exceeds 67dB with 1,550nm laser optics; the system includes front-panel controls for video gain and 1,000 feet of cable equalization; the video bandwidth of 10MHz supports HDTV, NTSC, PAL, SECAM and video with diplexed audio carriers at 4.5MHz, 5.8MHz and 6.4MHz; the video input and output is back-porch clamped.

Circle (354) on Action Card

VVCR digital disk recorder
Drastic Technologies

• VVCR digital disk recorder version 2.0: VVCR delivers a visually lossless image at a compression ratio of 2.5:1; for rough-cut editing and to maximize storage, rates up to 20:1 and off-line modes are also selectable; the new version features RAID 3 support, multihead capabilities, network data transfer support and removable storage media; other new features include time delay, close-caption recording and multiple video format conversion; VVCR provides completely seamless random access across the entire video storage medium; time code used by VVCR is independent of disk layout and is not limited by the actual storage time.

Circle (356) on Action Card

Broadcast and video furniture catalog
Winsted

• 1996 Winsted Furniture Catalog: a free 136-page full-color catalog that includes a helpful component and accessories section featuring a step-by-step design plan for creating a customized rack console system; complete information, specifications and pricing is also included on Winsted's extensive line of video cabinets, consoles, multimedia desks and tape storage systems.

Circle (355) on Action Card

Upgrades for Zydeco and Calypso
Kub Systems

• Zydeco and Calypso upgrades: significant enhancements have been made to the Zydeco and Calypso lines of real-time video and graphics compositing and animation systems; both Zydeco and Calypso image processors now have Intel Pentium-based CPUs, which double the bandwidth of real-time graphical effects; in addition, both products now feature software release version 2.0 with features such as enhanced chroma-key capabilities, hierarchical group outlining, improved spline path controls, multiple tracksheet views and an embedded QuickTime player; the 2.0 software also supports Macintosh floating windows, providing greater flexibility when integrating with third-party products.

Circle (360) on Action Card

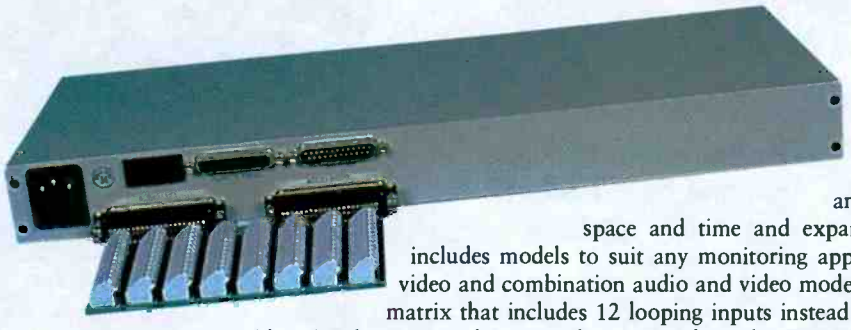
The GALLERY

Single-channel universal digital transport system

ADC Video Systems

• DV6300: a single-channel digital transport system that is the newest addition to the DV6000 universal digital video transport product line; the DV6300 is a single-channel transmission system designed to support the greatest variety of video and telephony channels available today; all existing DV6000 encoder and decoder cards are completely interchangeable with DV6300 installations providing the flexibility to transport any given signal type available such as baseband video, scrambled IF video, MPEG-2 compressed video, DX3/DS1, E3/E1, video carrier and more; the flexible and reconfigurable design of the DV6300 offers unlimited potential for any single-channel video or digital application; single channels can be economically inserted into or dropped from a high-speed DV6300 2.4Gb/s digital multichannel stream to support point-to-point single-channel applications; in addition, the unit can be used to implement stand-alone single-channel optical links.

Circle (368) on Action Card



Monitoring routers

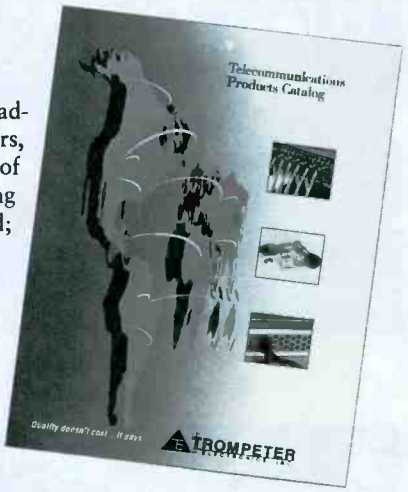
Leitch

• XPRESS series: a series of 12x1 stereo audio and video routers that increase productivity, save space and time and expand on standard control options; the XPRESS includes models to suit any monitoring application including analog and digital audio and video and combination audio and video models; the 50MHz-bandwidth routers offer a unique matrix that includes 12 looping inputs instead of the industry-wide 10; in addition, audio and video signals are routed to a single output where the XPRESS circuitry includes built-in distribution to send signals to four BNC connectors; all models are housed in a one-rack unit metal frame that includes the system controller and a power supply.

Circle (358) on Action Card

Telecom, broadcast and broadband product catalog

Trompeter Electronics

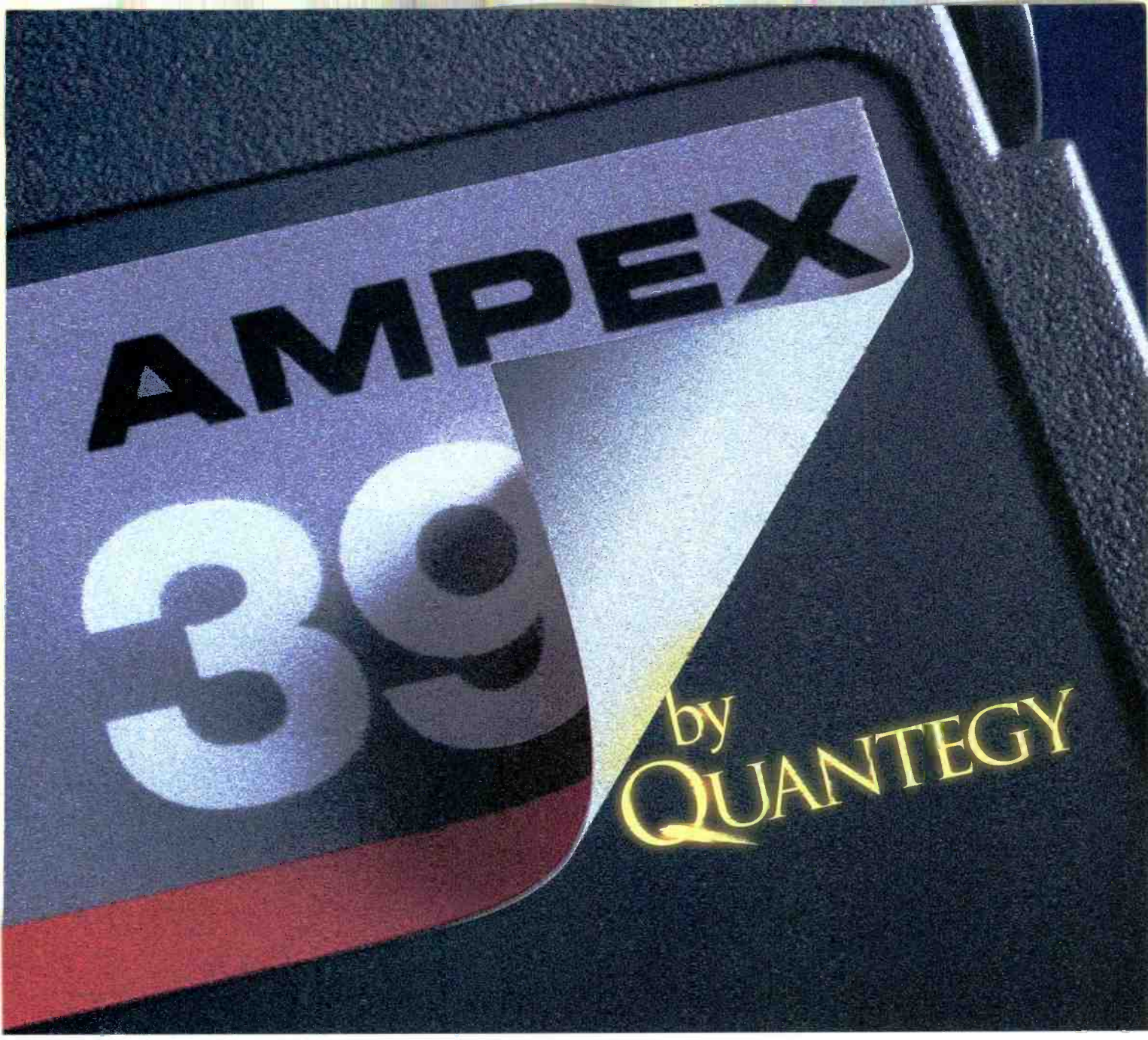


• Telecommunications Products Catalog: a 40-page catalog featuring new telecom, broadcast and broadband products; the catalog serves as a complete guide for coax connectors, assemblies, patch cords, tools and DSX products; the catalog encompasses a wide range of standard 75Ω BNC cable connectors, 50Ω wireless/radio connectors and a new offering of high-performance SI series custom cable assemblies, all of which are ISO 9001 certified; a glossary of terms and information on an installer training program is also included.

Circle (357) on Action Card

Circle (63) on Action Card

Circle (45) on Action Card



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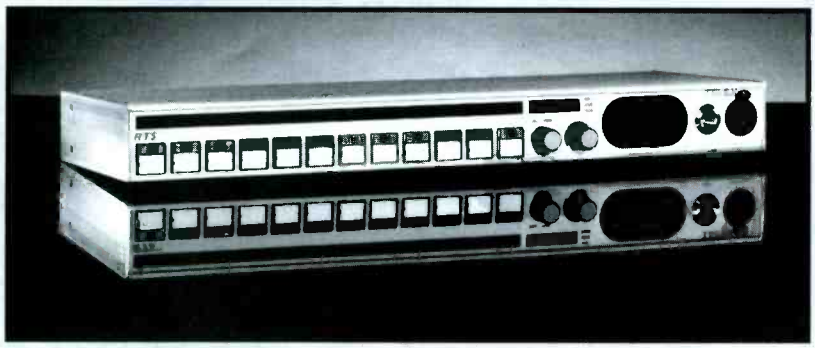
Midwest (Chicago)	(708) 540-5100	France & North Africa (Paris)	33-1-4731-7171	Central Europe (London)	44-1-734-302208 ext. 209	Canada (Toronto)	(905) 821-8840	Australia & New Zealand	61-2-869-0600



Keypanel products
Telex Communications

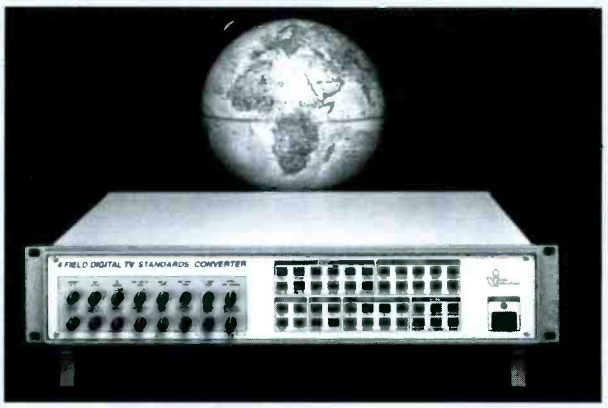
• RTS KP-12 series: keypanel products for the RTS CS9000, ADAM and ADAM CS series of intercom matrices; the KP-12 is a fully programmable communications keypanel that provides high-quality audio in a compact one-rack unit; the unit is available in push-button and lever key versions, each with 12 keys that may be assigned to talk/listen or any combination; the unit eliminates complex programming sequences through the use of selectable pull-down menus and alphanumeric displays to allow the operator ease of configuration; the KP-12 series uses the highest-quality electret microphone and pre-amplifier technology, coupled with a specially designed amplifier and speaker system to insure clarity of communications.

Circle (361) on Action Card

Redesigned universal video processor
Video International

• DTC 1604: a redesigned digital TV broadcast standard and format converter/median filter noise reducer; advanced features include 4-field/4-line motion adaptive interpolation, frame-based recursive noise reduction and median filter, 4:2:2 processing and digital encoder/decoder and Y/C and YUV component input/output; the stand-alone unit requires no additional TBC or synchronizer for operation, and it serves as an A-to-D and D-to-A format converter, framestore synchronizer and 2-D or 3-D median filter noise reducer.

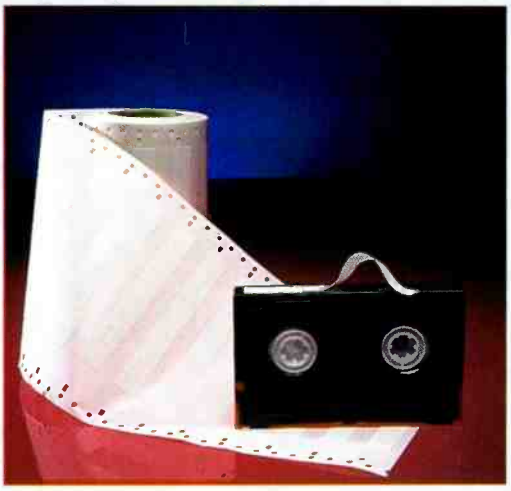
Circle (362) on Action Card



Automated software for program time delay and censorship
Tektronix

• Profile TimeDelay: application software that allows Profile PDR users to automate program time delay or program shifting more reliably and cost-effectively than previous manual methods; the Tektronix 4-channel Profile PDR, combined with the Profile TimeDelay software, offers up to a 12-hour time delay for two programs across one time zone, or one program across up to three time zones; the length of the delay is determined by the amount of storage and the compression factors used; start times are easily programmed within a 24-hour period and the Profile PDR can operate totally unattended; as an added feature for incoming live-feed materials, the TimeDelay software allows users to perform real-time editing of the material before going to air.

Circle (363) on Action Card



Labels
United Ad Label Co.

• BetaCart labels: labels featuring a clean-remove adhesive for hassle-free tape recycling; the labels have been pretested and approved by TV stations across the country as an effective and economical BetaCart labeling solution; ready-to-print labels can be ordered in a variety of tape formats specifically designed for use with automatic labeling equipment applications and thermal transfer printers; custom printing is also available.

Circle (364) on Action Card

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PHOTO - VIDEO - PRO AUDIO

DIGITAL PROCESSING SYSTEMS INC.

PVR-2500 Digital Video Recorder

The PVR-2500 offers powerful features for awesome animation, morphing and rotoscoping capabilities. With features like 720 x 480 resolution, 10-bit 2x oversampled video encoding, better than D1 scaling, component and S-Video outputs, multi-processor support and integrated FAST SCSI-2 controller, it empowers your computer to rival the finest professional production studios.

- The PVR-2500 is a full-length PCI card with a SCSI-2 interface that connects up to seven dedicated hard drives. Because the SCSI controller is integrated with the PVR-2500, video data never has to move over the PCI bus during playback. This avoids the bottlenecks found in systems which use the computer's hard drive for video storage.
- Designed to run under Windows NT 3.51 on computers employing Pentium, DEC ALPHA or MIPS processors. Perception's software utilizes NT 3.51's native support for multitasking and multiple processors, allowing use with-in the most powerful computers.
- Perception's multi-format virtual file system ensures complete integration with your existing Windows NT applications. Any acquired video or computer generated Perception video clips appear simultaneously in many different file formats including TARGA, SGI, BMP and TIFF. Also compatible with new NT versions of Lightwave 3D, 3D Studio, TOPAS 5.1, Softimage and Elastic Reality.
- Video output section utilizes 10-bit 2x oversampled encoding and provides broadcast quality CCIR-601 (720 x480) resolution. Its dynamic range is in excess of D1 scaling so that images are brighter, have more color and greater spatial resolution. Outputs component, composite and S-Video via the included breakout cables.
- Use with any compatible sound card while synchronization of audio and video is maintained by the PVR software. Captured audio is stored on the computer's system hard drive, not on the dedicated drives. This approach provides maximum flexibility for manipulating audio and video during editing.
- Can perform real-time interpolation of 30 fps video to 24 fps film rates or vica versa.
- VCR-like controls on the Perception's GUI simplifies the task of batch digitizing and recording. In this mode, it reads SMPTE time code from the source deck.
- Drivers for Windows 3.1 are supplied as well, so third party editing software like Adobe Premier can be used. In fact, the PVR-2500 bundled with the AD-2500 capture card, a sound card, editing software and one or more SCSI hard drives becomes a r on-linear editor of unparalleled performance at an unbeatable price.

AD-2500 CAPTURE CARD

- The optional AD-2500 is a video capture daughtercard, that transforms the Perception into a digital video recorder. It has component, composite and S-Video inputs for real-time recording and storage capacity is limited only by the size and number of your hard drives. Captured video can also be exported as sequential RGB files for rotoscoping and other compositing applications.
- The AD-2500 incorporates a sophisticated automatic entropy prediction circuit that analyzes the content of incoming video and dynamica ly calculates the optimum amount of compression on a field-by-field basis—even during real-time recording. You also have complete manual control over compression level/quality settings.

TRUEVISION TARGA1000/2000

PCI-based Digital Video Capture Boards for Windows

The TARGA 1000 and 2000 is an easy and affordable way to transform your computer into a powerful digita editing system. Along with their high-speed PCI interface, both the TARGA 1000/2000 incorporate all the functions you need to create spectacular multimedia content. They support NTSC and PAL video standards and let you capture, edit and playback full-motion, full-resolution digital video with fully sychronized CD or DAT quality audio. Designed for high performance IBM compatibles, their advanced architecture provides incredible processing speed for video and audio effects, titling and compositing capabilities.

- Allows recording and playback of video directly to/from hard drive at full motion, full frame rates (50 fields/sec - PAL, 60 fields/sec-NTSC). Video is stored and played back at the highest resolution for each format (768 x 576 x 24 bit - PAL, 640 x 480 x 24 bit - NTSC). Compression can be adjusted on the fly to optimize for image quality and/or minimum storage space.
- Genlock using separate sync input for working in professional video suites
- Equipped with composite and S-video inputs and outputs. Also available with component input/output (TARGA 1000 PRO).
- The audio is digitized at 16-bit resolution (at 44.1KHz or 48KHz sampling rates), yielding professional quality stereo sound. Since all audio and video processing is done by on-board DSPs, you are assured of perfectly synchronized sound and images.
- Optimized to work with Winsows NT-based software (Adobe Premiere 4.2, in:sync Speed-Razor MACH III)

TARGA 2000 Additional Features:

- Equipped with composite and S-video inputs/outputs Also available with component input/output (TARGA 2000 PRO)
- Accelerated Windows 3.11 and Windows NT display drivers offer integrated, true-color (24-bit), non-interlaced desktop up to 1152 x 870 pixels.
- Provides a large work area for displaying video, as well as editing application controls. Any part of the display (or even the whole image) can be recorded to tape (video-out-of-a-window).
- View your desktop and video-in-a-window on your non-interlaced high resolution desktop display while the processed video is output at NTSC or PAL resolutions to a video monitor and/or a VCR.

Turnkey TARGA 1000/2000 and PVR-2500 Perception Systems:

• Video capture board (specify) • 220-watt, 6-bay midtower case • PCI motherboard with 256K pipelined burst cache • Pentium 133 MHz processor • Diamond Stealth64 Video 2MB VRAM PCI display card • 32MB of EDO (Extended Data Out) RAM • Quantum 1.28GB IDE system drive • Seagate (Barracuda) 4.2GB SCSI-2 FAST/Wide hard drive • Adaptec AHA-2940UW FAST/Wide SCSI-2 controller card • 3.5" floppy drive • Teac CD-56e 6X EIDE internal CD-ROM drive • Altec-Lansing 300.1 three-piece deluxe speaker system • Princeton Ultra 17+high resolution 17-inch multiscan monitor • Focus 2001A keyboard • Microsoft MS mouse • MS-DOS 6.22 and Windows 3.11 or Windows NT 3.51 operating system software.

*PVR-2500/AD-2500 Windows System with Adobe Premiere 4.0a	$7295
*PVR-2500/AD-2500 Windows NT System with in:sync Speed-Razor MACH III	$8495
TARGA 1000 Windows System with Adobe Premiere 4.0a	$7795
TARGA 1000 PRO Windows System with Adobe Premiere 4.0a	$8295
TARGA 1000 Windows NT System with in:sync Speed-Razor MACH III	$8795
TARGA 1000 PRO Windows NT System with in:sync Speed-Razor MACH III	$9150
TARGA 2000 Windows NT System with AVID Real Impact	$11,250
TARGA 2000 Windows NT System with in:sync Speed-Razor MACH III	$11,250
TARGA 2000 PRO Windows NT System with in:sync Speed-Razor MACH III	$12,000

*PVR-2500 System Notes: 1) Does not include Adaptec SCSI-2 controller card (has built-in SCSI-2 port) 2) Includes Seagate Barracuda 4.2GB Narrow hard drive (doesn't accept Wide drives) 3) Includes Stealth64 Video 2MB DRAM PCI display card (Add $100 for 2MB VRAM card) 4) Requires sound card (DSP-equipped card preferably)–see "Expansions and Upgrades"

Expansions and Upgrades for all Systems:

Substitutions

Full Tower Case (10-bay)	add 100.00	Super Tower Case (12-bay)	add 200.00
Pentium 150 MHz processor	add 150.00	166 MHz processor	add 400.00
Seagate Elite 9.1GB Narrow drive (for PVR-2500)	add1000.00	Seagate Elite 9.1GB Wide drive	add 1000.00
Matrox Millenium 4MB VRAM PCI Display Card	add 250.00	Matrox Millenium 8MB VRAM PCI Display Card	add 400.00
MAG Innovision MXP-17F 17" multiscan monitor	add 225.00	MAG MXP-21F 21-inch multiscan monitor	add 1100.00
Altec Lansing ACS-500 three-piece surround sound stereo system			add 140.00

Add-Ons

APC Smart Ups 650 power backup	349.00	Conner 4GB QIC/ Wide tape backup IDE/SCSI	439.00
Ensoniq SoundScape Elite DSP-equipped 16-bit audio card (for PVR-2500 systems only)			199.00
MediaTrix Audio Trix Pro DSP-equipped 16-bit audio card (for PVR-2500 systems only)			279.00
Elastic Reality for Windows/Windows NT (includes Transjammer-30 transitions)			349.00
Transjammer Vol 1 (with 100 transitions)			89.00

in:sync SPEED RAZOR MACH III

Digital Video Editor for Windows NT

The ultimate digital video editing software, Speed-Razor MACH III allows you to edit full screen, 60 fields per second, CCIR 601 broadcast-quality video. Designed for the DPS PAR DR-2100/ Perception PVR-2500 and Truevision's TARGA 1000/2000 video capture cards, Speed-Razor MACH III is the fastest and most powerful tool for editing and compositing video clips, animations, stills, music and sound effects. Experience straight cut editing in real time and effects which fly on the fastest machines out there: Alpha,Intel, MIPs-based and PowerPC-based workstations, making this the fastest, most flexible software you've ever seen. Running under Windows NT, it offers three times faster than Windows 3.1 on the same machine and up to ten faster when used on Alpha-based systems.

Speed-Razor features infinite video, audio, transition and effects tracks and comes with Razor Blades—transitions and effects to enhance your production. There are preset tumbles, fades and wipes which you can easily customize and save as new presets. In addition, there are special image effects which are unquestionably the highest quality of any system—analog or digital. Speed-Razor sports anti-aliased 3D DVEs, an infinite channel chroma keyer and an excellent character generator. Use the effects or transitions which come with the package, layer them to create new ones, make your own grayscale bitmaps to use as transitions, or use third party plug-in effects—the flexibility is yours.

EDITING FEATURES:

- Real-time straight cut editing (this does NOT require a new file to be made and requires less space onthe hard drive to edit)
- The only video editor with the ability to cut to the field
- Work in Thumbnail or Final Output resolution mode (you set the resolution for each)

COMPOSITING:

- Infinite number of layers of video clips, still and animations can be composited together
- Handles any resolution from Betacam (720 X 480) up to Omnimax film (4000 X 4000)
- Video clips can be combined using an alpha channel, key color transparency, still or traviling mattes

FILE FORMATS:

- Reads and writes ANI files (created by DPS' PAR), PVD files (Perception), DVM files (TARGA 1000 and 2000) and sequences of TARGA files
- Convert files between any of the following formats: ANI, PVD, DVM, AVI, BMP, TGA, FLC, FLI, WAV
- Project-based Library for organizing your work

There are two user definable resolution modes (thumbnail and final) to facilitate editing. The thumbnail mode allows you to use Speed Razor in the field on a laptop computer then transfer the project file back at the edit suite and automatically recapture and re-render the entire project at final resolution. Speed-Razor also features RS-422 control and even does batch capture (new batch capture module allows you to automate video capture via SMPTE time code), so digitizing video and audio is simple and painless. In fact, with the innovative "Virtual Editing" function you can actually edit your project, complete with effects and transitions—before you've digitized a single frame of video.

AUDIO:

- Handles audio up to DAT (48 kHz) quality
- Infinite number of audio tracks for multi-layer audio mixing

EFFECTS:

- Blur (circular, gaussian, fast), tint, brightness adjustment, chroma key, crop, displacement, emboss, freeze frame, glass texture, greyscale, invert, loop, matte, pixelate, repeat fields, scale, transparency, strobe, turn red/green/blue
- 3D DVE (translates and/or rotates an image in three dimensions on the X, Y and Z axis)
- Sets a color channel to an assignable value)
- Titles (full blown CG using any Windows font in any color with automatic drop shadow)
- Sub-pixel rendering for incredibly smooth motion
- Effects can be applied to infinite sources

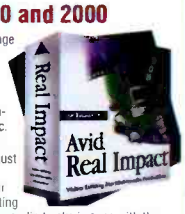
TRANSITIONS:

- Includes over 100 grayscale image transitions, crossfades, luminance fades, fade to/from black, fade to/from white, push, twirl, twist in/out tumbles, flip, turn, scale (zoom)
- Transitions can be applied between infinite inputs.

Real Impact

Windows NT-based Video Editor for TARGA 1000 and 2000

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



Easy to Use: A true 32-bit application (Windows NT 3.51), Real Impact's intuitive interface and extensive on-line help get you productive right away. It's powerful editing features let you work with video, audio, graphics, animations and titles with the simplicity of cut, copy and paste.

Video Capture: Digitize video and audio—without dropping a frame. Your video is full-screen, full-motion, 60 fields-per-second and your audio in sync. With its Dial-a-Quality image feature, Real Impact allows you to adjust image quality for differing system, storage and delivery requirements.

Create a Storyboard: Extensive media management with built-in media library and database let you easily find the video and audio clips that you want. Instant access makes previewing edits simple and immediate. And, with timeline editing, you just click and drag to experiment with different cuts, rearrange clips and assemble your story. There are 32 levels of undo/redo.

Add Graphics, Titles and Special Effects: Create and seamlessly incorporate audio, graphics and animations into your video using popular Windows-based applications. Real Impact supports AVI video files, WAV audio files, FLC animation files as well as BMP, JPEG, PCX, TGA and TIFF graphics files.

Add Audio: Polish your audio with music and narration. Adjust pan and volume in real time. Simultaneous playback of four audio tracks makes audio editing quick and easy. View your four audio tracks in sync with the video immediately, no waiting for tracks to compile.

Digital Media Interchange: Compatible with the Open Media Framework (OMF) Interchange, a file format for the seamless integration of digital data among applications and across platforms. Through OMF, you can import video and audio files from other OMF-compatible applications like Avid's Media Composer.

Output to Tape, CD-ROM or Over a Network: Gives complete control over video distribution. There's no long rendering process, creating professional quality tape is a snap. Embedding video in multimedia presentations for distribution on disk or CD-ROM is as simple as the click of a mouse. Supports third-party MPEG tools to create MPEG files for network distribution.

Avid's Support Advantage: Real Impact is backed by Avid's world-class customer service. Toll-free telephone support and bulletin board service are just some of the benefits.

FEATURES:

Video

- Real-time JPEG compression / decompression and playback at 60 fields per second
- Supports RS-422 control protocol and SMPTE time code.
- Edit two tracks of video for layered effects.

Audio

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

Import/Export

- AVI video files, WAV audio files, FLC animation files.
- DMF Interchange files.
- BMP, JPEG, PCX, TGA and TIFF graphics files.

Special Effects

- Filter effects with previews and adjustable parameters.
- Transition effects include wipes, dissolves, zooms, pushes and squeezes.
- Layered effects include picture-in-picture, luminance and chroma key.

Integrated Title Generator

- 32-bit processing (24-bit color and 8-bit alpha channel).
- Support for TrueType fonts and international character sets.
- Drop shadows, transparency and color blends.
- NTSC and PAL-safe color palettes.

Media Management

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

A note about our turnkey systems:

In addition to the systems listed on this page, we can further customize any system to fit particular needs. We carry a large variety of 2X and 4X CD-ROM recorders (HP SureStore 4020i, Sony Spressa, FWB Hammer CD-Rs), RAID subsystems (ATTO, FWB) and portable storage devices (Iomega, Syquest) to name a few. Tell us what you need and our salespeople will custom design a system for you. And if you happen to be in NewYork, please come and . . .

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Enhancements to Ensemble Gold nonlinear editing systems

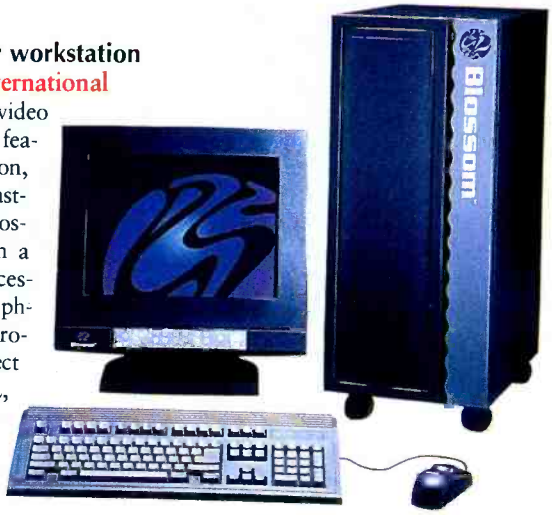
Editing Technologies Corporation

• Enhanced version of Ensemble Gold: a nonlinear series of editing systems that, through multiple video channel control, now include infinite video layering for compositing and effects; combined with the MULTILINEAR capabilities, Ensemble Gold provides a new level of versatility on nonlinear editing systems; the edit controllers combine the ease and flexibility of nonlinear editing with traditional features and power; time-clip management is combined with full EDL functionality; effects and transitions are produced with high-performance external switchers and DVEs for maximum quality and creativity; Ensemble Gold eliminates the need for time-consuming pre-digitizing and pre-selecting of scenes and footage; clips can be rolled in from tape or randomly accessed from the hard drive.

Circle (366) on Action Card

Nonlinear video editor workstation

Creative Equipment International



• Blossom: a nonlinear video editing workstation that features titling, 3-D animation, special effects and broadcast-quality digital editing; Blossom comes complete with a high-speed Pentium processor, 32MB of ram, PCI graphics card, custom-effects processor for accelerated effect rendering, NTSC or PAL, composite/S-VHS video CD-quality audio and high-resolution monitor; some of the technical specifications include 720x480 video pixel resolution, RS-170A and CCIR-601-compliant variable compression ratios of 4.5:1 to 50:1.

Circle (365) on Action Card

Contemporary enclosures

ESE

• LX series: a family of products featuring solid, streamlined enclosures; the black, texture-painted enclosures come with 1/2-inch bright yellow displays that are viewable up to 20 feet away; the products now available are the LX-161A (clock slave), the LX-192A/194A (master clock), the LX-361A (timer slave) and the LX-520 (master timer).

Circle (359) on Action Card

Digital input selector

Wohler Technologies

• DSS-8: a digital input source selector for AMP-1A and AMP-2 powered stereo audio monitors; the DSS-8 uses a rotary switch to select any one of eight AES/EBU digital audio inputs for D-A conversion and high-fidelity reproduction through the monitor's built-in amplifiers and speakers; for the rear-panel inputs, users may specify either 3-pole plug-in terminal blocks or BNC connectors.

Circle (369) on Action Card

Enhancements to the Axiom digital production system

Solid State Logic

• Axiom: new features have been added to Axiom, a digital production system that can be configured and specified to fit a facility's working needs; new remote mic amps offer a switchable limiter and selectable high pass filter, in addition to the standard gain, phantom power, impedance and pad functions; the system also now includes a central channel control that allows adjustments of any channel from the central area of the Axiom console; a new bi-level capability for the control surface has also been incorporated and each physical Axiom channel can switch control to another processing channel (this allows users to control a large number of mix channels from a smaller Axiom control surface); other features include FreeWay, a HiWay datastream on fiber-optic cables that allows maximum interconnection of distances to be measured in kilometers; a new SDIF-2 to HiWay interface option allows for direct digital connection of multitrack machines or other machines with SDIF-2 digital interfaces.

Circle (367) on Action Card

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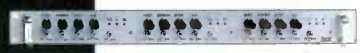

TBC-RMT (TBC Remote Control Unit) Remote control of up to 3 TBC's. For use with internal TBC's on BVW, DVW, PVW, UVW, and BVH Beta machines or any machine using Sony BVR-50 controller. Purchased with 1, 2, or 3 modules. With 3 modules. **$960**

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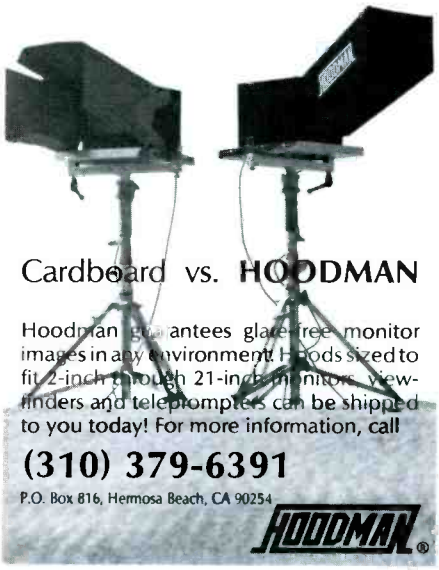

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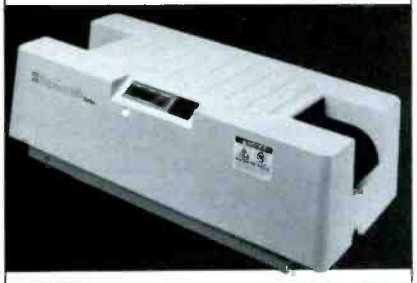

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By Paul McGoldrick

Digital tape formats

The best way to plan something is to get diverted from it, or so goes my excuse for not covering the promised interface/codec topic for this month. Instead, my electronic mailbag has had a number of tape format questions in it. It seems this is an area that is causing confusion and needs to be covered.

Having enjoyed (using the word loosely) another NAB and seen the plethora of new portable machines, it may be time to review the basic identities of the "mother" machines. This is not an attempt to push a particular format: that choice is not easy for anyone, and is a major decision for your operation with its own quirks and needs. Instead, this is an attempt to rationalize the numbers to help you make that choice. If there are mistakes here, please let me know.

The order of the "Ds"

In straight order of the "Ds": **D-1** is a Sony 4:2:2 component digital machine with 8-bit recording and no compression. BTS also manufactured a D-1 machine, but there were no tape interchange capabilities with Sony machines. **D-2** is an Ampex and Sony 4fsc composite digital machine with 8-bit recording and no compression. Both manufacturers have also made data recorders with the same decks. **D-3** is a Panasonic 4fsc composite digital machine with 8-bit recording and no compression. D-4 was going to be... but that's a whole other column! D-5 is a Panasonic 4:2:2 component digital machine with 10-bit recording and no compression. D-5 machines can also playback D-3. **D-6** is a digital HD recorder that records 64 minutes of 1.2Gb/s video on a D-1 large-shell cassette. Luminance sampling is 72MHz and chroma sampling is 36MHz with samples quantized to eight bits. D-7 is the proposed standard for the Panasonic and BTS DVCPRO, which is a 4:1:1 component digital machine with 8-bit recording and a 5:1 compression ratio using discrete cosine transfer (DCT) technology. Consumer DV tapes can also be replayed.

Other machines, in alphabetical order: **Betacam SX**, from Sony, is a 4:2:2 component digital machine with 8-bit recording and MPEG-2 Studio Profile compression of 10:1. **CamCutter**, from Avid and Ikegami, is a 4:2:2 component digital machine with 8-bit recording and proprietary compression. DCT from Ampex is a component recording format that uses 2:1 compression. **Digital Betacam**, from Sony, is a 4:2:2 component digital machine with 10-bit recording and a 2:1 compression ratio. The machines will also playback Betacam SP analog component recordings. **Digital-S**, from JVC, is a 4:2:2 component digital machine with 8-bit recording and a 3.3:1 DCT compression. Analog S-VHS tapes

can also be replayed on the decks. **DVCAM**, from Sony, is a 4:1:1 component digital machine with 8-bit recording and a 5:1 DCT compression, similar in specifications to the D-7. It will also playback consumer DV tapes.

Component digital machines

In general terms, the component digital machines with 4:2:2 signals should have frequency responses for luminance of about 5.75MHz, and 2.75MHz for both of the color-difference channels. 4:1:1 machines should have a luminance frequency response of 5.75MHz (though some are restricted for reasons other than the sampling) and 1.4MHz for the color-difference channels. Signal-to-noise ratios (SNRs) should be in the mid-50dB range for 8-bit machines, and perhaps 62dB for 10-bit machines. Claims of SNRs in the 60dB range for 8-bit machines should be noted with caution.

The earlier standards used analog audio tracks and the performance of the newer machines is higher in this respect. All of the machines listed here have at least two audio tracks, from D-3 onward they are all digital. Some of the machines have four audio tracks (D-3, D-5, CamCutter, Betacam SX, Digital Betacam and DVCAM) and the generally accepted audio standard is 16-bit recording at 48kHz. All of the machines have VITC and LTC time code.

Choosing a tape standard

The choice of a tape standard should be based on the format's capability for your needs for now and the reasonably foreseeable future. How does the format fit with your existing operation? Are there formats that you must have in your business for tape interchange or for clients? Will islands of differing formats help or hinder? Will any expensive signal transcoding be necessary or be saved? How does head life compare with your existing machines? Is the tape stock needed special and expensive? Are there multiple sources for tape? Do your existing edit controllers need replacing? What test equipment — electronic and mechanical — do you need with the machines? Is the recording length what is needed? For longer recording lengths does the specification of the machine reduce? Is there a logical choice to be ready for the next move into another recording medium?

In general, I do not believe that format choice should be based on an individual machine's feature set: the majority of functions available in one format are either also available in another or will be. When a format with compression is being considered, test the system with material that is typical for your operation. Consider the long-term implications of compression if your material is unique, maybe you want a non-compressed library, but compression on transmission machines.

Each tape format was developed to address a niche in the broadcast and post-production markets. It's up to you to identify which niche your operation falls into, and then identify which format addresses that niche the best. ■

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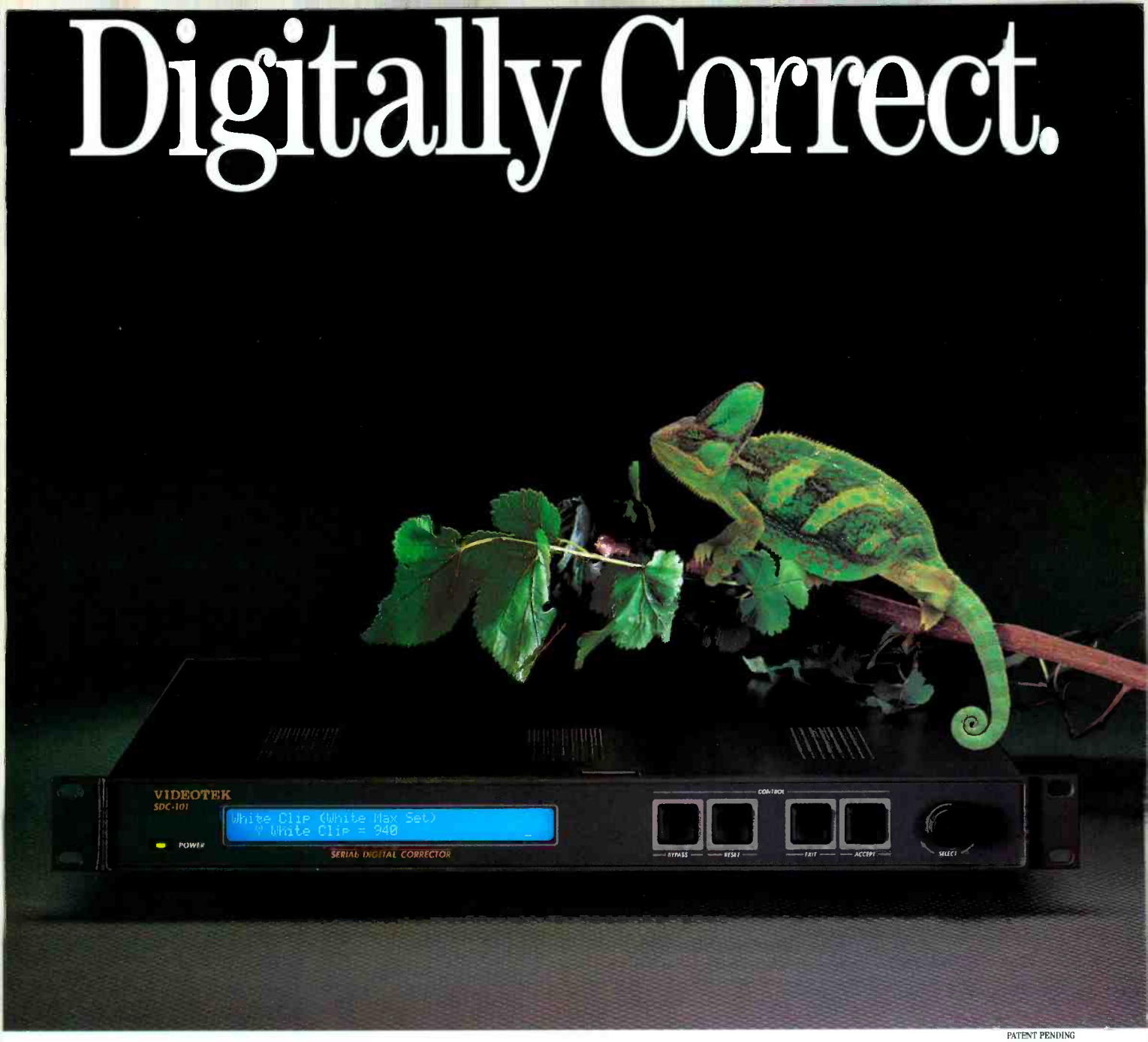

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