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SEPTEMBER 1998

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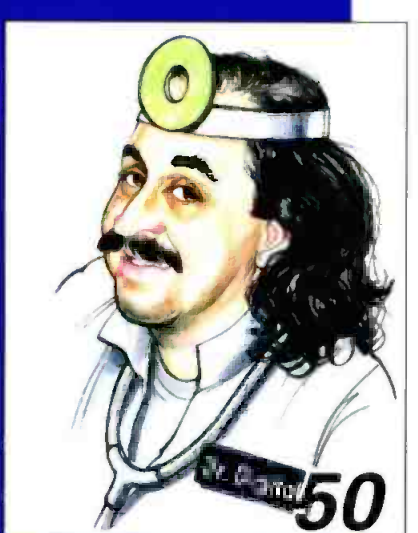

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ON THE COVER: *While complying with the new DTV standards, many broadcasters are taking advantage of features found in all-digital audio systems. Solid State Logic's digital broadcast console "Aysis Air" has become the console of choice for WLS-Chicago, KGO-San Francisco, WRC-Washington, D.C. and TV2-Norway (pictured). Photo courtesy Solid State Logic.*

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Editorial

One size doesn't fit all

Seems a new survey shows that the consumer's appetite for TV remains strong — and that appetite will translate into a demand for the new digital services now being developed by broadcasters and others. However, despite the driving forces of programming, there is new data from the research firm of Frost & Sullivan that shows it's the *replacement* cycle of TV sets that will actually drive the purchase of new TV sets. With a typical life span of 12 years, seems the old-fashioned analog sets will be around for a long time. In addition, *new* TV sets still have to work with *old* technology and that creates a problem.

Ever consider how important it is to keep one technical foot firmly planted in the good old days? For instance, that new digital stereo you may have bought probably has a couple of analog inputs. Why? Certainly not because there's a new digital turntable coming along. It's because the manufacturer thought you might want to play some of those old analog LP's that you're storing in the basement. Or, maybe you'd like to play some of your old analog cassettes; after all, not everyone has upgraded to mini-disc or DAT. New technology seldom exists in a vacuum. Rather, it usually has to work with legacy (that means old) equipment.

All this translates into the requirement that all those new TV sets will have to interface with an array of analog sources — VCRs, satellite TV IRDs, cable boxes and, heaven forbid, an old-fashioned TV antenna. The same goes for new set-top boxes (STBs). In addition, these devices will have to provide both analog and digital outputs. Why? Because, for the most part, the STBs will not be used with digital TV sets, but with old-fashioned analog TV sets. Those sets will require a 75Ω RF feed or video on an RCA plug.

There is also research showing that all this new DTV technology could mean bad news for cable companies, like Time Warner and TCI. In July, Ovum, a technology analyst group, released a study that predicted a sharp decline in the number of cable subscribers, as consumers adopt digital technology. According to the study, consumers will drop analog cable services unless that industry embraces digital technology. Ovum's principal consultant, John Moroney, said, "The cable companies now face a new competitive challenge in which both satellite and terrestrial broadcasters are able to offer viewers as many high-quality channels as cable service providers." He also states that consumers can expect to see cable companies and telcos align themselves against broadcasters in a head-to-head battle to win over the viewers. Moroney also said that unless the cable industry responds early to the new competitive threat from broadcasters, they will suffer major losses. Sounds like fun to me.

For more information on these two studies, see the company's respective web sites: Ovum www.ovum.com and Frost & Sullivan www.frost.com.

Brad Dick

Brad Dick, editor

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Reader Feedback

Readers knock cable and Ma Bell

Dear Mr. Dick,

Three cheers for your realistic comments on the TCI/AT&T deal. Consumers don't realize what the TCI/AT&T deal really means. We just gave Ma Bell back her house that we took away some years ago. They will be able to control the rates that affect each one of their users. I agree with you and have an eye on the sky (Echo Star). I just built a new house and declined cable service; the phone, however, is a another problem because I have two teenagers.

JOE CIRINCIONE
PRODUCT MANAGER
VIDEOTEK

Dear Brad,

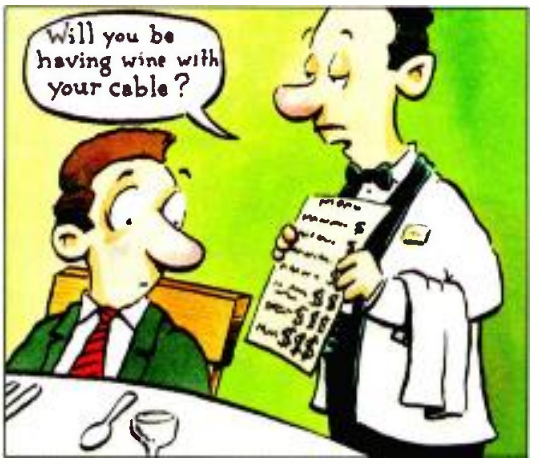
Thank you for the comment about TCI and AT&T merging. I can't think of a better place for me to share one of my favorite broadcasting stories.

Said the AT&T official in charge of radio:

"We have been careful, up to the present [1923], not to state to the public in any way, through the press or in any of our talks, the idea that the Bell System desires to monopolize broadcasting; but the fact remains that it is a telephone job, that we are telephone people, that we can do it better than anybody else, and it seems to me that the clear, logical conclusion that must be reached is that, sooner or later, in one form or another, we have got to do the job."*

What a visionary! Perhaps AT&T will return the spectrum to its "hands-off" attitude toward content. Could AT&T's capitalization uncapitalize the media element of TCI? Will conduit (media) be distinctive from content provider (media)? Maybe AT&T will offer a national OVS and return to charging content providers (programmers) for the transmission path to homes. Hmmmmm.

Alas, AT&T could provide innovations that broadcasters will latch onto, as they have in the past. Remember WEAF, the AT&T station, that first developed network syndication, commercial sponsorship and the audio mixer? No doubt they will continue to experiment with ways of integrating telephone and broadcasting facilities



— one reason WEAF was built (1922).

*Head, Sydney W. 1976, *Broadcasting in America: A Survey of Radio and Television*, 3rd Edition. Houghton Mifflin. (Danielian, N.R. 1939 AT&T: The Story of Industrial Conquest. Vanguard, New York. Rep. Arno Press, 1971.)

SAM DANA
ENGINEER
TUALATIN VALLEY COMMUNITY ACCESS (TVCA)

Hey Sam:

I think we could have substituted the name Microsoft in place of AT&T, changed telephone to computer and your story would sound like something written today! Scary, isn't it?

BRAD DICK
EDITOR

Need more information?

Dear Editor:

Can you send me some reading materials regarding DTV and HDTV. I haven't subscribed to *Broadcast Engineering* yet. Maybe you could help me. Thank you very much and I'll be waiting for your reply.

JAMES SANTIAGO
ENGINEER, SPECIAL PROJECTS

Dear James:

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Fortunately, once your subscription to Broadcast Engineering *magazine starts, you'll be kept up to date on all that's important with the new technology.*

BRAD DICK
EDITOR

The missing page

Seems that the printer goofed on the July issue and part of "Transmission-line trade-offs for DTV," on page 81 is missing from some copies. The story was written by Bob Leonard at the Andrew Corporation. You can download a complete copy of the article by visiting the *Broadcast Engineering* web site at www.broadcastengineering.com.

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News

Be-Gates!

BY LARRY BLOOMFIELD

Normally this would be considered a German greeting spelled incorrectly. Or is it really an omen of things to come? According to recent information, Microsoft and Thomson multimedia entered into a strategic relationship with respect to interactive television. Sources in Redmond, WA say that the companies will focus on the creation of enhanced television by offering supporting services and DTV products. If you've been following the computer industry's interest in getting involved in television, there isn't a person reading this that should be even remotely surprised.

Microsoft and Thomson jointly announced that they have signed a memorandum of understanding to develop and promote interactive and enhanced TV products and services, and to accelerate the adoption of digital television globally. Watch out!

After the normal wait-and-see due-diligence period and all the bureaucratic regulatory approvals, Microsoft proposes to take a 7.5% interest in Thomson multimedia and one seat on the Thomson board of directors. Microsoft will sit on a newly formed strategic committee of Thomson multimedia. The camel's nose is well into the tent.

You'd think getting into bed with Microsoft would be enough, but not for Thomson. In a parallel move, NEC, Alcatel and DirecTV are also entering into agreements with Thomson and, after the aforementioned legal mumbo-jumbo, propose to take 7.5% interest each in Thomson multimedia.

What could possibly come out of all this handshaking? According to news sources in the northwest, the companies will work to develop and promote new *enhanced* televisions (eTVs), which include an electronic program guide and support for interactive TV programs. Microsoft will provide HTML-rendering technologies based on the Microsoft Windows CE operating system for use in these eTVs. The new eTVs will provide consumers with an integrated TV receiver, in analog and digital versions, that provides access to the types of interactivity only available today through set-top boxes.

You'd think getting into bed with Microsoft would be enough . . .

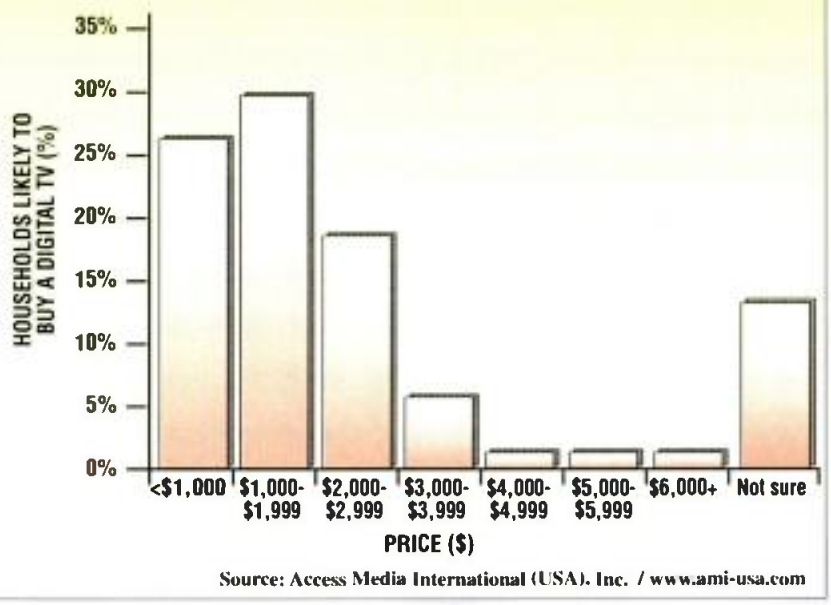
"Microsoft believes that consumers can only benefit from the fruits of this relationship," said Craig Mundie, senior vice president, consumer platform division, Microsoft. "Thomson's leadership in consumer electronics, combined with Microsoft's desire and ability to provide technologies to enable digital television, is sure to bring products and services to the market that consumers will embrace and which will improve their entertainment experience with TV." Thierry Breton, chairman and CEO of Thomson multimedia said, "The time has come for the information technologies industry and the consumer electronics industry to combine their skills in order to offer to the mass market innovative products and services." Breton added, "Our combined efforts will accelerate the emergence and the deployment of eTV, which for us is clearly based on interactive television and digital television. The strategic cooperation between Microsoft and Th-

FRAME GRAB

A look at the issues driving today's technology.

Cost matters

Only 6% of early adopters of DTV are willing to pay $4000+ for a digital TV set.



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omson multimedia will make intelligent television happen and enable both companies to enter successfully the next century's multimedia services arena." Microsoft has been trying to get their WebTV set-top boxes on the street, but has had little success. Also, as part of this move, Thompson will license and sell WebTV set-top boxes under its RCA brand in the United States and the Thompson brand in Europe.

In support of these efforts, Microsoft and Thompson plan to collaborate on products and services related to the future of television with a common U.S.-based team. One focus of this effort will be the development of products and services for digital television that combine WebTV technologies with Thompson technologies for satellite and cable operators. ■

FCC gets border agreements

Between Congressman Tauzin, Senator McCain, the FCC, the ATSC, CEMA and everyone else pushing for DTV, one would think that most all the hurdles had been cleared out of the way, so broadcasters could get on with spending their hard-earned money on

the road to better television; apparently this is not the case. According to information issued recently by our electronic watch dogs (the FCC), they've just cleared the way for five Los Angeles TV stations to air new higher-quality digital broadcasts.

The FCC entered into separate agreements with Mexico and Canada that remove a regulatory obstacle for stations in Los Angeles, New York and other top markets to air digital signals. A memorandum of understanding between the Federal Communications Commission and Mexico's Secretariat of Communications and Transportation was announced in late July. "The agreement will bring the benefits of DTV to consumers quickly," said FCC chairman Bill Kennard.

The stations involved include the three major network O&O's. Of these, KABC-TV, KNBC-TV and KTLA-TV have volunteered to start their digital broadcasts in November. KCBS-TV and KTTV-TV are required by the FCC to begin on May 1, 1999. Anyhow, the FCC said the agreement would permit all five U.S. stations to meet the commission's deadlines for beginning digital broadcasts.

And, that's not all; 17 other stations in New York, Boston, Chicago and Detroit had to be covered under a series of agreements that the FCC made with Canada. A list of these stations was not immediately available from the FCC. Additional agreements are still necessary to cover other U.S. stations on the Canadian border which will begin airing digital TV at a later date. Before broadcasting in digital, these "border stations" needed agreements with Mexican and Canadian regulators that their signals would not interfere with the respective

country's broadcasts. That's fair — we wouldn't want their stations interfering with us. But why wasn't this done before all the edicts about Nov. 1 and May 1, 1999, relating to the top 10 markets were issued?

Another example of your tax dollars at work in Washington. ■

DTV 101 for retailers

The Consumer Electronics Manufacturers Association (CEMA) recently announced that it will produce a digital TV transition guide for consumer electronics retailers.

The guide is designed to provide retailers with the language and information they need to facilitate a successful launch of digital and high-definition television later this year. CEMA says it will be distributed to attendees of their DTV summit and at other retailer educational events this summer.

This guide will be the definitive resource for the terminology, technical information and policy issues that surround digital television. CEMA will also distribute the guide to retailers as part of its Retailer Education Road Show. The tour is designed to provide retailers with an update on all aspects of digital TV from manufacturing, broadcasting and programming perspectives. The National Association of Broadcasters (NAB) is cosponsoring the tour, so it might not hurt for local TV folks to find out when and where these meeting will be held in their communities and participate, if possible.

The DTV guide will highlight the latest consumer research, market projections for digital TV products, regulatory issues affecting the roll-out manufacturers' plans for digital TV broadcasters' transition efforts and retail strategies for DTV and related technologies. There's nothing like being present to answer any questions from the broadcast standpoint.

Additional information can be found at **www.cemacity.org**. ■

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Must carry

Nobody likes to be told what to do, but this may be the case after the FCC gets finished with the must-carry issues as they relate to the new digital TV channels. The commission is walking a tightrope, trying to stay neutral.

The FCC has some of the best technical minds in the country, but these are not the good old days back when the commission did what *they* thought best for all concerned. As a result of that kind of thinking and action, we ended up with a very fine, technically superior, broadcast industry. The commission has, however, slowly drifted into a wishy-washy, let the non-technically, uninformed consumer, swayed by flashy layouts from Madison avenue ad agencies, make the decision for them.

Bill Kennard, FCC chairman

With that in mind, it appears that the commissioners are steering clear, as usual, of any broadcast/cable industry face-off over digital must-carry rules. The time-proven contest of the clash of differing opinions in a public form has always been the best way to ascertain the better way of doing things. Why should it be any different for this issue?

In their lack of effort to decide how the rules will apply to digital broadcast signals, the commissioners took no position, let alone a tentative one, on whether they will require cable systems to carry analog and digital signals of broadcasters.

So here we go again. The FCC has proposed seven possible approaches to the issue ranging from an immediate digital carriage requirement to no requirement during the industry's transition to digital television. Other options would phase in a digital must-carry requirement over a period of time. What kind of bunk is this?

Broadcasters are being required by Congress to spend millions of dollars at each of the nations more than 1,700 TV broadcast stations to comply with the move to digital delivery of TV signals. The cable companies are the conduits through which most TV signals in a local, and sometimes from not so local, area find their way into the homes of many Americans. It would stand to reason that they have a charter-bound obligation to continue to do so with any new, legal signal, irrespective of format. If the cable broadcasters can't keep up with the rest of the industry, perhaps they should get out of the business or turn it over to those who can keep up — and the FCC can be there to ensure this happens.

At the other end of the spectrum, FCC chairman Bill Kennard said, "I want this debate to focus on consumers." He urged the industries not to make bold pronouncements and plot litigation strategies, "We need to get beyond the rhetoric." To that, all I can say is look who's talking.

As expected, the broadcast and cable industry leaders have not surrendered any rhetorical ground to each other as they reacted to the FCC's neutral stance. National Cable Television Association president Decker Anstrom said, "We will vigorously oppose any attempt by the government to mandate carriage of both the broadcaster's digital and analog signals. We'll never agree to that."

It certainly appears that the cable industry wants to control the digital rollout. This is the tail wagging the dog. "The FCC has a responsibility to ensure that cable systems will not impede consumers from receiving the full benefits of this new technology," said National Association of Broadcasters president Eddie Fritts.

Any rules that the commission adopts on the must-carry issue will probably not take effect before the first stations begin broadcasting digital signals in November. Like good politicians, some officials indicate they are in no hurry to wrap up the rulemaking, copping out to the supposed uncertainty of consumer acceptance of the new technology. One proposal would defer the issue for a few years, suggesting that stalling would allow cable operators and broadcasters to find a successful business model for digital television.

Cable and broadcast industry leaders have been conducting their own talks about cable carriage of the digital signals, but no industry resolution of the must-carry issue seemed imminent.

According to our good friends at Tele-Communications Inc. (TCI), "An active dialogue continues about the issues surrounding digital broadcasting and what it entails. There are a number of extremely complex issues, and there seems to be very little consensus on how to approach this. It's very fluid at the moment."

Based on TCI's attitudes and cooperation in the transition to DTV and HDTV in the past, one could not expect anything more from them. TCI appears to be more focused on arriving at an overall strategy for dealing with the carriage of digital broadcast signals than on worrying about getting into agreements with broadcasters. Other cable industries pundits believe that with the numerous technical issues unresolved, definitive agreements are unlikely for several months. It appears that it's time to belly up to the bar and get these numerous technical issues resolved or let the local licensing agen-

TCI appears to be more focused on arriving at an overall strategy for dealing with the carriage of digital broadcast signals than on worrying about getting into agreements with broadcasters.

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cies permit competitors to who don't seem to have these problems enter the market place.

Getting the signal to the home is one thing. Kennard, is concerned that the industry isn't on a faster track for a device that will allow TV sets to receive a high-definition pictures, even if the cable set-top box cannot deliver all of the possible HDTV picture formats. The parts and technology are out there. Someone needs to tell the chairman so he won't let compromise slip into the arena.

Consumer electronics engineers have been working to develop standards for the so-called *firewire* device. However, skeptics do not expect them to complete that work in time to incorporate the devices into the first digital TV sets. Incentives can do wonders in this area. Keeping your job is one of them. Kennard added that he plans to call together stakeholders in the firewire work and ask them to commit to an aggressive timetable for completing the standard.

Other issues the must-carry rulemaking needs to address and the FCC also invited comments on are a broad range of issues, including how the primary video of TV stations should be defined and how ancillary services not covered by the must-carry rule should be defined. Other issues the regulators should seek input on are the channel positioning options for digital TV stations and which tier of cable service the digital TV stations should occupy.

Stay tuned. The fat lady isn't even near the microphone and time is getting short.

Why ABC chose 720p

In searching the ethers for cutting-edge information, I occasionally find someone who speaks simple, common sense about why their company did something. However, I have yet to find that with any of the 1080i proponents. In a conversation with Saul T. Shapiro, vice president, broadcast technology, ABC Television Network, Shapiro mentioned that there have been a few spools of threads unwound recently with respect to the interlace/progressive debate. He explained why ABC chose progressive scan distribution and transmission.

Saul T. Shapiro, vice president, broadcast technology, ABC Television Network

"The single most important fact to keep in mind is that there will not be consumer confusion over formats because all manufacturers of displays have affirmed they will decode and display pictures regardless of the received format. That means a program sent in 720p will show up on a 1080i native display receiver. Consumers do not have to choose amongst formats. The benefits of choosing a transmission and

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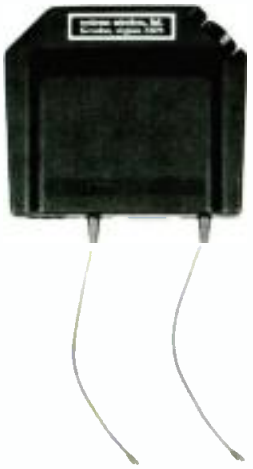

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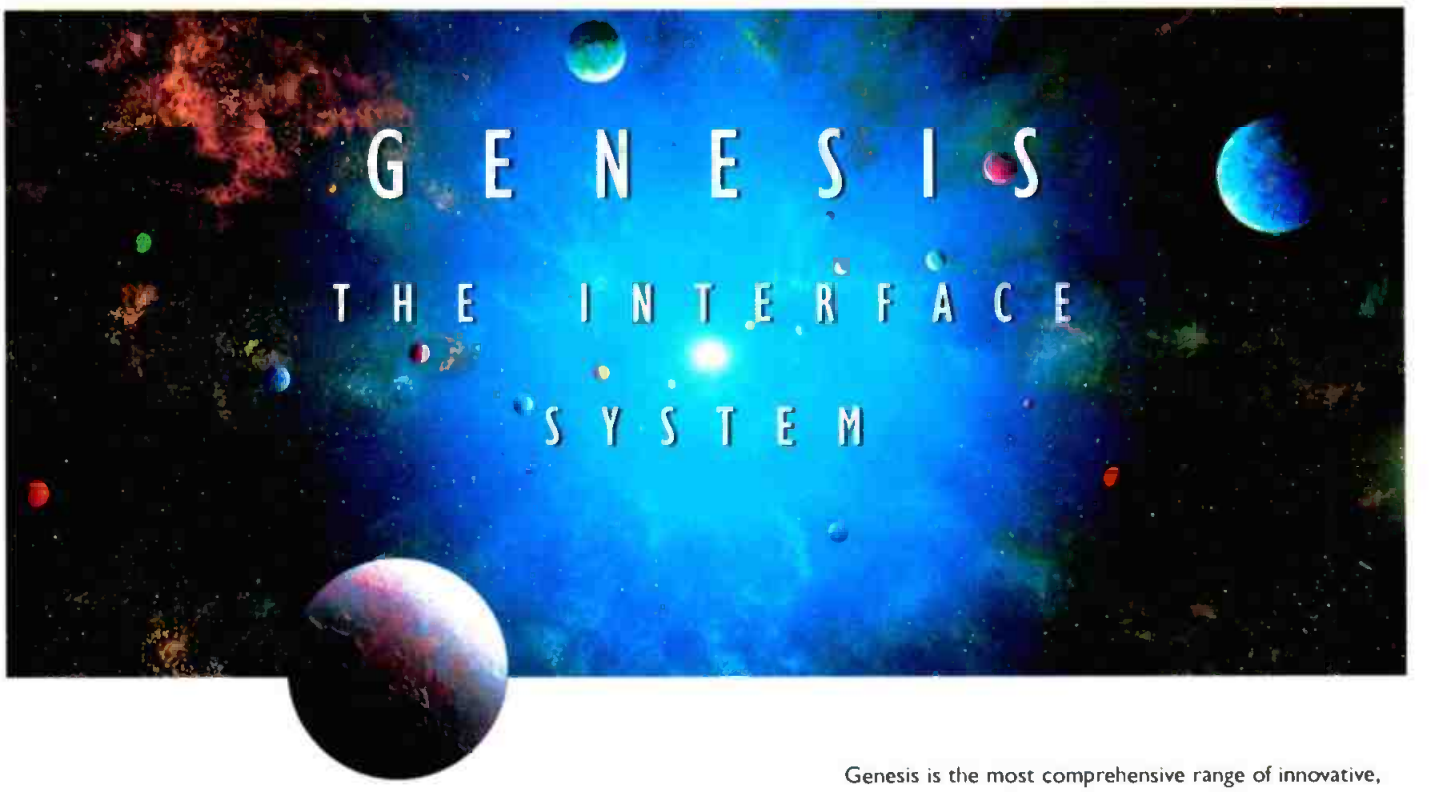

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distribution format accrue primarily to the network and affiliate. The consumers will enjoy detailed, rich pictures regardless of the format chosen by the network.

ABC chose 720p for the following reasons:"

• ***Better pictures:*** "We feel 720p provides the absolute best picture quality to the consumer. This conclusion was supported by the subjective testing done under the auspices of the FCC's Advisory Committee on Advanced Television Services. Progressive scan eliminates interline flicker caused by interlaced scan and is superior for moving pictures. It eliminates temporal artifacts because the entire picture is painted each frame. Because, effectively, all of television relies on moving pictures, we felt this was a highly relevant benefit. Leading video authorities agree that progressive scan is the proper goal. We feel we should go straight to that conclusion."

• ***Equipment is available:*** "The fact is, we were able to identify at least one vendor for each of the critical components of our digital release facility that could promise delivery in time for our November launch. There are many more in line shortly thereafter. While it is true that there is a broader choice of equipment available today for an interlaced-only solution, we have been able to carefully plan our facilities to allow for flexibility and choice amongst formats. Come November 1999, when many more of our affiliates must be on air to meet FCC guidelines, we can expect a variety of 720/1080 switchable equipment to be available."

• ***Future display technology:*** "Some folks justify using 1080i because many consumer receivers being planned for introduction this fall are 1080i rear-projection systems. We are taking a longer view. The development of large-area flat panels is proceeding at a remarkable pace, and the prices are falling quickly. Although a few thousand rear projectors may be sold over the next year, most consumers will embrace DTV, and HDTV in particular, via flat-panel displays. Flat panels are inherently progressive, and will most certainly be available in 720-line versions long before 1080-line models are cost effective for the typical living-room environment."

• ***Channel efficiency:*** "One of the most compelling reasons to use progressive formats, regardless of the line count, is that progressive formats compress more efficiently than comparable quality interlace formats. This is one reason the commission's advisory committee determined that 720 lines progressively scanned are comparable to 1080 lines of interlace. While it seems counter-intuitive that 720 equals 1080 (and the numerologists and pixel prophets like to take advantage of this confusion), there is ample scientific evidence that shows it to be true. We can send better pictures at the same bit rate or we can send the same quality pictures at lower bit rates. In the former case, consumers benefit from the absolute best possible pictures. In the latter case, they benefit from greater variety, in programming or digitally enabled information services. Either way, the consumer wins, and by extension, so does ABC. Initially we intend to fill our channel with the 720p picture, providing artifact-free encoding at any frame rate."

• ***Computer compatibility:*** "At the heart of the format debate, advocates for progressive have long promoted it as compatible with computer applications. We concur that this is an advantage. Here at ABC, we feel that progressive technology will allow us, as well as our parent and partner, Disney, to create new opportunities for enriched story-telling and information-rich programming. While it is still too early to clearly define precisely what form this programming will take, embracing progressive formats early provides us with the greatest technical flexibility to explore new forms of story-telling that has long been a promise of DTV."

"It is no secret that the cable companies have expressed a preference for progressive formats."

• ***Cable compatibility:*** "It is no secret that the cable companies have expressed a preference for progressive formats. Their reasons tend to have more to do with the costs of a set-top converter, but we are not disappointed that they have reached a conclusion similar to ours. We hope this will facilitate cable carriage of DTV programming, allowing for a more rapid conversion throughout the industry."

"These are the primary reasons for ABC choosing the 720p format for distribution and transmission of HDTV programming. Taken together, we feel they provide a compelling rationale for embracing progressive technology. However, while 720p works for ABC, we are not suggesting that 1080i is wrong for others. We will work closely with our affiliates who have chosen, for whatever reason, to use 1080i within their facilities. We are confident that we will be able to deliver contribution-quality HD material via satellite to our affiliates and, if they so choose, they will be able to do high-quality transconversions to the interlaced format. Consumers will enjoy spectacular pictures either way." ■

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What's FireWire?

I've seen this term used and when I asked another broadcaster what it was, I was told it is an elixir for the ills of digital television. OK. He obviously didn't know anymore about it than I did. So what exactly is FireWire? Technically speaking, FireWire is a cross-platform implementation of the high-speed serial data bus that is defined by IEEE Standard 1394-1995. What makes FireWire particularly attractive in the new digital TV scheme of things is that it is capable of moving video or large amounts of data into and out of computers or peripheral devices, as a purely digital signal, skipping the need for digital-to-analog and analog-to-digital conversion. And it does all this while maintaining zero loss in quality. FireWire features simplified cabling, hot swapping, and transfer speeds of up to 400Mb/s. I've been told that the experts, technical committees and design organizations are moving quickly toward a 1Gb data transfer rate. That's my whole hard drive in four seconds.

FireWire is an evolving standard (obviously) for a high-speed serial bus designed to communicate with devices that need capabilities that the current universal serial bus (USB) is unable to provide. A USB is only capable of delivering up to 1.5 MB/s data transfer.

FireWire features simplified cabling, hot swapping and transfer speeds of up to 400Mb/s.

FireWire will probably replace the USB soon because the USB did not win the peripherals manufacturers in time and Win95 doesn't support it — but Win98 may give it a new life. FireWire may even complement the IDE bus (i.e., ATA, AT Attachment). The 1394 is a

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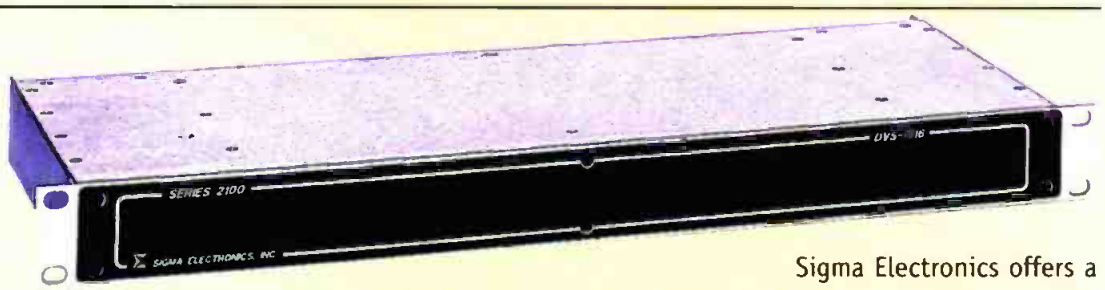

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same high-capacity half-inch tape of today. These extensions will make possible switchable 720/60P and 1080i high-definition recording and playback, as well as 480/60P recording and playback. And despite these dramatic advances in technology, JVC is committed to ensuring that the recordings you make with today's DIGITAL-S won't become obsolete in the future.

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bus that can serve these devices inside and outside the box, and can provide a transfer-rate roadmap that goes well into the gigabyte-per-second range. A single 1394 interface on the motherboard gives the system access to peripherals.

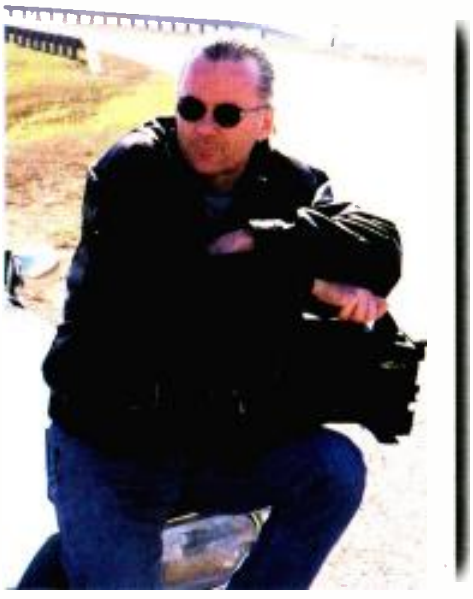
From what I uncovered, FireWire is an Apple technology that they've been using for several years. Major manufacturers of multimedia devices are already adopting the FireWire technology because it speeds up the movement of multimedia data and large files, enabling the connection of digital consumer products—including digital camcorders, digital video tapes, digital video disks, set-top boxes and music systems—directly to a personal computer. Its architecture is scalable, and it is hot-pluggable, so a designer or user can add or subtract systems and peripherals easily at any time.

Additional information can be found at these web sites:

- www.apple.com/firewire/
- devworld.apple.com/dev/FireWire/index.html
- roxa33.cern.ch/computing/dict/f/firewireidx.html
- www.firewire.org
- til.info.apple.com/techinfo.nsf/artnum/n24496 ■

The "Dark" side of HDTV

In a recent conversation with Randall Dark, the 11-year veteran and pioneer in the HDTV industry told me that his company, HD Vision Inc., will be expanding within the next several months. Dark said, "Having recently signed a deal with an (undisclosed) investment firm in New York, the company will soon be receiving second-stage funding with which we'll open HDTV facilities in Los Angeles and New York. HD Vision has been in operation in Dallas for over five years.



Randall Dark, president and CEO of HD Vision Inc., is an 11-year veteran and pioneer in the HDTV industry.

"These are exciting times to be involved in the TV industry, and we feel now is the time to expand our services and our reach," says Dark, president and CEO of HD Vision Inc. Dark's list of *firsts* in the HDTV business are many. (See "First opening day baseball game in HDTV," *Broadcast Engineering*, May 1998, p. 26.)

HD Vision boasts client relationships with companies such as Harris Corporation, Microsoft, A.H. Belo, Chrysler and CEMA, just to name a few. "I encourage competition and look forward to it," says Dark, "my company is very open and straightforward. If you want us to handle your production from start to finish, we will. If you want to simply rent gear from us and handle the details yourself, that's no problem. Our goal is simply to get HDTV out there in people's hands. This new technology is not just on it's way anymore, it has arrived and we are here to help those who are ready to get their feet wet with it"

When you are the first and only mobile HDTV truck, your schedule gets hectic. HD Vision boasts being the only company in North America with an HDTV mobile truck capable of handling a six-camera shoot. Their services are in demand and as proof, Dark said, "Our truck and gear are booked during the month of September for everything from football, to a symphony, to car commercials."

"This new technology (HDTV) is not just on it's way anymore, it has arrived and we are here to help those who are ready to get their feet wet with it."

Dark, the creative and marketing force behind HD Vision, is no new kid on the block. Throughout his career, he has distinguished himself as an artistic and technological visionary. The fact that he has the one-and-only HDTV mobile truck speaks for itself. As a writer, director and producer, Dark is a one-man show. He is able to offer an artist's point of view, while demonstrating the technological advantages of high definition.

Before founding HD Vision, Dark spent three years as vice president and producer for Captain New York Inc., where he was responsible for the production of a number of HD projects; many of his projects were nominated for awards at the International Electronic Cinema Festival in Switzerland.

Dark has over 150 HD productions to his credit in a career that began over ten years ago with *Chasing Rainbows*, the world's first mini-series shot in high-definition. With a $12 million budget, this 14-hour historical drama was the largest HDTV production undertaken worldwide.

In addition to his experience in high-definition, Dark is a theatrical director/producer and published playwright, with memberships in the Society of Motion Picture and Television Engineers, the Academy of Canadian Cinema and Television and the Playwrights' Union of Canada. The man is not just a production type. Trust me—don't get into any discussion about the technical aspects of the TV industry, unless you are well-grounded.

For more information about HD Vision or Randall Dark, check out HD Vision web site at www.hdvision.com. ■

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The passing of an era

Before television, and there really was a time before television — there was radio. Radio distinguished itself, in its early days, as being the lifeline between ships at sea and the remainder of the world. Incidents that live in the annals of radio history are many, but one in particular comes to mind; when a young Russian immigrant, David Sarnoff, copied the dots and dashes of the distress messages from the ill-fated SS Titanic. As most of us know, Sarnoff went on to become the head of RCA and probably did more to bring television into the homes of Americans than any other industry leader, but that is how he got his start.

As of March 1, 1999, the dots and dashes from the ships at sea will be silenced, as Morse code will disappear from the high seas. This is the date when all passenger ships and cargo ships over 300 gross tons will no longer be permitted to use Morse code for distress calls.

It is interesting to note that the International Maritime Organization (IMO) ends this phase of telegraphy only 22 days short of the 155th anniversary of Samuel F. B. Morris' first message, "What hath God wrought?"

The IMO says, "Morse code is being phased out because of its many drawbacks. These include the need for years of training and practice for operators to use it." The truth hurts, but the IMO says that if something happened to the radio operator, it is unlikely that anyone else onboard a ship would be able to use the telegraphy equipment. ■

Nine new fellows

Nine SMPTE members have been elected as Fellows of the Society. This year's inductees include:

- George I. Benkowsky, director of engineering for CBS Television, in Los Angeles.
- John W.S. Brooks, senior partner at Brooks/Fleming Associates, in Burbank, CA.
- Arthur J. Cosgrove, senior engineer, standards development, for the Eastman Kodak Company, in Rochester, NY.
- Neil B. Feldman, president and owner of Video Post and Transfer in Dallas.
- Alan J. Masson, director of engineering for Eastman Kodak Company, in Hollywood, CA.
- R. Fred Pfost, vice president of engineering for ABD Inc., in Los Altos, CA.
- Geoffrey A. Pryke, former project manager-controller for London Weekend Television. Pryke retired in 1991.
- Horst Schachlbauer, head of the recording and archiving section of IRT, in Munich, Germany.
- John F. G. Wilson, the current chairman of the IBC Management Committee Company in London England.

The Fellows of the Society are chosen based on their outstanding rank among engineers or executives in the motion picture, television or related industries. The nine new inductees will be named as Fellows at a ceremony on Oct. 30, during the 140th SMPTE Conference in Pasadena, CA.

For conference information, contact the SMPTE marketing department at 914-761-1100 or visit www.smpte.org.

Larry Bloomfield, a former chief engineer, is an industry consultant and author, located in San Jose, CA.

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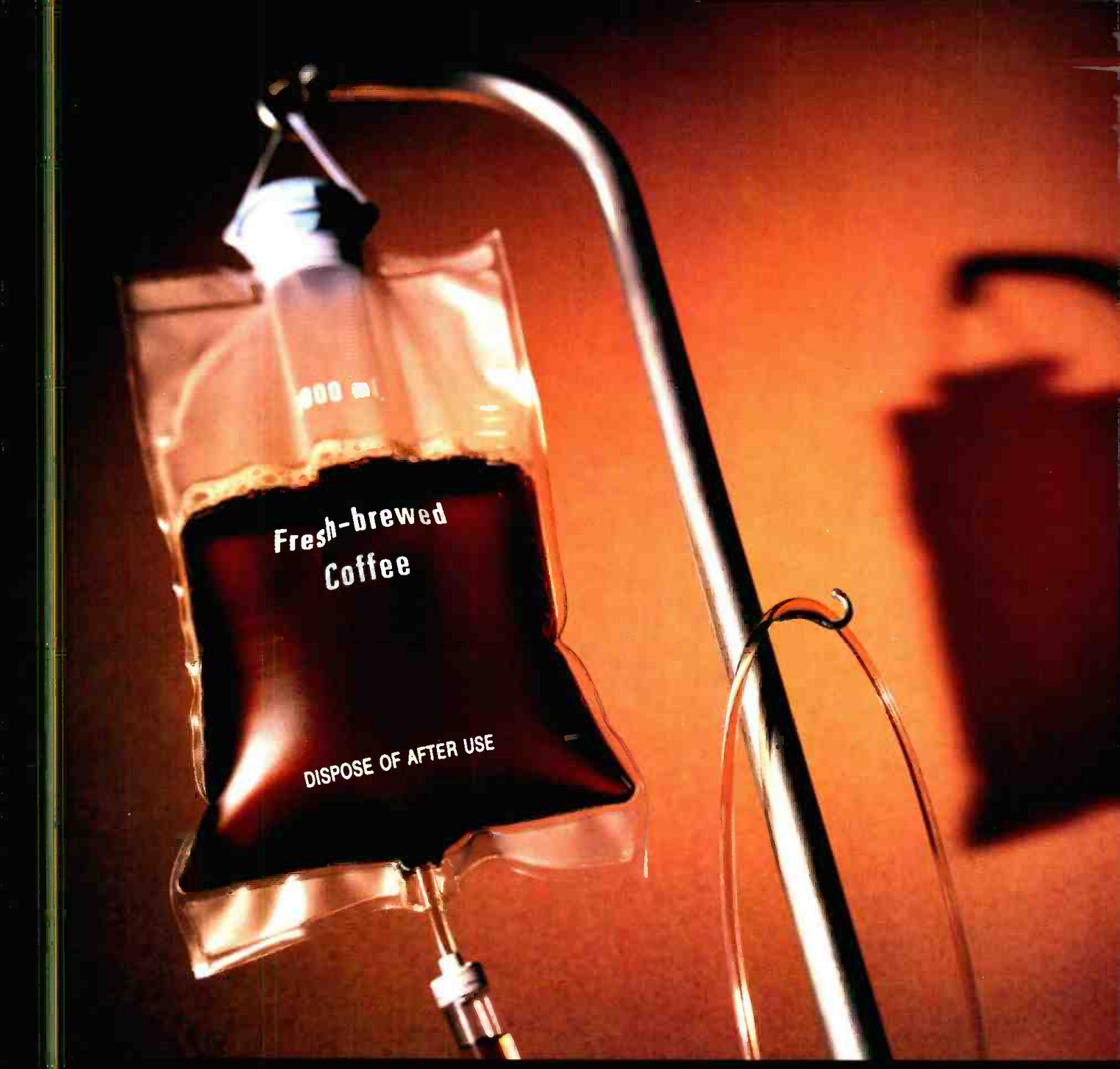

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FCC Update

FCC adopts auction procedures

BY HARRY MARTIN

After much anticipation, the FCC has announced the adoption of rules and procedures to govern broadcast station auctions. The auction rules will extend to virtually all mutually exclusive applications for commercial TV, radio, low-power TV, FM translator and TV translator stations.

The rules will also apply to mutually exclusive major modification applications for broadcast stations not resolved through negotiations. For most applications for new stations, interested parties will be required to file a short-form application (FCC Form 175), in a designated filing window, with enough engineering data to allow the FCC's staff to determine which applications will be included in the auction. Only the winning applicant will have to file the long-form application.

For pending mutually exclusive applications, applicants who wish to participate in the auction must file an FCC Form 175. Applicants who do not wish to participate may request a refund of their filing fees. Prior to the deadline for filing the FCC Form 175, applicants may enter into settlement agreements that comply with the FCC's settlement rules.

The rules specifically do not apply to cases involving frequencies reserved for non-commercial broadcast services for which only non-commercial entities may apply. In addition, the rules will not apply to comparative renewal cases. The commission intends to resolve such proceedings on a case-by-case basis. In an effort to avoid these lengthy and costly renewal proceedings, the FCC will continue to waive certain settlement rules.

Additional DTV processing guidelines

The FCC has released a Public Notice with additional application processing guidelines for digital television. An earlier notice had been released that focused on routine applications where applicants certify that their proposed facilities conform with the engineering parameters of the DTV. The recent notice focuses more on non-routine applications by explaining how the new provisions for de minimis interference, increased power via antenna-beam tilting and DTV allotment exchanges will affect the application process.

While the notice is not expected to answer all questions, it should provide engineers with enough information to prepare the bulk of the applications.

The notice reiterates that the commission will place priority on the routine applications (or checklist applications as referred to by the FCC) and the checklist applications will be granted within days of filing. With respect to the non-routine (or non-check-list) applications, the FCC will process these applications in the following order:

1) Applications of broadcasters who have voluntarily committed to begin operation on Nov. 1 of this year and stations in the 10 largest TV markets with a May 1, 1999 build-out date.

2) Applications in markets 11-30 with a build-out date of Nov. 1, 1999.

3) All other DTV applications.

In particular, the notice describes the preparation of the technical study required to accompany non-check-list applications. The following are some of the requirements outlined by the FCC for the preparation of the technical study:

- The study must be consistent with the process described in OET Bulletin No. 69 and used in the DTV rulemaking proceeding.
- The studies based on computer analysis designed to duplicate the FCC's computer analysis must state the computer and software used.
- The study must include an exhibit indicating which DTV or NTSC will be affected by interference.

The notice goes into an in-depth discussion on de minimis calculations and the methods employed to make such calculations.

The FCC also discusses the additional showings required where a station proposes to use antenna-beam tilting. While the notice is not expected to answer all questions in connection with non-check-list applications, it should provide engineers with enough information to prepare the bulk of the applications. ■

Harry Martin is an attorney with Fletcher, Heald & Hildreth, P.L.C., Rosslyn, VA.

Dateline

TV stations in Alaska, American Samoa, Florida, Guam, Hawaii, Iowa, Mariana Islands, Missouri, Oregon, Puerto Rico, Virgin Islands and Washington must file their annual ownership reports on or before Oct. 1. TV stations in Alaska, American Samoa, Guam, Hawaii, Mariana Islands and Oregon must file their renewal applications by Oct. 1. LPTV and TV translators in Iowa and South Dakota must also file their renewal applications on Oct. 1. In addition, TV station licensees must file their annual employment reports (FCC Form 395-B) on or before Sept. 30. ■

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Tape-based editing lives on

This month's question focuses on editing. With an ever increasing emphasis on non-linear editing, is there still a place for tape-based editing? If so, where and for how long?

EXPERT

I have owned a small video production company for the past 20 years. The article in *Broadcast Engineering* (see "Non-Linear Editing: A Reality Check," May 1998, p. 96) and other publications certainly hit home. It was well done. There is no question that the industry is streaming toward digital and NLE in a big way. But, for the immediate future, I am going to hand with my linear gear. Not because I'm still making payments on the stuff, but because we all know that old payments can easily be replaced with new payments. My four-year-old, high-end linear equipment is adequately serving my needs, as well as my clients' needs. And, I'm making a profit with the stuff. That's the ultimate goal.

Guy Maher, Lanier Media Video Productions.

I think that sometimes we're made to feel guilty for not having the latest and greatest NLE equipment. But, it's telling the story and the finished quality that count, and I don't mind shuttling some tape to keep from adding another $40,000 to the debt load.

What worries me is that although the emphasis is ever increasing toward NLE, there's still a bunch of us out here in the trenches making a living every day with Sony 1800s and JVC 822s, and we plan to keep on doing it that way for quite some time. In my case, the equipment is actually working for me, not the other way around. So, in planning future articles for your fine magazine, please don't forget the tape-based acquisition, linear-editing posting group. We would sure appreciate tips, tricks, techniques and advice on how to survive in a non-linear world with our linear gear. ■

VENDOR

It's been 10 years since Editing Machines Corporation began the "non-linear revolution" with its groundbreaking off-line non-linear system, the EMC2. It's been five years since ImMIX moved non-linear editing from the off-line to the on-line realm with its VideoCube — the first non-linear system with two-field-per-frame, broadcast-quality images.

Dan Wright, president and CEO, Scitex Digital Video.

Yet, despite the widespread adoption of non-linear finishing systems (and despite pundits' assertions that tape is dead), many broadcasters remain committed to tape-based editing, especially for news. And many owners of tape-based edit bays are holding out for the non-linear system of their dreams: an affordable disk-based solution with uncompressed images and no compromises in performance, i.e., no rendering. Facility owners are waiting for A/V rated drives to become even more affordable. And, they are waiting for uncompressed non-linear systems built by video companies, rather than computer companies.

In the meantime, it remains quite common for projects to be off-lined on non-linear systems and for the resulting EDLs to be brought to linear edit bays for finishing. The installed base of non-linear off-line systems will keep tape-based edit bays busy for several years to come. With digital television looming on the horizon, it seems likely that tape-based editing will enjoy an additional resurgence, because high-def VTRs have made it to market far in advance of high-def non-linear systems. And, hard news will likely be a bastion of tape-based editing for years to come — until cameras can readily record their images on disk-based media that's as durable, as portable and as affordable as videotape. ■

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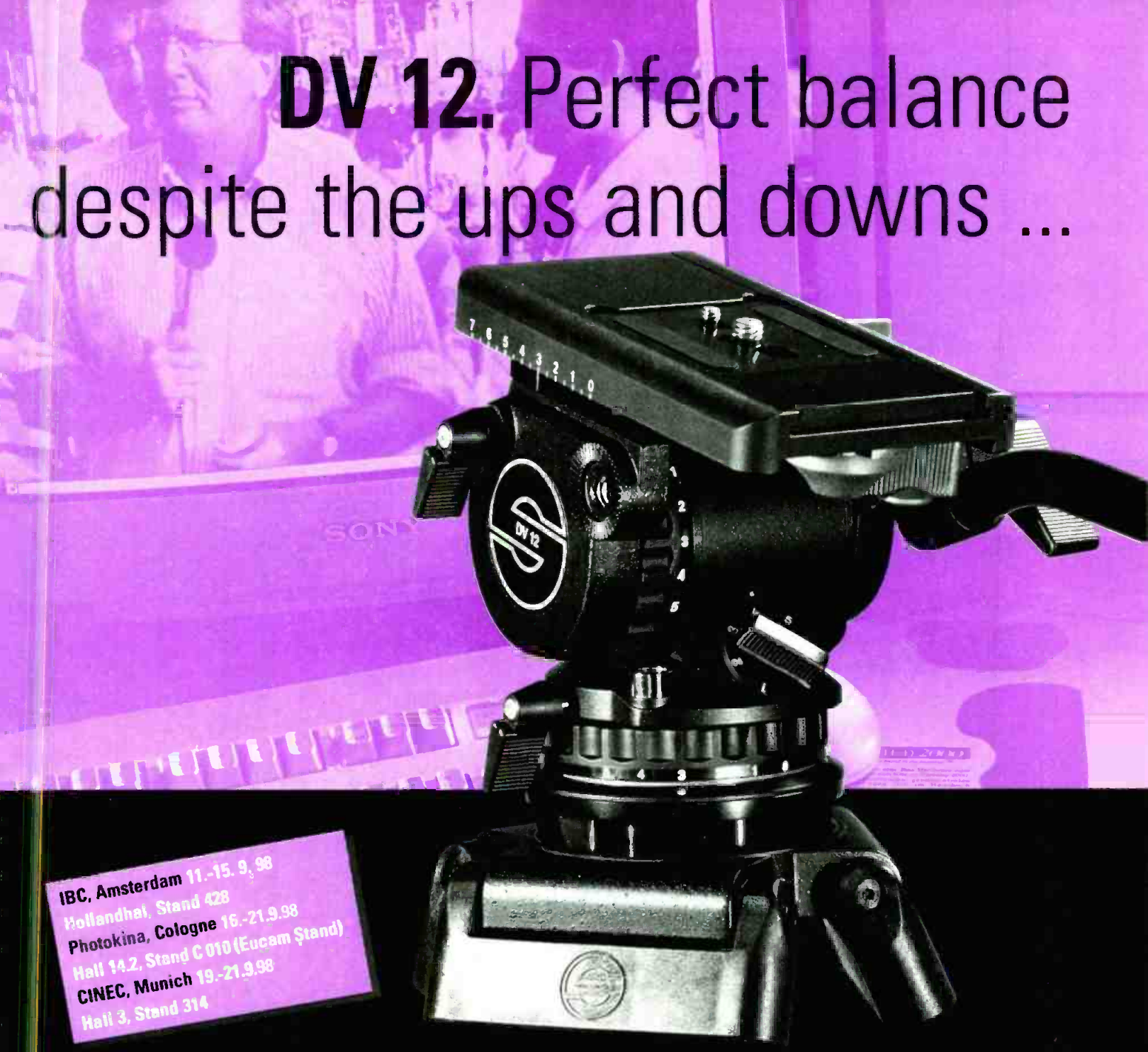
DV 12. Perfect balance despite the ups and downs ...



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VENDOR

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Scott Watson, vice president, product and market development, JVC Professional Products Company.

However, the death bells do not toll for tape — not yet, anyway. While NLE is the way to go for short-form programs, like advertising spots and promotional pieces, tape offers economical and production advantages that can't be overlooked.

Tape is a good acquisition medium. Most video material, including that edited on NLE, begins and ends on tape. Tape offers high capacity for low cost. For example, one DIGITAL-S cassette offers 75GB of video and audio data and provides virtually transparent spooling. It's been said that disk is 100 times faster than tape, but tape is 100 times cheaper than disk. If you put that in dollars, that's five cents for a minute of tape production vs. five dollars for a minute of NLE production.

But, it's the time that keeps many editors from moving completely to NLE. Long segments, like lectures or presentations, are simply easier to edit traditionally than they are to digitize and recompose. And in the case of time-sensitive applications, like the 6:00 news, even at four times transfer speed, NLE takes too much time. So, the strength of tape is often found not in what it can do better than NLE, but in what it can do more quickly.

So, how long will it take for NLE to capture the market from tape? The answer is contingent on the movement of the industry. Video's evolution toward HDTV may serve to extend the life of tape. As producer's shift up to high-def, both traditional tape and NLE systems will bear the brunt of increased data capacity and speed. Equipment manufacturers are already moving toward managing this increased capacity, as evidenced by JVC's 100 Mb/s extensions to DIGITAL-S which have the capacity to provide 720p, 1080i switchable recorders for true HDTV production. HDTV editing will likely take place on hybrid systems or on tape until the industry can build NLE systems that will accommodate the higher data demands. For the moment, the best of both worlds is found in hybrid NLE systems that use a variety of different compression ratios and schemes. May I suggest TimeGate by JVC? ■

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Transition to Digital

Monitoring video in a digital environment, part 2

BY MICHAEL ROBIN

Last month's issue discussed monitoring the bit-serial digital transport layer. This month, we will discuss operational monitoring concepts. In component digital environments, if the original component analog signal meets the relevant quality requirements, it will not be degraded after conversion to a digital signal, which leads to the concept of *source accountability*. This means that signal-generating equipment (e.g., CCU, CG, VTR and production switcher) operators need to verify that the analog information carried by the bit-serial carrier meets the requirements. The monitoring package (see "Monitoring packages," p. 42) would alert the operator if illegal signals are generated through on-screen alerts and picture-monitor flashing.

General requirements

Figure 1 shows a suggested block diagram emphasizing the source accountability concept. As shown, every signal source has a dedicated waveform monitor and a component analog picture monitor. In certain applications, it may be desirable for cameras to share a monitoring package. This requires a monitoring switcher and split (dual) bit-serial digital outputs from every camera — one feeding the monitoring switcher and the other feeding the production switcher. It is important to understand that bit-serial digital signal sources use individual drivers for every output. This is different from analog signal sources which use a single driver with split feeds. Consequently, monitoring one output of a bit-serial digital signal source does not guarantee that the other outputs are active.

Signal sources feeding a production switcher or an editing suite need to be synchronous, that is, locked to the station master sync system. In analog composite environments, in addition to be-

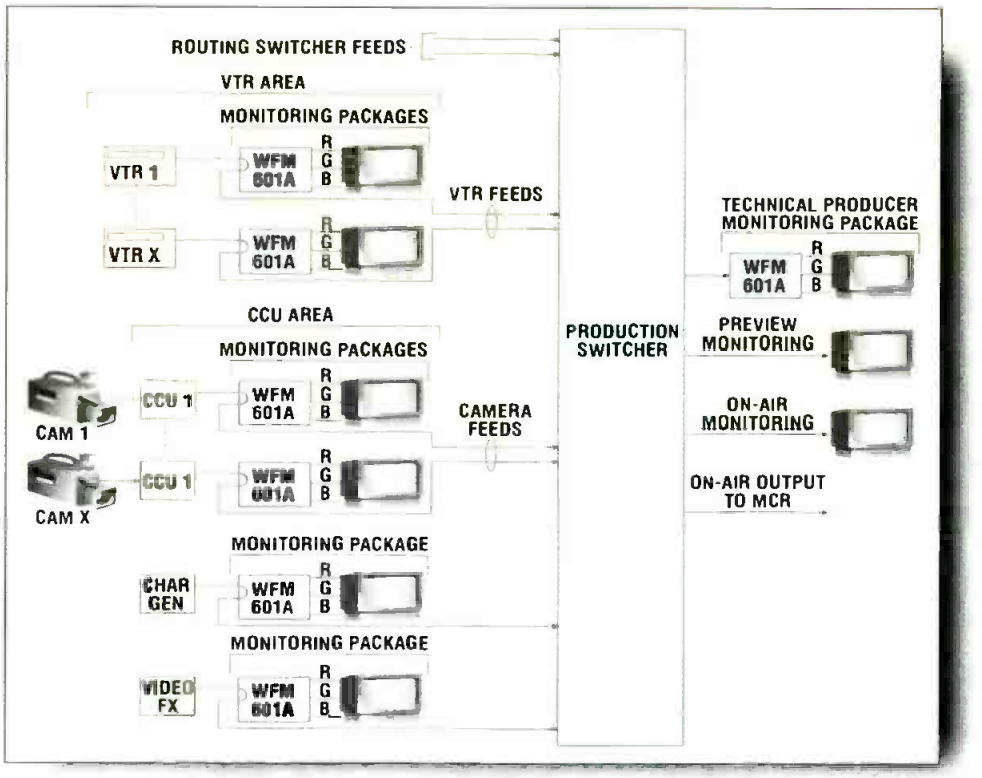

Figure 1. Simplified block diagram of medium-sized studio emphasizing the source accountability concept.

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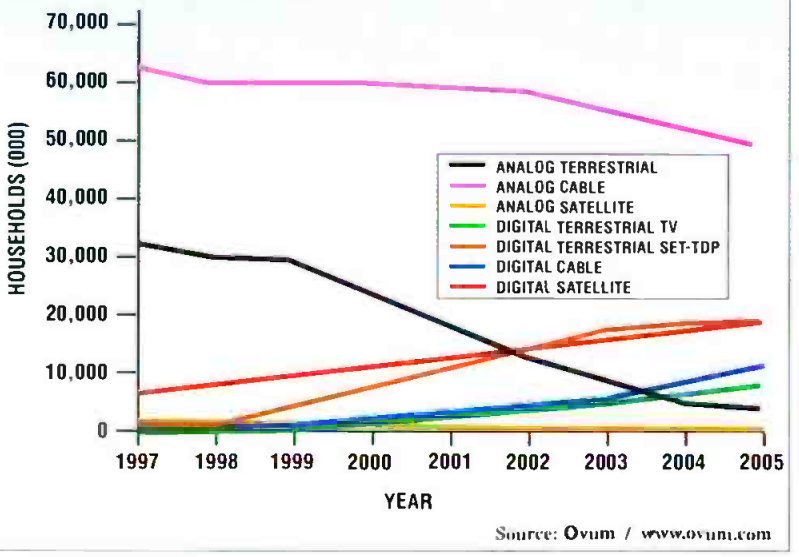

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ing synchronous, the signal sources have to be timed with respect to a reference feed such as a color bars signal. This requires the use of adequate waveform monitors and vectorscopes to verify that the signals meet three requirements:

- Horizontal timing to within less than thirty nanoseconds.
- Subcarrier phasing to better than one degree of subcarrier.
- SCH phasing to less than ten degrees of subcarrier.

Component digital environments only require signal source synchronism. Production switchers accept signals with horizontal timing spreads of plus-or-minus one-half line duration. Because there is no subcarrier, no requirements for subcarrier or SCH phasing need to be met. Consequently, operators are not required to adjust timing, which simplifies monitoring. Here are a few signal-monitoring and optimization guidelines for video in a digital environment:

- *The VTR area monitoring:* The digital VTR is, for all intents and purposes, a transparent medium. Therefore, there is no need to record a color bar leader to allow for throughput or playback optimization. This being the case, it is surprising to see the array of analog signal controls, such as video gain, setup, chroma gain and hue, made available by the manufacturers. These controls are used mostly to correct for the imperfections of field-recorded videotapes, generally due to improper lighting and/or inadequate camera optimization.

Alternately, when using some digital VTRs, the operators may be required to playback compatible analog tapes; usually these tapes start with a 75% color bar leader. Operators need to adjust the VTR controls to obtain a correct color bar vector display and also check for correct Y, Pb, Pr component video signal amplitudes. After playback signal optimization, operators should monitor the Y component in a manner similar to monitoring NTSC composite analog signals using a waveform monitor with a low-pass (IRE) filter, watching for illegal signals.

- *Camera alignment:* Camera alignment typically consists of grey-scale optimization and gamma correction, as well as colorimetry matching. The waveform monitor is adjusted to sequentially display the GBR signals obtained from the matrixing of the native (to the bit-serial digital signals) Y, Pb, Pr component analog signals. The standard grey-scale test transparency or chart is used in the usual manner and the red, green and blue channel gains, black level, white level and gamma are adjusted for identical sequential displays. The three waveforms are subsequently superimposed and fine-tuned for minimum display trace thickness. In NTSC cameras, fine-tuning may be achieved by balancing the chroma subcarrier modulators. In a component video environment, there is no color subcarrier, so the fine-tuning consists of optimizing the gains, black levels and white levels of the three channels.

For colorimetry matching, a color bars transparency (or chart) is used and the waveform monitor is operated in the component vectorscope mode, with one

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Monitoring packages

Suitable monitoring packages consist of a waveform monitor and an associated picture monitor.

Waveform monitors should have the following characteristics:

- Active loop-through bit-serial input(s) conforming to SMPTE 259M.
- EDH alarm capability.
- Display of the component analog signals in Y, Pb, Pr form or derived (by matrixing) G, B, R, either in sequential or individual display.
- Vector display of Pb/Pr color-difference signals.
- Gamut analysis and alert capability using the Diamond concept for GBR validity and the more recent arrowhead concept for derived composite analog NTSC validity. The waveform monitor should be programmable to display an alert for GBR and/or composite analog NTSC validity on the waveform monitor screen as well as a picture flashing on an associated monitor.
- Provide a decoded analog component signal set in GBR or Y, Pb, Pr (EBU N10) format for connection to a component analog picture monitor.

The picture monitor should have component analog GBR inputs with sync on Green as per SMPTE 253M. It is preferable to use GBR component signals since some component picture monitors are designed for Betacam type component analog signals and may display incorrect luminance and chrominance values when supplied EBU N10 component analog signals.

The monitoring package used by the author in several installations consists of a Tektronix WFM601A waveform monitor and a component analog picture monitor of a size suitable for the intended use. The chosen waveform monitor has no eye-pattern display capability. ■

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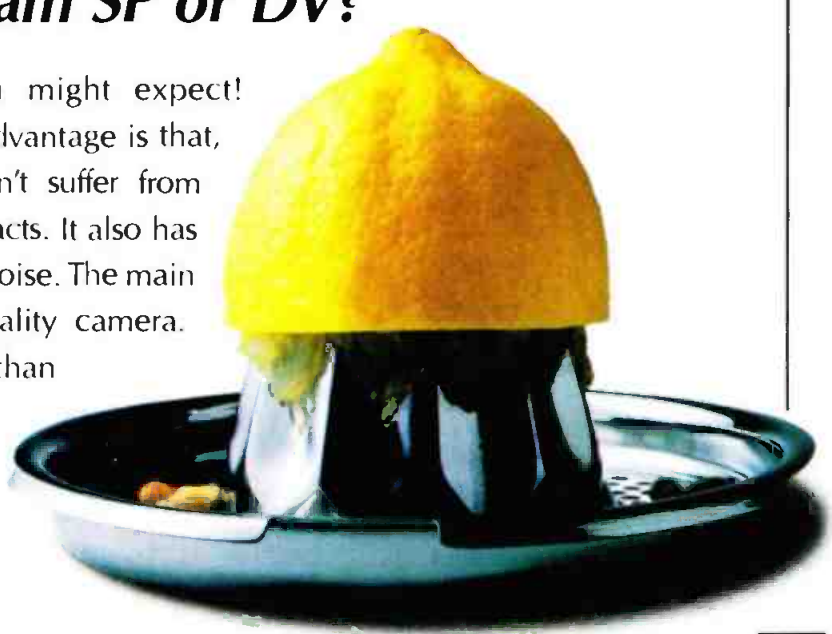

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camera serving as a reference. The camera masking adjustments, if available, are fine-tuned to obtain vector displays similar to that of the reference camera.

Following camera alignment, the CCU operator monitors and optimizes each camera output using the GBR sequential display in a manner similar to that used with analog cameras.

The described monitoring concept assumes a dedicated monitoring package for every camera. This may not be economical for certain small operations. Instead, a monitoring package that includes a switcher could be used for camera optimization and subsequent operational monitoring.

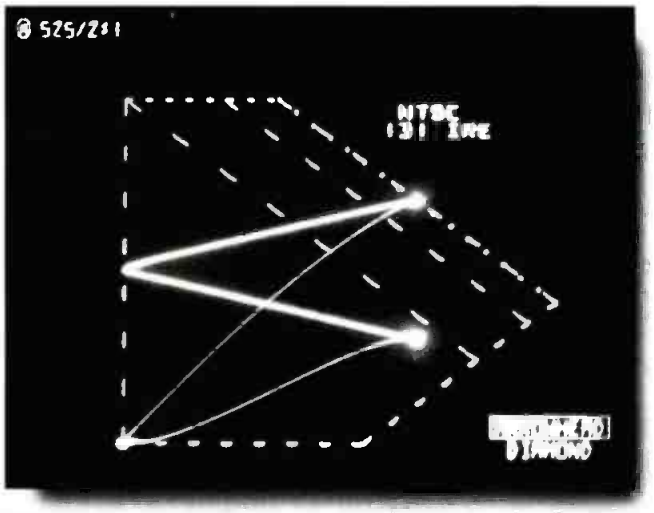

Figure 2. Arrowhead display of a signal with excessive chrominance (131 IRE).

• ***Character generator and digital video effects monitoring:*** The suggested method is to use the arrowhead display (see Figure 2) and program the waveform monitor to alert the operator if any chrominance components exceed 110 IRE when encoded into analog composite NTSC. When this happens, with the setup described in the sidebar (see "Monitoring packages," p. 44), an alert will be seen on the waveform monitor screen and the associated picture monitor will flash until the illegal signal has been corrected.

Well-entrenched analog monitoring habits need to be replaced by new methods better suited to the digital environment. Beyond the signal origination point, there is no need for waveform monitoring. This is because the analog message remains unaffected and the bit-serial waveform will be regenerated at the destination. The only operational position where analog signal monitoring needs to be carried out is in the master-control room, where outgoing composite NTSC-encoded signals are fed to common carriers or over-the-air transmitters and incoming signals are converted to bit-serial digital signals for in-house distribution. ■

Michael Robin, former engineer with the Canadian Broadcasting Corporation engineering headquarters, is an independent broadcast consultant located in Montreal, Canada. He is the coauthor of Digital Television Fundamentals, *published by McGraw-Hill (see below for details on this book).*

Michael Robin's book may be ordered directly from the publisher by calling 800-262-4729. It is also available from several booksellers.

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Backing up network data

BY BRAD GILMER

Network backups in conventional business environments can be complicated. In broadcast environments, network backups are no less complicated and typically include several unique challenges. Most broadcast facilities have several computer networks, such as an office network, a technical network, and in some facilities, a high-speed video network.

Backup technologies

Two technologies are widely used for data backup today — tape and hard disk. Other technologies, such as rewriteable CDs and magneto-optical drives, are available, but their use is limited. Tape is the most common network backup medium, primarily because of the high cost of redundant disk storage — about 80 times that of tape. The last five years have seen the advent of high-speed, low-cost helical scan data tape drives. These drives, most often used in the desktop environment, use a 4mm DAT cartridge with a capacity of 8GB and a sustained throughput of 730kB/s at 2:1 compression.

Digital linear tape (DLT) is the next step up and is a linear multitrack format with a sustained throughput of up to 10MB/s at 2:1 compression. At the high end, the Ampex DST stores up to 330GB on a single cartridge. The data transfer rate is over 20MB/s *without* compression. See Table 1 for a summary of different tape backup options.

While not a backup technology in the traditional sense, many sensitive applications now run on mirrored disks or servers. Improvements in fileserver technology now allow designers to provide redundant disks, processors, memory or all three.

Backup strategy has a great impact on the technology you select.

Backup strategy has a great impact on the technology you select. Choosing a tape-only strategy could possibly mean being without your data for several hours, while the data is restored from a backup tape. Beyond the fileserver are other items that may contain critical data, such as desktop clients. Decide whether you will provide backup services for those, as well. Many backup applications provide for backup of not only the fileserver, but also the hard disks on desktop machines attached to the network.

Backing up the desktop network

The largest challenges in backing up a desktop/office environment network are its size, the amount of data that typically needs to be backed up and potential bottlenecks, such as routers or bridges. Usually, the office network contains the most network nodes, the highest number of fileservers and the second-largest fileserver capacities (first are the video servers in video networks). These combine to make backing up an office network a real challenge.

One item common to all network backup systems is that when backing up data over the network, performance for other applications may slow to a crawl. This is because the network's overall bandwidth is shared among users. If one application begins to use a large amount of network bandwidth, all applications suffer. Because of this, many networks are designed for automated backup after hours, when network usage is low.

As the amount of network data increases, backup time requirements also increase. This can cause some real headaches if the backup cannot be completed outside of normal business hours. Recently, I configured a backup to run after hours and went home for the evening. The next morning I noticed that the

Manufacturer	Type	Cartridge Capacity (GBs)	Sustained transfer rate (MB/s) See note 1	Transport technology	Compression	Media Format
Various	DDS-2 (4mm DAT)	4/8	0.73/1.5	Helical	DCLZ	4mm DAT
Various	DDS-3 (4mm DAT)	12/42	1.2/2.4	Helical	DCLZ	4mm DAT
Various	DLT-4000	20/40	1.5/3.0	Linear	DCLZ	DLT-IV
Various	DLT-7000	35/70	5/10	Linear	DCLZ	DLT-IV
Ampex	DST 312	330	20 uncompressed	Helical	N/A	19mm
Sony	SDX/AIT	25/50	3/6	Helical	ALDC	8mm AIT
Sony	DTF	42/108	12	Helical	ALDC	12.65mm
StorageTek	Redwood SD-3	10/25/509	20 uncompressed	Helical	N/A	1/2"

Note 1: Assuming 2:1 compression, except Ampex and StorageTek.
ALDC is adaptive lossless data compression, DCLZ is data compression Lempel Ziv which was invented by Jacob Ziv and Abraham Lempel.

Table 1. Specifications of several systems used for tape backup of data.

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fileserver's performance was slow — I thought it had crashed. Later, I realized that the fileserver was still working on the backup that I had started the previous evening. The amount of data to be backed up had grown to the point that it could no longer be backed up overnight.

Running a network backup application on a fileserver, through a Novell NLM for example, can have a serious impact on network and server performance; many network designers choose to run the backup application on a standalone computer. This keeps the server from becoming bogged down by requests to service the backup application. It also is useful when you want to backup more than one fileserver.

When backing up more than one server, network configuration can affect performance. If a router is between a fileserver and the backup workstation, the result will be a significant drop in performance. Routers, by their very nature, are bottlenecks. They take time to analyze the header, and in some cases, the entire packet of an Ethernet message, before they forward the packet on to another network segment. This analysis takes time and can reduce router throughput by 30% or more, depending upon router technology. Backing up a fileserver across a router creates a large number of packets, each of which must be routed through the router. This degrades system performance and increases backup time. It would be better, in this case, to run a tape backup process on both fileservers or to put both servers on the same network segment.

As the office network capacity grows, you will likely exceed the capacity of a single backup tape. Fortunately, companies such as Advanced Digital Information Corporation (www.adic.com) have designed a wide range of autoloaders and autochangers that are capable of holding a large number of cassettes. These devices make it possible to backup a network every night for a week or more without having to make a manual tape change.

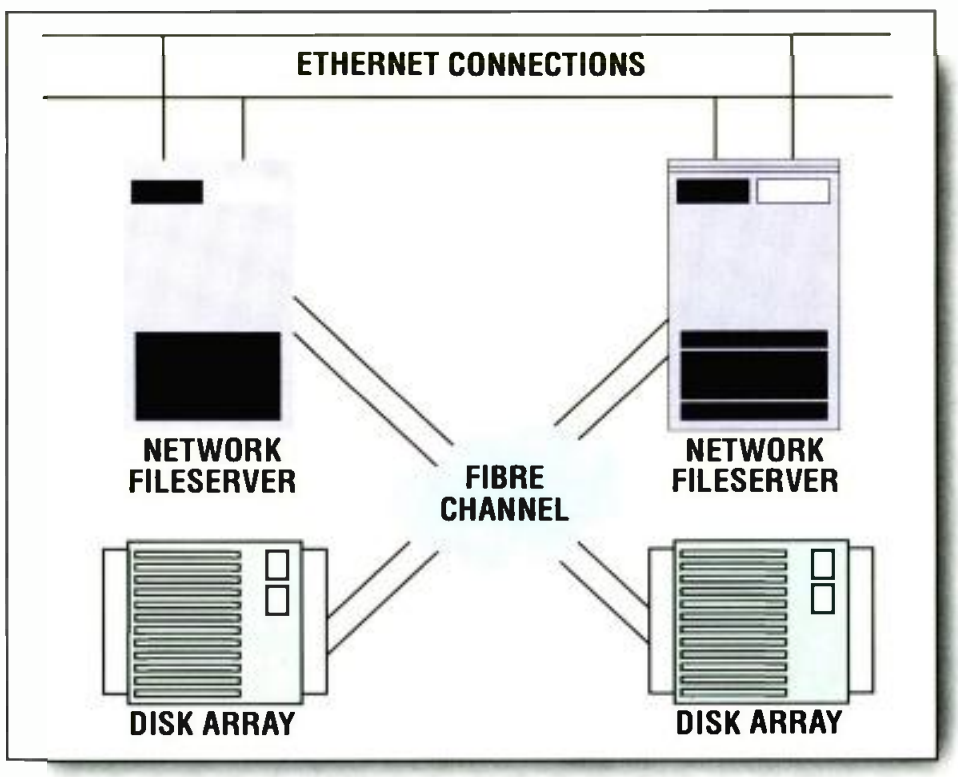

Figure 1. Typical configuration of a Hewlett-Packard K-200 high-reliability fileserver using redundant Fibre Channel connections.

Technical network backups

Technical networks are usually standalone networks used to support the on-air environment. Automation networks are a typical example, although now there are many devices in the broadcast environment that require network connectivity.

While the amount of data in these networks is usually smaller than the desktop network, two factors make backing up this network much more challenging. First, the network is in use 24 hours per day, seven days per week. Second, the network is used for critical on-air applications. Take extra care when developing a network backup strategy for this network. Be sure the backup does not interfere with on-air operations.

Because of the critical nature of these networks, a "tape-only" backup solution may be inadequate. Consider mirrored storage, mirrored servers, RAID or all three. Figure 1 shows a typical connection for the Hewlett-Packard K-200 high-reliability fileservers. Note that the servers and storage are mirrored through redundant Fibre Channel connections. Both servers can access either disk array. This installation provides excellent real-time backup. For extra security, a tape backup device can also be used.

Backing up high-speed video networks

A challenging backup task is backing up new high-speed video networks. The two greatest challenges in this environment are the speed of the network and the size and structure of the data. An additional complication is that these systems are in use 24 hours per day, seven days per week.

There are several backup possibilities for video networks. The easiest solution, although possibly not operationally feasible, is to backup material on traditional videotape. Because video networks are frequently employed in multichannel facilities to achieve efficiencies over tape environments, conventional videotape equipment may not be available. An option is to store material on data tape, such as DLT-7000 or DS-3, in a tape robot, such as the Powderhorn by StorageTek or one of the DST libraries from Ampex. Such a solution is not cheap, but it will provide secure storage for your media, and in a multichannel facility, there may be additional benefits. A final solution is to provide mirrored servers, which is the most common backup scenario used today. ■

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

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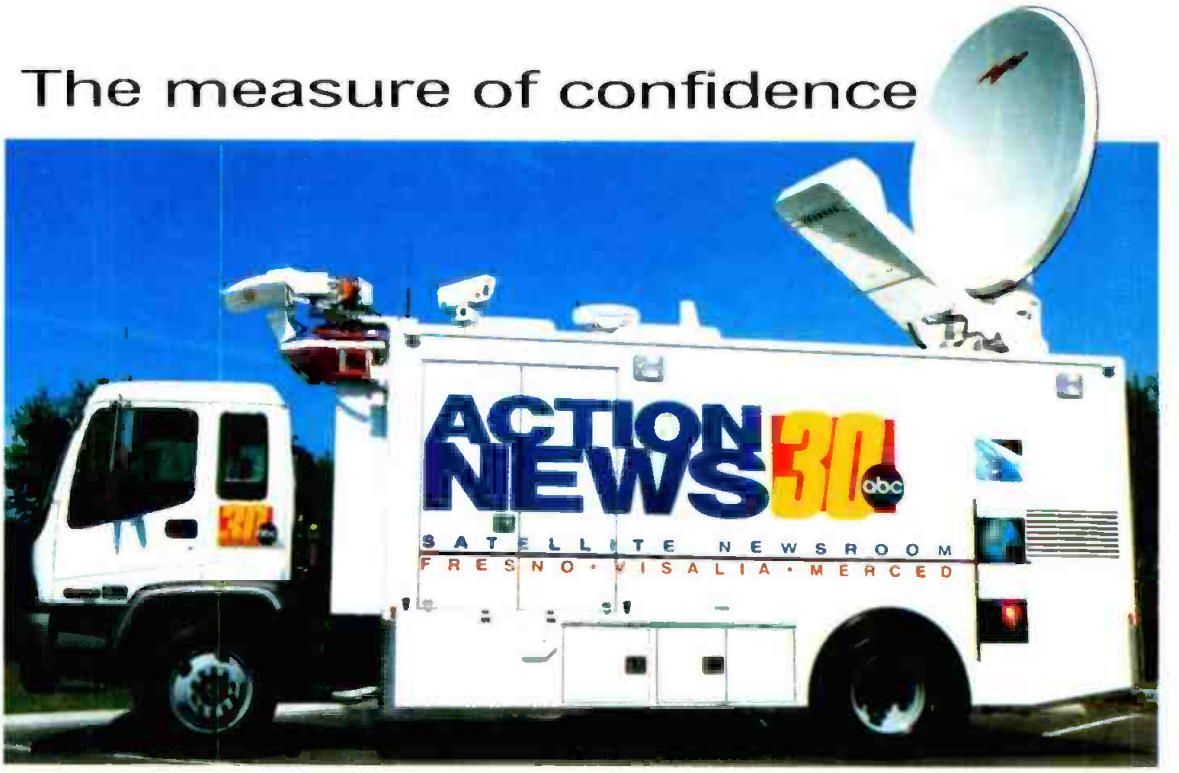
The measure of confidence



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Ask Dr. Digital

Number, please

BY STEVE EPSTEIN, TECHNICAL EDITOR

I am currently working on preparing a project proposal and would like to offer Bruel & Kjaer 2525 measuring equipment. I have tried unsuccessfully to obtain B & K's contact numbers from various A/V publications and would appreciate very much if you could help me find their phone and fax numbers in Denmark or their regional sales representatives.

By the way, do you know where I could source a Rion NA25 portable digital sound level meter? It is also part of the specifications of the same project.

Satvindar
Project engineer
Jebsen & Jessen Communications
Malaysia

I did some checking and here is the contact information for B&K that you requested:

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Home page: www.bk.dk/1200.htm
Address page: www.bk.dk/3000/3100.htm
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Fax: +60 3 732 2530
In Denmark:
Phone: +45 4580 0500
Fax: +45 4580 1405

No luck with the Rion NA 25, but I did find a Rion NA 24 listed in ARL's catalog. You can check them out at www.hutch.com.au/~acoustic/index.html

I need to bump up about 5,000 hours of old ¾-inch tape (library footage for the PGA TOUR). I would like to use a BVU-950 and process the Y C 688 output to maximize quality. I would also like to noise reduce the footage and preprocess the image for recording to Betacam SX. Any suggestions?

John Martin
Chief engineer
PGA TOUR Productions

I checked with the folks at Snell & Wilcox, and according to Julian Warren, the 688 output is a good way to go. He suggested getting in touch with the people at Merlin Engineering (yes, they're still in business) for some suggestions regarding exactly which TBC to use. Ken Zin at Merlin was quite helpful and suggested using an old Fortel Y688. It has a 688 output, and if you need one or two, Television Associates (TVA), in Mountain View, CA, has some for sale. You can reach them at 650-967-6040. ■

Today's electronic equipment is incredibly sophisticated, but for the most part, it lacks repairability. When was the last time you actually repaired a hard drive? Like much of today's equipment, hard drives are simply easier to replace than to repair. Older equipment, such as old scopes, VTRs and those 5- and 9-inch B&W monitors seem to last forever. Many of these items may be fully depreciated after seven years and still have at least seven more years of useful life left in them — assuming you can still get the parts. So when do you retire them?

Unlike aircraft, broadcast equipment does not need much maintenance relative to the number of hours of usage. For instance, few transmitters need to be taken off the air one night a week for maintenance, but most should probably be taken down once a month. If you put in five hours on that overnight maintenance task, once a week means that for every 160 or so hours, five maintenance hours (about 3%) are needed. At once-a-month intervals, that drops to less than 1%. As the transmitter ages, that number is sure to increase, but probably will never exceed 5%.

Few pieces of studio equipment require even that much maintenance time. Remember though, that most studio equipment is not in use all day. It may be powered up, but it is not in use. For example, compare the head-hours reading with the power-up reading, and they are vastly different. Nevertheless, when does the maintenance reach the point where it is time to retire the unit?

From a financial perspective, it is obvious — when major repairs are needed or when the unit constantly needs attention. Many times, perfectly operational units are replaced by newer ones because newer features are needed. In some instances, there is no real need for the older unit other than as a backup/spare. However, in many cases, the older unit can be used to increase usability at some other location, creating a ripple effect. Newer equipment goes where the best features or performance are needed most, and everything else ripples down.

Ultimately, operational equipment ends up at the bottom with nowhere to go. Then what do you do? Take it to the local swap meet? Put it in the "old equipment home?" Let me know. drdigital@compuserve.com. ■

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NVISION Provides a Solid Path to DTV

NVISION has developed a new line of modular processing products specifically designed to meet the current and future needs of all DTV facilities

The new 4000 Series is designed around a new generation of equipment frames that have been built to handle any digital signal format, from AES audio at 3.072Mbits to HD-SDI video at 1.5Gbits. In order to accommodate these data rates, this new frame architecture includes a highly specialized 'mid-plane' motherboard that incorporates an impedance matched connector system. To ensure that world emissions and safety standards are met, the frames are also fitted with special compressible conductive gasket material around the doors and I/O plates. The 4000 frames are currently available in two sizes: the 1RU frame (4001) accommodates four processing modules and the 2RU frame (4002) accommodates eight. The 4002 allows the installation of a redundant power supply.

Available modules for this system include the renowned NVISION AES products—A to D and D to A converters, distribution amplifiers, and reference generators—but with improvements over the NV1000 Series equipment. For example, the new A to D and D to A converters are switchable between 20 and 24-bit operation at all AES sample rates, including 96kHz. Each module contains two independent converters. This means that it is now possible to put up to sixteen high quality converters in just two rack units.

"The 4000 Series firmly establishes NVISION as a company that understands the technology issues facing DTV design engineers."

In addition, NVISION has added digital video products such as SDI DAs, embedders and disembeddets, HD-SDI DAs, and SDI and HD-SDI fiber optic convertets. As you would expect from NVISION, these products have been designed to provide excellent perfotmance as well as to fix problems that had been previously overlooked, while maintaining an affordable price point.

In the case of audio embedders and disembedders, NVISION has taken a unique approach to solving some previously ignored issues.

Avoiding Pops and Clicks

When a switch is made between two video sources that contain embedded audio data, it is difficult to resolve a clean audio transition at the receivet. This is due to two primary factors: 1) The audio data is not commonly phase aligned with the video data and othet audio channels. 2) In NTSC systems, any effotts to synchronize audio and video data can be lost if the video paths have diffeting processing delays.

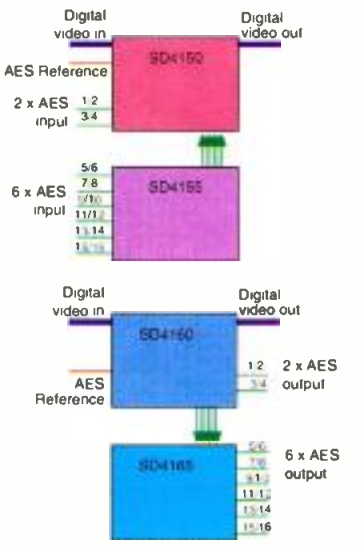
In order to ensure satisfactory audio reception, it is necessary to take care of data alignment at the point of insertion and subsequently provide a method of error concealment at the point of extraction.

NVISION has developed new embedder and disembedder devices that incorporate proprietary audio re-framing ASICs. These ASICs ensure that all audio data carried within each video stream is correctly timed. The output ASICs provide constant AES framing patterns, regardless of input signal. This ensures that AES receivers maintain constant lock, and it eliminates aberrations due to receiver PLL recovery. Also, error detection circuits within the disembedder ensure effective error concealment, regardless of the embedding method or device used during the insettion process.

A Multi-Channel Solution

When mote than four channels are required, the normal technique is to cascade embedders together. This process relies on the ability of the embedder to determine ancillary data content and decide where to allocate its audio channel group data. Receiving disembedders are also cascaded and must have a preset determination of which audio group to extract. The more channels inserted, the more difficult it becomes to determine location.

The new NVISION embedder module provides for one group of four audio channels to be inserted into the SDI data stream. (This is similar to other available products.) To insett more than four channels, another module provides for an additional twelve audio channels (three groups) to be directly fed to the embedder for allocation and insertion. This method provides two benefits. 1) The exact channel group location can be determined by the single embedder module. 2) 'Piggy backing' embedders is unnecessary; therefore, costs are drastically reduced.



NVISION Multichannel Embedding and Disembedding

NVISION's 4000 Series 2 Rack Unit Frame

NVISION's new disembedder module can detect the presence of channel groups and allow the operator to select which group is extracted. If the embedded data contains multiple groups, the addition of an expansion module allows a single disembedder to extract all channels in the order received. A futther featute of the disembedder is the built-in monitoring quality D to A converter and mini headphone jack, for convenient channel pair locating and subsequent output group assignment.

Fiber Optics

Fiber Optics is another area where NVISION demonstrates their understanding of signal handling and management. Their new products incorporate unique designs to ensure that pathological signal content is received without bit errors. In SDI signals, pathological content (long strings of all 0s or 1s) can cause a DC shift that results in bit errors at the receivet.

Fiber products for digital video convert the electrical signal into light pulses for transmission across the fiber. But, due to the pathologicals, transmitting the SDI signal is a difficult task. If the pathologicals are not compensated for properly, the results will show up as sparkles in the picture. This problem needed to be resolved, particularly for HD-SDI signals where 1.5Gbit distribution will rely on fiber far more than SDI has in the past.

New E/O, O/E and ttanseeivers from NVISION for SDI and HD-SDI incorporate proprietary technology to ensure that pathological signal content will always be received correctly, without bit errors.

Solid Ground

NVISION has developed an excellent reputation for providing high quality conversion and connectivity products at very reasonable ptices. The 4000 Series firmly establishes NVISION as a company that understands the technology issues facing DTV design engineers.

NVISION can be contacted at 1 800 719 1900 or by fax at (530) 265 1021. You can visit their website at www.NVISION1.com

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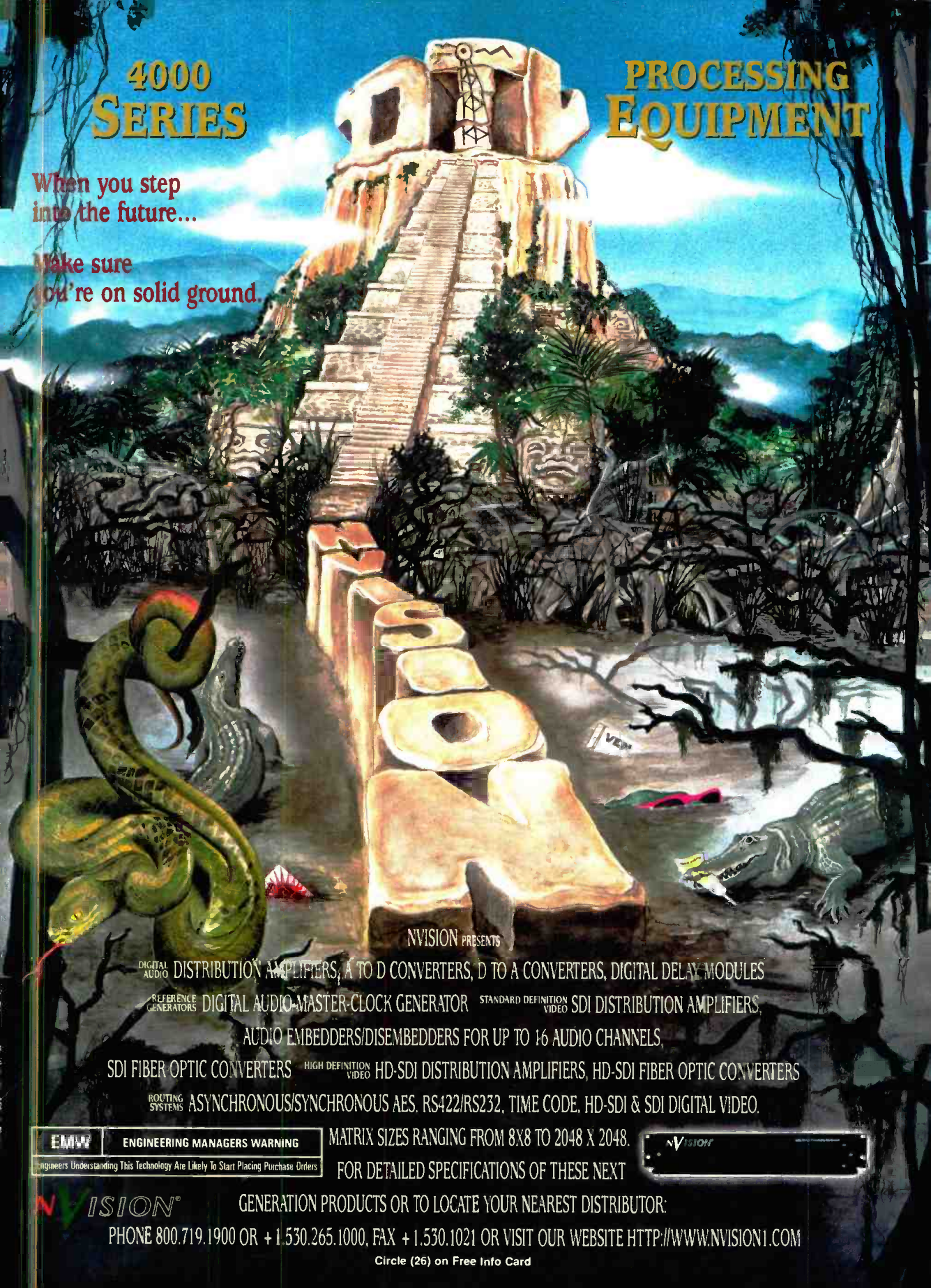

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Transmission & Distribution

Maintaining DTV transmitters

BY DON MARKLEY

Now there's an interesting subject. Unfortunately, it is one that this author, and most in the industry, knows little about. Be that as it may, let's look at what is widely known and at what we would like to know.

DTV transmitters are simply another piece of electronic equipment. The amplifiers are basically the same devices that have been in use for some time — albeit some of the new solid-state amplifiers will require some user education. All of the old approaches to maintaining these beasts still apply with regard to normal cleaning and cooling. For whatever reason, there seems to be a universal state of awe relative to DTV, accompanied by a panic that it will be uncontrollable. Let's stay calm and remember that DTV transmitters are still just big boxes that make RF. The primary change is the modulation scheme, which in turn, results in some differences in the tuning methods.

Power and tuning — two facets that must be reconsidered

Given that the average station technician knows the basics of transmitter care, what are some of the new worries? One change will be power measurement. For DTV, average power, rather than peak power, will be the standard for measurement. By definition, it will still be possible to check calibration using a water load. But it is the routine measurement of power on a full-time basis that is still puzzling. One way, suggested by Harris' Bob Plonka, is to use an average power meter, such as the Hewlett-Packard model 8992A with an appropriate sensor. Of course, that won't measure the output directly; a coupler must be used to bring the signal down to an appropriate level.

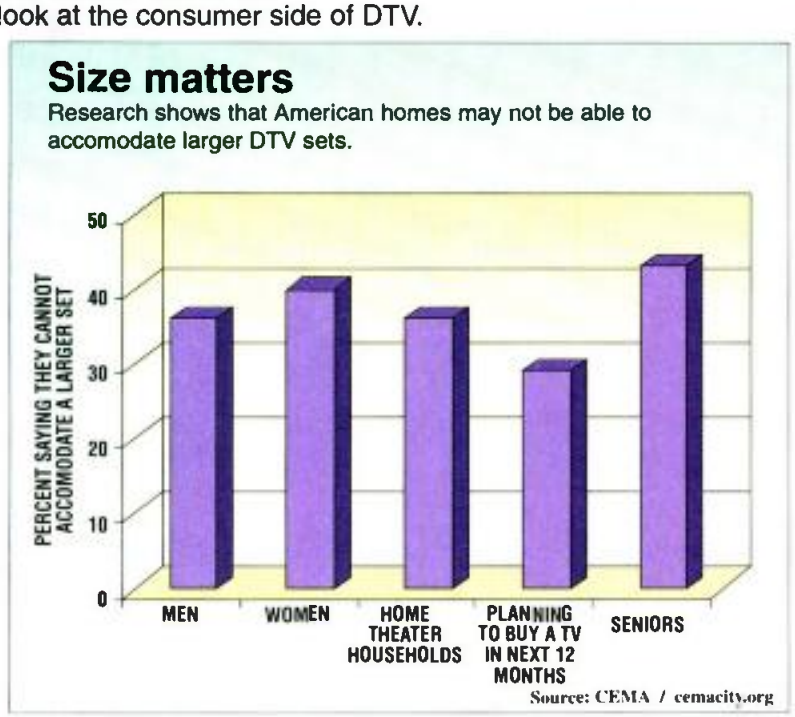
To adjust the coupler, a device must be used that can accurately generate a test signal and then accurately measure the coupling loss. It should be possible to do this with a spectrum analyzer and a tracking generator or with a network analyzer. In either case, an adapter will be necessary to couple the generated signal into the transmission line. With a network analyzer, a second adapter could be used to compare the coupled signal to the signal fed through the line. Regardless, the test setup must be accurately calibrated if the overall measurement is to have reasonable accuracy.

Next, transmitter tuning is likely to be trickier than it is for NTSC systems. In particular, the tuning must now include group delay measurement and its adjustment. The group delay of the amplifiers can be measured with a network analyzer, but that doesn't include the adjustment of the exciter correction circuitry. Even more interesting and puzzling, the antenna manufacturers tell us that their antennas will introduce some group delay into the system. Assuming that the exciter will compensate for that factor, how can it be conveniently measured in the field at a typical TV station? Obviously, the signal can be sampled into the transmission line and corrected up to that point. Perhaps the effects of the antenna will simply have to be assumed to be constant and minimal.

There is a great deal of difference in a carefully set-up system in the laboratory and the average station in the field. Typical stations are also different than the DTV stations currently in operation. These transmitting facilities must still be considered test stations. They also have the advantage of manufacturers hovering about making sure that everything is working correctly. What is really needed is to determine just what test equipment is necessary for an average station's operation and standard procedures for optimizing the entire RF system. Expanding on that, what we need is more experience in the care and

FRAME GRAB

A look at the consumer side of DTV.



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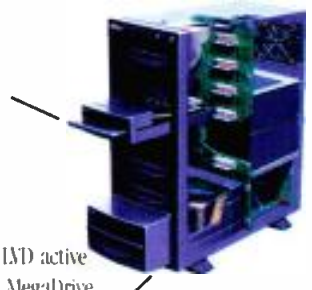

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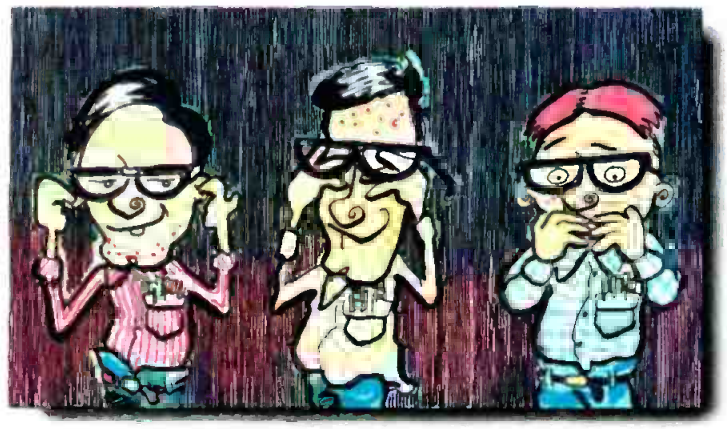
feeding of DTV RF systems. Determining these requirements is roughly akin to finding out the average life of a new type of tube — only time will tell.

Expect the unexpected

It should be apparent by now that unexpected problems will arise as DTV is more widely implemented. One example was the recent problem in Dallas where a hospital thought everyone checked out simultaneously when their heart monitors reacted unfavorably to a local DTV signal. While that was a unique problem, rest assured that others will be found.

A recent series of magazine articles seemed to add confusion to the issue. For example, one writer indicated that based on their tests, indoor antennas would be of little use for DTV. Another writer indicated that based on their tests, only highly directional outdoor antennas would work. We have seen



Transmitter engineers will need to learn new test and maintenance procedures with DTV transmitters. It will not be possible to "hear no evil, see no evil, speak no evil" — the old tried-and-true analog methods of see, hear and touch won't work anymore.

articles saying that DTV will be strictly line of sight, and other articles indicating that the service will be similar to the existing NTSC areas. Who is right?

But, back to the transmitters. Other than tuning and correcting for group delay and other errors, the DTV transmitter will be much like those we are already familiar with. Tuning will be a little more broadbanded as the amplifiers are not concerned with any one section of the channel over another. From what can be seen so far, everything will be similar, but a little fussier. No, you won't tune the final slightly on the inductive side. That was a trick learned over the years with tube transmitters, and it obviously doesn't apply here. However, new tricks will be learned as we get further and further into this new modulation scheme. These tricks, like those of the past, will be based on experience. It will not be possible to "see no evil, hear no evil, speak no evil" when it comes to learning the secrets of DTV transmitter maintenance. ■

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

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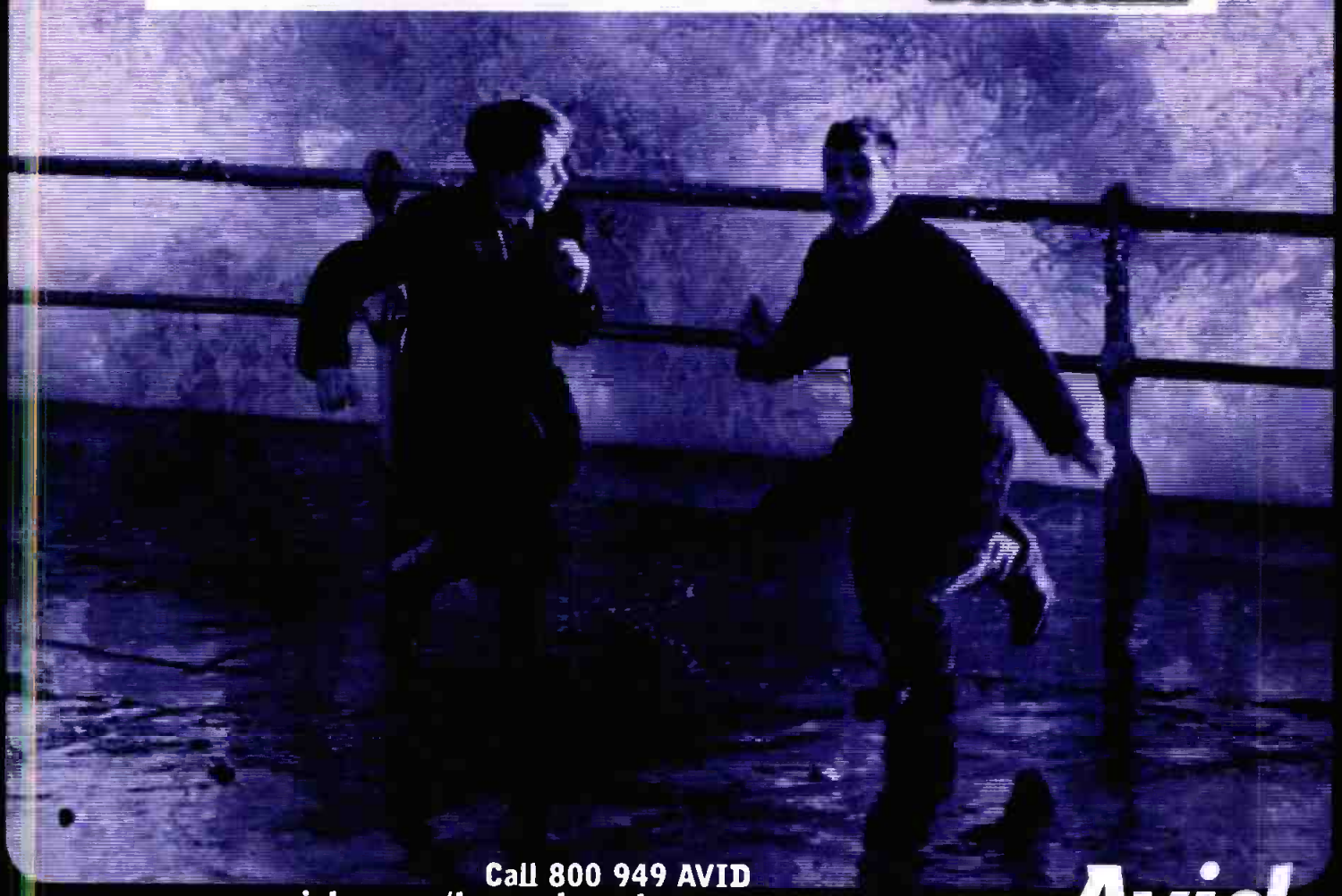

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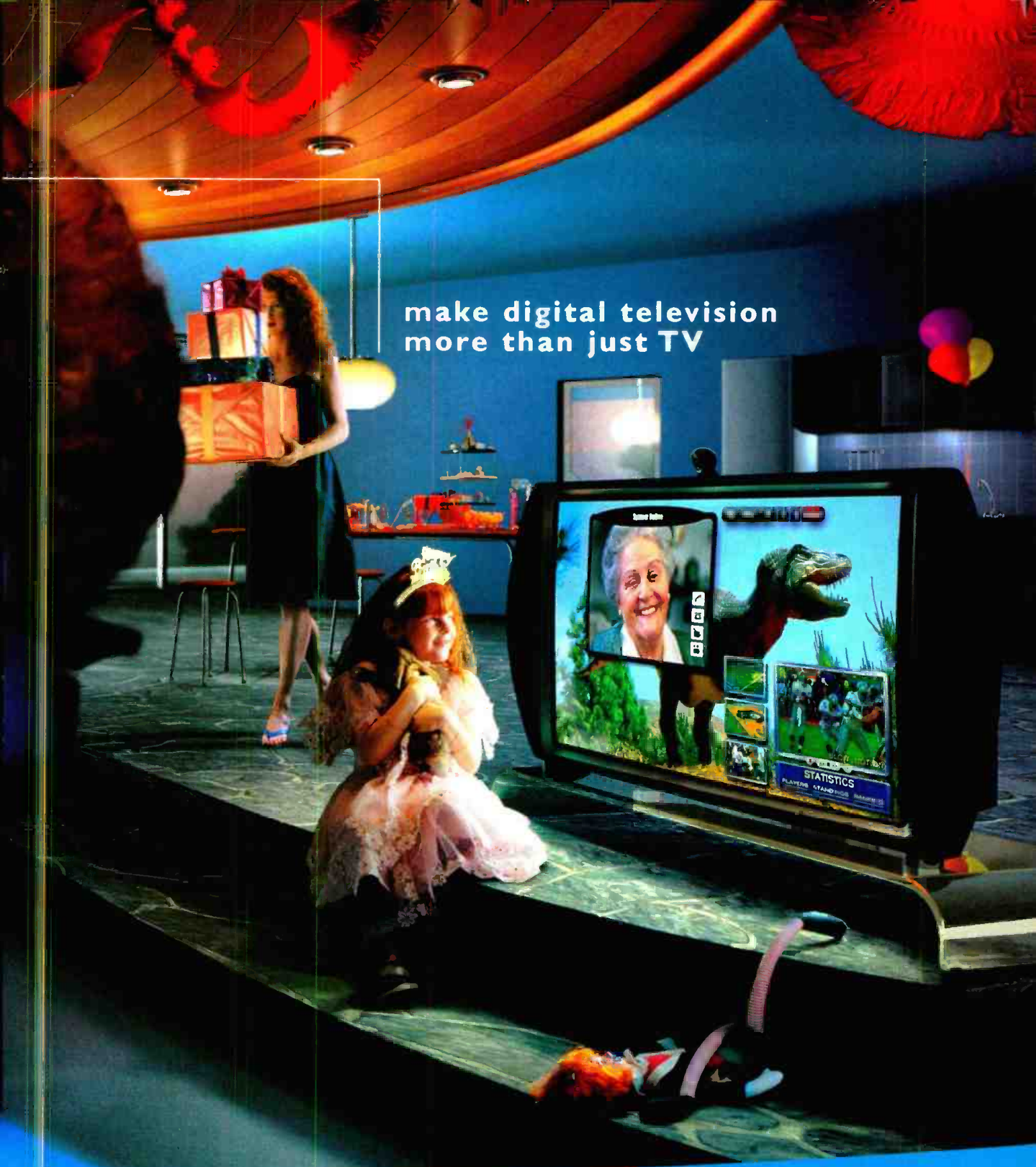

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Understanding intercoms

BY BRAD DICK, EDITOR

Intercoms — everyone has used them, and probably without much thought. Put on the headset or press the button, and you have communication. In today's complex and fast-paced broadcast world, the need for rapid, reliable and flexible communications has never been greater. Unfortunately, the lowly intercom system is frequently left out of budgets or is grossly underfunded. The key to the proper purchase, installation and use of intercom equipment begins with a thorough understanding of equipment basics.

System architecture

From a usage standpoint, there are two basic kinds of intercom systems: *point-to-point (matrix)* and *conference line*. These names stem from how the communications take place — in a point-to-point (private line) manner or on a conference (also called party-line or PL) system where everyone hears everything.

To further confuse matters, digital technology has resulted in a new classification for intercoms, although they do the same thing. From an overall design standpoint, these new digital systems are sometimes referred to as *distributed crosspoint* and *centralized crosspoint* systems. And if that does not create enough confusion, the term "digital system" can mean different things. It might indicate *digital control only*, or digital system might mean the system can be fully digital in control and audio functions. Related communications systems called *interrupted foldback* (IFB) and *isolated intercoms* (ISO) are often included in any intercom discussion, but we'll leave them for another time.

Point-to-point or *matrix* systems allow you to speak to a selected person or area. Simply put, the communication travels from one point to another point. No one else or no other location receives that communication. These types of intercom systems provide complete privacy between stations and may also provide custom programming capability from a central computer or terminal. With many systems, you can also create groups or *virtual party lines* providing greater flexibility.

Matrix systems usually require a four-wire interconnection (although a two-wire matrix is possible). Such systems are well-suited to post-production operations where the system configuration remains relatively constant. Being a four-wire topology, talk and listen signals to and from each station are carried on separate paths. The connection paths between intercom stations may be wires, RF, digital links fiber-optic or coax paths.

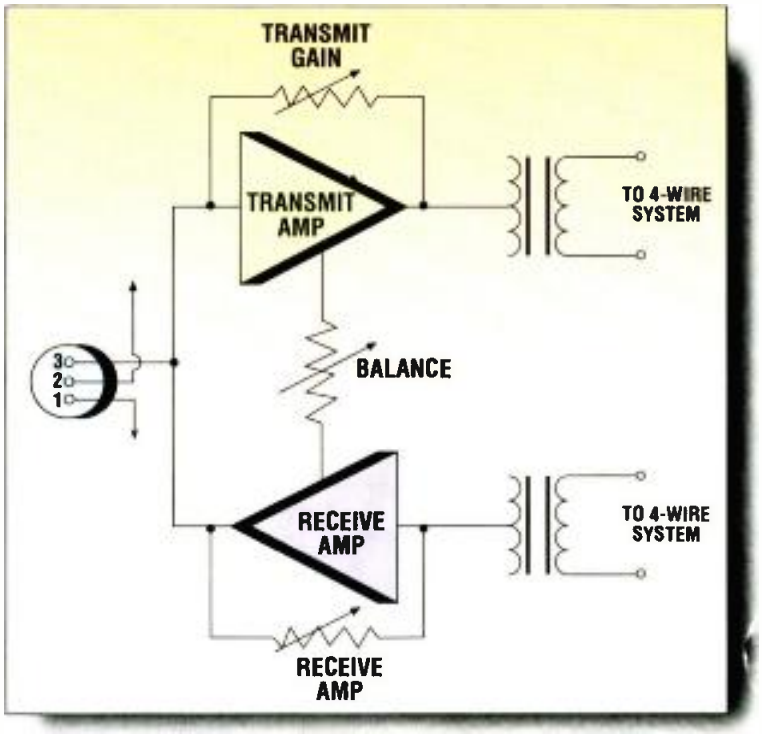

Figure 1. Connecting a four-wire intercom system to a two-wire intercom system requires that the proper interface box be used. The interface provides all of the necessary impedance and level correction. Be sure that you buy the proper interface from the manufacturer of your intercom.

Some advantages of four-wire matrix systems include simple interfacing to other devices, no hybrid null problems, selective calling to all stations, call tally and privacy. Disadvantages of the four-wire topology used to include all the multipair cabling required; however, modern matrix systems, like the Clear-Com Matrix3, the RTS/Telex ADAM and some models from DRAKE, eliminate most of these problems.

The second type of intercom system is the *conference-line system*, also known as party-line (PL) systems. These are the simplest form of intercom systems and are typically used for teamwork activities, like remote productions. Anyone connected to the intercom line hears all of the communication that takes place.

Live studio broadcasts and outside broadcast activities are best served by party-line systems. Party-line intercoms are generally two-wire systems. Talk-and-listen audio is carried on the same pair. Power may be carried on the audio pair or separate conductors. A party-line intercom can also be implemented with four-wire techniques, but it is much simpler and less expensive to use the two-wire technique.

In a PL system, all operators share a common channel or number of channels. The only privacy is provided by multiple channels or a camera isolation subsystem. Some signaling can be provided, but usually not to the extent that would allow every operator to selectively signal another operator.

Advantages of two-wire PL systems include simple wiring, easy expansion for additional stations, less complex central equipment, low cost per station

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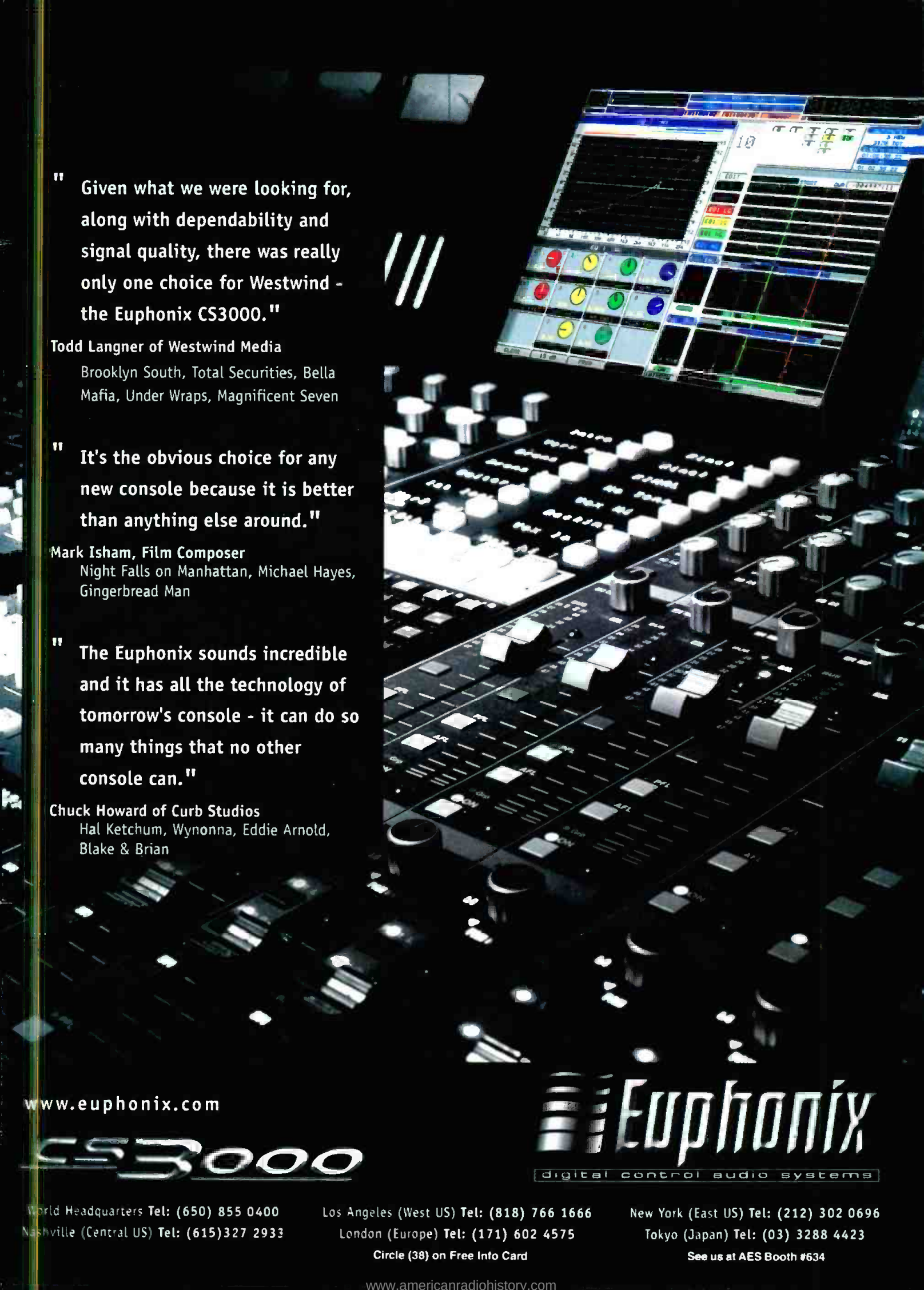

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and simple operation. Two-wire PL systems can be quickly and easily reconfigured, which is especially important for remote trucks and mobile venues.

There may be a size limitation for two-wire PL systems, especially when referring to ease of installation. Once you go above a five- or six-station system, the matrix solution may become more viable and easier to use. A disadvantage of two-wire PL systems is their reliance on hybrids and the difficulty in interfacing them to other (often incompatible) two-wire systems. In addition, they lack selective calling and offer limited privacy.

Power and interfaces

Intercom stations can be powered in two ways. Rack- or wall-mounted (fixed) stations can be powered from available AC by way of external DC supplies. These stations can then communicate via *dry* lines carrying audio only. On the other hand, beltpack stations are powered via *wet* communications lines carrying 24-32VDC and audio. Some fixed stations can also take power from a wet line.

No matter how the power is supplied, it is used to drive several necessary functions. With the low-impedance headsets in use today, intercom stations include a headphone amplifier with volume control, switching circuits for microphone and channel selection, call-light, a pre-amp for the headset microphone and sidetone amplifier, usually with screwdriver-adjustable gain control and associated power supply and switching system.

Intercoms are not plug and play. Even though intercom manufacturers use standard low-impedance microphone cable and XLR connectors as their standard interface, they are all wired differently. A case in point is the difference between the two-wire schemes used by Clear-Com and Telex. Clear-Com uses pin one for ground, with operating voltage on pin two and audio on pin three. Telex uses a method similar to microphone phantom powering, using pin one for ground and pins two and three for both balanced audio and simplex power.

In addition, there are times when it's necessary to use two- and four-wire intercoms together. Figure 1 illustrates the basic interface that must be used between such intercoms. Typically, you can buy a brand-specific solution — you just go to Clear-Com to get an interface for an RTS/Telex intercom and vice versa. This ensures that the interface is compatible first with your main system and then with the foreign intercom.

Clear-Com Matrix Plus digital intercom stations at VTS Studios in Belgium.

This is an area where operator knowledge is critical. Beltpacks are not interchangeable and using the wrong type can load down the system or even cause damage. Digitally controlled and fully digital systems have interfaces that provide the conventional two-wire analog lines to beltpacks.

Signaling

As mentioned previously, signaling is an important aspect of intercom capability. In a conference-line intercom, signaling is normally referred to as a *call* or *signal*. Signaling provides a means (usually visual) to attract the attention of a person who is not wearing a headset or who has turned off the loudspeaker. In a conference-line system, all stations in a given channel of communication will be signaled at once. It is generally not possible to signal individual users in the conference-line system.

Signaling is accomplished by applying a high-frequency tone or a DC signal to the audio pair. When using audio instead of DC for the trigger, the tone passes through any interfaces that may be in the line. However, DC signaling is less complicated and usually costs less.

Signaling functions of the intercom also can be used for remote control purposes. For example, in a small ENG or SNG truck, the call light signaling circuit can be wired to turn on the two-way radio through a relay, operating in a PTT mode. When the signaling is activated, the talent and the engineers know that the studio is hearing the conference-line audio because all of the signal lights are illuminated.

Digital solutions

No discussion of intercoms would be complete without a look at digital intercoms. The term digital system and digitally controlled system are used interchangeable today, but they should not be. The key point here is that digitally controlled or digitally based does not necessarily mean that the signals between stations are digital. It may simply mean that the central switching matrix and audio processing are digital.

Although several current intercoms feature a digital switching matrix or internal digital audio processing, there are only a few on the market that actually send digital audio signals to the user stations. Various digital implementations are available from Clear-Com, Drake and RTS/Telex.

These new digital systems allow remote key panels to be located almost anywhere. Using dark fiber, coax or even an ISDN line, it's possible to install

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an intercom control panel in one city and have complete communication capability to another location thousands of miles away. This technique was used effectively in the Olympic Games in Atlanta.

Today's newer intercoms eliminate the need for daisy-chaining because most of the digital switching matrixes can deliver 128x128 crosspoints and are often expandable to 512x512 or larger.

As digital hardware costs continue to fall, you can expect the trend toward digital audio distribution to continue, especially in the case of large central crosspoint systems. The major advantage of taking digital audio all the way through the system is the elimination of induced electrical hum and noise. This can be appreciated by anyone who has ever had to run intercom lines around a pile of lighting cables and SCR dimmers.

Finally, digital doesn't necessarily mean serial digital (coax) installation. Depending on your application, being able to interconnect the stations with runs of coax may offer a lot of advantages. Just check with the manufacturer to be sure that their definition of digital matches your definition.

Cost-basis analysis

Now it's time to consider the cost. The cost structure of the two systems, distributed crosspoint and centralized crosspoint, typically means that a centralized crosspoint architecture is more appropriate for a large facility, while the distributed architecture approach may be more cost effective for a smaller facility.

The single most expensive component in the centralized architecture approach is the frame containing the crosspoint circuitry. In this design, the individual stations are typically one-half to one-third the price of an equally sophisticated distributed architecture user station. So, if you need a large system, implementing a distributed architecture system can get expensive.

Conversely, if the system is small, it may be difficult to amortize the expense of the frame across only a few stations. For example, a facility that buys 50 distributed crosspoint stations costing $6,000 each will spend $300,000 and have limited circuits. That same facility using a centralized architecture approach will spend $100,000 on a frame and $100,000 on stations at $2,000 each for the same total of $200,000. In this example, for less money you get additional versatility and an expansion path that is only $2,000 per station.

Obviously, not all systems are this big, and the numbers can vary greatly. It would be just as unwise to spend $50,000 on a frame to connect eight $2,000 stations together. In this case, it would be better to spend $48,000 on eight $6,000 stations.

These two architectures are not the only choices. There are some that combine features of each, however, the industry trend is to focus on great versatility along with low fault tolerance and focused attention or a limited highly tolerant and more consistent system.

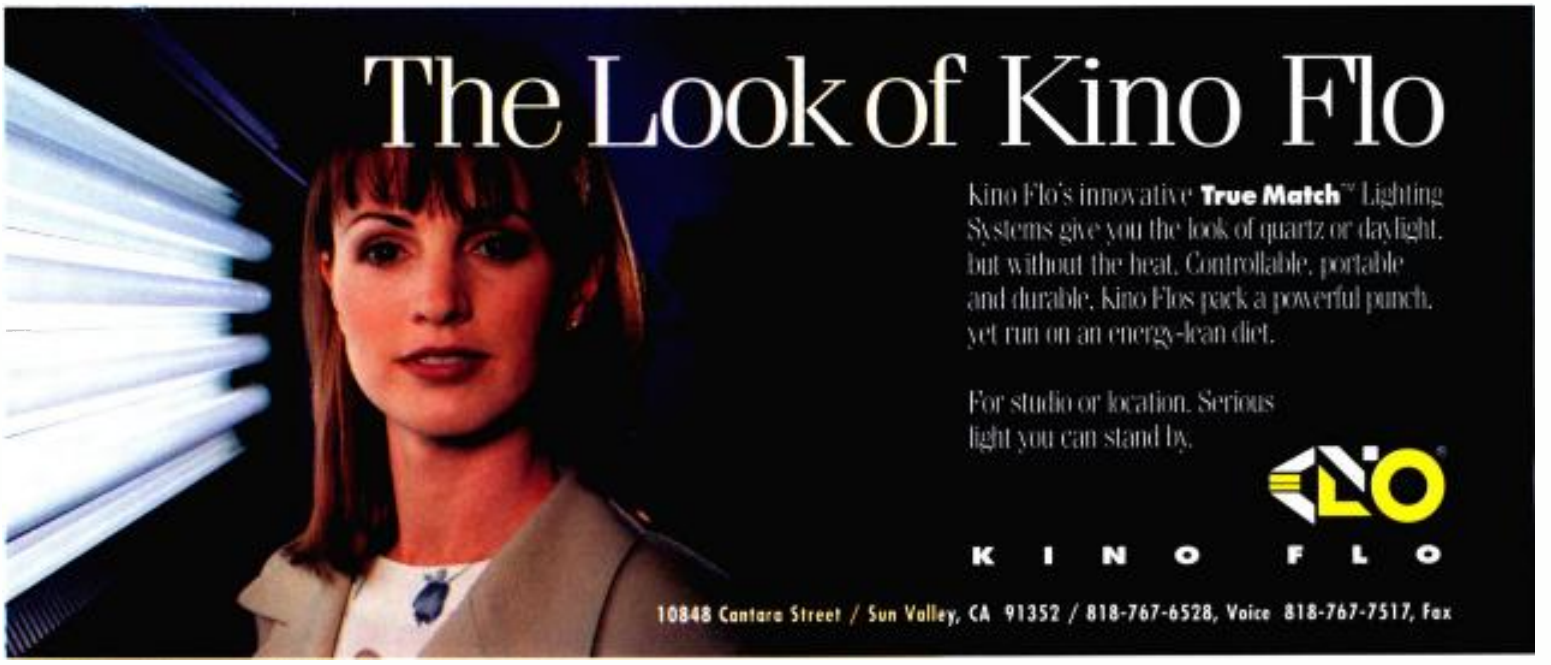
Intercoms are a true workhorse in any TV or OBV operation. If it's time to replace your intercom system, do two things: first spend sufficient time analyzing exactly what your communication needs are; and second, discuss those requirements with several manufacturers. There are many new features and options, so look at all the vendors before you make a decision. ■

Acknowledgments: The author would like to thank Ed Fitzgerald, Gary Parks and Bob Tourkow from Clear-Com, and John King from RTS/Telex for their help with this article.

More info on intercoms

For more information on intercoms see the following *Broadcast Engineering* articles:

- "Choosing an intercom system," July 1997, p. 46.
- "Intercoms: No longer an afterthought," May 1995, p. 54.
- "Intercom system design," March 1986, p. 74.



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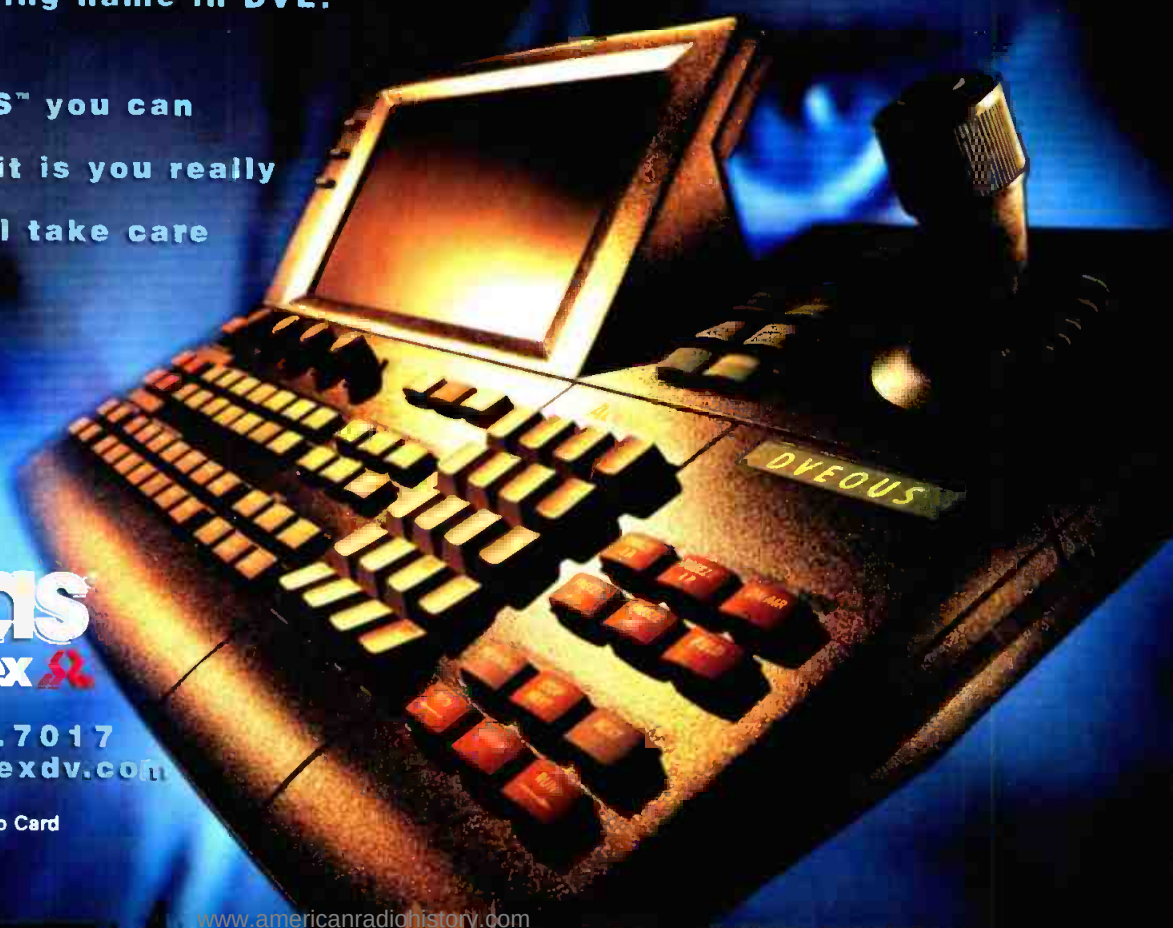

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Preparing your building for digital television

By Walter L. Gregg, AIA

Dreading the switch to digital? Whether you're building a completely new plant or renovating an existing facility, the move to DTV will entail significant building changes. With a digital facility, your facility needs will be different from today's analog plant. Proper planning for your station's changing facility needs, along with new studio and transmitter building requirements, will help make the transition a smoother and less painful process.

Many areas of your existing facility will be affected by the change to DTV.

Photo: The Georgia Public TV control room. (All photos courtesy of Rees Associates.)

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The Georgia Public TV control room relies on the latest in digital technology to meet viewer needs.

Included in that list are changes to the technical core, master control, production suites and studios. However, don't let the list overwhelm you. Here are some ways to smoothly pave the way for your facility's change.

Changes to the technical core

Larger racks with more densly packed equipment will require more power, and thus, more cooling capacity. In addition, heating, ventilating and air-conditioning systems (HVAC) in the technical areas will require more reliable temperature and humidity control. Redundancy will be needed to keep the sophisticated electronic equipment from shutting down due to excessive temperature conditions, above 85°F. Today's digital systems require HVAC systems that are designed to ensure around-the-clock, continuous uninterrupted service.

Proper acoustical design to reduce ambient noise to acceptable levels is important in noise-generating and critical-listening technical and production spaces. The use of self-contained computer-room-type air-conditioning (CRAC) units with built in redundancy (dual compressors or with chilled water with direct expansion backup) is a common solution for electronic rack room and related technical areas. Effective humidity control can be easily achieved with these units when used in conjunction with proper vapor-barrier placement. One key to their use is correct location and ductwork design to minimize acoustical concerns. Manufacturers of these units include Liebert and Trane.

Clean and reliable power is an extremely critical component to having a reliable digital TV plant. If you are planning a new facility, consider having two separate sources of primary service installed. Be sure the feeds come from two different substations or two separate power grids. Install automatic or easily accessible manual switches,

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so you can quickly switch from the main to an alternate power source when needed. The power company can supply you with historical data on power outages for any given area. If two power sources are not available, then a standby generator may be called for. The generator does not need to power non-critical areas, such as elevators. However, be sure it is sized to carry the critical loads of the facility, including HVAC systems for the technical and transmitter areas if co-located. An uninterruptable power supply (UPS) will also be required to bridge the time gap between power failure and when the standby generator comes on-line.

Be sure the electrical service into a new facility is split among the various areas and types of loads. This will allow technical power to be isolated from large mechanical loads, studio lighting loads and normal building power to minimize costs to provide clean (and backup) power to the important technical areas.

If you're going to rebuild your existing facility, it's often more difficult to get clean power in all the needed areas. The use of power conditioners and transient voltage surge-suppression devices may be required to eliminate spikes, transients, surges, sags and unwanted noise if a UPS system is not used. The use of shielded isolation transformers can help filter out high-frequency spikes, but are less effective with low-frequency spikes and don't correct voltage sags or surges that last several cycles.

In a new or an existing facility, a properly designed technical grounding system is critical. Various grounding system designs are possible and selection will depend on building and site conditions, as well as personal preference of the broadcast system design engineer. A lighting protection system is a wise investment in most locales also. The system will minimize damage to sensitive electronic components and potentially pay for itself several times over should a lightening strike occur.

Design big — despite the miniaturization that digital technology affords, technical spaces don't seem to be getting any smaller. In fact, even more equipment requires the use of the larger, 36-inch-deep equipment racks. This increase in depth, along with considerations for handicap access required under the Americans With Disabilities Act, requires more floor space in the technical areas than ever before. The mix of HDTV and multichannel broadcasting is likely to require even more technical space. Don't cut floor space in the technical areas.

Rack and equipment rooms only get smaller. It's crucial to build them larger than initially needed if there's to be room to grow. WJXX-TV technical room begins with 12 rows of deep racks.

Master control

Multichannel operation will impact the master-control area more than any other space. Other spaces affected by multichannel broadcast will be the rack room and transmission areas. Additional monitoring, switching and playback will have varying degrees of impact depending on how many channels are carried and the types of digital video systems used. While you won't have to plan for a wall of quads, tape and disk playback systems still can take up a lot of space. That's especially the case with disk systems when you include all the peripheral rack space they require. In addition to the space for the primary disk storage device, additional rack space is needed for audio modules, multiplexing frames and power supplies. Don't shortcut the space here.

> The mix of HDTV and multichannel broadcasting is likely to require even more technical space.

Finally, remember that you'll need more equipment in these spaces tomor-

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row than you need today. Plan for expansion. Consider a multiplier factor and apply it to your designed rack space; a good growth factor might be 50% for the next 10 years. While you may not be able to maintain that extra space in all areas, technical support spaces always seem to fill up first.

Production studios and post suites

The smaller equipment required for digital production switchers and editing systems has freed up some square footage required in edit spaces. The large bulky consoles of the past are now replaced with smaller consoles for desktop-type systems. However, the number of people occupying these spaces has not changed radically. Everyone wants to be in on the action so allow room for people, too.

Don't forget audio — a major selling factor of DTV is audio. Unfortunately, quality sound has not been a priority for many stations and that will have to change. Most TV stations currently lack quality audio equipment or the kind of acoustical space that allows for proper monitoring. However, along with the improvements that viewers will see, TV stations and production rooms will have to provide matching improvements that consumers can hear. Stations must be able to monitor 5.1 audio with the same kind of quality control that they typically provide for video.

Studios for DTV need to accommodate the 16:9 aspect ratio in lieu of the 4:3 ratio traditionally used. This requires new news sets and wider studios, which also means more space. The other side of the coin is the possible decreasing need for studio space with the advent of virtual sets.

Other news considerations are the edit spaces. The ability to edit video from the desktop and totally networked systems can reduce the number of traditional viewing and editing stations required. On the other hand, because this capability is easy and relatively inexpensive to provide, more news staff may require access to these features. This means the need for more working spaces in the newsroom.

All this technology requires new networking systems. Be it fiber or other high-speed system, networks will be a major part of any new digital installation. This requires space for cabling and the need to wire every desktop to a network.

Other areas to consider

Having some "swing" space available to accommodate DTV for the time period when you must carry both signals will be a challenge for many stations. The ideal situation would be if you have existing space adjacent to your existing technical core; however, most stations are not that fortunate.

The only other option may be to build new technical operations area if not a complete new facility. An analysis of the station's needs and a facility planning study should be conducted by an architectural firm experienced in broadcast facility design as early as possible to determine how DTV can best be accommodated. The need for flexibility and economy of construction will only increase in the digital future as paradigms change for broadcasters. Increased competition from all sources will most likely change the economics of broadcasting.

Finally, stations may want to take the opportunity, at this time of change in the broadcast industry, to think about what they want to be in the future. With the ability to broadcast multiple-channel CD-quality sound and multiple channels of standard and high-definition video, the broadcaster of the future may be transmitting two or three TV channels, a digital radio station, a newspaper, a paging service or a super high-resolution TV picture. That calls for operational and facility planning with an eye to options and flexibility. Successful stations will be those that can take advantage of the new service opportunities and technology as they occur. ■

TV stations used to look utilitarian. Thanks to modern design techniques, a TV station can be as modern-looking as individual style — and budgets — allow. Shown here is the new KETC building in St. Louis.

Walter Gregg is an architect with Rees Associates Inc.

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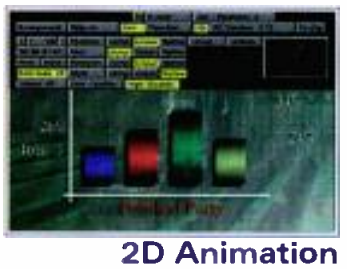

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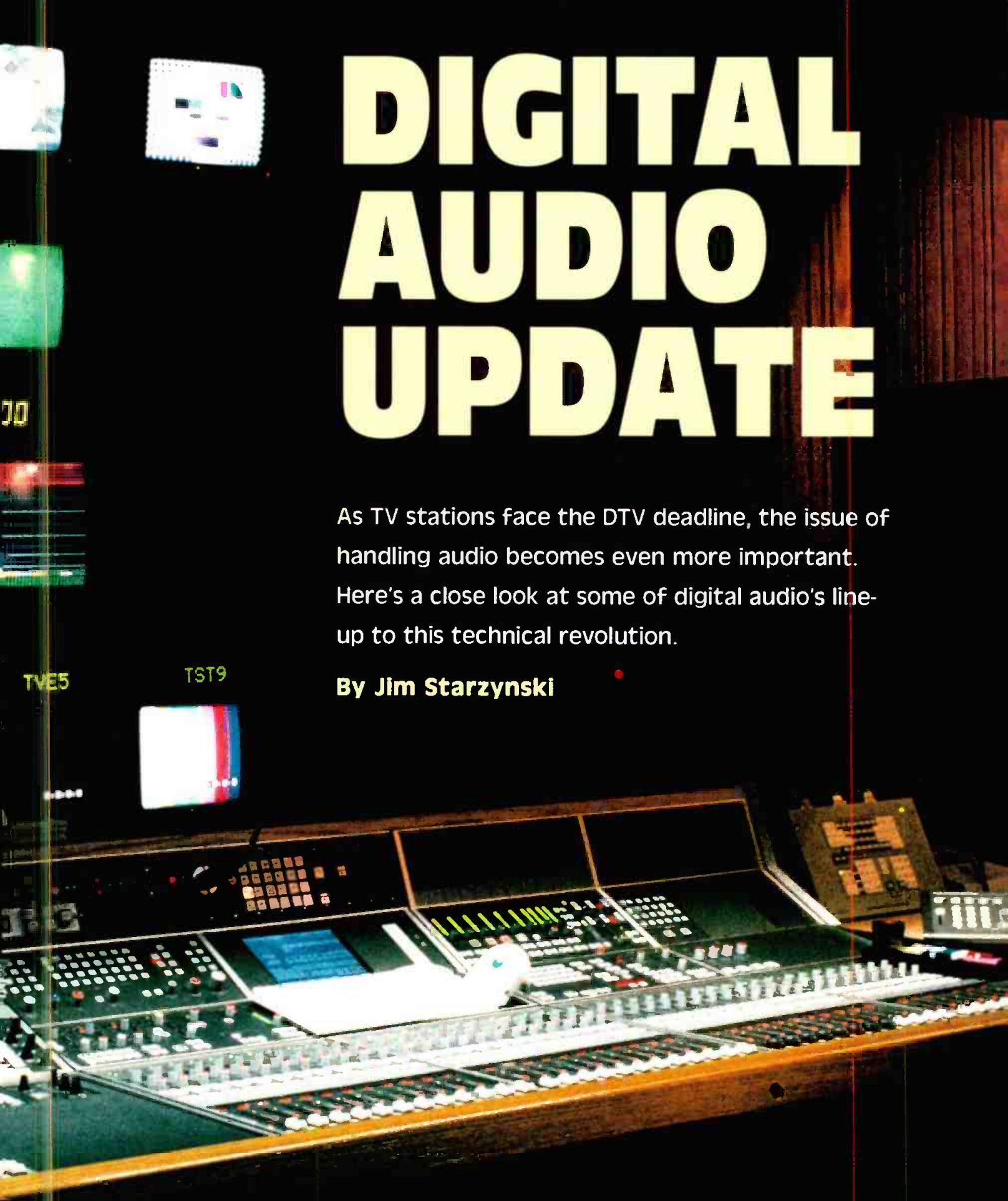
DIGITAL AUDIO UPDATE

As TV stations face the DTV deadline, the issue of handling audio becomes even more important. Here's a close look at some of digital audio's line-up to this technical revolution.

By Jim Starzynski



Pictured above is the Calrec T Series digitally controlled analog console installed at Suddeutscher Rundfunk studios in Stuttgart, Germany.

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What was the first piece of digital audio gear you can remember? If you're like me, it was an effects device that packed more than 50 sound-processing programs into a single rack space. It may have been a revolutionary storage unit that recorded perfect audio by using an analog consumer videotape machine to do it on. The latter was a product of the late '70s and the former a device that sprung up in the '80s — and a more refined and less expensive version still exists today.

Just like these pro-audio products that introduced us to the power, quality and economy of digital technology, contemporary digital audio gear for the broadcaster has significantly evolved over the last two decades. So much so it's earned an inescapable role in catapulting the industry into broadcasting's greatest challenge since color supplanted black and white. This challenge for the broadcaster is digital television or DTV, and it's coming to the top ten major markets in the country in November. If all goes as planned, it will completely replace the nation's analog NTSC system by 2006.

The path of how this digital technology grew and the catalog of gear for its engineers and audiences is a story to be told. The challenge of putting digital signals on the air is an unfolding engineering and operational journey and its outcome will revolutionize the industry.

Let's take a close look at some of digital audio's line-up to this technical revolution and then unfold digital audio's roadmap for DTV.

The Yamaha 02R and 03D shown here are being used by Houston Rodeo to provide full digital mixing capabilities.

The digital catalog

A significant amount of digital-mixing products has become available to the broadcaster on a variety of different levels. The entry equipment starts off with desktop devices, 8x2 with both digital and analog spigots available. This much digital horsepower comes with a price tag of around $1,200. If editor control is important, another mixer in a 26x4 structure is available, notch the cost up just a bit to about $5,000, including the edit interface software. These boards aren't featured-down versions either; similar consoles have mixed Grammy-winning albums for the music business. This is digital doing what it does best — increasing the quality and decreasing the cost.

At the top end of the range, a number of solutions are available. They fall into three basic categories: digitally controlled analog mixers, all digital mixers using proprietary processing and software and all-digital mixers using general-purpose digital-signal processing (DSP) and software written for standard PC operating systems.

Digitally controlled analog gives the user the capability to store setup information and configure work surface ergonomics. An input strip can be virtually laid out anywhere on the console as programmed by the operator. It performs like an all-digital console in this respect, but processes analog audio that can be sampled and converted to interface with a digital system. Some consider this to be the best of both worlds — the power of digital control with the sound of high-end analog. These consoles

Tape-based cart machines are a thing of the past for any new audio studio. Shown here is the 360 Systems DigiCart II Plus hard-disk recorder, which provides the old-style cart portability with all the advantages of digital storage.

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are available from both British and American manufactures at prices from $200,000 to $600,000, depending on console configuration.

Large-scale, all-digital consoles come in at the higher end of their analog counterpart's price range. Each have control surfaces like the console described previously, but their signal path is digital, as well. Each type uses a flexible matrix in front of its inputs and minimizes — if not eliminates — the need for patching. Reset-ability is standard, as is sample conversion and signal delay. The proprietary approach boosts the reliability associated with a specifically designed and controlled architecture. The design using a more standardized general-purpose approach benefits from innovation from a fast-moving semiconductor industry. These digital consoles are made throughout the world.

Maintenance of digital systems will be more centralized than ever. Test stations like the one shown here will concentrate sophisticated test equipment at one location where signals can be carefully analyzed.

Digital technology continues to revolutionize audio playback equipment, as well. The days of cart machines with repeating tape loops are dead, replaced by hard disks wrapped in a familiar size package with front-panel readout and minor editing functions built inside. Go a step further in the process and see the extinction of open, real editing, a hard-disk recorder with scrub wheel and waveform readout. It does the job non-destructively at a price of around $2,500. No razor blades required.

In the large open reel multitrack arena, analog and digital machines hold their place in the recording world with analog offering what some call a warmer sound. If the broadcaster opts for multitrack as part of the session, digital machines are available starting with eight-track versions, recording on inexpensive videotape. These decks can be cascaded for increased track capacity. Large format machines of 24 or 48 tracks use more costly half-inch open-reel tape. Be on the lookout for a four-track, hard-disk-based machine to work side by side with a DAT and comes in at a price unheard of just a few years ago.

In the sweetening room, a digital audio workstation based around Macintosh technology rules with an unending menu of plug-ins from familiar industry specialists. If you don't like that noise in the background, you can find it, mark it and scrub it away digitally.

If anything is going to make an eye-opening impression, contemporary digital metering leads the pack. A variety of different solutions are available with or without phase displays. The capability to view an averaging VU signal simultaneously with the peak signal is a digital snap. Just take a look: presence and headroom checks in a high-resolution, one-rack-unit package.

In most new TV audio installations, just monitoring and routing the audio will be a big problem. New solutions based on an integrated housing, coupled with a variety of plug-in cards, are now available from companies like Miranda, which showed the new Symphonie at NAB. The card frame holds 16 audio or video function cards.

The softer side of maintenance

This ongoing transition to digital has made a significant change in the maintenance area also. Engineers who once spent a good portion of their tours assigned to patching and setting up levels for productions now find themselves evolving into software specialists. Soon, gone will be the days when a small screwdriver and a multimeter are the main tools to cure an unhealthy circuit. An audible alert and a query into a diagnostic program are the norm. This is usually followed by the installation of the most recent soft-

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ware installed from CD, or better yet, a file just pulled down from the web. This is the new day-to-day affair.

If any one area can be sighted as benefiting from the revolution to digital, it's the inconsistencies inherent to the analog path. The task of tweaking in a level is over. For the most part, if the signal is present, its level is on the money, and if not, it's a matter of checking the software to determine a set-up. No need for a correction and compensation as components break down.

Viewers want digital audio

If anything is going to make an immediate impact on the home audience as we approach the next millennium, it's the sound quality and features associated with the audio program for DTV. This transformation will occur as audiences gear up with new digital receiving equipment now hitting the market. Let's take a look at the process and the necessary techniques and hardware needed to successfully meet the digital audio challenge for the broadcaster. We'll start with the most-talked-about aspect of DTV's audio system, Dolby's AC-3.

It's important to understand exactly what the new digital audio format, AC-3, is and is not. Dolby AC-3, or Audio Coding Version 3 (also referred to as Dolby Digital at the film and the consumer level), is a bit-reduction algorithm based on perceptual coding. Basically, this is a formula to remove unnecessary information in the audio signal that a listener can't really hear anyway. It's goal is to pass a complex multichannel audio signal in a minimum amount of digital bandwidth. This is partially based on audio masking, a process of our hearing system that occurs when one type of sound makes another sound undetectable. In simplest terms, it's a loud sound drowning out a soft sound that occurs at the same time. The loud sound is prevalent and important, the soft sound undetectable. AC-3 exploits this phenomena by including only the important sounds and focuses its coding on maximum quality and establishing smallest required bandwidth.

By the U.S. ATSC-accepted standards, this bandwidth is 384kb for 5.1 discreet digital channels. AC-3 is intended to be the final emission format that gets transmitted to the home. It was not designed for the creative process of contribution or for distribution in a plant or station. There's a solution coming, but more on this later.

Many stations will want to purchase audio encoders so they can produce their own surround sound. Shown here are the Dolby broadcast encoders.

What's metadata?

Along with the audio, the digital AC-3 signal will carry *metadata*. This is information intended to identify the program material and set up a receiver's (pro or consumer) AC-3 decoder to the proper parameters for playback. The concept of metadata is entirely new to transmitted audio and is responsible for some pretty remarkable breakthroughs for both the broadcaster and the home viewer.

For instance, an operator will now create a *one-size-fits-all* mix. There's no longer a need to tailor dynamic range to fit an analog "window." Everything is mixed wide open. Opposite to what was required in the past, DTV enhances the listening experience by making full dynamic range possible and controllable by the audience. More on this feature later.

Bitstream mode: Type of service

As a program supplier, you'll be able to electronically label the type of service you're providing. Keep in mind that all of the following acronyms refer to labels used for Dolby AC-3. The labels are those seen when programming an AC-3 encoder.

A complete main (CM) indicates music, effects and dialog are present in a single stream. Music and effects (ME) indicate the presence of music and effects only, dialog is added from another simultaneous stream based on the listeners selection, IE, a choice of language. There's also associated services available for emergency programming (E), dialog (D), voice over (VO) and

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commentary (C). Also provided are choices for the visually impaired (VI), the hearing impaired (HI), and believe it or not, karaoke.

Audio coding mode

Metadata allows the programmer to determine the signal the listener will hear from each speaker. Choose 1/0 for mono from a single center speaker, 2/0 for stereo from a left and right speaker (this mode is also used for matrixed surround). 3/2/L is used for 5.1. The L meaning the low frequency effects channel (LFE or the .1) is turned on.

Compatibility with Dolby Surround

The surround on/off bit is set if the 2/0 channel information is coded with matrixed surround otherwise know as LT, RT or Dolby Pro Logic (DPL). This will turn on the DPL decoder circuitry required and supplied with every AC-3 decoder. As before, this will enable a steered center channel and a mono surround signal to the appropriate loudspeakers.

Dialog normalization (Dialnorm)

The days of commercials overpowering program sound are short-lived. Metadata information entered during the contribution process will establish the correct level for all parts of the transmission.

Dynamic range (Dynrange)

Dynrange parameters will establish the amount of dynamic range desired for a particular playback environment. Mentioned earlier, the audio mixing engineer will no longer provide a compressed program compensating for limits of the analog medium. The program will be mixed for widest dynamic range ,and the meradata, along with the requirements and environment of the listener will determine the softness to loudness ratio.

In the beginning months of DTV, the entry of this information will most likely occur just ahead of the transmission process. This is done by setting up parameters on the Dolby DP 567 (two-channel) or Dolby 569 (six-channel) encoder. The entry is loaded by scrolling through a menu on the front-panel display and choosing the appropriate parameters corresponding to your programming.

Six channels of surround sound audio and multiple video channels require new space-saving methods of audio metering. Shown here are Logitek under-monitor VU meters.

Contribution

In November, in many cases, the audio launch for DTV may be limited to the use of mono, stereo or matrixed surround as program material. The use of 5.1-channel program material may not hit the air until the following criteria are met. First, there needs to be the availability of program sources in multichannel 5.1. Live events require a manageable way to mix multichannel (DTV) and mono, stereo and LT, RT (NTSC) mixes simultaneously. Post-production, like current film techniques, may incorporate separate passes for different formats.

Distribution

Unlike the introduction of matrixed surround for broadcast in the mid-'80s, 5.1 tracks are not included with the stereo recordings that are readily available. The program suppliers, whether they be Hollywood film companies, TV production companies, commercial suppliers or sports, will need to provide an independent multichannel mix to fully use the capabilities of DTV. This most likely will coexist with a stereo track matching the video. Because of the need to record and store multiple channels (5.1 or really 6, remember the LFE is the band-limited low-frequency effect channel), the supplier requires a place to put this information.

Currently, only a double system can provide the format for doing this comprehensibly and effectively. This requires a programmer to sync a multichannel tape machine to the video recorder supplying the necessary space for the extra audio channels. The VTR may provide the tracks for the accompanying stereo program. This makes the delivery more complicated, requiring a separate tape for multichannel audio only that stays locked to the videotape. It also requires a means to route the additional signals through the plant or station. This can be a huge or impossible task considering that most facilities simply don't have multiple-channel distribution capabilities.

From the audio purist standpoint,

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passing the signal as discreet, uncompressed PCM as a double system could, may be the most effective, however it may also be the least feasible.

The Dolby E solution

Considering this problem, there is another solution in the works that will aid both the program supplier and the broadcaster in their new DTV mission. As mentioned earlier, AC-3 was intended as an emission focused, high bit reduction format. It's capable of multichannel, but it simply can't hold up to the riggers of decoding and recoding required by a station or network as it performs the routine operations of voice-overs and station IDs, etc. When this problem surfaced along with the identification of no readily available and cost effective VTR technology supporting more than two AES audio channels, something needed to be developed.

Dolby Labs has been working on a new less-compressed algorithm to help the broadcaster with this issue. This new technology, called Dolby E, is slated to hit the market in first quarter of 1999. This coding scheme will be capable of eight channels of discreet audio (enough room for the 5.1 information, plus the stereo pair or second-language tracks). It can do 10 cascades of the audio material and will be capable of switching or editing on the video frame without pops or clicks. Dolby E compresses the eight channels of information to about 2Mb and will have accompanying metadata capabilities compatible with AC-3. It is formatted and packaged as an AES pair, and therefore, compatible with current AES hardware.

Consider this, a program supplier could record Dolby E on the second AES channel of a high-definition VTR and have a stereo and multichannel programs exist right on the videotape. No need for separate media or chance for sync failure. The broadcaster can then playback this material sending the stereo program to the NTSC plant and the 5.1 material to the DTV plant. This would become a more manageable scenario considering that the E stream can be routed on a single AES pair and not be subject to pops and clicks as it passes through the digital plant's audio router. It would also be compatible with satellite modems and integrated receiver decoders (IRD), the devices needed to digitally uplink and downlink to and from a satellite. At present, these devices are outfitted with at least one AES channel of audio.

Where necessary, this compressed signal could be tapped and decoded for Q/C purposes and monitored. In the case of a voice-over, the signal can be routed to the control room, decoded, mixed with voice over and re-coded. The metadata information would be routed along and re-inserted with the signal. Because the metadata streams between Dolby E and AC-3 are essentially the same, this process is simplified and will become more automated as the technology progresses. This program would then be re-encoded and sent to the AC-3 encoder or sent to the encoder as decoded, uncompressed AES audio based on the particular configuration of the station or plant. An AC-3 encoder with a direct Dolby E input is being considered. Boxes to simplify the voice-over process, eliminating the need for decodes and re-codes and restoring compressed audio to the AES level, are also possible.

For some applications, only a double system of recording will provide enough audio tracks. Shown here are a Tascam DA98 and DA88 eight-track recorders.

Another approach

Nvision is developing a different solution for the multichannel distribution problem. In their current proposal to SMPTE, Nvision describes a process where 12 discreet audio paths (six AES channels) can be multiplexed to one bit stream at about 19Mb/s.

This signal would consist of non-compressed audio and would use a single AES wrapper instead of the normal six. A single piece of coax could carry the multichannel signal, and it would switch on one crosspoint. Because of the data rate, the new process would require proprietary I/O and routing and a spe-

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cial Nvision-type input on future VTRs. Look for more on this after the SMPTE September meetings.

New listener options

The features and sound quality available to the audience at home are directly in line with the capabilities of the new digital broadcaster. The DTV listener will be able to outfit his or her system with anything from a self-contained picture monitor with stereo speakers, to an external home-theater receiver capable of accessing all the high-end features incorporated into the new technology.

The scenario for a high-end home system would be something like this: The antenna on the roof passes the DTV RF signal to either a set-top box or directly into a digital television with a receiver built in. The first-generation systems will use the set-top boxes. Either way, the internal or external DTV receiver will provide an AC-3 spigot that will be the digital connection passing the compressed audio and the metadata to the external AC-3 decoder. This device will be built into a familiar type audio receiver or be another outboard box. Like some current DVD players, a DTV receiver may also decode the AC-3 internally, eliminating the need for external decoding.

The metadata information will automatically set up the receiver for the type of program, i.e., complete main or music and effects with a choice of multilingual dialogue. It will also set dialog normalization and dynamic range parameters. The listener will be able to access user controls that will allow manipulation of the dynamic range of the material to suit the environment. A kind of neighbors home switch (film light mode with limited dynamics) or film standard mode (full dynamic range). Remember, because the DTV production was mixed with full dynamics, this choice, unlike the NTSC days, is now up to the audience to make; an audiophile's dreams come true.

The receiver also has bass management capabilities, allowing signal-to-speaker optimization, i.e., lows to the sub (if there is one) and mids and highs to the rest.

These breakthroughs are just an example of the leap in technology. The full-frequency, discreet-channel, wide dynamic range audio will steal the DTV show.

What to do now?

Broadcasters need to determine the type of audio provided with their program material. Mono, stereo or matrixed surround can be routed through the facility and used as the source for a two-channel AC-3 encoder, such as the Dolby DP 567. This unit accepts analog or digital inputs. This will fulfill the requirements for ATSC DTV. Metadata will be originated and entered (CM, 2/0, DSPL) by this encoder using a front panel window. This output feeds the ATSC encoder. This signal, via a multiplexer, passes to the 8VSB modulator built into the transmitter. The digital receiver at home will pick up the signal. The decoder will process the signal per the metadata and provide a stereo/mono compatible matrix surround signal to the amps and speakers.

With 5.1 channel reproduction being the ultimate goal, the broadcaster will need to acquire discreet audio in the analog or the PCM domain or as a future digitally compressed or multiplexed signal. Either way will require digital routing or patching to pass the signal through the plant. Q/C is next via a decoder that may soon be available inside a self-powered speaker panel. Voice-over by decoding and re-assembling with a mixer is next. This new signal would connect to a Dolby DP 569 six-channel encoder and pass on through the remainder of DTV hardware to the home. If a potential voice-over box is available from Dolby, the E signal would accept voice-over at this point and connect directly to a new encoder with a standard E input.

As before, the metadata would process the signal, setting up the decoder to determine the correct playback parameters for the type of channel configuration, dialnorm and dynrange. The listener would adjust the features on the AC-3 receiver/amplifier to suit the desired effect.

For point audio monitoring needs, you can't beat some of the new rack-mounted audio monitors, which accept analog or AES digital audio. In addition to providing audio monitoring, systems from Harris and Wohler provide multiple channels of input, phase check and LED monitoring.

Predicting the future

What happened in the late '70s and early '80s may help predict our own DTV future. Familiar consumer-product Japanese manufacturers will enter the digital mixing game in a big way with small pricing. In addition to the first-generation DTV equipment, later improvements in audio gear will give us large-scale mixers capable of providing a comprehensive stereo mix as an "automatic" product of a 5.1 channel mix. Mixing board automation may interact with metadata processing to streamline the data input chores associated with this new technology.

You can expect a wide range of automation features to accompany many of these new products. So hang on, the ride has just begun. There's a lot more fun ahead. ■

Jim Starzynski is a project engineer at NBC headquarters, New York.

Acknowledgment: The author would like to thank the following for their help with this article: Steve Lyman and Tim Carrol, Dolby Laboratories; Martin Dombey, Yamaha Pro Audio and Joe Wellman, Nvision.

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DIGITAL JITTER

Measurement techniques can make a world of difference.

By Michael Robin

Distributing digital signals requires converting the signal into an analog physical representation at the sending end (the transmitter) and interpreting that representation to extract the data at the receiving end. The eye-pattern (or eye diagram) is used in specifying and verifying the characteristics of a bit-serial digital signal. The name results from the appearance on a storage oscilloscope of sections of digital symbol patterns superimposed on one another. For an infinite-bandwidth system, the transitions from 0-to-1-to-0 are instantaneous; consequently, the eye is square. However, practical systems have a finite bandpass, resulting in transitions with a slower risetime and the familiar eye shape. Figure 1 shows the formation of an eye pattern from superimposed binary patterns. Bit-serial digital signals are specified in terms of frequency and amplitude-related effects, such as eye amplitude, risetime and decay time, overshoot and undershoot, as well as jitter, a timing-related disturbance.

Data is encoded using a self-clocking method such as non-return-to-zero (NRZ), non-return-to-zero-inverted (NRZI), scrambled NRZI or bi-phase-mark (BPM). Each of these methods is aimed at optimizing some aspect of the bit-serial digital signal, such as the spectral distribution, the DC content and the clock recovery. The clocking information is usually extracted using phase-locked-loop (PLL) circuits. SMPTE 259M specifies a channel coding known as scrambled NRZI, which randomizes long sequences of zeros and ones, as well as repetitive sequences that can make clock regeneration difficult.

The serializer

Figure 2 shows the simplified block diagram of a 4:2:2 component digital serializer. It performs several functions implemented in dedicated ICs.

Photo: As facilities move to a completely digital environment, digital signal measurement will become the norm. Digital signal specifications will need to be monitored to keep operations such as this telecine room at Laser Pacific running smoothly.

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These are:

• *Parallel-to-serial conversion:* This is performed by a 10-bit shift register that is clocked at 270MHz (ten times the input rate).

• *Scrambling:* The scrambler randomizes long sequences of zeros and ones, as well as repetitive data patterns. It also helps eliminate the DC content and provides sufficient signal transitions for reliable clock recovery.

• *Conversion from NRZ to NRZI:* The scrambler can produce long runs of ones, which are converted to transitions by an NRZ-to-NRZI converter.

• *Serial clock generation:* The serial clock is generated using a VCO operating at the bit-serial clock frequency. Its frequency is derived from the parallel clock frequency and is controlled by a PLL circuit. The derived VCO frequency control voltage is low-pass-filtered by an unspecified filter that determines the capture range and the hold-range of the VCO and removes high frequencies from the control voltage. This allows the serial clock to follow low-frequency jitter or drift (wander) of the parallel clock, as well as correct for a temperature-related drift of its own.

• *Cable driving:* Following the NRZI converter, there are active line drivers for each output. This is unlike baseband analog video where multiple outputs can be split from a single active driver.

The deserializer

Figure 3 shows a simplified block diagram of a 4:2:2 component digital deserializer. It performs several functions implemented in dedicated ICs. These are:

• *Cable-loss equalization:* An automatic cable-loss equalizer for high-frequency (>8MHz) and low-frequency

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(<8MHz) losses introduced by the coaxial cable. The equalization capability is left up to the manufacturers.

• *NRZI-to-NRZ conversion:* This is the reverse of the process taking place in the serializer.

• *Descrambling:* This is also the reverse of the serializer process and results in the recovered data being identical to the original data.

• *Clock recovery:* Clock recovery relies on the fact that the scrambled NRZI datastream contains a large number of transitions. Current state-of-the art technology relies on PLL concepts for locking the receiver data extraction circuitry to the incoming data. PLLs have a specific bandwidth, which is determined by the low-pass filter at the output of the phase detector. The bandwidth should, ideally, be narrow to achieve a high level of noise immunity. Narrow-bandwidth PLLs have a correspondingly narrow pull-in (capture) range. This requires a highly stable crystal-controlled VCO to prevent drifting beyond the PLL capture range. Noise immunity and capture range are conflicting requirements in PLL circuitry design. The current dominant technology relies on a PLL bandwidth of approximately 2MHz, meaning that the VCO will follow incoming signal jitter frequency-domain components up to a limit of 2MHz. In addition, the VCO free-run frequency may drift up to a limit of 2MHz from the wanted frequency and the PLL will correct for this hypothetical frequency drift. The regenerated 270MHz serial clock feeds the NRZI-to-NRZ converter and the descrambler. It also feeds a timing generator that regenerates the 27MHz clock required by the serial-to-parallel converter.

• *Serial-to-parallel converter:* The serial-to-parallel converter recovers the original parallel data for further processing.

• *Regeneration of a reclocked bit-serial signal:* This function, available with some designs, permits the regeneration of a high-quality noise-free bit-serial signal from the corrupted input signal. The low-frequency jitter of the input signal, inside the PLL bandwidth, is carried through, but high-frequency jitter is eliminated.

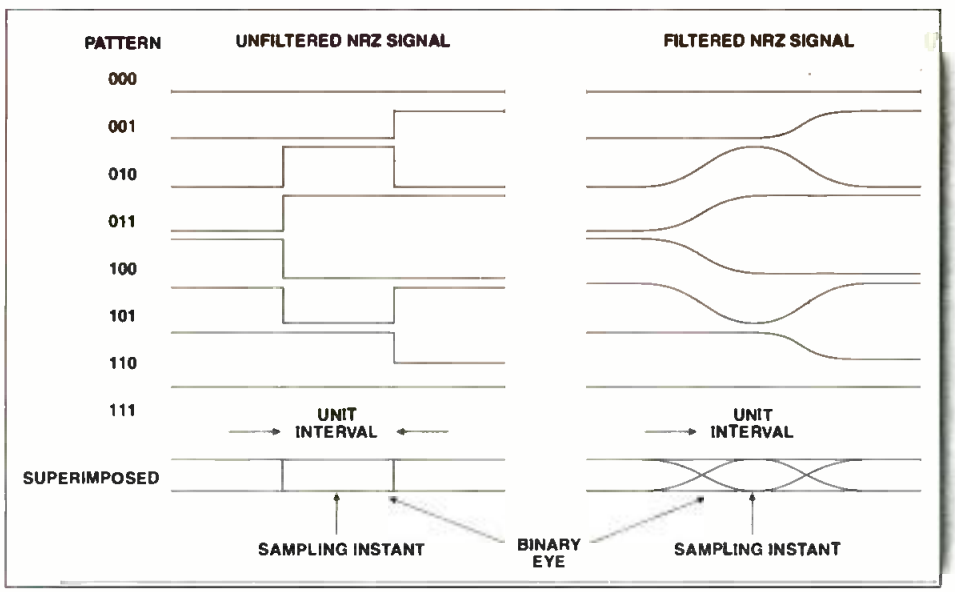

Figure 1. Formation of the eye pattern from superimposed binary patterns.

Jitter

Jitter is one of the performance indicative parameters of analog and digital signals. In analog composite NTSC video, jitter affects the displayed picture stability and/or color hue. In digital video, jitter leads to difficulties in recovering the original signal. Jitter may also degrade the analog signal performance if transferred through the digital-to-analog conversion process.

In an ideal digital transmission system, the pulses of the digital pulse stream arrive at times that are an integer of the pulse repetition period T. In real systems, pulses arrive at times that differ from integer multiples of T, resulting in

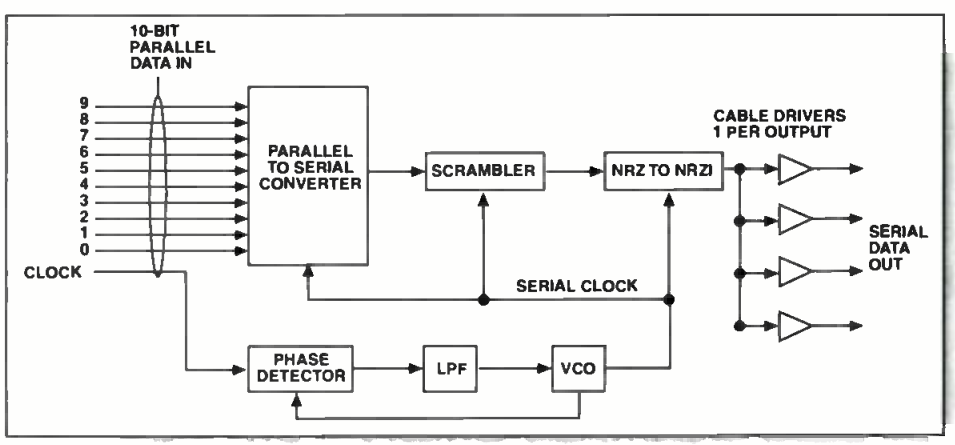

Figure 2. Block diagram of a 4:2:2 component digital serializer.

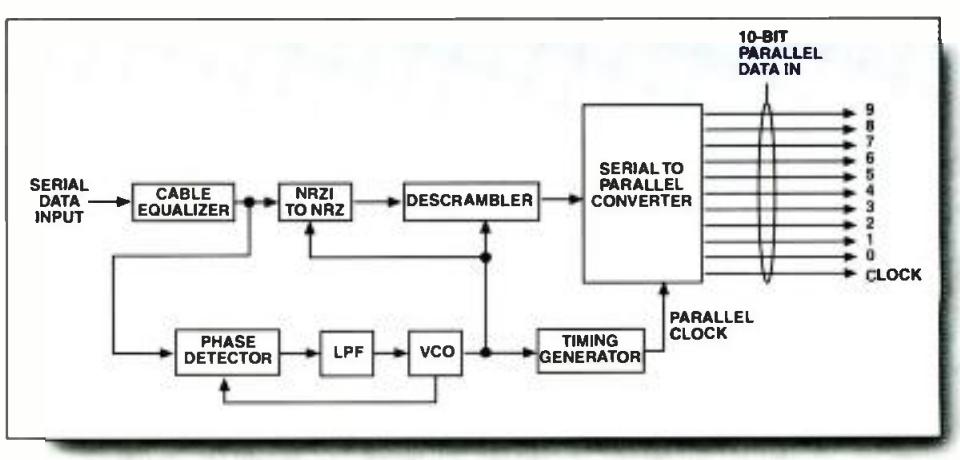

Figure 3. Block diagram of a 4:2:2 component digital deserializer.

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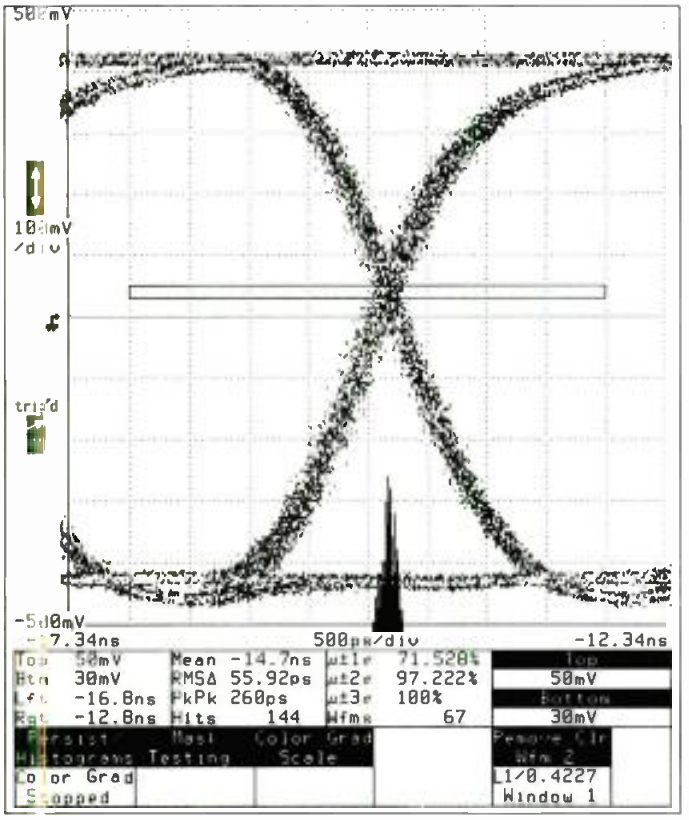

Figure 4. Tektronix 11403 digitizing oscilloscope display printout (horizontal histogram mode) of a 270Mb/s bit serial signal with 100Hz jitter. The oscilloscope is triggered by a positive transition in the signal, masking the 200Hz jitter. The measured relative value of jitter is 260picoseconds p-p.

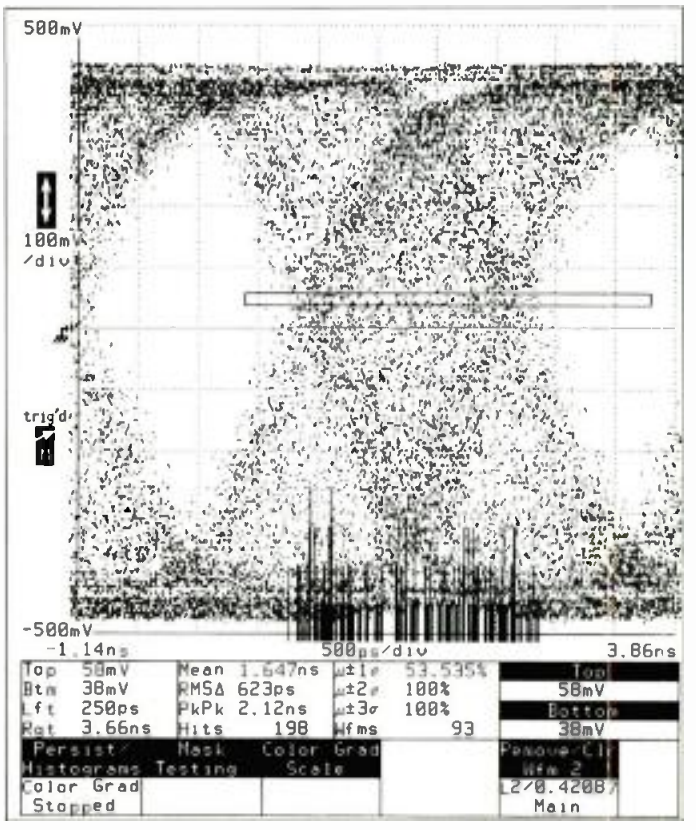

Figure 5. Tektronix 11403 digitizing oscilloscope display printout (horizontal histogram mode) of a 270Mb/s bit serial signal with 200Hz jitter. The oscilloscope is triggered by a stable and synchronous reference signal. The true measured absolute value of jitter is 2.12nanoseconds p-p.

a phase modulation known as jitter. The pulse position can be modulated by a sinusoidal component, an aggregate of discrete frequencies or be completely random in nature. The causes and effects depend on the nature of jitter.

The reference with respect to which the pulse position is measured determines the type of jitter. Depending on the reference's characteristics two types of jitter can be identified:

- *Absolute jitter:* Ideally, the jittery pulse position is compared to a stable and jitter-free primary reference clock. The p-p eye-crossing position change with respect to the reference is expressed as "absolute" or total jitter. The measured value contains all the pulse position modulation (jitter) frequencies.
- *Relative jitter:* An alternate method of jitter measurement uses a measurement reference clock derived from the jittery signal itself, resulting in a measurement of relative jitter. Depending on the clock extraction method, in particular the PLL bandwidth, the recovered clock will contain some of the jitter spectral components of the signal to be measured. The SMPTE Recommended Practice RP 184 specifies two types of relative jitter in terms of the measurement bandwidth:
- *Timing jitter:* Jitter measured in a bandpass extending from 10Hz to one-tenth of the clock rate.
- *Alignment jitter:* Jitter measured in a bandpass extending from 1kHz to one-tenth of the clock rate.

Jitter measurement

There are three oscilloscope-related methods of measuring bit-serial digital signal jitter:

- *The self-triggered method:* This method displays the eye-pattern on a wideband analog or digital oscilloscope directly triggered from a positive or negative transition in the signal. The oscilloscope time-base follows the signal jitter and masks a great deal of jitter components. The measurement displays the jitter components which vary with respect to the time-base trigger timing. Early jitter measurements used this method and an early SMPTE standard specified jitter in terms of "peak-to-peak jitter measured over the duration of one line." The implicit assumption

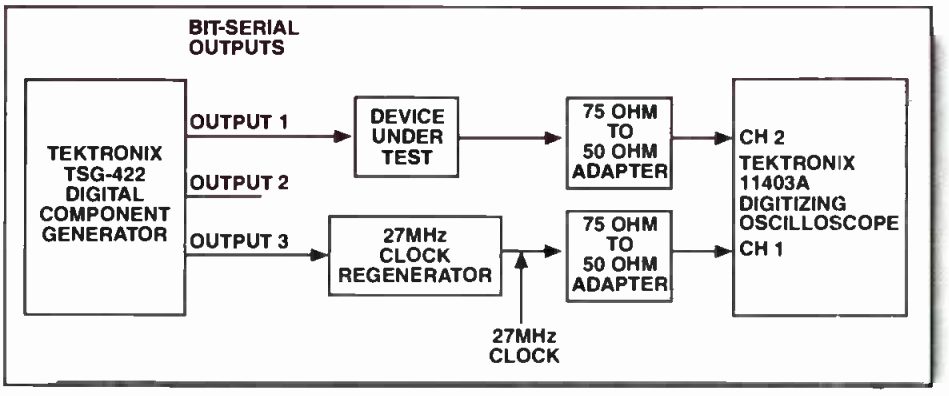

Figure 6. Test setup for measuring six selected parameters using an oscilloscope such as a Tektronix 11403.

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was that the oscilloscope would be triggered by a line (horizontal) synchronizing pulse and, by using a variable time delay the operator would analyze all eye-crossings occurring during the active horizontal scanning line and express jitter as the maximum p-p position variation. This method was at best inaccurate and ambiguous, and resulted in optimistic digital signal jitter measured values.

As an example of jitter measurement ambiguity, Figure 4 shows a horizontal histogram display of a 270Mb/s bit-serial signal with 200Hz jitter. The digitizing oscilloscope is triggered by a positive transition in the signal. The timebase follows the 200Hz jitter and masks it. The relative jitter measurement reads 260picoseconds p-p. Figure 5 shows the display of the same signal but now the oscilloscope is triggered by a stable and synchronous reference signal. The true, measured absolute value of jitter is 2.12nanoseconds p-p.

• *The jitter-free reference method:* Measuring jitter with respect to a stable, synchronous, reference signal is a more precise measurement method. It requires a stable and synchronous reference signal that is readily available in a lab environment. Figure 6 shows a test setup used by the author and featuring a wideband digitizing oscilloscope. The signal generator feeds the input of the device under test (DUT). The oscilloscope is triggered by a 27MHz clock derived from the bit-serial 270Mb/s output of the test generator. This allows for unambiguous synchronization of the oscilloscope. The accuracy of the measurement depends on the oscilloscope time-base stability and the stability of the clock. These are constant parameters and, consequently, their effect on the measured signal jitter value is unchanging. The oscilloscope is programmed to measure six performance indicative parameters including peak-to-peak jitter at the eye crossing. The data accumulation time is one minute. This method has the advantage of digital processing, screen display of the test results and screen display printout capabilities. Note the presence of 75Ω to 50Ω adaptors. These are required because the majority of wideband (2GHz) oscilloscopes are built for a 50Ω environment. The oscilloscope can be programmed to compensate for the impedance-matching voltage loss. Figure 7 shows a screen display printout of a signal with low jitter.

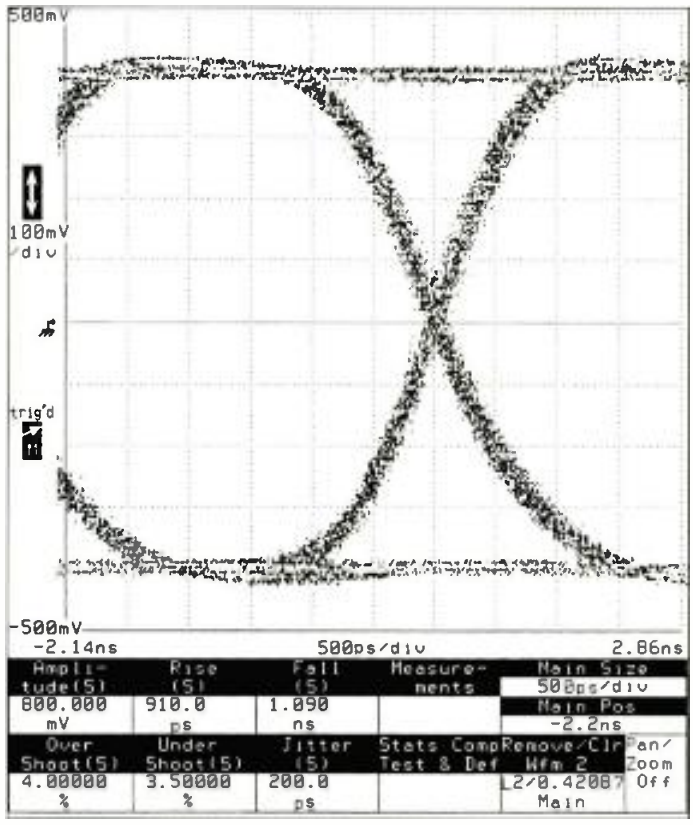

Figure 7. Tektronix 11403 digitizing oscilloscope display printout of a good signal with low jitter. The oscilloscope is triggered by a stable and synchronous reference and is programmed to make six performance-indicative measurements. The measured absolute jitter value is 200picoseconds p-p.

• *The clock extraction method:* Test setups can use a clock regenerator as suggested in SMPTE Recommended Practice RP 192. It should be noted that such clock regenerators are not commercially available for use with wideband digitizing oscilloscopes. However, commercially available digital waveform monitors (e.g., Tektronix WFM 601i, WFM 601B and WFM 601M) use this method of jitter measurement. Depending on the model, they allow a choice of PLL bandwidths and jitter measurement display methods.

Figure 8 shows the display on a WFM 601i waveform monitor of a bit-serial digital signal with a jitter of 200Hz. The selected jitter measurement low-frequency limit is f1=10Hz and the display shows a timing jitter measurement of 2.040nanoseconds p-p.

Figure 9 shows the display of the same signal, but with a selected jitter measurement low-frequency limit of f2=1kHz. The 200Hz jitter frequency is now ignored, and the display shows an alignment jitter measurement of 416 picoseconds p-p.

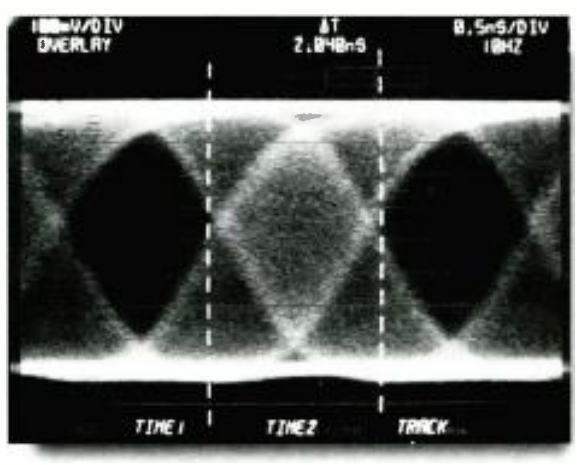

Figure 8. Display of a signal with 200Hz jitter. With a jitter measurement low frequency limit of 10Hz, the measured timing jitter is 2.040nanoseconds p-p.

Effects and remedies

The effect of jitter becomes noticeable at the output of the resampler, which cannot reconstitute the transmitted signal from irregular samples. As a consequence, the output acquires a distortion component. The current dominant technology relies on a PLL bandwidth of approximately 2MHz. This means that the VCO will follow jitter frequency domain components up to a limit of 2MHz.

Incoming jitter frequency domain components within the receiver PLL bandwidth force the VCO to

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follow the signal jitter. These components are additive, therefore a chain of PLL circuits will acquire a significant amount of "low-frequency" (i.e., below the PLL cutoff frequency) jitter. Receivers can tolerate large amounts of low-frequency jitter. Eye-crossing location variations of several unit intervals (UI) are tracked without difficulty. However, excessive low-frequency jitter results in unacceptable analog NTSC jitter if the sync and subcarrier are derived directly from the jittery 27MHz parallel clock without the use of an elastic store. Figure 10 shows an NTSC vectorscope display of a 100/0/100/0 color bars signal derived from a 270Mb/s bit-serial digital signal with a 2.092 nanoseconds p-p 10kHz timing jitter. This jitter can be eliminated by reducing the timing jitter of the digital signal or by using a 270Mb/s-to-NTSC converter with a digital frame synchronizer.

Incoming jitter frequency domain components outside of the receiver PLL bandwidth, such as random noise, are not tracked by the receiver. Receivers can tolerate considerably smaller amounts of high-frequency (i.e., above the PLL cutoff frequency) jitter. Eye-crossing location variations in excess of 0.25 UI are not tolerated and will result in excessive bit-errors. The limiting factor in the performance of the receiver is the noise factor of the first amplification stage which — given the specific circuit elements, the temperature and the bandwidth — is a physical constant. The SNR at the input will then depend on the coaxial cable loss. Limiting the cable length keeps the SNR under control. Current technologies permit an error-free 270Mb/s digital signal distribution with up to 300 meters of Belden 8281 coaxial cables. Limiting maximum cable lengths to 200 meters provides a 100-meter headroom, avoiding cliff effects.

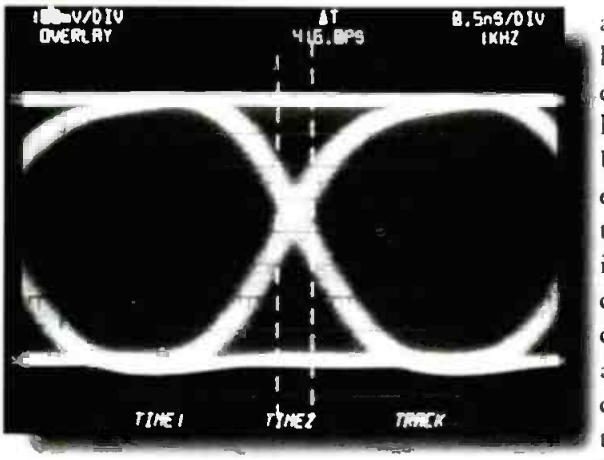

Figure 9. Display of a signal with 200Hz jitter. Using a jitter measurement low-frequency limit of 1kHz, the measured timing jitter is 416picoseconds p-p.

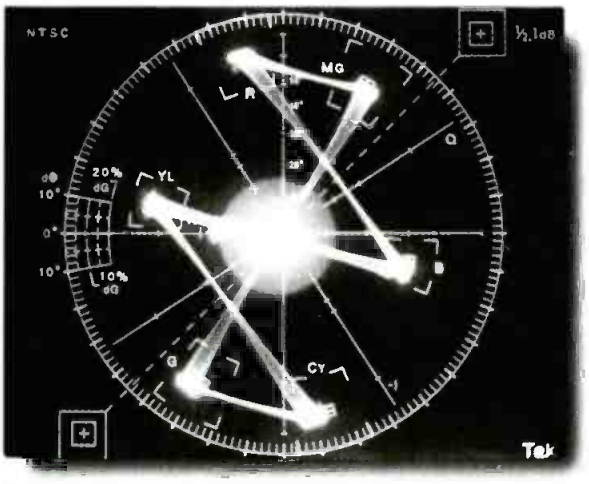

Figure 10. NTSC vectorscope display of a 100/0/100/0 color bars signal derived from a 270Mb/s bit serial digital signal with a 2.092nanosecond p-p, 200Hz timing jitter.

Michael Robin, former engineer with the Canadian Broadcasting Corporation engineering headquarters, is an independent broadcast consultant located in Montreal, Canada. He is the coauthor of Digital Television Fundamentals, published by McGraw-Hill.

Glossary

Absolute jitter: The variation in position of a signal's transitions relative to those of a synchronous stable reference clock.

Alignment jitter: The variation in position of signal's transitions relative to those of a clock extracted from that signal. The bandwidth of the clock extraction process determines the low-frequency limit for alignment jitter.

Clock extractor: A device capable of extracting the bit-serial data clock from a serial datastream and generating a clock-related trigger for the measuring oscilloscope.

Input jitter tolerance: Peak-to-peak amplitude of sinusoidal jitter that, when applied to an equipment input, causes a specified degradation of error performance.

Intrinsic jitter: Jitter at a device's output in the absence of input jitter.

Jitter: The variation of a digital signal's transitions from their ideal positions in time.

Jitter transfer: Jitter at the output of equipment resulting from applied input jitter.

Jitter transfer function: Ratio of the output jitter to the applied input jitter as a function of frequency.

Output jitter: Jitter at the output of equipment embedded in a system. It consists of intrinsic jitter, as well as jitter transferred from the input.

Relative jitter: The variation in position of a signal's transition relative to those of a clock extracted from the signal. The extracted clock will contain some of the signal's jitter frequency domain components, depending on the bandwidth of the phase-locked-loop controlling the regenerated clock VCO.

Timing jitter: The variation in position of a signal's transitions occurring at a rate greater than a specified frequency, typically 10Hz or less.

Unit interval (UI): The period of one clock cycle. It corresponds to the nominal minimum time between the transitions of the bit-serial signal.

Wander: The variation in position of a signal's transition occurring at a rate of less than 10Hz.

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DTV Multicasting

Getting 10 pounds of data in a one-pound packet.

By Michael Isnardi

Digital TV broadcasting is still in its infancy, but this revolutionary new technology has already proved to be more flexible and more efficient than analog broadcasting, which has served us for over 50 years. U.S. broadcasters must implement DTV between Nov. 1998 and May 2003. The new ATSC standard in place here can support high-definition television (HDTV), standard-definition television (SDTV) multicasting and a host of new digital services.

HDTV offers surround sound and pictures with spectacular detail and sharpness. Although transmission of HDTV is not a requirement for U.S. broadcasters, most broadcasters have said that they will transmit a single channel of HDTV for five to ten hours per week during prime time. In the near term, many broadcasters are discussing SDTV upconverted to HDTV for daytime broadcast; but this is an inefficient use of channel capacity.

It seems certain that SDTV will be used most extensively in multicasting. In this article, the term *multicasting* will mean a transmitted bitstream containing more than one TV program. Business models for multicasting are still under development, but the technology for multicasting has been well-established by digital satellite broadcasters. Some broadcasters, like PBS and Fox, appear more inclined to multicasting than others. As DTV broadcasting matures, expect to see more multicasting during the daytime.

Photo: Many facilities will enter the DTV arena with multichannel broadcast capability. Shown here is the new multichannel control room at WTTO, Birmingham, AL, built by A.F. Associates and Comark Digital Services.

The structure of DTV

Multicasting is based on *packetization*, the key technology that enables DTV's flexibility, interoperability and extensibility. The packetization of the compressed video and audio elements of a TV program, as well as all other data structures, such as program guides and subscription services, allows the broadcaster to change the program mix in the transmitted bitstream dynamically — whether it be over the air, over satellite or over cable. For instance, a broadcaster can adjust the ratio of packet rates (which ultimately means adjusting the bit rate and quality) between the video and audio elements of a single program, and can also adjust the ratio of packet rates among several programs within a multicast.

The 6MHz DTV channel used in the United States can support a total payload of 19.4Mb/

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s, and each broadcaster must decide how to divide that capacity among all the services it plans to provide during the programming day. During prime time, for instance, a single HDTV program may be sent; however, up to eight standard-definition TV (SDTV) programs may be multicast during other parts of the day. Additionally, new digital services may be added to the mix. Examples of such services could include subscriptions to national newspapers — all delivered directly to the viewer. The possibilities are endless. Figure 1 shows some of the options allowed by packetized television.

Before we get into the details of multicasting, let's look at Figure 2, which offers a high-level view of an ATSC transmission system. The video and audio elements of each TV program get compressed by MPEG-2 and AC-3 encoders, respectively. These bitstreams are mapped into fixed-length (188-byte) packets and are multiplexed, along with any associated data packets and a *program map table* (PMT), into a conceptual construct known as a *single program transport stream*. The PMT is required for MPEG-2 systems compliance and indicates the *packet IDs* (PIDs) associated with each program element.

If the total bit rate for a single packet

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multiplexed program does not exceed 19.4Mb/s, additional programs or services may be multicast. Figure 2 shows several other single program transport streams multiplexed into a construct known as a *multiple program transport stream*. In order for the transmitted bitstream to be MPEG-2 compliant, a *program association table* (PAT) must be sent. The PAT is a miniature program guide that indicates how many programs are contained in the transport stream and associates a PID with each PMT. A *conditional access table* (CAT) and associated *entitlement management messages* (EMMs) and *entitlement control messages* (ECMs) must also be sent if any of the programs are scrambled.

The ATSC standard requires a more advanced program guide called *program and system information protocol* (PSIP) to be multiplexed into the stream as well. The decoder can ignore PAT and PMT and instead use the PSIP for program guide generation and selection. (See ATSC document A/65 at www.atsc.org.)

Finally, the transmitted transport stream, now at 19.4Mb/s, is sent to a channel coder, where the stream is made rugged for transmission. An 8VSB modulator and an RF amplifier/transmitter prepare the bits for transmission over the air.

Multicasting from multiple encoders

In multicasting, compressed versions of more than one TV program are multiplexed into a single transmitted MPEG-2 transport stream. The TV programs can be encoded independently using different encoders with different time bases; some programs might be encoded live, while others might be precompressed and played out of a server. In order to understand how this works, we need to learn a little about packets, timing and multiplexing.

We have seen that packets are the key to DTV's flexibility, extensibility and interoperability. For broadcast applications, short, fixed-length packets are used because they can be switched and error-corrected quickly and easily in hardware. Conceptually, the video and audio bitstreams (called *elementary streams*) are first transformed into an intermediate construct known as a *packetized elementary stream* (PES). A PES packet is basically a coded access unit (i.e., a coded video or audio frame) with a PES header. The PES header contains, among other things, the type of data in the stream, as well as *presentation time stamps* (PTS) and *decode time stamps* (DTS), which are important for A/V synchronization in the decoder.

PES packets are further mapped into 188-byte *transport packets*. A *transport header* appears at the start of each transport packet, and contains, among other things, the PID and an optional adaptation field. Samples of a 27MHz *program reference clock* (PCR) are dropped into the adaptation field of selected packets for each program. The decoder recovers the 27MHz clock and re-creates a reference time base from the PCRs. The PTS/DTS time stamps are used for decoder timing and A/V synchronization. Figure 3 shows PCRs inserted into a single program transport stream, which consists of a series of audio and video transport packets. It also shows audio and video time stamps referring to the PCR time base for proper A/V synchronization.

In multicasting, each program may contain its own, independent PCR time

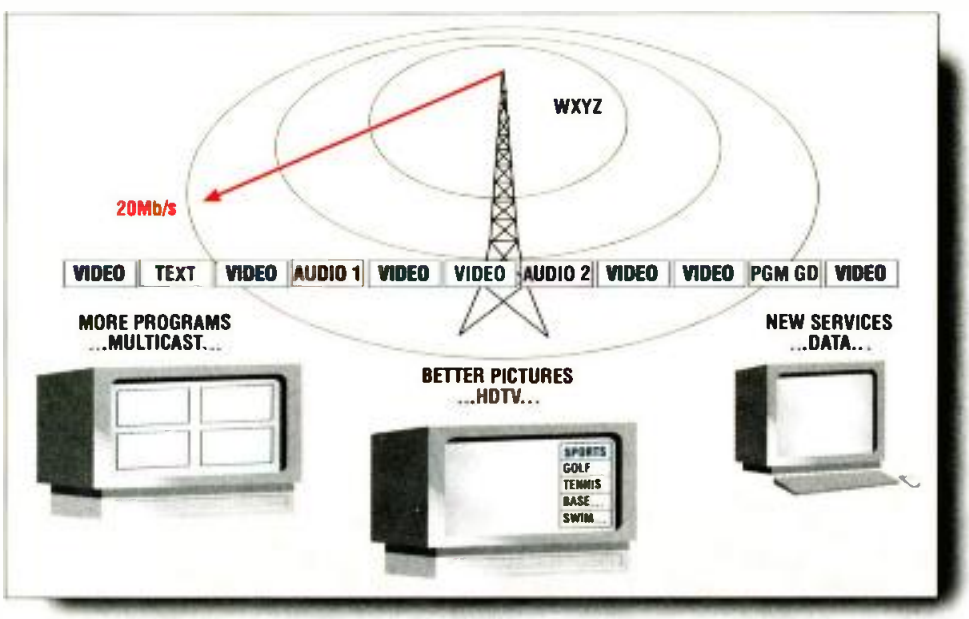

Figure. 1 Packetized television offers HDTV, SDTV multicast and new digital services.

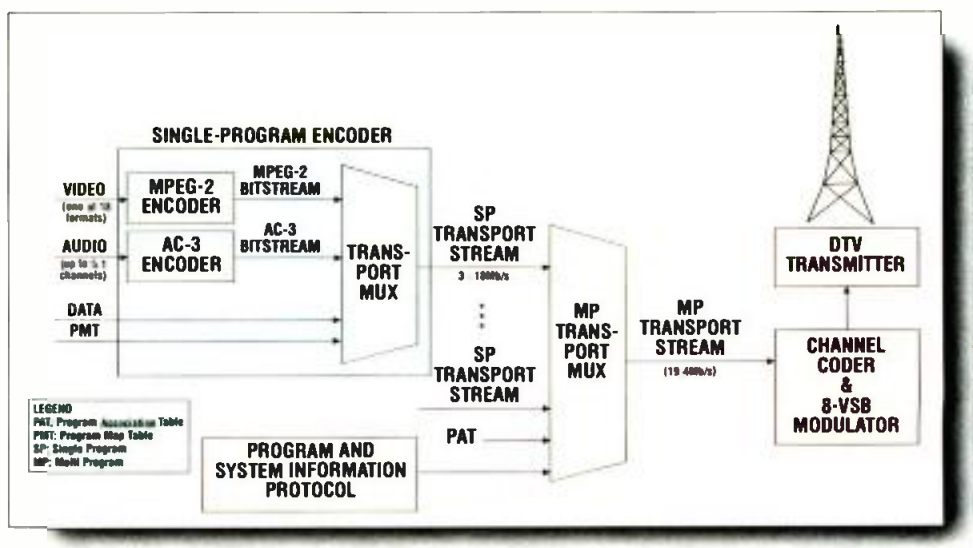

Figure 2. ATSC transmission system.

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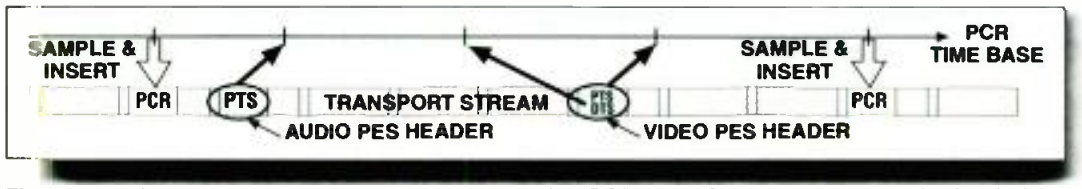

Figure 3. A single-program transport stream showing PCRs and time stamps, essential for timing and synchronization.

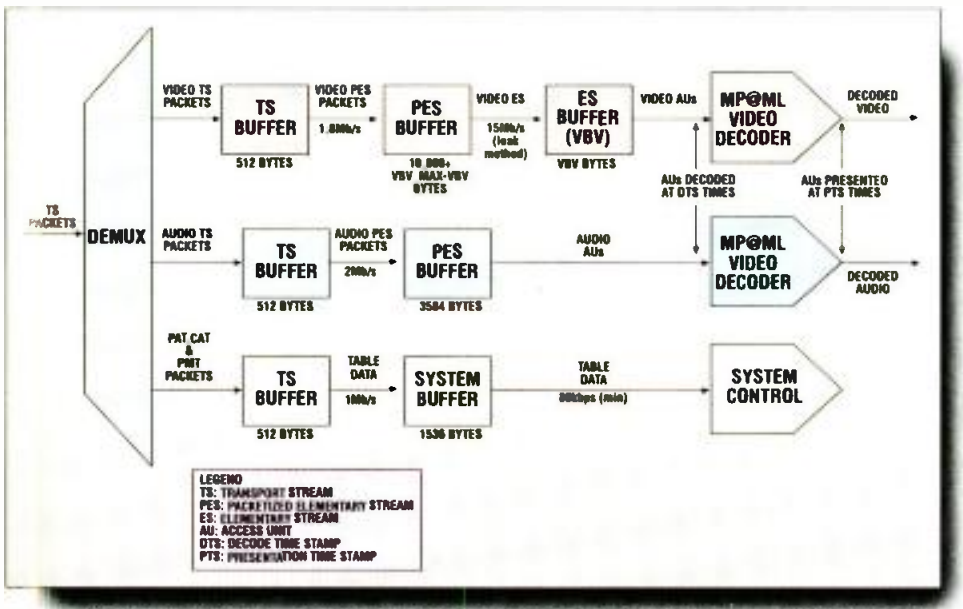

Figure 4. Transport stream system target decoder for main profile, main level (MP@ML). The packet scheduler must avoid buffer overflow or underflow when scheduling packets for delivery.

base; in other words, each encoder may have independent 27MHz clocks that do not need to be locked together. This allows mixing of programs that have been compressed by different encoders at different times and at different locations. When a decoder switches to another program within a multiple program transport stream, the new PCR samples are acquired from the stream, and a PLL circuit reconstructs the 27MHz clock associated with the new program.

Multiplexing video, audio, data and programs

Ultimately, we want to get a single bitstream that contains multiplexed packets from one or more TV programs. At first glance, it might seem that packets coming from all sources could be arbitrarily multiplexed together and the system should work. A little thought will reveal that this is not the case; in fact, packet multiplexing must adhere to a number of constraints. It would not be wise to transmit all the video packets for a two-hour movie, followed by all the audio packets, since the final credits would roll before the opening theme music started. Instead, packets for each source are multiplexed in proportion to their instantaneous bit rate. For instance, if an SDTV video source is MPEG-2 compressed to 7.68Mb/s, and the associated six channels of audio are AC-3 compressed to 384kb/s, then roughly one audio packet will be multiplexed into the single program transport stream for every 20 packets of video.

The device, or algorithm, that schedules packet delivery is called the *packet scheduler* or *transport multiplexer*. The packet scheduler must monitor the buffer levels of a hypothetical decoder called the *transport stream system target decoder (TS-STD)* and make sure that none of the many video, audio and system buffers overflow or underflow (although underflow is allowed in certain circumstances). An example TS-STD is shown in Figure 4.

Another issue is *constant bit rate*

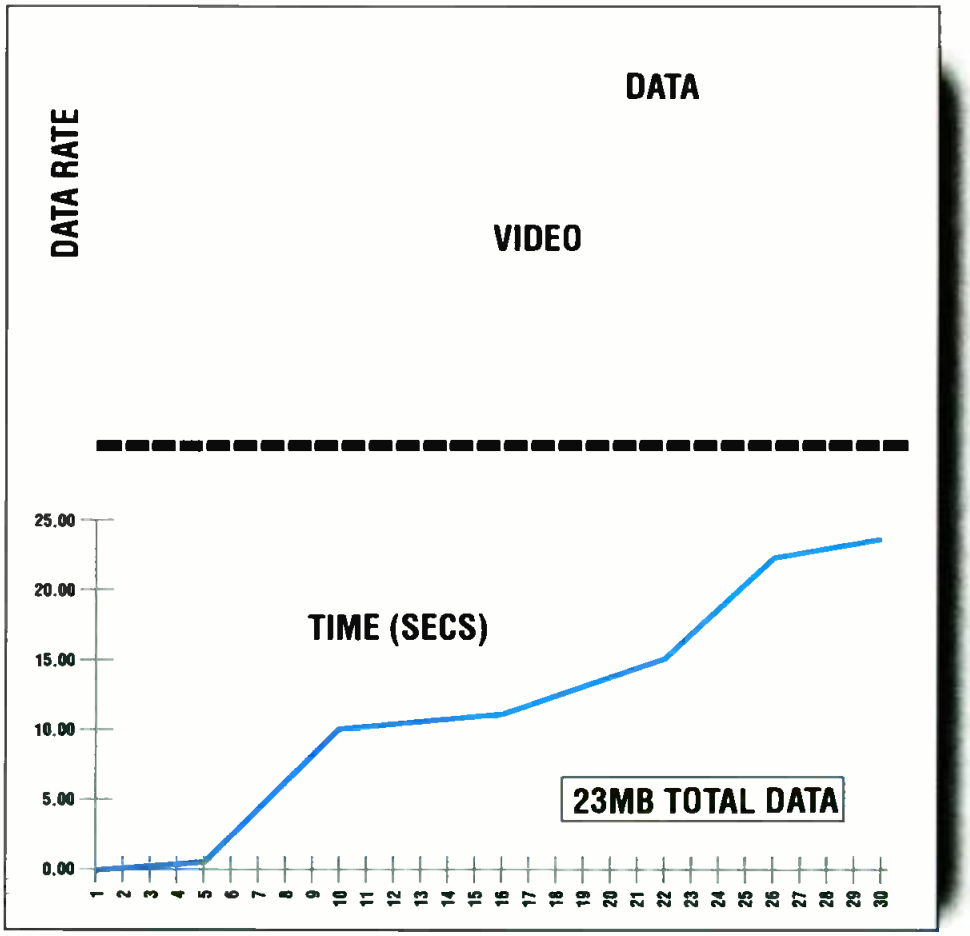

Figure 5. Video and data bit rates and cumulative data transmission during a 30-second commercial.

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(CBR) vs. *variable bit rate* (VBR) sources. Packet scheduling is relatively straightforward for CBR sources, but can become quite sophisticated for VBR ones. Here are two applications for VBR sources.

• **Opportunistic data:** Because compressed video, by its nature, is bursty, one can send additional data to make up the bit capacity difference during easy parts of the scene. During still or easily predicted scenes, the video bit rate will drop, and the packet scheduler can send null packets, or better yet, other data packets to make up the bit rate difference for the capacity allocated to that program. An example of opportunistic data was shown by the Grand Alliance at NAB '97, in which an interactive brochure was downloaded during the easy parts of a car commercial. After the commercial finished, you could browse and navigate through the brochure at your leisure. Figure 5 shows graphs of the video and data bit rates during the commercial segment, and reveals that 23MB of interactive brochure data was transmitted during the 30-second spot.

• **Statistical multiplexing:** An area ripe for invention, this technique is starting to reap real gains for broadcasters. Statistical multiplexing, or *stat muxing* for short, exploits the fact that the video streams from different programs are generally uncorrelated. When several video streams are encoded jointly, it is rare that all streams become hard to code at the same time. Although the sum total of all video bitstreams cannot exceed a maximum bit rate, significant quality gains over CBR can be achieved by giving more bits to video encoders that need them. Thus, the bit-rate peaks of some streams coincide with the bit-rate valleys of others. If many or all streams become easy simultaneously, null packets can be inserted to pad out the bit rate. If many or all streams become complex simultaneously, then the stat mux controller will have to throttle back the bit rate on some or all encoders. Many stat mux algorithms have been invented — few do them well. Ask for a demo before you buy.

In order for stat mux to work well, the program mix must be carefully planned. Stat muxing all high-action sport games together might cause problems, because all may require high bit rates at the same time. Rather, a mix of genres (highly interlaced sports, slow-action news and 24frame/s movies) might give better results. Digital satellite broadcasters, such as DirecTV, face this issue in spades. How they mix 200 programs into just several dozen satellite transponders is their secret, but it provides proof that multicasting can be done — and done well.

It's even possible to stat mux HDTV and SDTV programs together, and broadcasters may start to do this as the compression efficiency of HDTV encoders improve. Figure 6 shows a possible scenario in which one HDTV and zero, one or two SDTV programs, along with additional data, are sent throughout the broadcast day.

As stations begin implementing DTV, more opportunities will develop than are obvious now. It's important that engineers remember that they are no longer just TV stations with a single picture and audio channel. Instead, today's TV broadcaster is a transportation system carrying multiple channels of audio, video and data. ■

Michael Isnardi is the head of Compression Systems, Sarnoff Corporation.

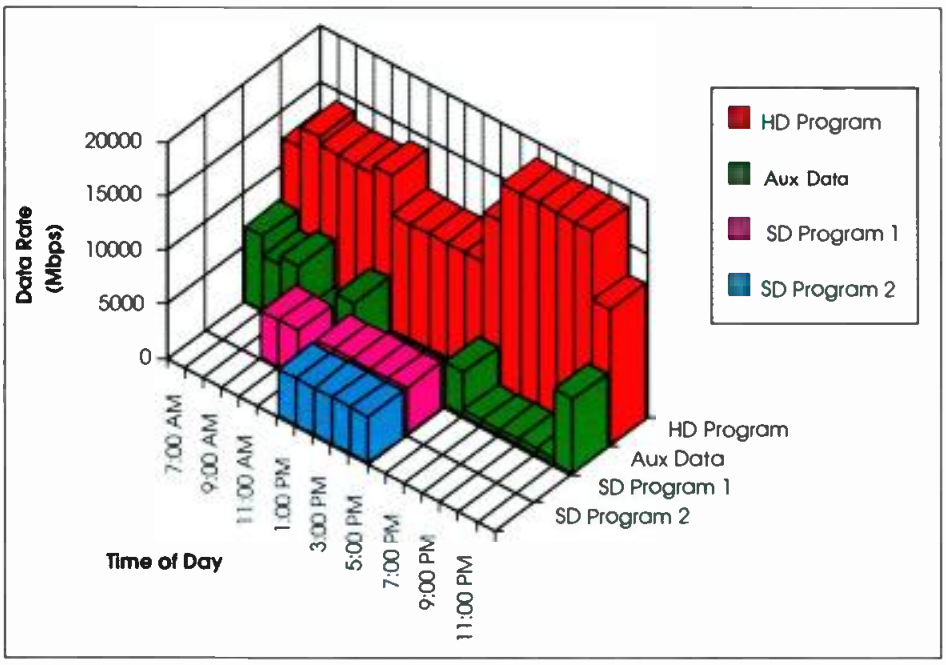

Figure 6. HDTV, SDTV and auxiliary data bit rates for a broadcast day in a possible multicasting scenario.

Product solutions

Several companies offer products for HDTV and SDTV multicasting. Here's a sampling. Descriptions are drawn from manufacturers' latest published data sheets available at the time this article was written. The following companies offer products that can encode a single HDTV or multiple SDTV programs:

- General Instrument (215-674-4800; www.91.com)
- Harris/Lucent (415-453-3400 or 217-222-8200; www.broadcast.harris.com)
- NDS (714-725-2500; www.ndsworld.com)
- Scientific-Atlanta (770-903-6057; www.sciatl.com)
- Thomson Broadcast Systems (+33 1 34 20 7000; www.thomsonbroad.com)
- Tiernan Communications (619-587-0252; www.tiernan.com)

In several architectures, an HDTV image is coded by a parallel array of standard SDTV encoders, so the same chassis could also support single-program HDTV or parallel encoding (multicasting) of several SDTV sources. For statistical multiplexing products see:

- Divicom (408-944-6700; www.divi.com)
- NDS (714-725-2500; www.ndsworld.com)
- Philips (801-978-1757; www.broadcast.philips.com) ■

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VAMP Audio/Video Monitor

Available in Analog and/or SDI Digital

Monitor Both Video and Audio from either Digital Or Analog Sources in 2U.

Television Broadcast NAB98 EDITORS' PICK OF SHOW

SDI input for video and embedded audio, with auxiliary AES and analog audio inputs. Confidence monitoring with built-in LCD screen, and composite video output for use with larger external video monitors. Ideal for all situations in video facilities needing confidence-level video monitoring where operator-convenient rackspace is at a premium.

SQ-1000 Aspect Ratio Converter

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What are you telling the world?

BY KARE ANDERSON

The secret to knowing what you are telling the world is in understanding a code. That code is how we tell each other what we really feel without words. Gestures are emblems of your feelings. Using too many gestures usually detracts from your natural presence, just as talking fast, loud or at great length can diminish your power and credibility. Few of us notice the subtle signals that indicate strong emotion in others, or we misread them. Your body is like a three-dimensional movie that is running constantly; it shows others how you feel about yourself and the world.

Tour your body for vital signs

Take some time to examine what your body is saying about you. For example, if you are literally uptight, people might instinctively resist your comments. This phenomenon is akin to bounding a hard rubber ball on a concrete surface as opposed to bouncing it on a soft carpet. The ball bounces higher and faster against the hard surface, but it bounces less against the carpet. When you present a hardened surface, others will usually react against you more.

To help avoid resistance, you should loosen up physically before you enter a potentially volatile situation. Stretch and work on the areas where you tend to hold most of your tension. Like many people, you probably hold your shoulders higher and slightly more forward than is natural. If someone can give you a quick shoulder and neck massage beforehand, you can enter a situation more relaxed. In response to your relaxed state, others will respond more positively to you.

If you don't know where you hold your tension, take a tour of your body to determine what needs to be loosened up the most. Are you shouldering the world's responsibilities or perpetually drooping? In your determined drive toward success, do you plant your feet solidly on the ground in a gesture of hostility or defiance? Perhaps you have a forward-leaning posture, as if ready to spring into action, actually expressing a lifelong pattern of flight away from psychologically threatening situations.

Your body speaks to you all of the time, telling you your needs. Listen to these signals. Not only is it free, it is a sophisticated medical feedback testing system, that continuously shows you where your inner tensions are, as well as your state of mind. When your body is misaligned and tense, you expend outrageous sums of energy in the everyday gestures of life. We all hold great muscle tension in blind remembrance of fearful events, long after the actual events have been forgotten. You continue to tighten these muscles each time you experience similar situations, thus guaranteeing that you make your pattern of uptightness habitual. Eventually, it becomes a permanent condition that you no longer recognize as abnormal.

Spend more time exercising to relax and loosen your muscles. If you don't begin a regular practice of exercise and stretching, you may lose mobility sooner as you age. When you are sitting at your desk at work, stand and stretch at least every 20 minutes. Walk to the restaurant for lunch. Walk and talk on the way to a meeting. Literally move toward the one you want in your life and loosen up together. Your life could depend on it. ■

Kare Anderson is a speaker and author. To get a free subscription to Kare's on-line newsletter, Say It Better, *sign up at her web site www.sayitbetter.com.*

Reading the signs

Follow this guide when observing the physical changes in someone else to help you discern their possible emotional meaning. But remember, these indicators are not true for everyone.

Sweating: Might indicate an increase in some emotional feeling.
Blinking more: Might signal an increase in some emotional feeling.
Dilated pupils: Often indicates arousal or fear.
Blushing: Might signal embarrassment, shame, anger or guilt.
Talking louder and faster: Usually signals anger, fear or other excitement.
Talking slower and softer: Might indicate sadness or boredom.
Body gesturing: Often signals a negative emotion, usually fear or anger.
Breathing fast and shallow: Indicates the presence of emotion.

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Extron is now shipping the highly anticipated **3200 Series Matrix Switchers.** With 32 inputs and 32 outputs it seems reason enough to choose the matrix router that offers serious performance and reliability. The 3200 Series provides routing for RGsB, RGBS, RGBHV, composite video, S-Video, component video and audio. It delivers 230 MHz (-3 dB) video bandwidth, even when fully loaded and the intuitive front panel controller makes this switcher easy to operate. The 3200 also provides modular flexibility that will accommodate your system long after the initial installation. With internal busing card slots you can expand the router through the front panel without disconnecting any existing cables.

Need more reasons to switch? Extron provides 24-hour technical support 7 days a week. Whether you need technical information, system design assistance or product information, Extron's technical support representatives are ready to respond to your needs. We also offer customer training, educational literature and more.

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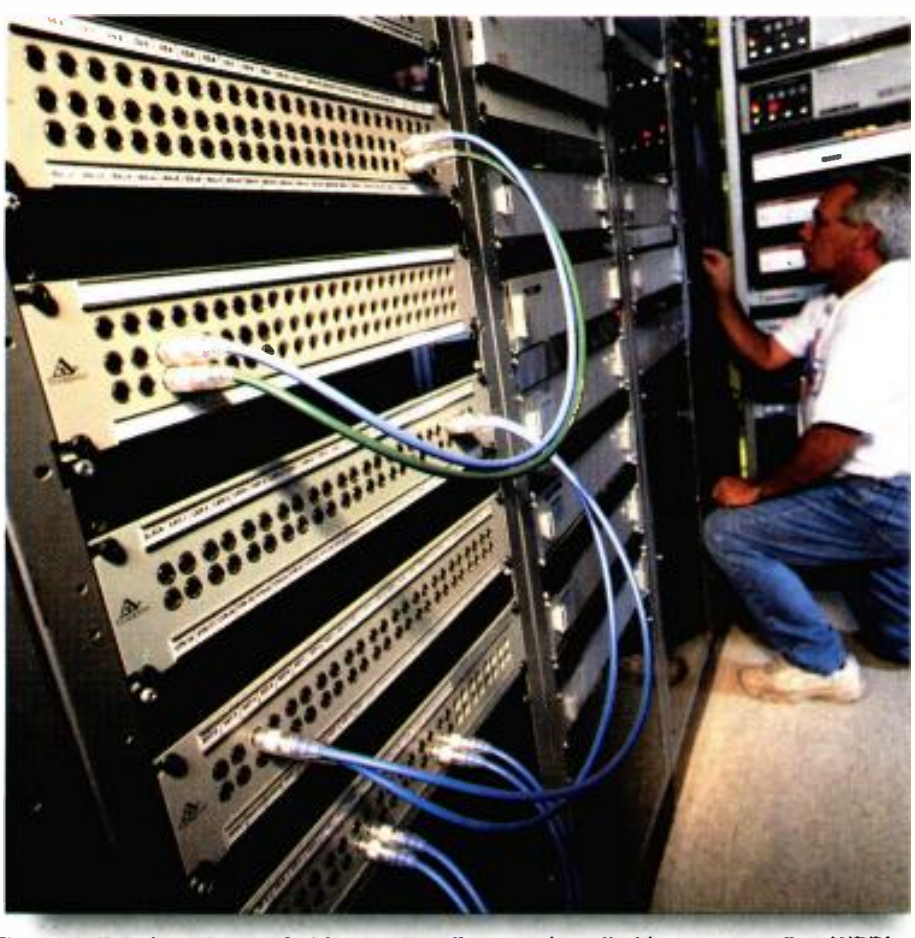
Field Report

Quick solution to serial digital terminations

BY CAMILLE COX

In 1996, CBS affiliate WPRI-TV merged with Fox affiliate WNAC-TV. Part of the business strategy called for sharing the production assets of WPRI-TV to add local evening news programming to the Fox station. With the digital conversion mandate looming, and the geographic proximity of the two properties (East Providence, RI and Rehobeth, MA are within a few miles of each other), Clear Channel decided to co-locate the stations in a state-of-the-art showcase studio at WPRI-TV's existing site. Because construction of the upgraded facility would involve a complete rebuild, the timing seemed perfect to make WPRI-TV/WNAC-TV the first in the Clear Channel family of stations to enter the new digital era.



The new digital routing, switching and cabling was installed in stages — first WPRI-TV was completed, then the new sister station WNAC-TV was added. The final step was relocating the new station to the facility and removing the old analog equipment. (Photography by Jonathan Kinnair, Boston.)

Station staff organized for rebuild

The launching point was a complete new studio layout and implementation plan. Chief engineer Bill Hague divided the project into systems and tasks, assigning project responsibilities to different members of his small team. With the exception of one contract installer hired for a three-month assignment, the four-man in-house engineering/technician team was responsible for the planning, purchasing, engineering and installation.

The first stage of the plan was construction of a new digital master control room for WNAC-TV within the WPRI-TV facility. Walls were created from floor-to-ceiling racks that were simply sealed with doors and windows. This efficient approach not only kept the amount of construction to a minimum, but also provided well-ventilated easy access to the back wiring of the components. For the six-month duration of the rebuild, the analog cable and components remained in place for total system redundancy.

When the new digital WNAC-TV control room was complete, WPRI-TV made a temporary move into it, and the existing analog master-control room was rebuilt with new digital products. Once the digital cabling of the technical plant was complete, WPRI-TV moved into its newly upgraded control room, and WNAC-TV relocated from the facility in Rehobeth to its new home with WPRI-TV. The old system was finally shut down and removed from the facility.

Selecting products

Being one the first can have its disadvantages, such as fewer options in equipment selection. Fortunately, there were sufficient choices available to the staff so that performance wasn't compromised. Although, when it came to cable, that wasn't necessarily the case. The only serial digital cable available at the time was Belden's 1694A, precursor to the lighter 1505A. Over the course of the project, cable cost per roll declined 58% as the market matured, and the station moved from a local distributor to Zack-Joseph Electronics, located in Chicago. Zack-Joseph offered one-day fulfillment and overnight delivery, improving the engineering team's ability to stay on top of their cable supply as the project proceeded.

For the audio, an early decision was made to remain in the analog domain. WPRI-TV believed that the quality improvement gained from upgrading to digital didn't justify tackling the complexity of timing issues at stake. Multi-colored Studiflex cable was selected on the merits of superior electromagnetic shielding and flexibility. Maintenance engineer Jim Costa devised a color-

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coded system, with each audio channel wired in a different color for easy identification.

Digital patch bays

Another key vendor, Trompeter Electronics, located in Westlake Village, CA, provided interconnects and the in-station high bandwidth wireline. Offering the only serial digital patch jack, as well as the only high frequency true 75Ω BNC plugs, Trompeter provided a rich knowledge base of broadband, highly reliable applications. In addition to a more advanced product selection, Trompeter was able to provide a complete system approach to the station upgrade, including the support needed to meet the aggressive schedule.

Two major wiring challenges involved the extremely tight space constraints. Combining the two stations into one facility created a tremendously dense cabling situation, and working around the existing system proved to be problematic. Part of the solution to the density problem revolved around Trompeter's BNC plugs which were available in straight, 45° and 90° versions. Alternating layers of the different angled plugs in tiers created a clean, organized layout with intelligently managed weight distribution. Specialized tools for working in this environment were provided that made plug insertion easy and secure.

Cable management solutions

As each part of the plan was implemented, the team encountered challenges in the form of roadblocks and opportunities. One of the first was finding a solution for managing the hundreds of sources and miles of cabling that had been installed over time, parts of which were close to 20 years old. This aspect of the project was also managed by Costa, whose many years service with the station made him highly familiar with the in-place hardware and the inherent problems. With little documentation to go by, the process-of-elimination method was the only way to trace problems. Costa saw this upgrade as an opportunity to solve that problem for the future. "My goal was to put a system in place that would allow anyone to step in and immediately see the

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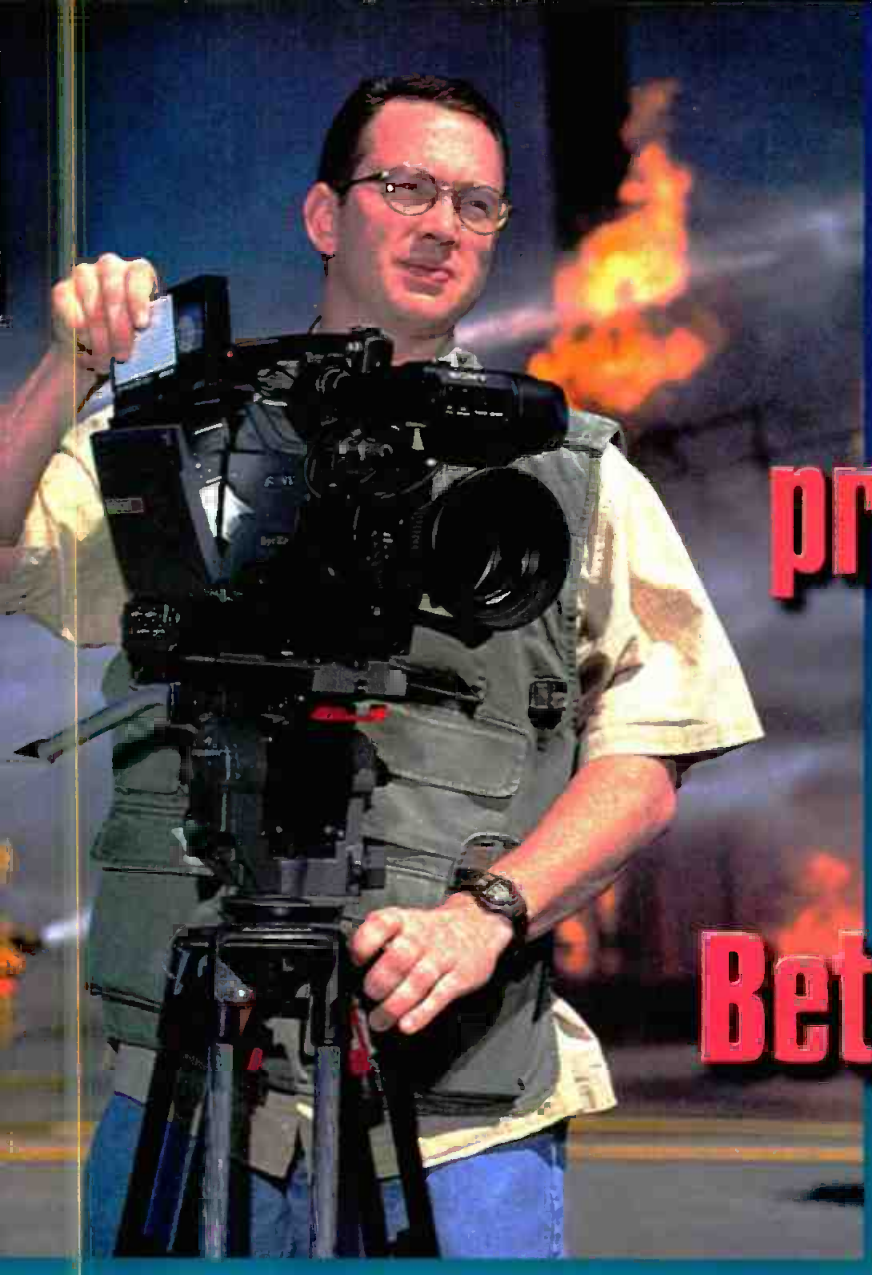

Why are more video professionals switching to BASF Betacam tape?

Ask Michael Alexander, producer for CableTime, the country's largest third-party turnkey cable advertising company

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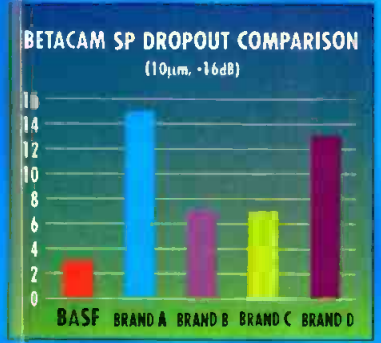
"Honestly, the first thing that attracted us to BASF was the recommendation of another producer. So we tested BASF. I shot several hours' worth of footage in Mexico City. When I watched the tapes, I couldn't find any dropouts. I brought in my boss. We stared and stared at the footage, and we just couldn't spot any dropouts. BASF's lack of dropouts is what got us to switch. Our old brand practically guaranteed two dropouts a minute!"



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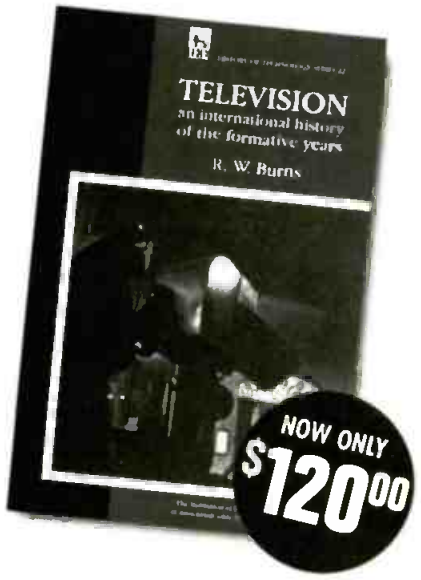

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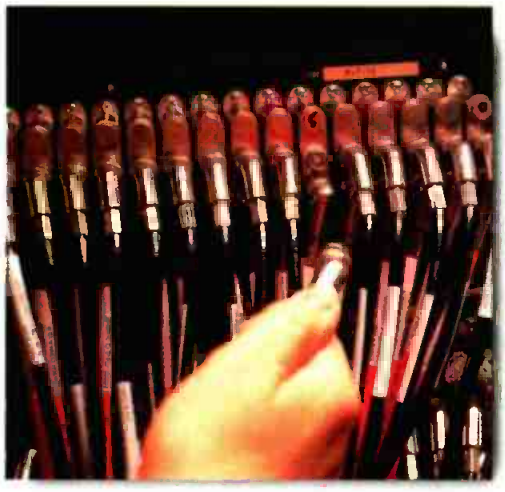
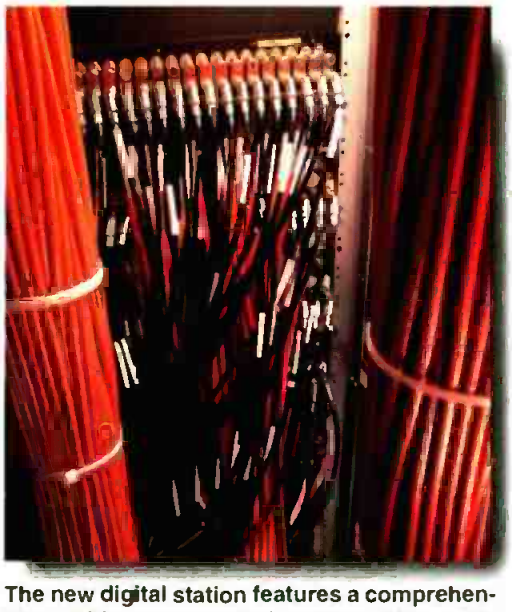


Alternating tiers of Trompeter's 75Ω BNCs in straight, 45° and 90° versions provide a clean, organized installation.



The new digital station features a comprehensive cable management system with more than 3,000 cables clearly identified and mapped.

source and destination of any cable. With this knowledge, not only would fixing problems be faster, but future expansion and upgrades would be far less work."

The magnitude of bringing in miles of new cabling, operating redundant systems for a half a year, and then removing more than four tons of old cable in the midst of daily station operations was daunting. The solution was to create a comprehensive inventory of the source and destination of each of the 3,000+ new cables to be installed. Using a computer database customized for the task, the entire new station design was mapped and documented. Each cable was assigned a unique number and labeled on each end with the source/destination information for immediate, accurate identification.

The system map that resulted from this cable inventory system contributed significantly to making the installation process smooth . Each day in the course of the rebuild the next group of cables was printed out with labels and instructions and handed over to the installers.

Thinking out of the box

Another roadblock was how finding a way for the small team to accomplish fitting 3,000+ cables to connectors within the time frame. The budget didn't permit purchasing a hydraulic crimper, and even with the special handtools provided by Trompeter, the time involved was unacceptable. (Trompeter now offers hydraulic crimpers for lease to its connector customers.)

The answer came from a quick-thinking technician familiar with a local jewelry factory where he could obtain an old foot press. The press was fitted with Trompeter tool dies — and crimping plugs were no longer a problem.

Still to be resolved is how the combined facility will handle the discrepancy between the 1080i format choice that CBS has made and the format Fox chooses. But not to worry, it's the fourth quarter of 1998, and product solutions abound these days. ■

Camille Cox is a technical writer based in Thousand Oaks, CA.

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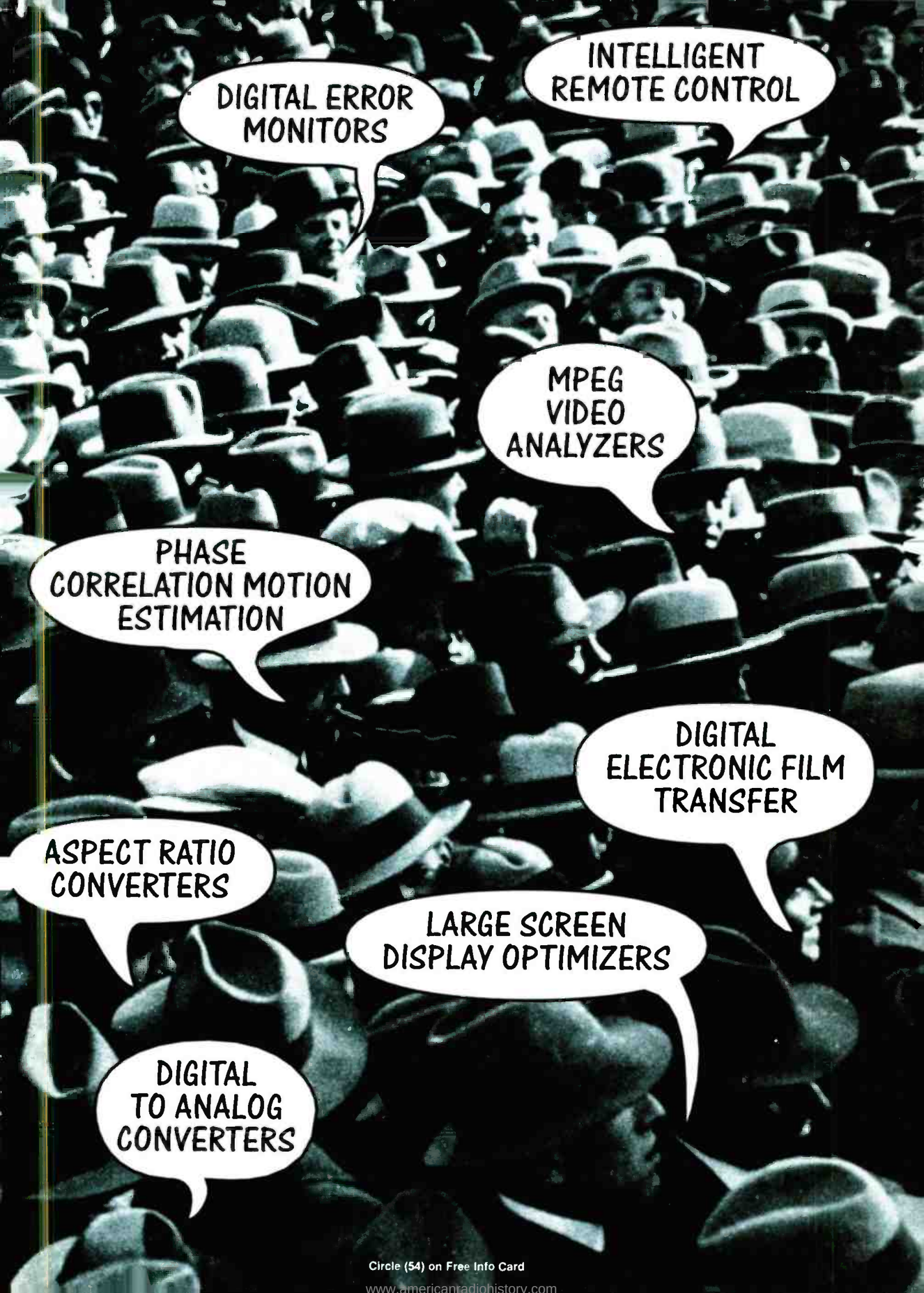

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Field Report

The intercom

BY ROBERT STEWART

TV stations are in the communications business. KTVT, the Dallas/Fort Worth CBS affiliate, strives to communicate to the audience daily during four hours live newscasts and a one-hour live talk show.

Throughout the day video is coming into the main studio in Fort Worth from more than nine satellite dishes, four remote microwave relay dishes, four ENG trucks, one satellite uplink truck, a mobile newsroom production truck, two helicopters, the Dallas studio microwave link, photographers who bring in tapes and many other sources. All of these video sources must be routed, including the technical operations center, the news VTR pit, the dub recording room, the art department, the recording feed station, one of three control rooms, one of twelve edit bays in the Fort Worth studio or the Dallas studio or one of the special projects edit rooms. All of these rooms are manned by station employees.

Before the team can bring all of these resources together to communicate to the audience, they have to communicate with each other. The TV studio intercom, one of the most important systems in the station, is the communications link that allows all the players on- and off-camera to come together in a timely manner.

Growing demands

KTVT has had a Telex CS9500 50x50 crosspoint intercom system for about seven years. It has provided reliable service, however, as the news programming efforts have grown, so have the demands placed upon the intercom system. This includes more newscasts, IFBs, live events, employees and recording/editing stations, all pushing the intercom usage to the limits of a 50x50 crosspoint capability. The system has been reliable with few intercom problems. The configuration is easy to program by means of a PC-based computer and the control program is straightforward. However, we realized it was time for a larger intercom with more crosspoints.

Many factors had to be considered once we decided a new intercom system would need to be purchased. The system had to be reliable — any intercom downtime is not acceptable. If the intercom fails, a newscast or live show could be lost. The audio quality had to be excellent and intelligible.

The new system would have to provide IFB capabilities, many mix-minus and various program inputs, talkback, 2-way radio and SAP-channel keying, telephone dial-up interfacing and be fully user programmable. There also had to be room for expansion.

We compiled our main concerns into a list of questions. What kind of I/O connection panels were available? What would become of the present CS9500 system, which was still good working order? What about the more than 25 intercom station panels we already owned? Would they all have to be replaced with a new system?

Telex provided the answers with its Advanced Digital Audio Martix (ADAM) intercom system. The ADAM is a true digital intercom system. The crosspoints are digitally controlled and the audio is sampled at 44.1kHz, with 16-bit samples, the same as compact discs. There are dual power supplies and dual control cards, which switch automatically in the event of a fault.

The "B" control producer's station, shown here, provides full communication to both local and remote locations (some 30 miles away) through the new Telex Adam intercom.

The master controllers contain flash memory. The setup and configuration is safe from power outages. Diagnostic LEDs on the front panel of the controller cards indicate the status of the system functions and show which controller is active and which is standby/ready. There are eight interchangeable crosspoints on each user interface card. The PC-controlled administrator program also has a diagnostic section allowing the system administrator to see what is going on within the ADAM.

The ADAM diagnostic program shows all the crosspoint conditions so it can be determined which panels are forced talk or forced listen. It shows data-line conditions for each intercom

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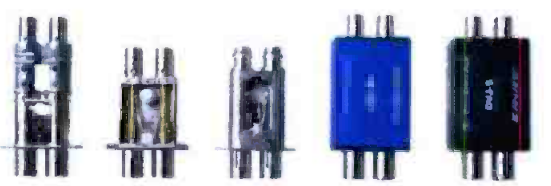

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panel in-house, so that when a panel stops chattering with the mainframe, this fault will show up on the diagnostic page.

The ADAM intercom matrices are fully compatible with all other Telex matrix products and accessories. This means that older intercom panels, the IFB program assignment panel, the camera delegation panel and all the telephone interfaces could be used. The I/O panels were set up for six pin RJ11 connectors and punch-down blocks for audio in, audio out and data. The RJ11 connectors are easier to use when connecting intercom panels. The punch-down block works well with audio in and out that does not use data connections, such as IFB talkbacks, 2-way radios, camera intercoms, SAP channel cueing and IFB outs.

The CS9500 intercom that the ADAM is replacing will be put to good use. The two intercom systems can be trunked together. The trunking allows users on one matrix to communicate with users of another matrix. With the CS9500 in the Dallas studio and the ADAM in the Fort Worth studio, any intercom panel in Dallas can talk to any intercom panel in Fort Worth, which is over 30 miles away. The studios are already linked via microwave with available T1 space. Workstations in Dallas will have a much broader point-to-point communication link with the main studio.

The interrupted foldback (IFB) can be one of the most confusing areas of a large intercom system. Some reporters want to hear themselves in their earpiece and others do not. Reporters in the field, fed back to the studio via satellite, should be fed a mix minus, or they will be faced with a audio time delay. If you have multiple reporters coming in on satellites, they must each be given a separate mix minus, so that they will not hear themselves, but will hear each other. Some reporters want to hear the commercials during a break and others do not. The situation changes constantly, and it could become a nightmare if it were not for the program assignment panel (PAP). This panel allows the operator to assign any program source into any one of the IFB earpieces. Without it, the IFB area of the intercom could become a jungle. Over half of the 50x50 intercom system was being used by IFBs, with more needed.

Talkback, used with the IFB system, provides a necessary feature in a news production. During breaks, producers need to talk and listen to the talent in the studio. Each button on an intercom panel has two functions: to activate the buttons assigned to listen-input or to activate the buttons assigned to talk-output. By wiring and configuring, a particular button on the intercom panel can be latched to listen to the talent's pre-mixer microphone and talk to the talent's earpiece. Even when the audio booth mixer is potted down, the producer can still hear the talent's mic. The talent's earpiece audio is interrupted by the producer's activated talk button.

The videotape and CCU at KTVT. The Telex Adam "list" function allows users to be assigned group communications as needed, preventing everyone from having to hear all communications.

The party line

If the intercom is the heart of TV news production, then the intercom feature called *party line* is the bloodline. The party line is an exclusive circle of point-to-point users. By administrator policy, only the director and the producer are allowed to talk on the party line. This allows them to talk to the production crew through the script without being stepped on by other intercom users.

The *special list* feature on the ADAM is also useful in news production. When the air control room switches to the news production control room, the air director gives in- and out-time countdowns. Not everyone on the crew needs to hear these countdowns. By creating a special list of intercom stations that need to hear the countdowns, the air director can reach all these stations with the push of a button. Each camera operator can be addressed individually and a special list can be created allowing other users to address all camera operators easily. Special lists are handy when only a few crew members of a production are involved in a small area of the overall production.

The intercom system brings all the resources together in news production. Timing is everything, on or off the air. The director must talk the show though the production relaying rolls, cues, standbys and takes to the members of the production crew. Without this valuable link behind the scenes, communication to the audience would not be possible. ■

Robert Stewart has been an engineer with KTVT, the Dallas/Fort Worth CBS affiliate, for 18 years.

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CHRIS ROMINE

Whether or not you believe HDTV is real, there is no escaping the fact that the topic is the hottest issue that our industry has seen since the introduction of color television.

By now, most readers are aware of the FCC mandate for DTV/HDTV broadcasting, and the various network's and cable company's positions regarding formats. Without making a political statement or casting judgement about these positions, this article will address how production and post-production facilities, as well as some broadcasters, are using a versatile, new multistandard recording device to respond to the challenge. Who knows what the format standards of the future will be? How can you be both responsive to your client's demands and profitable at the same time? Standard definition against high definition; interlace against progressive. How can you win your share of battles in this new multiformat war and emerge victorious?

Why HDTV now?

Many respected industry consultants, advisors and even editors, are suggesting that we just wait: wait until the issues are resolved; wait for standardization and wait until the technology is less expensive. After all, the FCC did not actually mandate HDTV, just DTV. (Of course, Congress has expressed a more elevated opinion about that.) However, like it or not, advancements in the state-of-the-art and quality of experience are usually facilitated by forward-thinking people willing to assume risks for the opportunity to be better.

It is on these early-in-the-conflict battlefields that standards are set, costs are reduced and sometimes the eventual winners are determined. We all need these pioneers and risk-takers and should be applauding their courage instead of admonishing their intensity.

The industry *needs* HDTV. Without discrediting the wonderful work that is now being done on the desktop, a general confusion has developed at the client level about the value of high-end video production and post production. Just as professional printers lost business to their own clients when "acceptable" desktop publishing became affordable ten years ago, high-end video facilities have seen their market share deteriorate in a similar fashion. HDTV raises the bar, provides identity and it looks great.

But we have to make a living, too

The early adopters of HDTV technology comprise those with extensive resources and some with a lot of smarts. Many have no choice — the client says "do it, or I'll find someone who will, two hours a day." Wait a minute, a $1,000,000 room for two hours a day? One client with 1080i, another with 720p, and both *really* want 1080p next year. Oh, and what about that "old" 1035i stuff I need to work with (talk about pioneers)? And, I just started making money on all of that 601 equipment they told me I needed to catch up to the digital world. (We won't even talk about those computers collecting dust in the back room that were state-of-the-art and an absolute requirement two years ago.)

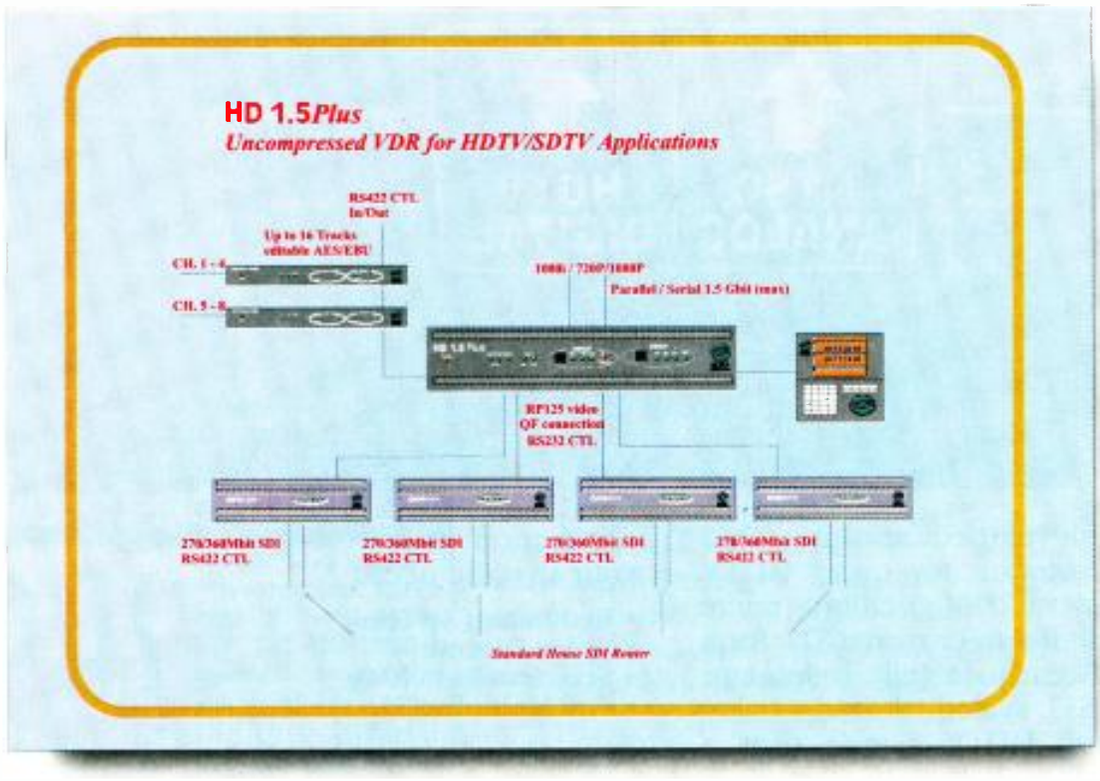

Figure 1. The Sierra Design Labs HD 1.5*Plus* combines four Quick*frame* VDRs providing a versatile, multiformat, uncompressed high-definition recorder.

Combat strategy

A couple of video equipment manufacturers (the computer guys claim omnipotence already, but remember that back room) seem to understand the challenge, and are providing their customers with weapons for today's battlefield of format and

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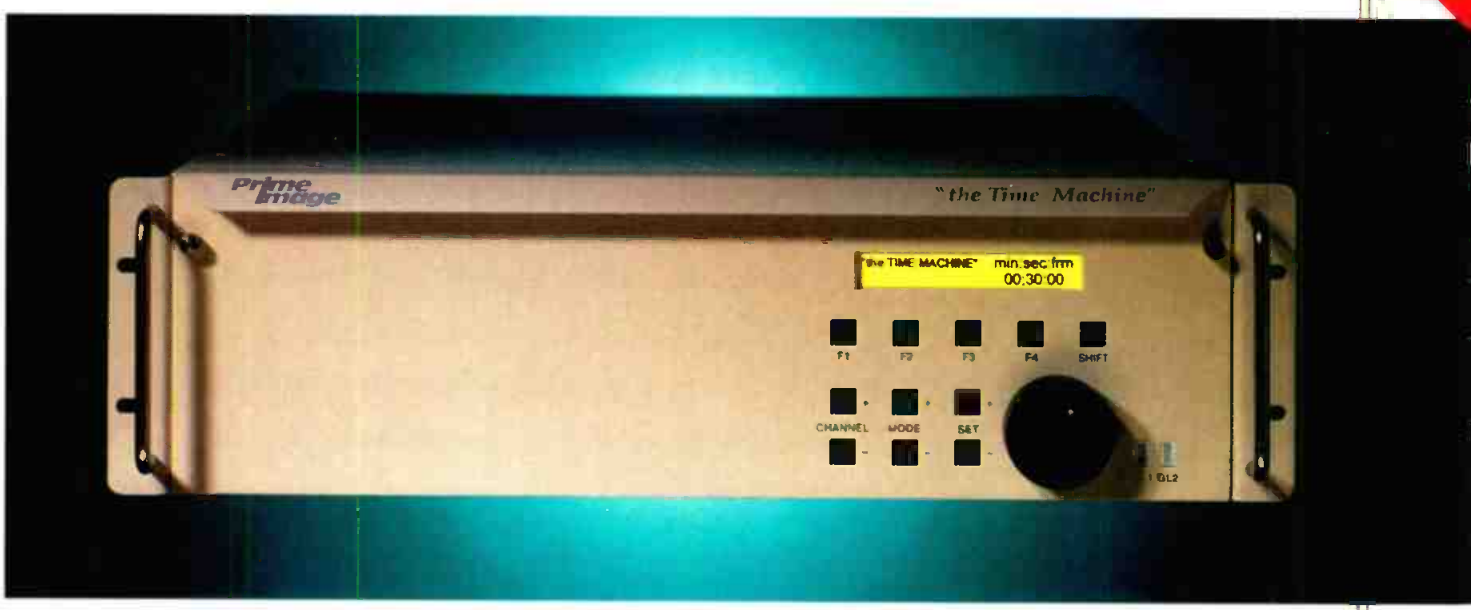

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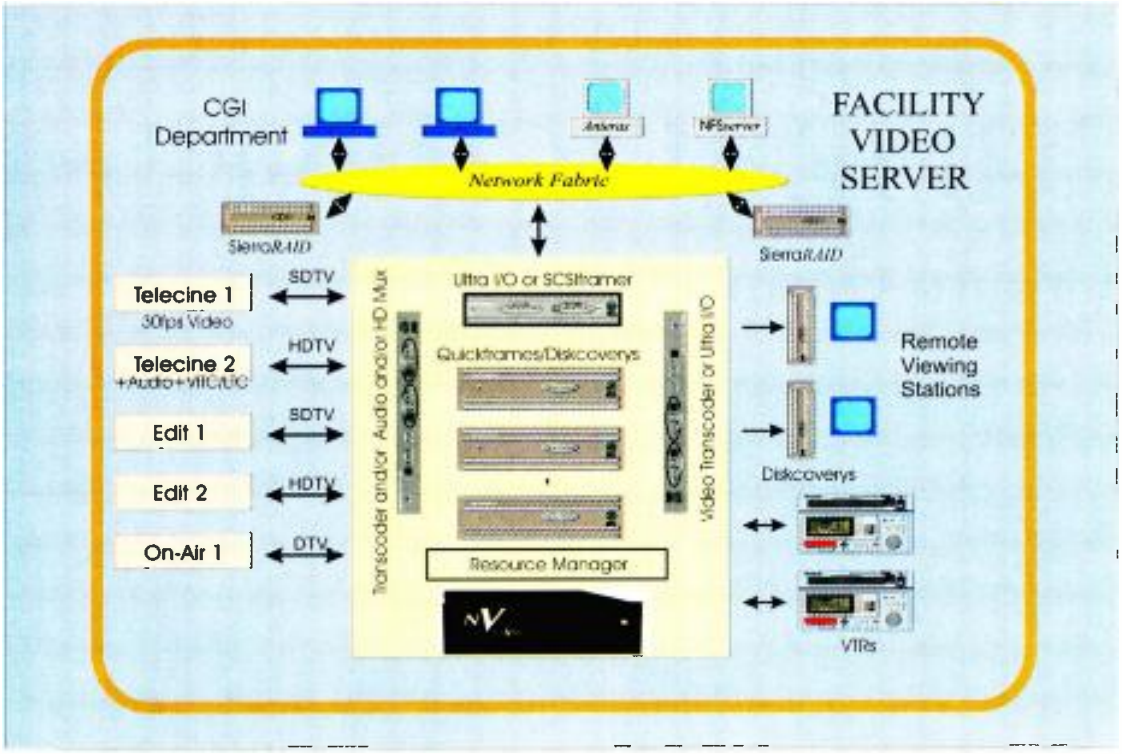

Figure 2. This diagram shows the building blocks that are currently available for a complete facility video server.

standards conflicts that should survive to fight another year, or hopefully, another decade.

Sierra Design Labs started five years ago with a non-obsolescence product philosophy that is being tested vigorously by these new HDTV/DTV developments. Many manufacturer's business plans dictate that they supply new weapons when the battlefield scenario changes. Sierra's modular product architecture is the foundation for a strategy that is now protecting our customers in this brave new HDTV world. The subject of this article, the HD1.5*Plus* (see Figure 1), comprises four Quick*frame* (NAB '94 Pick Hit) uncompressed video disk recorders, a high-definition adapter (HDA) and a multifunction hard control panel. The optional advanced audio modules add up to 16 channels of fully synchronized and editable AES/EBU digital audio.

The beauty of this solution, as many of our happy customers have confirmed, is something we call the *don't panic button*. The button turns that two hour a day financial challenge into a 24 hour a day money-making solution. A push of this button converts the HD1.5*Plus* from an uncompressed high definition 1080i (59.94 or 60fps) recorder to a high definition 720p (23.976, 59.94, 60fps) recorder. Another push converts it into four standard definition uncompressed ITU-R BT601-4 disk recorders capable of 270Mb or 360Mb operation. And, the audio remains synchronized, whatever the format. Soon, these same users will have 1080p (23.976fps) format capability available. Sierra also provides an option that can adapt any one, or all, of the individual Quick*frame* VDRs into our HD*360* high-definition recorder, compatible with the Panasonic AJ-HDP500 HD processor, a component of its HD D-5 multiformat videotape recorder, for an economical HDTV hybrid disk/tape recording/editing solution with non-linear random-access capability.

Theaters of operation

HD1.5*Plus* users currently comprise high-end production and post-production facilities, including Pacific Title, American Production Services, Downstream Video, Fotokem and Tape House. HD1.5*Plus* is integrated into many popular edit systems, not with a VTR emulation, but as a true random-access non-linear player and recorder. High-definition film and tape transfers to the recorder often are subsequently accessed by high-performance SGI workstations running Sierra-provided multithreaded SCSI transfer and file-conversion utilities. Paint, effects, compositing, editing and film-cleaning application software is already available for high-definition work and is being used successfully by these facilities to make money today. With uncompressed high-definition recording, the user does not have to worry about concatenation problems when the inevitable compression, whatever it may be, is applied downstream. And, because their video recording and storage equipment is comprised of multiformat modular building blocks, they will be winning the battle and making money with it tomorrow, no matter which direction the next attack comes from.

The next objective

Without looking too far into the crystal ball or divulging too many product plans, the early adopters of HD1.5*Plus* HDTV technology can look forward to the elimination of the bottlenecks and to higher productivity and profitability. Faster, more efficient bridges between the video world and the computer world will be made available for an incremental investment. Included will be higher performance interfaces, real-time colorspace conversion and even more DTV format support.

Perhaps more importantly, veterans of these early HDTV battles will continue to benefit from product compatibility between vendors resulting from alliances born out of the mutual need to win this noble war. Cooperation between manufacturers and between manufacturers and customers has probably never been stronger.

The big picture

How does all of this fit into the dream of serving up video and audio to an entire facility from a many-

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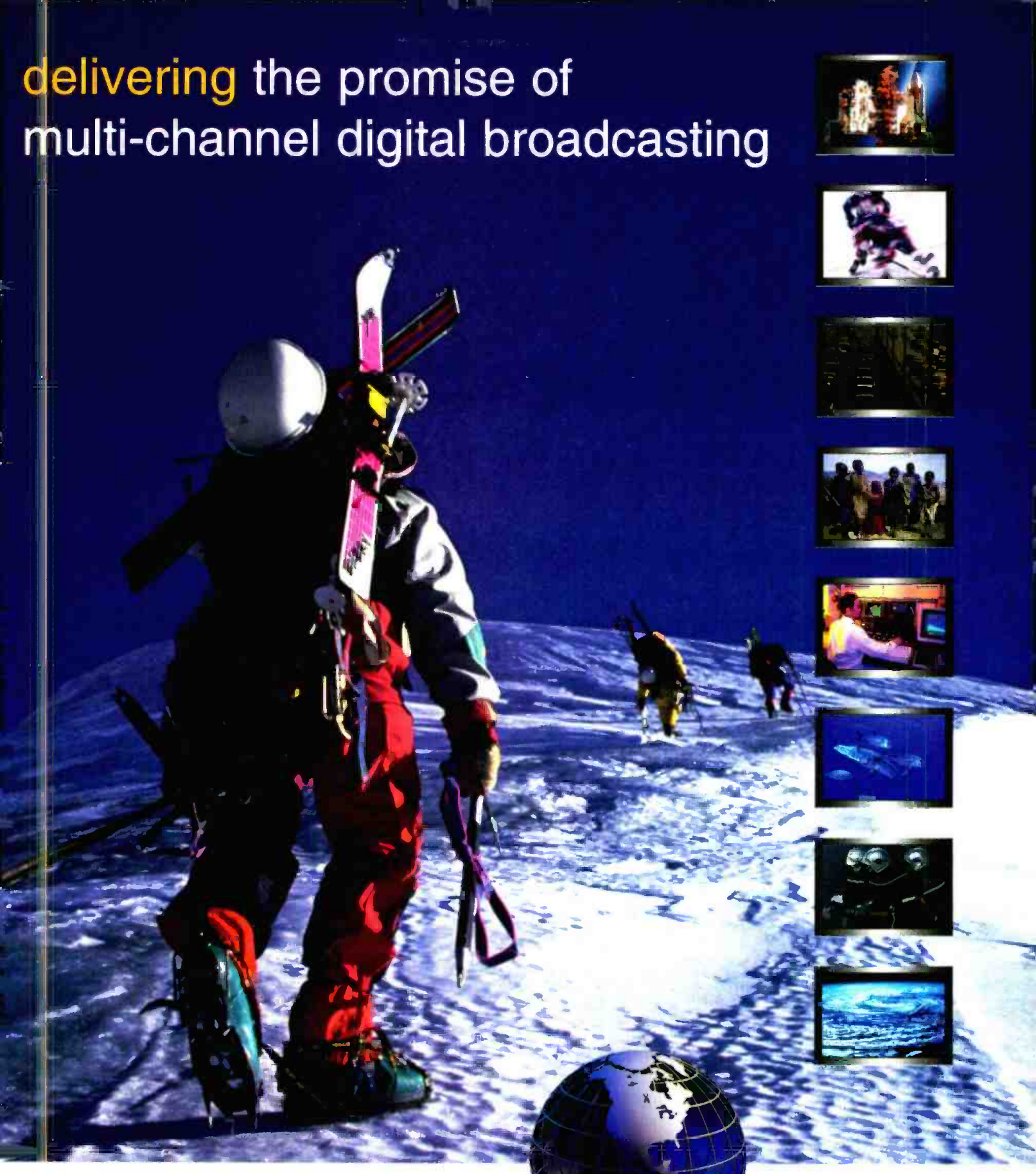

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channeled storage architecture with single control and management points? The HD1.5*Plus*, comprised of multiformat building blocks, is a building block for the complete facility video server. When adding another module, like NVision's new EnVoy family of multiformat video and audio switching routers, the video and audio storage assets of a facility can be assigned dynamically, as needed.

The ability of the EnVoy to switch connections dynamically in a vertical interval, combined with the multiformat Quick*frame*'s true non-linear random-access record/playback capability, means that these assets will have the ability to be combined into configurations of virtual disk recorders limited only by aggregate bandwidth and the number of physical connections. For example, at 2:00 p.m., Edit 2 needs four 22-minute 601 play/record channels, and Telecine 3 needs an hour of 1080p to record a film transfer. Assign them and route them. At 3:00 p.m. the hour of 1080p can be converted to six hours of 601, and the four 601 channels can be format-switched and used for a quick 1080i transfer, and then accessed by your Fire HD through a fully-integrated computer interface. Figure 2 depicts currently available building blocks for a complete facility server. From the graphics (CGI) department to on-line edit and on-air broadcast, the video and audio storage assets are available as native devices, fully integrated into the relevant application, their true personalities transparent to the user.

HD1.5*Plus* users have armed themselves well enough for the DTV format wars that they look forward to the battle with enthusiasm. Being a weapons supplier in peaceful times is more fun than we thought. ■

The Sierra Design Labs HD1.5*Plus* uses four Quick*frame* VDRs to provide multiformat receive capability.

Chris Romine is president of Sierra Design Labs, Incline Village, NV.

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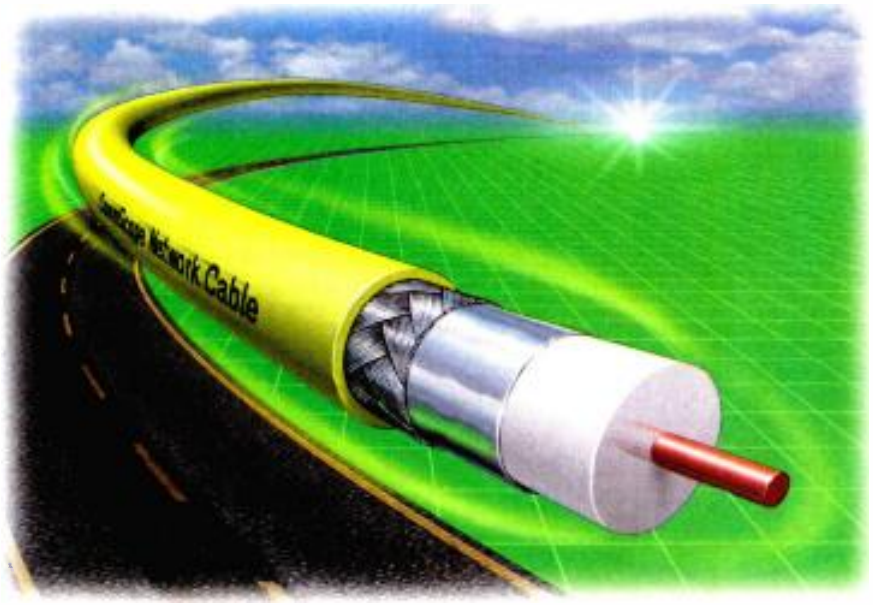

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Portable lighting

BY THE *BE* STAFF

Portable lighting used to mean 100 pounds of steel and glass crammed into a wooden crate. Even a one-person interview required at least 20 pounds of lighting.

Today, things are easier. Perhaps the biggest reason lighting is easier has nothing to do with the lights themselves; it's the increased camera performance that makes lighting easier. Today's cameras are up to four times more light sensitive than those of only 10 years ago. That means a shooter needs only one-half to one-quarter as much light to get the same results. Where you used to need a 1000W light, now as little as 300W is needed. This all translates to reduced weight, lower-power consumption and less hassle. And, if you make a living shooting or doing ENG remotes, that "hassle factor" is what really counts.

New features

Today's lighting kits offer lots of options and features. In the hands of a skilled shooter or lighting person, even a small assortment of lights and accessories can produce a wide variety of lighting options.

To manufacturers, this means selling more, but smaller, systems. Whereas a crew would formerly use one, or at most, two lighting stands of 1,000W each, today, that same crew, or probably a smaller crew, may have four lights accompanying stands and all the accessories. Both manufacturer and consumer have more products from which to benefit.

Portable lighting kits range in price from $1,000 to $2,500. Some may run as high as $8,000. The basic, tungsten-based lighting kits today come complete with fixtures, stands and accessories to satisfy most basic ENG and EFP productions. Higher-end kits are available to introduce a whole new range of lighting possibilities for location production. These include HMI and fluorescent lighting fixtures.

What do you need?

So, what should a good lighting kit include? While this is largely a personal matter, here are some general suggestions:

- Fresnel-lensed lights: Fresnels provide a more attractive light, especially when lighting faces, than do open-faced instruments. And, you get more control over spill light.
- Light box: A portable, collapsible soft light box is a must-have item for any light kit. Light boxes provide bright, yet soft, light sources without the use of bulky frames and silks.
- Portable fluorescent: While fluorescents used to be strictly for studio applications, compact lighting fixtures are now available from several sources. These lights offer a soft light quality, high light output and low power draw. Fully color-corrected versions of the lamps are available.
- Many shooters prefer HMI lighting fixtures: Formerly considered by some as too heavy and bulky, that's not the case today. The use of electronic ballasts has lightened the load and made portable HMI kits a reality.

In a digital world, lighting is sometimes one of the last things to consider. However, with today's new lighting technology, being last on the list needn't mean featureless. Compact lighting kits are widely (and expensively) available. Don't let your shooter go out without one. There are a number of unique lighting options available today.

Frezzi Sun Gun HMI on Sony AX, all powered by hot swap NP1-3P1 with Frezzi FND-1MH battery.

Kino-Flo Diva-Lite 400, providing full range dimming and universal AC input (85vac 0 265vac).

Lighting equipment manufacturers

So, with this information as a guide, where do you go for the products. Thought you'd never ask. Read on. The following vendors responded to our request for product line information.

- Cool-Lux: Manufacturer of a complete line of lighting equipment for motion picture, TV, videotape and photographic. For more information circle reader reply number 361 on page 139, or call 800-ACDC-LUX.

Cool-Lux U-3 Tri-Light.

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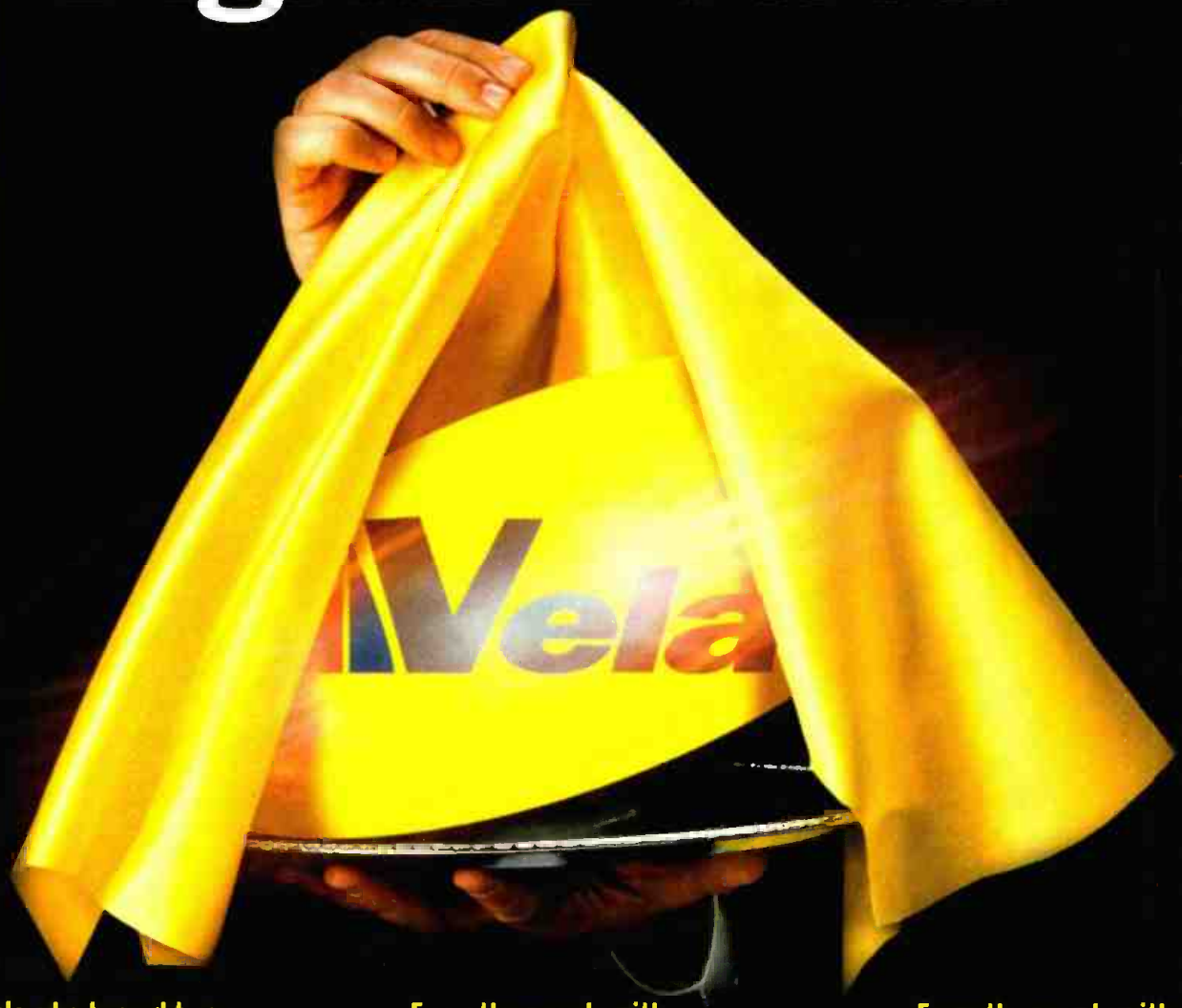

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• **Frezzi:** Manufacturer and distributor of professional power and lighting products. Mini-Fill tungsten lights, Mini-Arc, HMI portable, location lighting kits, diachronic filters for daylight or daylight correction, barndoor, scrim, light/mic stands and carrying cases. For more information circle reader reply number 357 on page 139, or call 800-345-1030 or see the web site at www.frezzi.com.

• **K 5600:** Manufactures portable HMI lighting fixtures for location lighting. Product line includes Joker 200, 400W and 1,200W PAR systems, compact and lightweight units and kits for TV, video and film crews. New products include the 'Bug-Lite,' a barebulb UV-protected 200W HMI fixture, the Joker-Bug, a combination openface, daylight balanced fixture. For more information circle reader reply number 362 on page 139, or call 800-662-5756 or see the web sitewww.K5600.com

• **Kino-Flo:** Provides a full line of fluorescent lighting systems for film and video production. For more information circle reader reply number 356 on page 139, or call 818-767-6528.

• **Lowel-Light:** Lights, control, mounts and kits for imaging professions, innovatively designed and built for rugged dependable use, ease of operation and portability. New products include the Lowel Dimmer (an intelligent location dimmer), GO Kits (small and light enough to travel as carry-on baggage, plus innovative accessories, including the Missing Link Clamp. For more information circle reader reply number 359 on page 139, or call 718-921-0600.

• **Sachtler:** Provides a complete line of camera support equipment for ENG, EFP, OB and studio cameras, as well as a new line of lighting for news and production, both open-faced and fresnel technology, tungsten and flicker-free daylight HMI from 125W to 5K, for battery and AC operation. For more information circle reader reply number 358 on page 139, or call 516-867-4900

• **Videssence:** Designs and manufactures image-enhancing energy-efficient lighting systems for TV, video and film. Product line is based on patented sustained RGB light technology, custom electronic lighting systems for architectural and general lighting purposes. For more information circle reader reply number 363 on page 139, or call 415-579-7577; see the web site www.videssence.com.■

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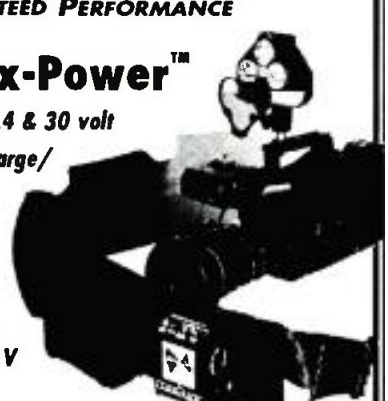

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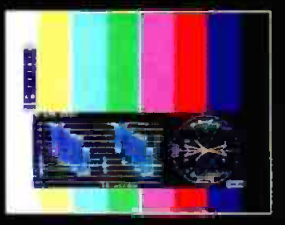

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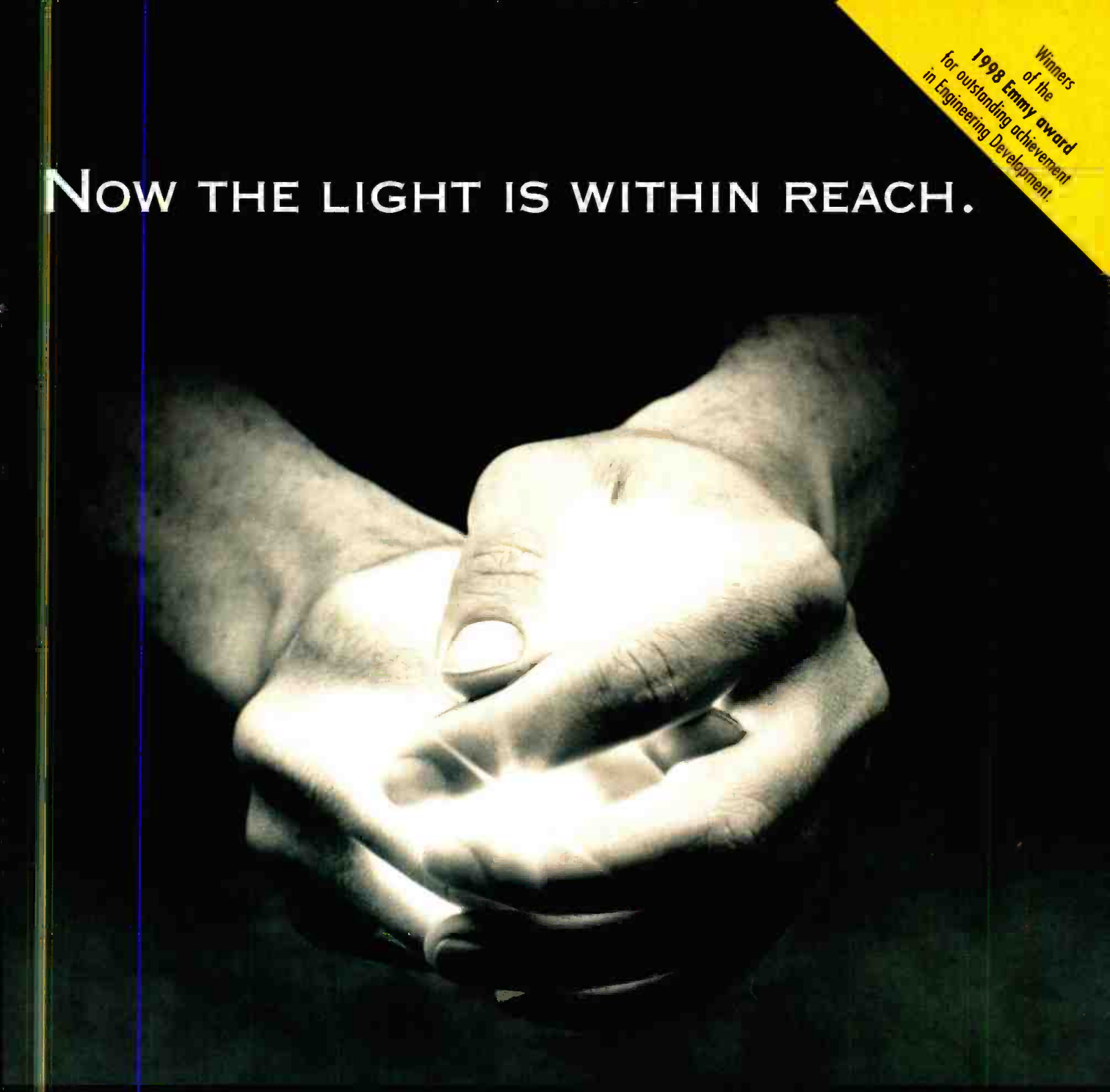

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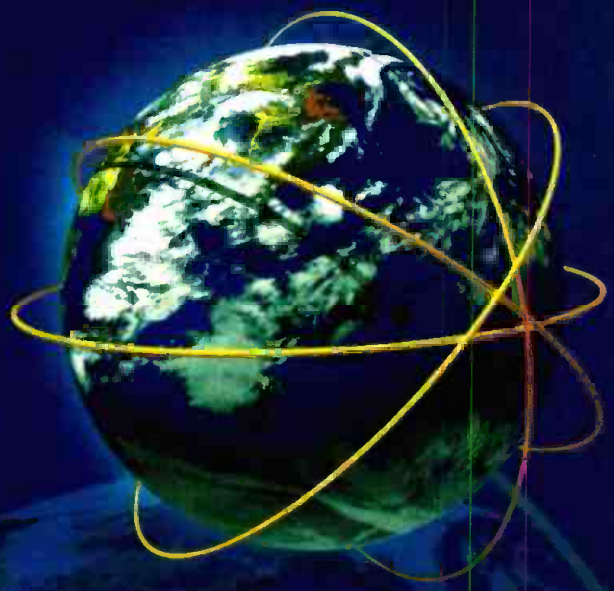

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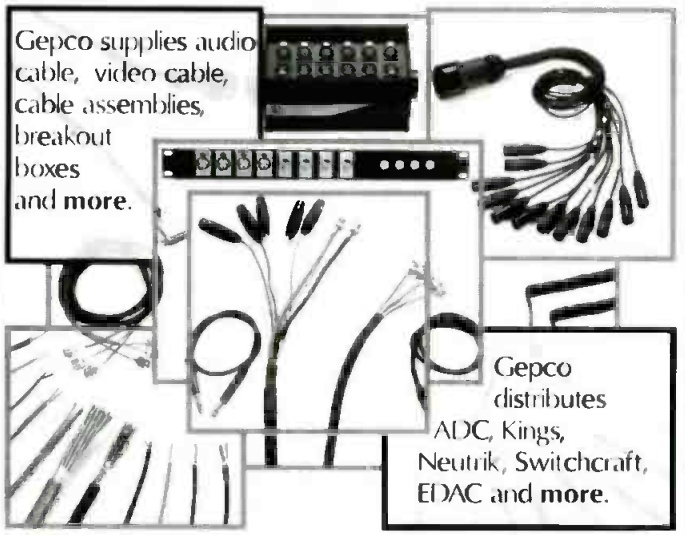

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Pinnacle Systems DV/1394: an interface option for Pinnacle System's ReelTime family of video editing and video special effects products; the DV/1394 interface provides a high-speed serial connection between digital cameras and computers; this option allows ReelTime and ReelTime Nitro users to move fluidly between DV and analog file formats; video editors can incorporate source material from virtually any analog or digital source and output to virtually any digital or analog device; 650-526-1600; www.pinnaclesys.com

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Discreet Logic edit* version 4.0: a versatile WindowsNT-based real-time non-linear editing software featuring greater flexibility; some of the new features include a trim window with slip-and-slide capability, a key-frame/channel editor and user definable columns for bin and database management; V4.0 also offers an expanded level of integration with Discreet Logic paint* and effect*, which in turn offer 2-D and 3-D integration with the Kinetex 3-D StudioMAX; 514-393-1616; www.discreet.com

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SPHERE VERSION 2 SOFTWARE

Scitex Sphere version 2: this enhanced version features widescreen aspect-ratio support and a QuickTime 3.0-native file format that delivers cross-platform compatibility through the new Sphere WindowsNT codec; included as standard on all new Sphere systems, the software is available as an upgrade for existing systems; DTV-compatible Sphere

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Euphonix Mixview version 3.2: the latest software upgrades for the Euphonix CS series of mixing consoles improves the console's 5.1 surround-sound capabilities; it features a comprehensive automation editing suite of tools specifically designed for the Euphonix Hyper-Surround panning system; it is now possible to edit an entire scene or slip an individual panning move; fader glide has also been added on the motorized and non-motorized fader systems; 818-766-1666; fax 818-766-3401; www.euphonix

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Business

NFL Films will install the Solid State Logic Avant digital film-mixing console as part of a general expansion of its Mount Laurel production facilities. The new room will have a voice-over booth and a related machine room. The monitor system will be set up for six- and eight-channel surround mixing in stem

format for voice, music and effects. The NFL Films' console offers 192 channels in a 48-channel frame with two Fairlight digital audio workstations integrated into the system.

Pappas Telecasting has made a large-scale, second-round purchase of Panasonic DVCPRO camcorders, laptop editing systems and VTRs to convert three of its stations to digital newsgathering. The sale, valued at $2.7 million, also includes Postbox elite non-linear editing systems. Empire Sports Network has also purchased Panasonic DVCPRO equipment valued at more than $500,000. The purchase included two AJ-LT75 laptop editing systems, five AJ-D700 camcorders, 22 AJ-D650 studio editing VTRs and AJ-D640 player/recorders, 18 AJ-D230 desktop VTRs and three AG-EZ1U DV-format camcorders. Complete Post has purchased a complete Panasonic HDTV post-production editing and effects system. The facility will purchase six AJ-HD2700 1080 interlace/720 progressive switchable D-5 high-definition VTRs with AJ-DEC2000 480p downconverters, an AV-HS3100 1080i post-production switcher, an AT-H3015W 30-inch master HD monitor and three DT-M3050W 30-inch 16:9 multiformat monitors.

Hewlett-Packard and DIRECTV have signed a multimillion-dollar deal in which HP provides on-air digital storage and playback video-server systems for the new DIRECTV Los Angeles Broadcast Center. HP will provide more than 30 MediaStream broadcast servers to perform content-receipt, storage and playback functions for the new DIRECTV broadcast center, which is scheduled to begin full operations in the second quarter of 1999. The DIRECTV programming services currently originate from its uplink facility in Castle Rock, CO. The two facilities will share broadcasting responsibilities and provide broadcast-system redundancy.

Pro-Bel America, Chyron's routing and automation subsidiary, received a purchase order to provide a $5 million integrated routing system to DIRECTV for its new Los Angeles Broadcast Center (LABC). Pro-Bel will supply a complete turnkey distribution and routing system, including nine Pro-Bel routing switchers ranging in size from 16x16 to 448x448 for serial digital video/audio matrix routing. A combination of digital and analog configurations supports full integration of video, audio and control equipment. Pro-Bel is also supplying the patchbays and distribution amplifiers that surround the routing core. All equipment is supplied with dual redundant control and power-supply modules, and the system will allow for in-service, no-downtime expansion as DIRECTV's business needs grow.

Drake Automation Limited (DAL) will supply an extensive multichannel automation system for the DIRECTV Los Angeles Broadcast Center. DAL will supply automation management that will initially support the digital transmission of more than 200 channels via satellite. The DAL technology may also play a role in future expansion of the center to support new DIRECTV programming services.

NASDAQ has added two more Hitachi Z-2010A digital cameras to the single Hitachi camera originally used to shoot stock-market reports and interviews in front of NASDAQ's "Marketsite" 100-monitor videowall, which

displays real-time stock quotes in graphical, company-logo format. Broadcasters covering business news from the NASDAQ stock market supply a correspondent; NASDAQ provides the rest.

A Magic DaVE from Snell & Wilcox is used with a videowall that enlarges the imagery of the day's events for Tom Brokaw's *NBC Nightly News* news-

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cast. The news set comprises a Power 5dv projector from Digital Projection and a 6'x8' DNP rear-projection screen. The Magic DaVE is used as a central switching and supplementary special effects device to process the images sent to the Syncom multi-image processor that drives the videowall.

TVRS 98, the official broadcast and production arm of World Cup '98, shot the World Cup '98 events using lenses

from Fujinon. The AH55X and AH66X TV zoom lenses were coupled with the IDK-23HS, a specialized camera manufactured by Philips in cooperation with EVS. The cameras, which provide high-quality slow motion at 75fps, were used with Fujinon lenses with fast apertures, broad zoom ranges and a near absence of ramping between focal lengths. The S 4X7.3BWMD wide-angle teleconferencing lenses were also used on 55 remote-controlled JVC KY-F32 cameras, and A10X4.8BEVM lenses were used behind the goals in each stadium.

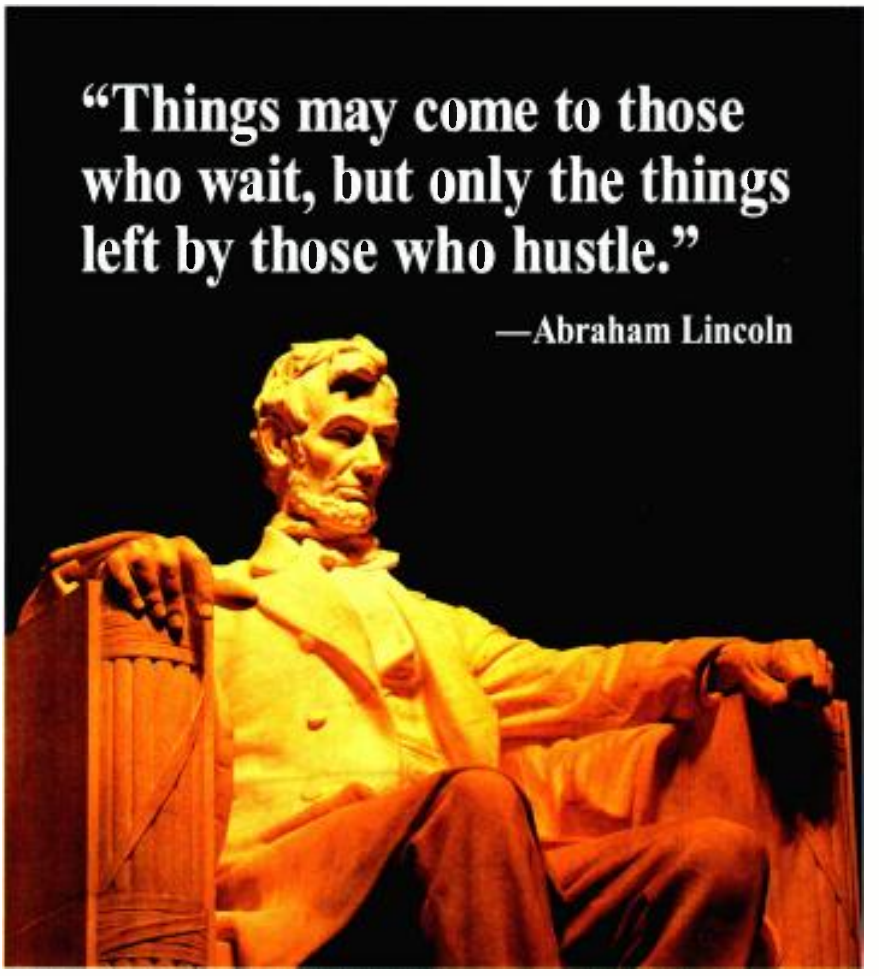
Tiernan Communications has been selected to provide high-performance digital encoders and decoders that will enable ABC to meet its on-air target for delivery of 720p HDTV services in November 1998. Tiernan's THE-I modular DTV encoders and TDRG modular integrated receiver decoders will be used for the distribution of both 720p HDTV and SDTV programs. Tiernan also announced that its encoders and decoders, supporting both 1080i and 480p, will be ready in time for the scheduled on-air date of Nov. 1.

Leitch Technology will reorganize its European and Asian operations to consolidate Leitch and Tekniche sales and customer service. The combined forces will promote and support all Leitch group brands in their respective regions.

Universal Studios has installed eight TASCAM MMR-8 modular multitrack recorders and eight TASCAM MMP-16 modular players into its motion-picture and TV-dubbing facilities. The recorder was chosen because it is Pro Tools compatible, which allows it to be used without retooling.

Thirteen/WNET has chosen Tektronix HD master control and digital transmission equipment to provide an HDTV infrastructure for its new facility in New York. Thirteen/WNET will outfit its master control with Tektronix Grass Valley routers, which will accommodate standard- and high-definition transmissions, allowing Thirteen/WNET to offer single-channel HDTV programming, as well as multichannel SDTV and data broadcasting mixes. Tektronix will also build a digital editing training center that will enhance Thirteen/WNET's on- and off-line nonlinear editing suites. These flexible, multipurpose rooms, which will complement Thirteen/WNET's 25 digital editing stations, will accommodate cutting and finishing of video and audio broadcast, as well as new media. The facility was designed and built by A.F. Associates (AFA), which is designing the technical operations center to accommodate the transition to multichannel broadcasting. The facility will comprise two studios, a studio-control room, a master-control room, an air/record room and an adjacent library, a technical operations center, several non-linear off-line and on-line rooms networked to video file servers and two full-time linear high-end on-line rooms.

Tektronix has also announced the opening of its North Hollywood office, which will provide Los Angeles customers easier access to training facilities and customer support. The new office incorporates the video and networking division, the measurement business division and the color-printing division into one location.



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QUICK DIAL 74

SONY

DSR-200A

3-CCD Digital (DVCAM) Camcorder

Combining a compact and lightweight body with the superior picture quality of DSP (Digital Signal Processing) and the DVCAM format, the DSR-200A is the ideal acquisition tool for video journalists, event and wedding videographers, stringers and production houses. 500 lines of horizontal resolution, 48kHz or 32kHz digital audio, three hour record time, and minimum illumination of 3 lux is only the beginning. Other features include 16:9/4:3 capability, Steady Shot, high resolution 1-inch viewfinder, time code operation, time/date superimposition and an IEEE-1394 interface for direct digital output. Offers full automatic as well as manual control of focus, iris, gain, white balance and shutter speed.

Variable servo 10X optical power zoom lens goes from 5.9 to 59mm in 1.7 to 24 seconds. The manual zoom rocker is continuously variable right up to where the digital 20X zoom kicks in.

Sony's Super Steady Shot reduces high frequency camera shake without compromising image quality. SteadyShot uses horizontal and vertical motion sensors that allow it to work accurately while zooming, moving (even shooting from a car), and shooting in low light conditions.

Has digital effects including audio and video fade, overlap and Slow Shutter.

Automatic and manual focus, iris, shutter, gain and white balance. Iris is adjustable in 12 levels from F1.6 to F11, shutter from 1/4 to 1/10,000 of a second in 12 steps. Gain from -3 to +18dB in 8 steps.

Zebra Pattern indicator, built-in ND filter.

Custom Preset function lets you preset, store and recall custom settings for color intensity, white balance (bluish or reddish), sharpness and brightness.

Stores Photo, Date/Time, Shutter Speed, Iris, Gain and F-stop for easy recall. So if you have to re-shoot, you know your original settings for every scene and frame.

- Records Drop/Non-Drop Frame time code. Time code can be read either as RC time code or as SMPTE time code.
- Has a large 1-inch B&W viewfinder with 550 lines of resolution for easy focusing even in low contrast lighting situations. Separate information sub panel displays time code, battery time, tape remaining and other camcorder functions without cluttering up the viewfinder.
- Records 16-bit/48kHz audio on one stereo track or 12-bit/32kHz with two pairs of stereo tracks (L1/R 1, L2/R2), so you can add stereo music or narration.
- One-point stereo electret condenser mic for clear stereo separation. Directivity can be selected from 0°, 90° & 120°.
- Automatic & manual (20-step) audio level record controls. Monitor audio with headphones or from the LCD panel which has an active VU meter.
- XLR input connectors for mics and audio equipment.

DSR-200A Field Package:
- DSR-200A Camcorder • NPA-1000/B Battery Case Adapter
- 3 NP-F930/B 7.2v 4000 mAH Batteries
- AC-V900/B AC Adapter, Triple Battery Charger
- VCT-U14 Tripod Adapter • LC-2000CP System Case

DSR-30 DVCAM Digital VCR

The DSR-30 is an industrial grade DVCAM VCR that can be used for recording, playback and editing. DV standard 4:1:1 sampling digital component recording with a 5:1 compression ratio provides spectacular picture quality and multi-generation performance. It has a Control L interface for editing with other Control L based recorders such as the DSR-200A DVCAM camcorder or another DSR-30. It also has a continuous auto repeat playback function making it ideal for kiosks and other point of information displays. Other features include high quality digital audio, IEEE-1394 Digital interface and external timer recording. The DSR-30 can accept both Mini and Standard DVCAM cassettes for up to 184 minutes of recording time, and can playback consumer DV tapes as well.

Records PCM digital audio at either 48kHz (16-bit 2 channel) or 32kHz (12-bit 4 channel).

Equipped with Control L, the DSR-30 is capable of SMPTE Time Code based accurate editing even without an edit controller. Edit in editing functions include assemble and separate video and audio insert.

By searching for either an Index point or Photo Data recorded by the DSR-200A camcorder, the DSR-30 drastically cuts the time usually required for editing. The DSR-30 can record up to 135 Index points on the Cassette Memory thanks to its 16K bits capability.

Audio Lock ensures audio is fully synchronized with the video for absolute precision when doing an Insert edit.

- Built-in control tray has a jog/shuttle dial. VCR and edit function buttons. The jog/shuttle dial allows picture search at ±1/5 to 15X normal speed and controls not only the DSR-30 but also a player hooked up through its LANC interface.
- DV In/Out (IEEE 1394) for digital dubbing of video, audio and data ID with no loss in quality.
- Analog audio and video input/outputs make it fully compatible with non-digital equipment. Playback compatibility with consumer DV tapes allows you to work with footage recorded on consumer-grade equipment. Tapes recorded in the DSR-30 are also compatible with Sony's high-end DVCAM VCR's.

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

13-inch and 19-inch Presentation Monitors

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

They Feature:
500 lines of horizontal resolution
They handle NTSC, NTSC 4.43, PAL, and SECAM

- Picture (chrome, phase, contrast, brightness) and setup adjustments (volume, aspect ratio) are displayed as easy-to-read on screen menus.
- Closed captioning is available with the optional BKM-104 Caption Vision Board.

PVM-14N2U/20N2U Only:
- (Last Input Switch) - Contact closure remote control allows you to wire a remote to an existing system so that the monitor's input can be remotely controlled to switch between the last previously selected input and the current input.
- 4:3/16:9 switchable aspect ratio.

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

13-inch and 19-inch Production Monitors

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

- HR Trinitron CRT enables the PVM-14M4U and 20M4U to display an incredible 800 lines of horizontal resolution. The PVM-14M2U and 20M2U offer 600 lines of resolution. M4 models also use SMPTE C phosphours for the most critical evaluation of any color subject.
- Dark filter for a higher contrast ratio (black to white) and crisper looking edges.
- Each has two composite, S-Video and component input (R-Y/B-Y, analog RGB). For more accurate color reproduction, the component level can be adjusted according to the input system. Optional BKM-101C (video) and BKM-102 (audio) for SMPTE 259M serial digital input.
- Beam Current Feadback Circuit
- 4:3/16:9 switchable aspect ratio.
- True multi-system monitors they handle four color system signals: NTSC, NTSC 4.43, PAL, and SECAM.
- External sync input and outputcan be set so that it will automatically switch according to the input selected.
- Switchable color temp: 6500K (broadcast), 9300K (pleasing picture), User preset (3200K to 10000K).
- Blue gun, underscan and H/V delay capability.
- On-screen menus for monitor adjustment/operation.
- Parallel remote control and Tally via 20-pin connector.

QUICK DIAL 72

SONY

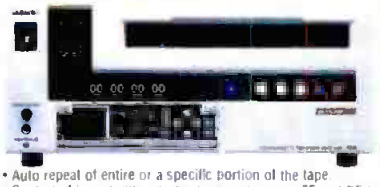
UVW-100B

More affordable than ever, the UVW-100B offers 700 lines of horizontal resolution, 60dB S/N ratio, 26-pin VTR interface, compact design and ease of operation– making it ideal for field shooting applications.

- Three 1/2-inch IT Power HAD CCDs with 380,000 pixels attain sensitivity of F11 at 2000 lux (low light is 4 lux). S/N ratio of 60dB and 700 lines of resolution.
- Gain-up can be preset in 1dB steps from 1dB to 18dB.
- Auto Iris detects the lighting conditions and adjusts for the proper exposure.
- Clear Scan records computer monitors without horizontal bands across the screen. Shutter speed can be set from 60.4 to 200.3 Hz in 183 steps. Also has a variable high speed shutter from 1/100 to 1/2000 of a second.
- SMPTE LTC time code and UB generator/reader. Rec Run/Free Run, Preset/Regen are easily set. For multi-camera operation, genlock to an external time code is provided.
- Genlock input and built-in color bar generator.
- 26-pin VTR interface for feeding component, composite and S-Video signals to another VTR for simultaneous recording. Sart/stop are controlled and external VTR status such as Rec and Tally are shown in the viewfinder.
- Diecast aluminum, 1.5-inch DXF-601 viewfinder is rugged yet comfortable while providing 600 lines of resolution.
- Large diameter eye cup reduces eye strain and simplifies focusing. Diopter adjustments (-3 to 0) compensates for differences in eye sight.
- Zebra level indicators, safety zone and center marker generator. Shows tape remaining and audio levels.
- 8-digit LCD display indicates time data, warning indications and video status. Battery status audio level are also shown in a bar graph meter.
- With Anton/Bauer Digital Batteries remaining battery power is displayed on the LCD panel and through the viewfinder.
- Weighs 15lb with viewfinder, battery, tape and lens. Shoulder pad is adjustable, so you maintain optimum balance when using different lenses and batteries.

UVW-1200/UVW-1400A

Betacam SP Player • Player/Recorder



The UVW-1200 and UVW-1400A are non-editing VCRs which deliver Betacam SP quality and offer features for a wide range of playback and recording applications. RGB and RS-232 interface make them especially ideal for large screen, high quality video presentation, scientific research and digital video environments.

- Ideally suited for work in computer environments, because RGB signals can be converted into component signals and vice versa with minimum picture degradation.
- 25-pin serial interface allows external computer control of all VCR functions based on time code information. Baud rate can be selected from between 1200 to 38,400 bps.
- Built-in Time Base Stabilizer (TBS) locks sync and subcarrier to an external reference signal as well as providing stable pictures. High quality digital dropout compensator further ensures consistent picture performance.
- Equipped with two longitudinal audio channels.
- Both read LTC Time Code) and UB (User Bits). The UVW-1400A also generates LTC and UB (Free-Run/Rec-Run).
- Built-in character generator can display VTR status, time code, self-diagnostic messages, set-up menu, etc.
- Auto repeat of entire or a specific portion of the tape.
- Control of jog, shuttle, playback, record, pause, FF and REW with the optional SVRM-100A Remote Control Unit.
- Composite and S-Video as well as component via BNCs which are switchable to RGB output. The UVW-1400A has two switchable sync connectors and a Sync on Green.
- Built-in diagnostic function and hour meter.
- Initial set-up menu for presetting operational parameters. Settings are retained even after power is turned off.

UVW-1600/UVW-1800

Betacam SP Editing Player • Betacam SP Editing Recorder

The UVW-1600 and UVW-1800 are the other half of the UVW series. They offer the superiority of Betacam SP with sophisticated editing features. They feature an RS-422 9-pin interface, built-in TBCs and Time Code operation. Inputs/outputs include component, composite and S-Video. **All the features of the UVW-1200/1400A *PLUS*—**

- Optional BVR-50 allows remote TBC adjustment.
- RS-422 interface for editing system expansion.
- Two types of component output: via three BNC connectors or a Betacam 12-pin dub connector.
- Frame accurate editing is assured thanks to sophisticated servo control and built-in time code operation. In the insert mode of the UVW-1800, video, audio Ch-1/2 and time code can be inserted independently or in any combination.

PVW-2600/PVW-2650/PVW-2800

BETACAM SP 2000 PRO SERIES

Whenever versatility and no compromise performance is needed, there is only one choice. Legendary reliability and comprehensive support for its many users has established the PVW series as the standard in broadcast and post production. The PVW Series includes the PVW-2600 Player, PVW-2650 Player with Dynamic Tracking and the PVW-2800 Editing Recorder. They feature built-in TBCs, LTC/VITC time code operation and RS-422 serial interface. They also offer composite, S-Video and component video inputs and outputs. Most important they are built for heavy, every day duty.

- Built-in TBC's and digital dropout compensation assure consistent picture performance. Remote TBC adjustment can be done using the optional BVR-50 TBC Remote Control.
- The PVW-2600, PVW-2650 and PVW-2800 (generates as well) read VITC/ LTC time code as well as User Bits. Ext/Int time code, Regen/Preset, or Rec-Run/ Free-Run selections.
- Built-in character generator displays time code or CTL data.
- Set-up menu for presetting many functional parameters.

PVW-2650 Only
- Dynamic Tracking (DT) playback from -1 to +3 times normal speed.

- Two longitudinal audio channels with Dolby C- type NR.
- Recognizable monochrome pictures at up to 24X normal speed in forward and reverse. Color at speeds up to 10X.
- Two types of component connection: three BNC connectors or a Betacam 12-pin dub connector. They have composite and S-Video signals as well.

PVW-2800 Only
- Built-in comprehensive editing facilities.
- Dynamic Motion Control with memory provides slow motion editing capability.

UHF WIRELESS MICROPHONE SYSTEMS

Consisting of 5 handheld and bodypack transmitters and 6 different receivers, Sony's UHF is recognized as the outstanding wireless mic system for professional applications. Operating in the 800 MHz band range, they are barely affected by external noise and interference. They incorporate a PLL (Phase Locked Loop) synthesized control system that makes it easy to choose from up to **282** operating frequencies, and with the use of Sony's pre-programmed channel plan, it is simple to choose the correct operating frequencies for simultaneous multi-channel operation. Additional features, like space diversity reception, LCD indicators, reliable and sophisticated circuit technology ensure low noise, wide dynamic range, and extremely stable signal transmission and reception. Ideal for broadcasting stations, film production facilities, and ENG work.

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Panasonic

QUICK DIAL 74

WJ-MX50 Digital A/V Mixer

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

Canon

IF+ Series Zoom Lenses

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

J15ax8B

A next generation internal focusing lens with the shortest MOD and widest angle of any standard lens, the J15ax8B IRS/IAS is a standard ENG lens that lets you shoot in tight or restricted areas at the closest minimum object distance ever possible and capture more of the subject. It incorporates all the great features of IF+lenses including a built-in 2X extender, high MTF performance, Hi-UD glass, square lens hood and Canon's "Ergonomic Grip".

J20ax8B IRS/IAS

Excellent for ENG, sports and production, the J20ax8B IRS/IAS lets you squeeze in shots from 8mm and still take you all the way out to 320mm with its built-in extender. Incorporates all IF+ features, plus is the only lens (besides the J9ax5.2B IRS/IAS) with aVari-Polar lens hood, enabling rotation of attached filters.

GLIDECAM INDUSTRIES

V-16 AND V-20

Camera Stabilization Systems

The V-16 and V-20 allow you to walk, run, go up and down stairs, shoot from moving vehicles and travel over uneven terrain without any camera instability or shake. The V-16 stabilizes cameras weighing from 10 to 20 pounds and the V-20 from 15 to 26 pounds. They are both perfect for shooting the type of ultra-smooth tracking shots that take your audience's and client's breath away - instantly adding high production value to every scene. Whether you are shooting commercials, industrials, documentaries, music videos, news, or full length motion pictures, the Glidecam "V" series will take you where few others have traveled.

sachtler

CADDY systems

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

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

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

MILLER Fluid Heads and Tripods

Miller 20 -Series II Fluid Head

- Dynamic fluid drag control
- Sliding/quick release camera platform
- Weighs 4 lbs. - handles up to 22 lbs.
- Counterbalance system compensates for nose heavy or tail heavy camera configurations and permits fingertip control of the camera throughout the tilt range.
- Includes independent pan and tilt locks, bubble level, dual pan handle carriers and integrated 75mm ball levelling.

Miller 25-Series II Fluid Head

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

#601-Lightweight Tripod

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

#649-2-Stage Tripod

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

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

Vinten

Vision SD 12

Pan and Tilt Head with Serial Drag

The Vision SD 12 head features "Serial Drag" pan and tilt system. System consists of a unique, permanently sealed fluid drag and an advanced lubricated friction drag. You achieve the smoothest pans and tilts regardless of speed, drag setting and ambient temperature.
- Patented spring-assisted counter-balance system permits perfect "hands-off" camera balance over full 180° of tilt.
- Instant drag system breakaway and recovery overcome inertia and friction for excellent "whip pans."
- Consistent drag levels in both pan and tilt axis
- Flick on, flick off pan and tilt caliper disc brakes.
- Greater control, precision, flexibility and "touch."
- Touch activated, time delayed illuminated level bubble
- Working conditions from as low as -40° up to +60°C.
- SD 12 weighs 6.6 lbs and supports up to 35 lbs.

Vision 12 Systems

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

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

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

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

The ultimate in lightweight and innovative tripods, they are available with durable tubular alloy (Model #3513) or the stronger and lighter, axially & spirally wound carbon fiber construction (Model #3523). They incorporate torque safe clamps to provide fast, safe & self-adjusting leg clamps.
- "Torque Safe" requires no adjustment. Its unique design adjusts itself when required, eliminating manual adjustment and maintenance and making for a much more reliable clamping system.
- New hip joint eliminates play and adds rigidity.
- They both feature 100mm levelling bowl, fold down to a compact 28" and support 45 lbs.
- #3513 weighs 6.5 lbs - #3523 CF (Carbon Fibre) weighs 5.2 lbs.

VIN-5ST and VIN-10ST

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

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

anton bauer

QUICK DIAL 74

DIGITAL Gold Mount Batteries

Acknowledged to be the most advanced battery in the industry, the Logic Series DIGITAL batteries deliver the feature most requested by cameramen: a reliable and accurate indication of remaining battery power.

DIGITAL PRO PACS

The ultimate professional video battery and recommended for all applications. The premium heavy duty Digital Pro Pac cell is designed to deliver long life and high performance even under high current loads and adverse conditions. It's size and weight creates perfect shoulder balance with all camcorders.
- **DIGITAL PRO PAC 14 LOGIC SERIES NICAD BATTERY**
  14.4v 60 Watt Hours, 5 1/8 lbs. Run time: 2 hours @ 27 watts, 3 hrs. @ 18 watts
- **DIGITAL PRO PAC 13 LOGIC SERIES NICAD BATTERY**
  13.2v 55 Watt Hours, 4 3/4 lbs. Run time: 2 hours @ 25 watts, 3 hours @ 17 watts

DIGITAL TRIMPAC

Extremely small and light weight, the Digital Trimpac still has more effective energy than two NP style slide-in batteries. High voltage design and Logic Series technology eliminate the problems that cripple conventional 12 volt slide-in type batteries. The professional choice for applications drawing less than 24 watts.
- **DIGITAL TRIMPAC 14 LOGIC SERIES NICAD BATTERY**
  14.4 v 43 Watt Hours, 2 3/4 lbs.
  Run time: 2 hours @ 20 watts, 3 hours @ 13 watts.

QUAD 2702/2401

Four-Position Power/Chargers

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

HyTRON 50 Battery

Weighing a mere 31oz (880 grams) and packing 50 Watt-hours of energy - enough to operate a typical ENG camcorder for two hours, the HyTRON 50 is the most advanced lightweight battery in the industry.
- Made possible by recent advancements in a cell technology originally designed for the mobile computing industry, it incorporates nickel metal hydride cells that provide the highest energy density of any rechargeable cylindrical cell available. High performance is further assured through the integration of Anton/Bauer InterActive digital technology.
- Equipped with an on-board "fuel computer" which monitors energy input and output as well as critical operating characteristics and conditions. This data is communicated to the InterActive charger to ensure safety and optimize reliability.
- In addition, remaining battery capacity information is available by means of an LCD display on each battery and in the viewfinder of the most popular broadcast & professional camcorders.
- Special low voltage limiter prevents potentially damaging overdischarge.

Specifications: 14.4 V, 50 WH (Watt Hours)
5-3/4" x 3-1/2" x 2-1/4", 1.9 lbs (88kg)
Typical runtime: 2 hours @ 25 Watts, 3 hours @ 17 Watts

Dual 2702/2401

Two-Position Power/Chargers

The DUAL 2701 (70 watt) and 2401 (40 watt) are sleek, rugged, economical two position Power/Chargers that have all the features of InterActive 2000 technology including DC camera output and LCD display. The DUAL 2701 will charge any Gold Mount battery in one hour, the DUAL 2401 charges ProPac batteries in two hours and Trimpacs in one. Compact, lightweight design makes them the ideal for travel. They can also be upgraded with the Diagnostic/Discharge Module and/or with Expansion Modules to charge up to 6 batteries of any type.

PROFESSIONAL VIDEO TAPES

QUICK DIAL 71

FUJI

Professional Grade VHS

PG-30	2.39	PG-60	2.59	PG-120	2.7

Broadcast Grade VHS Box

BGR-30	3.59	BGR-60	4.29	BGR-120	4.9

H471S S-VHS Double Coated

ST-30	6.99	ST-60	7.49	ST-120	7.9

M221 Hi 8 Double Coated

Metal Particles				Metal Evaporated	
P630HMP	4.99			E630HME	8.3
P660HMP	6.49			E660HME	10.4
P6120HMP	8.49			E6120HME	13.9

M321SP Metal Betacam (Box)

05S	17.95	10S	18.49	20S	19.9
30S	22.95	60L	31.95	90L	49.9

DP121 DVC PRO

12M (Med.)	8.29	23M	9.79	33M	12.9
63M	22.49	64L (Lg.)	23.99	94L	33.9
123L					43.9

maxell

Hi8 Metal Particle (XRM)

P6-120 XRM					6.5

Broadcast Quality Hi8 Metal Particle

P6-30 HM BQ	5.39	P6-60 HM BQ			6.0
P6-120 HM BQ					7.9

P/I PLUS VHS

T-30 Plus	1.69	T-60 Plus	1.99	T-90 Plus	2.0
T-120 Plus		2.19	T-160 Plus		2.6

HGX-PLUS VHS (Box)

HGXT-60 Plus		2.69	HGXT-120 Plus		2.9
HGXT-160 Plus					3.9

BQ Broadcast Quality VHS (Box)

T-30 BQ	5.49	T-60 BQ	6.19	T-120 BQ	6.9

BQ Professional S-VHS (In Box)

ST-31 BQ		7.19	ST-62 BQ		7.9
ST-126 BQ		7.99	ST-182 BQ		16.9

Betacam SP

B5MSP	15.75	B10MSP	17.75	B20MSP	19.7
B30MSP	16.99	B60MLSP	27.99	B90MLSP	39.9

Panasonic

Mini DV Tape

AY-DVM-30	9.99	AY-DVM-60			11.9

DVCPRO

AJ-P12M (Medium)	8.49	AJ-P23M			9.9
AJ-P33M	13.49	AJ-P63M			22.9
AJ-P64L (Large)	24.99	AJ-P94L			34.9
AJ-P123L					44.9

SONY

Hi-8 Professional Metal Video Cassettes

P6-30 HMPX	4.59	P6-30 HMEX			7.9
P6-60 HMPX	6.59	P6-60 HMEX			11.4
P6-120HMPX	8.89	P6-120HMEX			15.4

PR Series Professional Grade VHS

T-30PR	2.39	T-60PR	2.59	T-120PR	2.7

PM Series Premier Grade Professional VHS

T-30PM	3.49	T-60PM	3.99	T-120PM	4.7

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

T-30BA	3.59	T-60BA	3.99	T-120BA	4.7

MQ Master Quality S-VHS (In Box)

MQST-30		7.49	MQST-60		7.9
MQST-120					8.3

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

KCS-10 BRS (mini)	8.29	KCS-20 BRS (mini)			8.9
KCA-10 BRS	8.19	KCA-20 BRS			8.6
KCA-30 BRS	9.69	KCA-60 BRS			13.3

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

KCS-10 XBR (mini)	8.79	KCS-20 XBR (mini)			10.1
KCA-10 XBR	9.29	KCA-20 XBR			10.6
KCA-30 XBR	11.99	KCA-60 XBR			15.6

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

KSP-S10 (mini)	9.59	KSP-S20 (mini)			11.0
KSP-10	10.09	KSP-20			11.5
KSP-30	12.99	KSP-60			16.9

BCT Metal Betacam SP Broadcast Master (Box)

BCT-5M (small)	12.29	BCT-10M (small)			13.2
BCT-20M (small)	13.99	BCT-30M (small)			14.9
BCT-30ML	21.49	BCT-60ML			23.4
BCT-90ML					34.9

Mini DV Tape

DVM-30EXM w/Chip	15.99	DVM-60EXM w/Chip			19.9
DVM-30EX "No Chip"	12.99	DVM-60EX "No Chip"			14.9
DVM-30PR "No Chip"	9.99	DVM-60PR "No Chip"			12.9

Full Size DV Tape with Memory Chip

DV-120MEM	26.95	DV-180MEM			34.9

PDV Series Professional DVCAM Tape

PDVM-12ME (Mini)	19.50	PDVM-22ME (Mini)			22.9
PDVM-32ME (Mini)	24.95	PDVM-40ME (Mini)			26.9
PDV-64ME (Standard)	34.95	PDV-94ME (Standard)			36.9
PDV-124ME (Standard)	39.95	PDV-184ME (Standard)			49.9
PDVN-64N	27.50	PDVN-124N	34.95	PDVN-184N	43.9

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NewTek

Calibar 3-Oz. Pocket-Sized Test Generator

The size of a ball point pen and running on a single battery, Calibar is an NTSC test signal generator that packs a rack mount's worth of test equipment into a battery operated instrument. Calibar is the fastest, easiest and most portable way ever to calibrate video equipment. No patch bay racks. Just one cable. So besides giving you fast, accurate readings in the studio, it's perfect for off-site events or trouble-shooting in the field.

- Designed for studio and field operation, it produces 24 test pattern functions at the touch of a button. 10-bit precision digital-to-analog conversion assures highly accurate signals.
- Calibar's combination of low cost, portability and full-featured operation makes it ideal for broadcast engineers, television production facilities and video post houses.
- Tuck Calibar in your pocket and you're ready to go. Touch the button to generate SMPTE color bars, touch it again to calibrate convergence and so on.
- With the supplied AC adapter, it also functions as a black burst generator.

CHYRON PC-CODI & PC Scribe

Text and Graphics Generator and Video Titling Software

PC-CODI incorporates a broadcast quality encoder and a wide bandwidth linear keyer for the highest quality, realtime video character generation and graphics display. A video graphics software engine running under Windows 95/NT. PC Scribe offers a new approach and cost effective solution for composing titles and graphics that is ideal for video production and display applications. Combined, them a total solution for realtime character generation with the quality you expect from Chyron.

PC-CODI Hardware:

- Fully-antialiased displays • Display and non-display buffers
- Less than 10 nanosecond effective pixel resolution
- 16.7 million color selections • Fast, realtime operations
- Character, Logo and PCX image transparency
- Variable edges, border, drop shadow and offset
- Full position and justify control of character and row
- User definable intercharacter spacing (squeeze & expand)
- Multiple roll/crawl speeds • Automatic character kerning
- User definable tab/template fields
- Shaded backgrounds of variable sizes and transparency
- Software controlled video timing
- User definable read effects playback: wipes, pushes, fades
- NTSC or PAL sync generator with genlock
- Board addressability for multi-channel applications
- Auto display sequencing • Local message/page memory
- Preview output with safe-title/cursor/menu overlay
- Composite and S-video input with auto-genlock select

PC-Scribe Software:

- Number of fonts is virtually unlimited. Also supports most international language character sets. Fonts load instantly and the level of anti-aliasing applied is selectable.
- Adjust a wide range of character attributes. Wide choice of composition tools.
- Characters, words, rows and fields can color flash.
- Character rolls, crawls and reveal modes. Speed is selectable and can be auto timed with pauses. Messages can be manually advanced or put into sequences along with page transitions.
- Multiple preview windows can be displayed simultaneously.
- Transitions effects include: cut, fade, push, wipe, reveal, peel, zoom, matrix, wipe, spiral, split, weave and jitter.
- Import elements to build graphics. This includes DLE objects, iNFiNiT! RGBA and TGA with alpha channel. Scribe also imports and exports TIFF, JPEG, PCX, TGA, BMP, GIF, CLP, ASCII, IMG, SGI, PICT and EPS formats.

PC-CODI and PC-Scribe Bundle.....2995.00

TRUEVISION / AVID

TARGA 1000/MCXpress NT

Professional Video Production Workstation

Incorporating the award-winning TARGA 1000 video card and Avid MCXpress NT non-linear editing software, this fully-configured workstation meets the needs of production professionals, corporate communicators, educators and Internet authors.

TARGA 1000 Features:

The TARGA 1000 delivers high processing speed for video and audio effects, titling and compositing. Capture, edit and playback full motion, full-resolution 60 fields per second digital video with fully synchronized CD-quality audio.

- Compression can be adjusted on the fly to optimize for image quality and/or minimum storage space. Has composite and S-video inputs/outputs. Also available with component input/output (TARGA 1000 PRO).
- Genlock using separate sync input for working in professional video suites.
- Audio is digitized at 44.1KHz or 48KHz sampling rates, for professional quality stereo sound. Delivers perfectly synchronized audio and video.

MCXpress Features:

The ideal tool for video and multimedia producers who require predictable project throughput and high-quality results when creating video and digital media for training, promotional/marketing material, local television and cable commercials, CD-ROM and Internet/intranet distribution. Based on Avid's industry-leading technology, it combines a robust editing functionality with a streamlined interface. Offers integration with third-party Windows applications, professional editing features, powerful media management, title tool and a plug-in effects architecture. It also features multiple output options including so you save time and money by reusing media assets across a range of video and multimedia projects.

TARGA 1000/MCXpress Turnkey Systems:

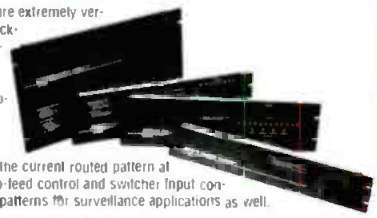
- 300-Watt, 6-Bay Full Tower ATX Chassis
- Pentium ATX Motherboard with 512K Cache
- Pentium II- 300 MHz Processor
- Matrox Millenium II AGP 4MB WRAM Display Card
- 64MB 10ns 168-Pin (DIMM) S-DRAM
- Quantum Fireball 6.4GB IDE System Drive
- Seagate Barracuda External 9.1GB SCSI-3 Ultra Wide Capture Drive
- Adaptec AHA-2940UW Ultra Wide SCSI-3 Controller Card
- Teac CD-532e 32X EIDE Internal CD-ROM Drive • 3.5" Floppy Drive
- Altec-Lansing ACS-48 3-Piece Deluxe Speaker System
- Viewsonic G771 17-inch (1280 x 1024) Monitor (0.27mm dot pitch)
- Focus 2001A Keyboard • Microsoft MS Mouse
- Windows NT 4.0 Operating System Software
- Avid MCXpress for Windows NT
- Truevision TARGA 1000 or 1000 Pro Video Capture Card

With TARGA 1000.....$5995.00
With TARGA 1000 Pro (component input/output).....$6495.00

KNOX VIDEO

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

Video/Audio Matrix Routing Switchers



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

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

LEADER

Manufacturing test and measurement equipment for over 40 years, Leader Instruments is the standard which others are measured against for reliability, performance, and most important—cost effectiveness.

5860C WAVEFORM MONITOR

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

5850C VECTORSCOPE

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

5100 4-Channel Component / Composite WAVEFORM

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

5100D Digital Waveform/Vectorscope

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

5870 Waveform/Vectorscope w/SCH and Line Select

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

5872A Combination Waveform/Vectorscope

All the operating advantages of the 5870, except SCH is deleted (line select retained), making it ideal for satellite work.

5864A Waveform Monitor

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

5854 Vectorscope

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

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

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Classifieds

Help Wanted

HEAD-END TECHNICIAN

Time Warner Communications, a rapidly expanding leader in the high tech telecommunications industry, is looking for an individual with excellent analytical and troubleshooting abilities to maintain the technical operations of the Memphis Division signal processing centers, studios, and commercial insertion systems. Responsibilities include evaluating new equipment, installing, repairing, calibrating, and adjusting all process and signal source equipment.

Qualified individuals will have a 2 year electronics degree or related experience, a thorough knowledge of RF communications, and 1 year experience in an audio/video production facility, television station, cable television system or equivalent. The candidate will also need an understanding of UNIX (SCO system 5), Windows NT, IBM OS/2, and DOS computer environments.

We offer a comprehensive compensation and benefits package including medical, dental, vision, and life insurance; pension and employee savings plans; and paid holiday and vacations. Candidates should mail or fax your resume to:

TIME WARNER COMMUNICATIONS

Time Warner Communications
6555 Quince Road, Suite 400
Attn: Human Resources - JB
Memphis, TN 38119
Fax: (901) 369-4515
EOE M/F/D/V

MAINTENANCE TECHNICIAN

NBC affiliate has an excellent opportunity for a team oriented, hands on broadcast technician. The candidate must have experience in component level maintenance on all broadcast video and audio equipment. Full time 4 day work week. Send resume to Ken High, KAMR-TV, P.O. Box 751, Amarillo, TX 79189 or e-mail resume to khigh@kamr.com. Females and minorities are encouraged to apply. EOE

WTNZ FOX 43 IN KNOXVILLE, TN, a Raycom Media station, has immediate opening for Assistant Chief Engineer. Seasoned TV Engineer with 5 years maintenance experience and a good working knowledge of UHF television transmitters. Must possess above average computer, technical and people skills and be able to work in an "on call" status. Send resume and salary requirements to: Human Resources, 9000 Executive Park Drive, Suite 300, Knoxville, TN. 37923. Or fax to (423) 691-6904. EEO

Post a job opening and promote your company!
Advertise in Broadcast Engineering's Help Wanted section!

CHIEF ENGINEER

Experienced with transmitters, microwave, computers, analog and digital. A leader, manager, team player and motivator to take us into the digital future. Send resume to General Manager, KULR-8 Television, 2045 Overland Ave., Billings, MT 59102. EOE, confidential.

WETA

MAINTENANCE TECHNICIAN

Digital television broadcasting has arrived at WETA TV26/FM90.9, Arlington, VA (Washington, D.C.). Motivated, experienced Maintenance Technician is needed for WETA's DTV team to perform technical maintenance on television production and broadcast operations equipment. Requirements: AS degree in electronics or equivalent experience, SBE Certification (television) a plus, solid knowledge of television standards and practices, related computer hardware/software experience. Working knowledge of digital television systems and RF highly desired. Send cover letter, resume, and salary requirements to WETA, Human Resources, P.O. Box 2626, Washington, DC 20013, or fax to 703/998-2034. Visit our website: **http://www.weta.org**, for more information. EOE/D/M/F/V.

Use the Reader Service Card.

IMMEDIATE OPENINGS WDAY-TV has two full-time openings for broadcast engineers. One position is for the operation of ENG and SNV vehicles, master control operations and limited technical electronic repair work. One position is to be on the technical electronic repair staff which requires experience in this field. Both positions require a good driving record, minimum of a two year degree or experience, and strong knowledge of computers. Send resume to: Tom Thompson, Chief Engineer WDAY-TV P.O. Box 2466 Fargo, North Dakota 58108 or fax to: Tom Thompson at (701) 241-5368 EOE

MAINTENANCE ENGINEER POSITION San Jose, Ca. ABC affiliate is currently seeking a Studio / ENG News Equipment Maintenance Engineer. Qualified candidates must have experience installing and maintaining both digital and analog video / audio broadcast studio equipment. Component level trouble analysis and repair of equipment problems will be required. Experience with Newsroom computer systems and general Ethernet networks will be a plus. This job location will mainly be at our San Jose facility and require both night and weekend shift work. A degree or equivalent experience and FCC / SBE certification is preferred. KNTV is a Granite Broadcasting Station, with an excellent benefit package and opportunity for advancement. Send your resume, cover letter and references to the Personnel Department, KNTV, 645 Park Ave., San Jose, CA. 95110. KNTV is an EOE Employer.

MAINTENANCE ENGINEER Immediate opening for a person with 2 years of technical training, military electronics training or 3 years experience in TV broadcast repair. Must be SBE certified or be able to obtain certification. Send resume: Human Resources, WSAW-TV, 1114 Grand Ave., Wausau, WI 54403. E.O.E.

BROADCAST ENGINEER - WB18 WKCF-TV Orlando, Florida, is seeking a qualified individual with a minimum of 3-5 years experience in the installation, maintenance, and repair of television broadcast equipment. Applicants must have working knowledge of digital and analog video/audio systems, PC operation and troubleshooting, and UHF transmitters. Familiarity with Tektronix Profile, Scitex StrataSphere, and Automation Systems a plus. SBE certification required. EOE. We invite you to submit your resume to HR/BE, 31 Skyline Drive, Lake Mary, FL 32746 or Fax to 407/647-4163. No phone calls, please!

TELX, THE PRODUCTION ARM of The Indianapolis Motor Speedway is looking for a qualified KU Operator and a Maintenance Engineer for our Mobile production facility. Travel will be required. Call Ken Gardner at 317 481 0060

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EOM

Another shot at (commercial) interactive television

BY PAUL MCGOLDRICK

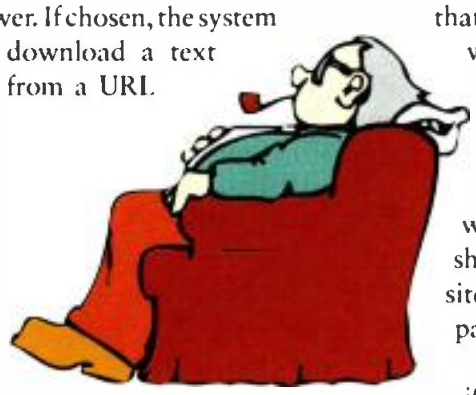
Don't you just hate it when you get outfoxed by the guys in Washington State and Santa Clara? When all the fuss started some months ago over Internet transmissions in Line 21, I mused about the market size for such a slow delivery system for one-way web activity; well, that isn't what it was about at all. Yes, folks, it's another attempt to make that belly-flop of an idea — interactive television — get a repeat appearance in our world. Or is it that simple?

At the end of July, another of those world-famous *cross-industry groups*, usually a euphemism for Wintel++, came out of the back closet to make a statement about what they would like us to watch and how they are going to do it. For $2,500, you can join them (yes, they take credit cards or you can send your check to an Intel address) — "they" being CableLabs, CNN, DirecTV, Discovery, Disney, Intel, Microsoft/WebTV, NBC Multimedia, Network Computer, NDTC Technology, PBS, Sony, Tribune and Warner Bros.

Quoting the statement: "The group called the Advanced Television Enhancement Forum (ATVEF) has defined protocols for TV programming enhanced with data, such as Internet content. The goal is to allow content creators to design enhanced programming that may be delivered over any form of transport (analog or digital TV, cable, or satellite) to all types of broadcast receivers that comply with the proposed specification."

What does all that mean? The technology is straightforward, and uses a modified HTTP called UHTTP (unidirectional hypertext transport protocol), with content transmitted as a multicast. Apparently, the notions promulgated around NAB concerning this being a personal Internet delivery system were a camouflage. It appears the "personal Internet delivery system" is not being offered as a choice. If stations decide to transmit this interactive data, there is no space left for any personal transmissions. That apparent deception — which some of us bought with reservations — makes me uncomfortable about buying into this new story.

Digging deeper makes me inherently suspicious about the direction this is taking. The actual appearance of data is triggered. The triggers are real-time events broadcast inside the IP multicast packets. Triggers could be used to flash the availability of enhanced content to the viewer. If chosen, the system would download a text header from a URL



— "Find Out More!" — and if the viewer accepts that, a full script would appear. Of course, the interactive idea behind this is kind of one way — you can only accept the information offered or reject it.

Offerings could be analyses of scores in the game being watched or more information on the guy who just appeared in your favorite soap. Some of these might even be useful, such as an alerting teletext system with the information coming in today's format from various Internet locations.

Why cringe at such features?

What am I afraid of? These are laudable organizations involved in the project, as are the dozen or so who have indicated they will also join the party, including National Geographic and The Weather Channel. None of these organizations would be doing this for anything but educational/entertainment reasons, right? I would certainly hope not, especially from PBS, although I get concerned when PBS spends money on things like this during the development stage.

In those oft-repeated words from *Star Wars*, "I've got a bad feeling about this." I would hazard that the vast majority of these enhanced data announcements are going to be purely commercial. The idea that we'll be forced to react to avoid a sales pitch scares me. For example, what if I buy a receiver that is ATVEF-ready, and there is no way to turn off the announcements. I will be forced to reach for the remote to say no to the announcements. Those of us who already do that regularly with cookies understand the hardship; and one of the worst web sites for cookies is one of these participants, good old Disney.

Why am I suspicious? The specification on triggers includes the wonderful statement, "Receiver implementations will set their own policy for allowing users to turn on and off enhanced TV content." And the statement from the group says, "Enhanced television offers new entertainment and commerce opportunities, such as . . . ads that allow consumers to order merchandise with the click of a button."

The first specification is expected to be cast in stone by the end of the year with appliances being built soon after. Next year, work will start on an improved version, probably going beyond text. If you want to look at the draft specifications go to www.atvef.com. You can also find the address to send Intel a much needed $2,500 — surprise, surprise. ■

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

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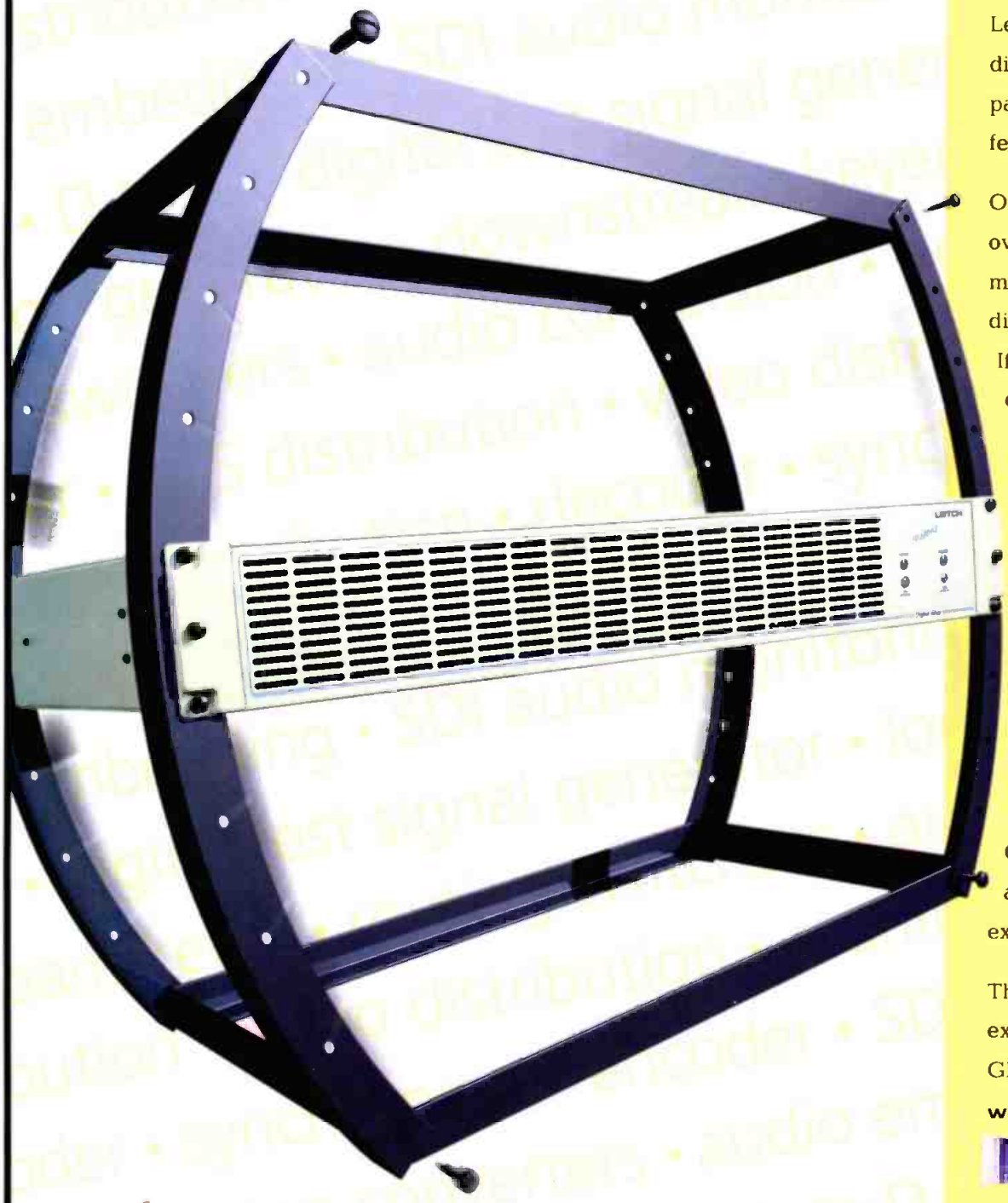

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