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NOVEMBER 1999

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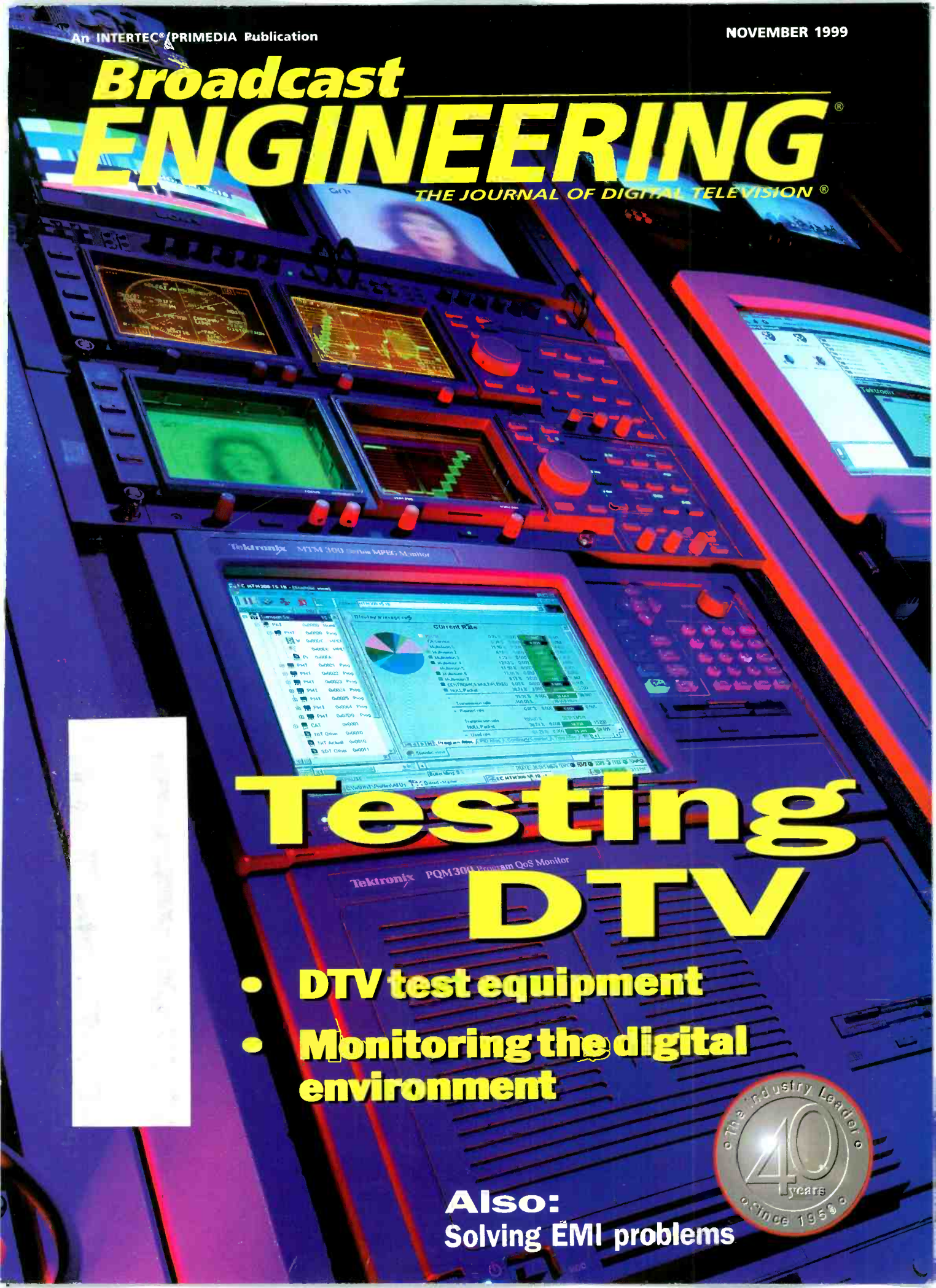

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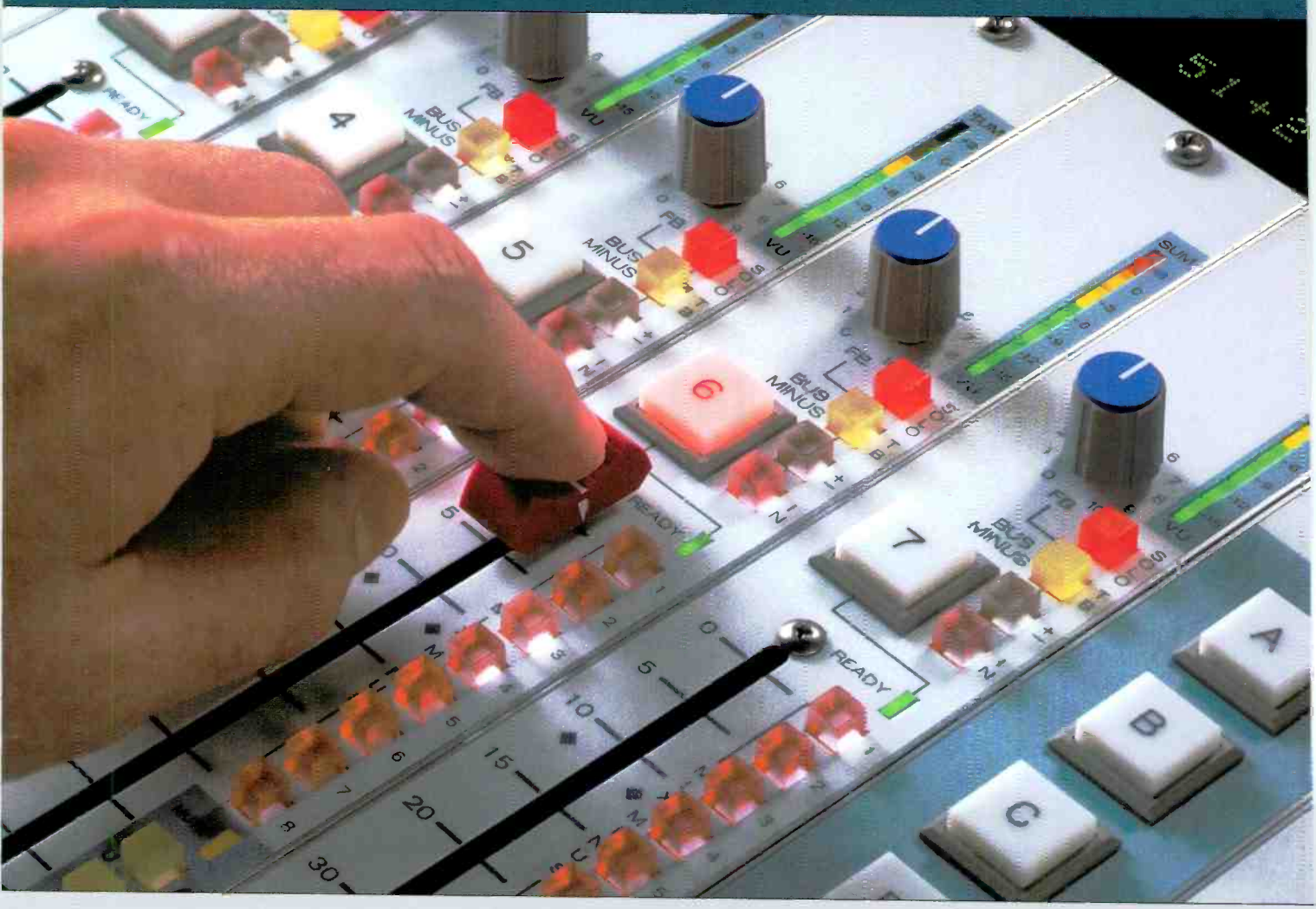

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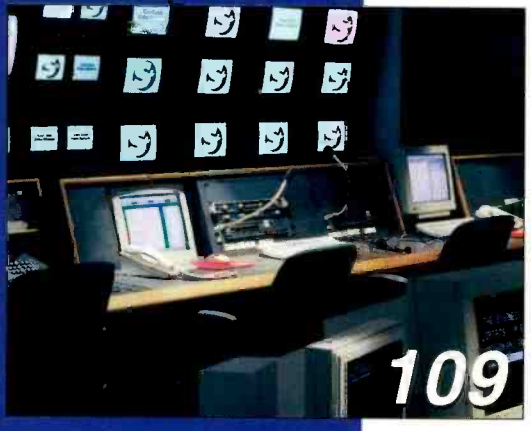

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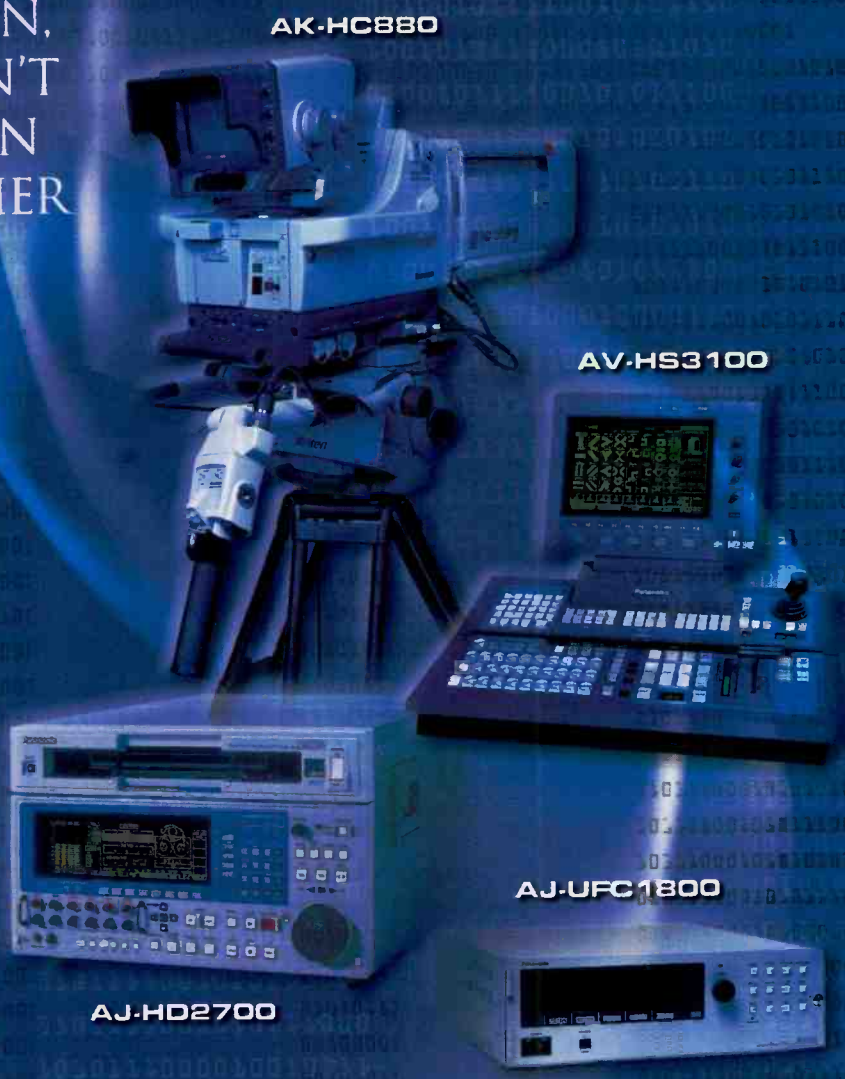

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ON THE COVER: *Ensuring the quality of transmitted digital video requires new tools such as program quality of service monitors and MPEG protocol monitors. Photo courtesy of Tektronix.*

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Questions? Contact:
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jim_saladin@intertec.com
913/967-1905 fax

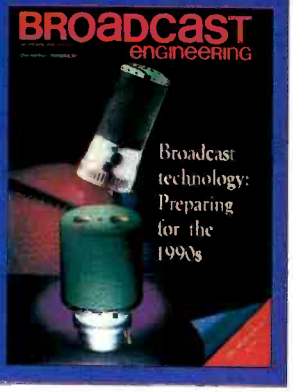
FREEZE FRAME

A look at the technology that shaped this industry.

Do you remember?

In December, 1989, *Broadcast Engineering* interviewed ATSC's (then chairman) Jim McKinney and Atlantic Bell's CEO, Ray Smith. What key technology did both men say was crucial to the future of television? And, which of today's widely popular technology was not mentioned as being an important development?

Send your answer to brad_dick@intertec.com. Selected correct entries will receive a Broadcast Engineering T-shirt. Previous winners not eligible.



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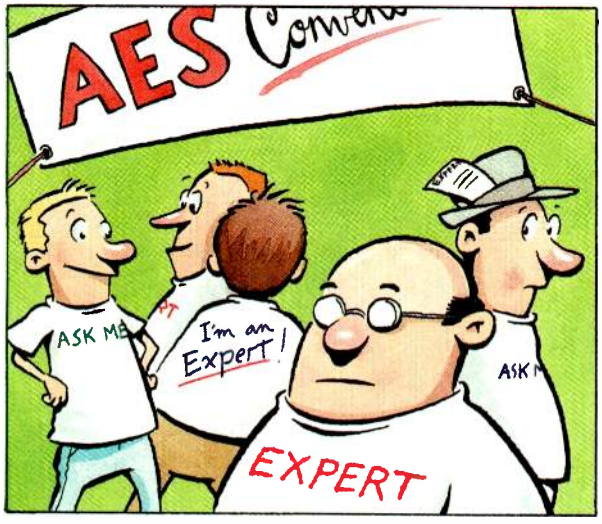
Editorial

Everyone's an expert

I run across as many experts as anyone. I travel to several conventions and seminars, and I'm fortunate enough to see lots of manufacturing sites. On these trips, I get to talk to the people who invent much of the equipment *Broadcast Engineering's* readers use every day. From cameras to transmitters, I can name some really knowledgeable people. However, nothing in all my trips compares to the number of experts I find at AES.

The AES convention should change its name to "The Experts Show" because I've never found so many experts in one place. There must be enough total knowledge gathered together at AES to invent anything. In fact, I'd almost bet this crowd did invent everything. And it's not just audio. Golden Ears consider themselves experts on everything from DC to light. It doesn't matter what the topic is, they're experts. Just ask them.



This year, I decided to just spend some time just listening to conversations, trying to learn as much as possible. Here is some of what I learned at this year's AES convention.

It began on Saturday morning, the second day of the show, when I was riding the shuttle bus from my hotel to the convention center. There were two guys sitting across the aisle from me discussing the new 96kHz sampling standard for audio recording.

I've been to 96kHz demos and, frankly, I can't hear the difference. Of course, once you pass your 40th birthday, you're deaf anyway, according to some. Anyway, the claim is that with double (or even 192kHz) sampling, audio has much higher fidelity. The result is a more lifelike and transparent experience for the listener. Thesound is crystal clear ... blah ... blah ... blah. You get the idea.

Anyway, these two guys on the bus were bantering about the benefits of 96kHz sampling. "You don't understand," said one. "With 96Khz sampling, air modules are affected differently than with 48kHz. The transmission of audio is simply different with 96kHz. The whole physics of audio transmission changes with 96kHz."

The other guy, not to be outdone, responded, "Yeah, I know. When I heard 96kHz for the first time, it was like, you know, a whole new experience. I could actually feel the difference."

On Monday, I heard a guy say the difference between listening to 48kHz-sampled CDs and 96kHz-sampled audio was similar to the difference between a 78rpm record and surround sound.

But the know-it-alls weren't limited to attendees. We're all familiar with the stories of how people can hear the differences in wire. Well, how about hearing the differences based on RLT? Never heard of RLT?

At a convention, one company claimed to be demonstrating new products with the latest technology called RLT. Not to be outdone, a competitor claimed they had pushed the technology limits even further by providing three new technologies: RLT, GLT and YLT in their products.

In case you haven't figured out, RLT, GLT and YLT mean red LED technology, green LED technology and yellow LED technology. I know you think I'm kidding, but I'm not.

Next time you need an expert just attend the AES.

Brad Dick

Brad Dick, editor

Send comments to:
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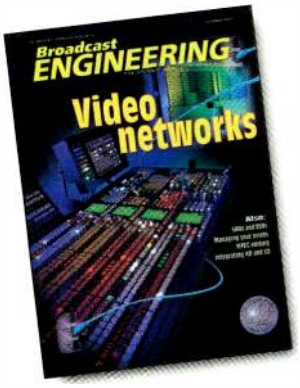

Dear Editor,

In this age of computers and advanced technology, why not allow online requests for the Broadcast Engineering magazine? This would save paper, postage, etc. and make it easier for the consumer to order.

Thanks!

FRANK DANIELS
ASSISTANT CHIEF ENGINEER
KRGV-TV
WESLACO, TX

Frank,

We maintain an excellent website with a wide variety of reader resources at www.broadcastengineering.com. The entire month's issue is online by the time you receive your printed copy. Last year's features and selected columns are available in the archive section.

As for just doing an online version, it's probably not in the near future. Most readers still prefer the advantages of a magazine, especially when it's coupled with a good Web version. Besides, you'd miss all those great colorful ads.

BRAD DICK
EDITOR

If cable leaks — it's free!

Paul McGoldrick's September column on being able to receive "free" cable stirred a lot of interest. Paul responds to readers' comments.

Are you sure it's illegal? Doesn't the Electronic Communications Privacy Act specifically exclude signals on broadcast frequencies? Now it would certainly be illegal to sabotage the cable system to obtain this reception, or to run an unauthorized cable to the CATV company's splitter, etc. But if the cable system is operating 12 pirate TV stations (which is essentially what they're doing by permitting leaks of this strength to exist), I sure don't think there's anything legally — or morally — wrong with watching them.

Of course, it's not a good idea to depend on cable leaks for reliable viewing. I would certainly say you're right to want the problem resolved. What I might suggest is a tongue-in-cheek letter to the cable company thanking them for the free service. At the end of the letter, to be sure they get the point, remind them a copy of your letter is going to the FCC Compliance and Information Bureau.

DOUG SMITH
NASHVILLE, TN

Paul McGoldrick responds:

Doug:

You were the first, but not the only, reader to suggest that receiving leaked signals was not in violation of the relevant Acts. I like your notion that the cable company is pirating the bands and that is obviously where the FCC compliance boys fit in.

But as a devil's advocate, are all the cable TV transmissions on "broadcast frequencies"? If it is defined by a spectrum then they are; if it is defined by channel allocations then they are not. That's an interesting question for a broadcast attorney.

Another reader writes:

Paul:

It is NOT stealing cable if the signal leaks so badly that you can pick it up with a TV antenna and watch it! You have a blessing — enjoy it and do not call the FCC about it! I would do the same thing. If the signal is not scrambled and leaks on to your property it is not stealing to get it! As for your DSS dish and "the network problem," do you have a country cousin or aunt? Use their address for your bill and they will turn your nets on or get DishNetwork and order your locals from Dish.

MORGAN PARK

Paul responds:

Morgan:

I have to say that you may be right. The couch-potato lawyer in me, however, says that because those cable transmissions don't fall slap on broadcast channels (which I am allowed to receive) I am breaking another law by receiving off-air signals on unlicensed bands.

I don't like their signals anyway, so I still want them to stop it!

Freezeframe winners

Not many readers knew the answer to September's Freezeframe question: In what year and month did former BE editor Jerry Whitaker make this forecast: "By 1999 ATV will be transmitted by a majority of TV stations in the U.S. ATV will carry over-the-air television through the year 2000, when fiber-optic delivery of 'real' HDTV will begin." The following received the new *Broadcast Engineering* "digital" T-shirt for the correct answer, which was May 1989. Maybe I should have asked when HDTV over Internet2 began.

September T-shirt winners:

Tom Anderson

Don Norwood
Digitrak Communications Inc.
Hickory, NC

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News

Sinclair Broadcasting files FCC petition

BY LARRY BLOOMFIELD

After months of comparative testing between 8VSB and COFDM, Baltimore-based Sinclair Broadcasting has petitioned the FCC to allow broadcasters to use COFDM, a modulation scheme it claims is superior to the ATSC standard.

Sinclair's decision to file the petition came after conducting a series of digital television reception tests at several dozen sites in and around metropolitan Baltimore over the past several months. During the tests, Sinclair invited engineers from other broadcasting groups to observe the proceedings.

Nat Ostroff, vice president of new technology at Sinclair, has remained skeptical of the 8VSB technology. "We became concerned that the ATSC 8VSB standard could not replicate the same ease of reception as provided under the current NTSC standard, particularly as it relates to areas within urban environments," he said.

Ostroff said the purpose of conducting the tests was to raise the visibility of this potentially major obstacle to the DTV rollout. The tests, which were conducted within Baltimore's Grade A and Grade B contours, used existing consumer indoor antennas. The Sinclair tests demonstrated that 8VSB failed consistently where complex multipath existed, while COFDM provided a reliable picture, even at the fringes of coverage.

We cannot stand idly by knowing that the designated digital transmission standard, 8VSB, cannot easily be received based on currently available receiver technology. — Sinclair Broadcasting President David Smith

Sinclair's petition asks the FCC to permit COFDM because it claims it is a more robust and more reliable modulation scheme and allows for digital television to be more easily received. Citing this as a requirement for consumer acceptance of DTV, Sinclair feels COFDM is necessary for the successful rollout of digital television.

"We believe that filing this petition is the right thing to do for the public, the broadcasting industry and Sinclair," Sinclair president David Smith said. "We cannot stand idly by knowing that the designated digital transmission standard, 8VSB, cannot easily be received based on currently available receiver technology."

Sinclair's television group represents 59 stations in 38 markets and reaches approximately 24.4 percent of U.S. television households and includes ABC, CBS, FOX, NBC, WB, and UPN affiliates. In addition to Sinclair, 250 other television stations, representing 16 other broadcasting groups, are also signatories to the FCC petition. Sinclair and other signatories represent approximately 18 percent of the television stations in the U.S.

Paxson Communications, representing 100 broadcast stations, was among the latest broadcast groups to offer its support for the Sinclair effort. "With COFDM, broadcasters can overcome the complex multipath conditions, which hamper DTV reception under the 8VSB standard," Pax TV president Dean Goodman said.

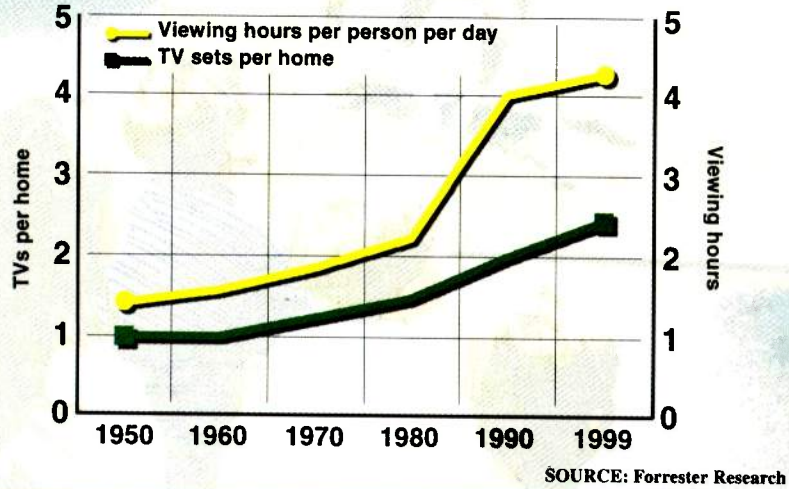
Sinclair had delayed filing its peti-

FRAME GRAB

A look at the issues driving today's technology

TV's and viewing continue to grow

TVs per home and viewing hours per person per day



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(09-04-98)cs

tion after two receiver chip manufacturers, NxtWave and Motorola, announced they had developed chips that solved multipath problems. Sinclair now believes those claims are overly optimistic.

"No consumer electronics manufacturer has proven that it has the technology to address the multipath issues," Smith said. "The benchmark for digital television reception has been raised by the COFDM standard and broadcasters should be allowed to use that technology.

"Based on the Consumer Electronics Manufacturing Association (CEMA) model for 8VSB reception," Smith said, "it is estimated that the additional cost to the consumer for an outdoor antenna and rotor to receive 8VSB vs. COFDM is approximately $400 per household, representing a $40 billion tax on the American television viewing public."

In response, CEMA requested that the FCC dismiss Sinclair's petition because many of the concerns raised in the petition have been addressed and second generation receiver technology improves reception. The consumer electronics organization also claims that a change in modulation schemes would derail DTV by causing confusion and additional expense to stations and consumers alike.

"If a technical problem actually existed with the 8VSB standard, CEMA would be in the vanguard petitioning for change," said Michael Petricone, CEMA's director of technology policy. "Our members have every economic incentive to ensure that all Americans can enjoy the benefits of DTV." ■

The FCC weighs in

A few weeks before Sinclair requested both modulation standards be used, the FCC's Office of Engineering and Technology issued a report comparing COFDM and 8VSB in response to Sinclair's modulation tests.

The study recognizes both standards offer "certain advantages and disadvantages" for DTV reception but concludes with the recommendation that the 8VSB standard be retained. Contributing factors to the FCC's decision include 8VSB's higher data rates data rate, spectrum efficiency and transmitter power requirements

"The problems identified by Sinclair are solvable with improved adaptive equalizer performance and that a well-designed 8VSB receiver should be able to provide satisfactory reception at the Sinclair locations," the report states.

The FCC report also states, "The test results indicated that DTV service availability approaches that of NTSC service in most instances and with expected receiver improvements will exceed it in the near future."

The executive summary and full text of the FCC's report can be found at www.fcc.gov.

Group	# of Stations
ACME	10
Bahakel	8
CCA	9
Granite	12
Gray	15
Lambert	3
NexStar	15
Northwest	7
Pappas	12
Paradigm/Quorom/Sullivan	15
Paramount	19
Paxson/DP Media/partners	100
Pegasus	10
Second Generation	2
Sinclair	59
USA	12
White Knight	1
Total	**309**

Table 1. Sinclair's petition was supported by 16 other broadcast groups, representing about 250 television stations.

Motorola introduces DTV module for TV sets, STBs

Motorola has unveiled its new M-DTV module, which is designed to drive either a full-blown digital display monitor capable of HDTV or permit viewers to continue to use their current analog TV set but offer features available to DTV.

The Motorola MCT5100 M-DTV module integrates Motorola's new anti-multipath, 8VSB demodulator, along with their MPEG decoder and controller. This combination is capable of delivering a complete compliment of ATSC DTV formats. In addition to this, the M-DTV module is also designed to increase the precision and clarity of the picture and enhance the audio of the viewer's television set. Although the module is design primarily to be included inside a TV set, VCR and the like, it will most likely be available in the familiar set-top box (STB) format to satisfy a very large, existing market of would-be digital TV viewers.

"Motorola's M-DTV module makes digital television available to consumers, providing higher-quality video and audio at competitive prices that they're willing to pay," said Jeff Davis, vice president of Global Sales and Marketing, Imaging and Entertainment Solutions group for Motorola.

M-DTV accepts analog IF input and features Dolby Digital 5.1 channel audio data output, various video output formats and a serial control port. The viewer will need a separate Dolby decoder to do the 5.1 channel audio bit. They will also need whatever interface device is required to do what they will do with the data port as well.

The idea behind the Motorola's M-DTV module is for manufacturers of televisions, VCRs and set-top boxes to be able to design low-cost alternatives to expensive HDTV sets. Monitors capable of showing a full HD picture in 16:9 aspect ratio may cost from $3000 to $10,000, and STBs that receive DTV broadcasts start at about $700. The M-DTV module was specifically designed to address the cost

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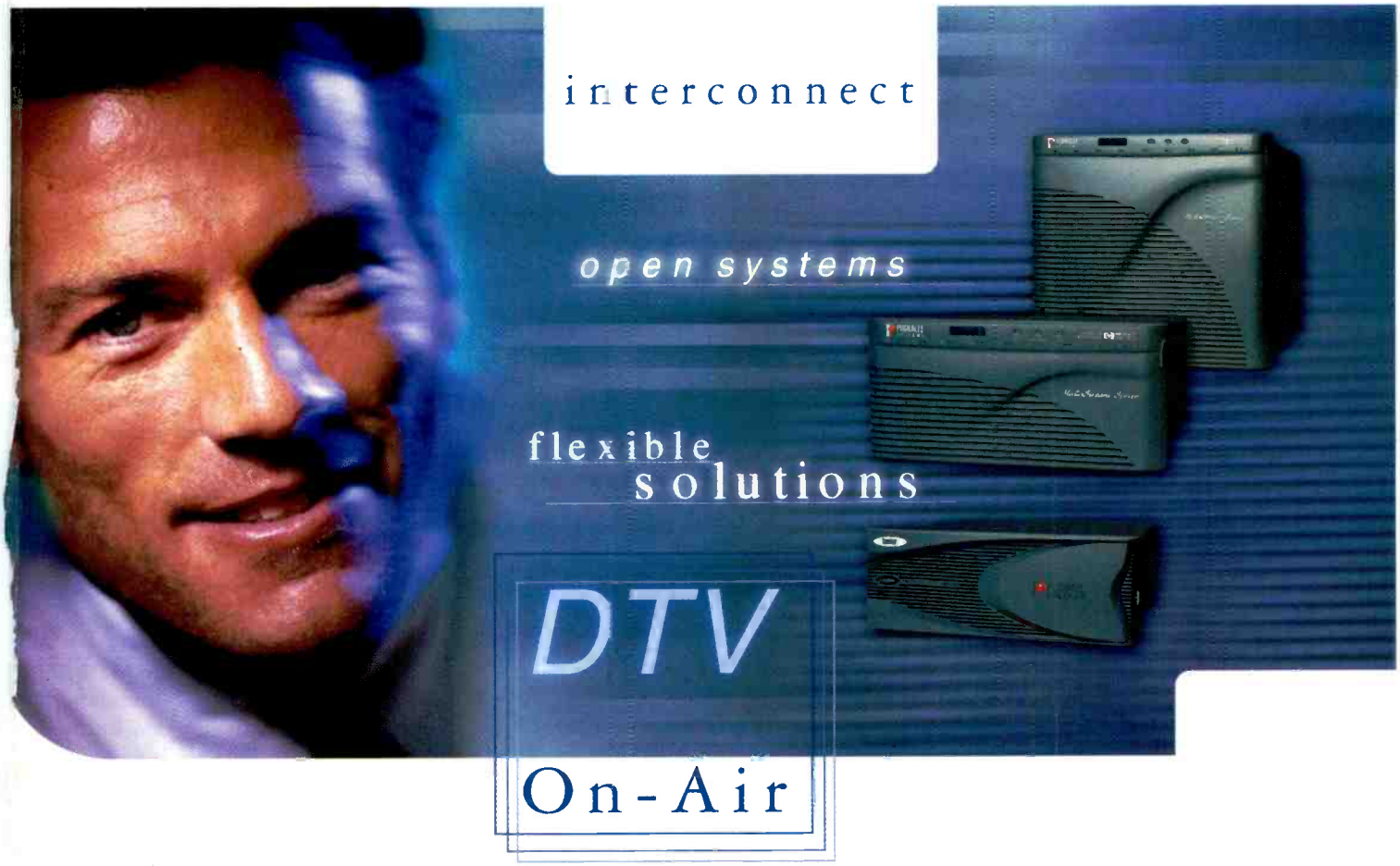

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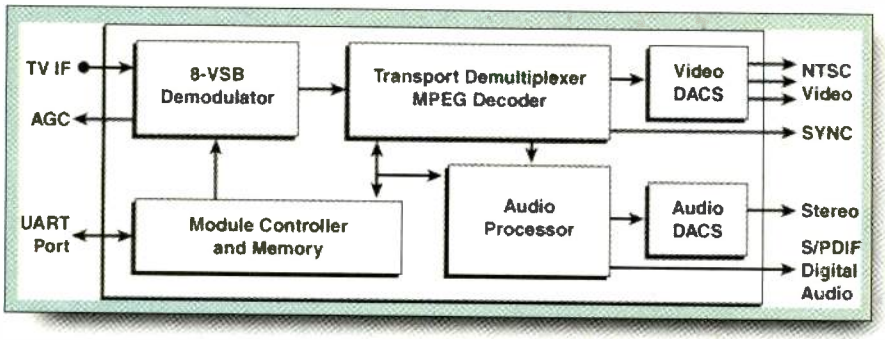

Motorola's MCT1500 module includes Motorola's 8VSB demodulator, and MPEG decoder. The chip, designed to be placed in TV sets and set-top boxes, is also designed to address the price barrier for retail TV sets and STBs.

of the design and production of digital TV sets and STBs and the development effort to bring a new DTV to market. With an initial price tag in the $150 range and expectations of that to come down to below $100 within the first year, that ought to be encouraging news to broadcasters.

Motorola is looking to have these modules available to their OEM partners by the end of the year and, depending on these partners, on the street shortly after the first of the year. ■

CBO, CEMA urge must-carry rules for cable

For broadcasters, the transition to digital has gone less smoothly than predicted. Factors such as construction delays, the current modulation scheme battle and a tepid consumer reception to DTV have slowed digital broadcasting's progress. In a recent report, the Congressional Budget Office (CBO) highlighted yet another DTV stumbling block: the lack of strong must-carry rules for cable.

In its report, titled "Completing the Transition to Digital Television," the CBO determined the DTV transition will continue beyond the 2006 deadline, a time when all TV stations must be broadcasting digital. At that time the analog spectrum is to be auctioned.

Currently, 30 percent of U.S. households receive TV broadcasts terrestrially, but the CBO expects that number to decline steadily through 2006 as more households subscribe to cable or satellite services. An estimated 67 percent receives its television solely through cable services. That number is expected to climb to 70 percent by 2006.

A successful transition to DTV is defined, in part, by its ability to be received by 85 percent of U.S. households by 2006. With the vast majority of households subscribing to cable providers and those providers' reluctance to carry digital programming, the CBO concludes DTV will falter without strong must-carry rules for cable from the FCC.

"Without digital must-carry rules for cable systems during the transition, a move that most cable operators oppose, the likelihood of reaching the 85

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MASTER CONTROL

PROGRAM TRANSPORT

TRANSMISSION

TECHNICAL SUPPORT

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Running digital and analog can be tough. Good thing there's geeks like us.

Making the digital transition would be tough enough if that was the only thing you had on your plate. But it's not. You've also got to keep your primary analog moneymaker up and running - and profitable. If you're not already in the throes of dual station operation, chances are you will be soon. So, if you're starting to wonder how you can possibly keep all these balls in the air at once, it's time to call in the geeks. At Harris, we have the top engineering minds in the business dedicated to developing solutions to help stations survive — and prosper — during this time of change.

Look no further than Harris for a full range of analog and digital solutions. We go beyond transmission to total solutions for systems, design, integration and newsgathering. All backed by our reputation for reliability and service.

Transmission Solutions That Work

You know our reputation for building the best transmitters in the business. That hasn't changed, and our record speaks for itself. Our analog transmitters are a "stationhold" name throughout the industry, and we're leading the charge for DTV, too. We have more DTV transmitter installations under our belt than any of our competitors. Why should you care about all this? Because analog reliability is more important than ever in this dual station environment. And when it comes to getting your DTV signal on the air, our experience and track record are proof that we can deliver a solution for your station. And do it right the first time.

Smart Solutions for Studio Design and System Integration

We've seen it happen too often - stations that are trying to get on the air in a hurry end up with an island of digital within their existing station that quickly becomes inadequate and, in some cases, obsolete. That's why we've taken a forward-looking approach to system design and integration. We can help you meet your current needs with an eye to the future, and we've developed innovative encoding, master control and monitoring solutions to make it possible. Whether you're building a ground-up facility or incorporating DTV into your current plant, we can help you design a system that will grow with you.

Newsgathering Solutions, Too

The news isn't going to stop happening while you're making the transition to DTV. Look to Harris for mobile newsgathering units with up-to-date solutions, including our new **Reporter Tx²** ENG/SNG combination vehicle. Equipped with both microwave and satellite communications systems, this lightweight vehicle offers unlimited coverage area and increased flexibility for small, mid- and larger-sized markets. What's more, we have revamped our entire line of trucks. So, if you haven't considered a Harris-built mobile system lately, give us another look.

Business Solutions for Profitable Transition

Harris offers business solutions to help you manage the transition financially as well as technologically. Ask us about our new financing program designed to help stations make the jump to DTV.

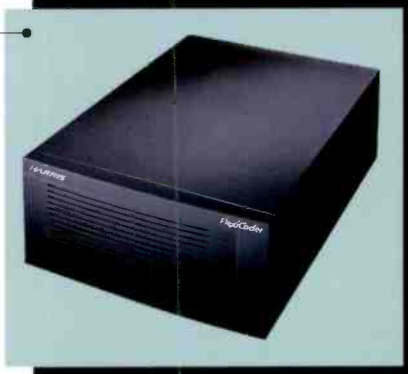
Harris provides total DTV product solutions. Not that the GM needs to know that.

With Harris as your DTV equipment provider, you can relax. As one of DTV's pioneers, we've got hands-on experience in helping many stations get their DTV signal on the air. But there's more to making a successful digital transition than getting a signal out to meet the FCC requirement. To take full advantage of DTV's incredible new capabilities, you need an intelligent, cost effective migration path that includes encoding, master control, PSIP, data insertion, monitoring and audio. That's where our experience comes in. We go beyond transmission to offer you total DTV product solutions that work. Solutions to help you get - and stay - on air. And if you don't want to tell your GM, that's fine with us.

From digital master control to transmission, and nearly everything in between, Harris has the industry's deepest bench of digital television product solutions.

ENCODING PRODUCTS

FlexiCoder™ Encoding Solutions



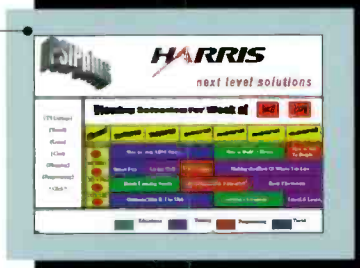
Our family of ATSC MPEG-2 encoding systems includes the cost-effective **UniCoder™ SD** and **HD**, the modular **FlexiCoder™ VS5**, and the top-capacity **FlexiCoder™ VS21**.

These encoding solutions are available in 24 configurations - from basic, single channel standard definition or high definition encoding to fully redundant, multichannel HD encoding. The flexible designs allow for easy plug-in upgrades and expansions. The complete line features next-generation software enhancements including video-enhancing HD compression management, SD Statistical Management, Closed Captioning (CC), PSIP and data interface ports.

MASTERplus™ for Digital Master Control

When it comes to digital master control, it's time to start thinking "inside the box." Our revolutionary ***MASTERplus™*** eliminates the standard, multi-box approach and frees up rack real estate by combining the functions of an SD to HD upconverter, two graphics keyers with multi-frame buffers, a test pattern generator, video and audio mixers onto a single circuit board designed to work inside the Harris FlexiCoder. The result: seamless switching between local SD feeds local HD feeds and network HD programming, local branding, voiceovers and more. ***MASTERplus*** is compatible with 1080i/720p and 480p 60 formats.

PSIP Solutions



Harris' ***PSIPplus™*** is your fully automated solution for gathering, formatting and disseminating program system (PSIP) data. ***PSIPplus*** not only manages incoming external electronic program guide information, but also has easy-to-use local program editing capabilities. Harris' new **PSIP.com** makes it even easier for your station to offer an electronic program guide (EPG). With this new service, your station can download directly to your ***PSIPplus*** server.

DATAplus™ MPEG-2 Data Encapsulator

DATAplus™, the industry's first MPEG-2 data encapsulator, makes it possible for you to add new revenue-generating services. ***DATAplus*** inserts data into the MPEG-2 transport stream, allowing you to use 100% of your bandwidth and deliver data up to ten times faster than current telephone modems. ***DATAplus*** maximizes bandwidth usage by opportunistically inserting data into null packets in the ATSC transport stream. ***DATAplus*** gathers information from a variety of sources including IP, ATM, synchronous and asynchronous data.

MONITORING AND FIELD MEASUREMENT

ATSC Professional Receivers

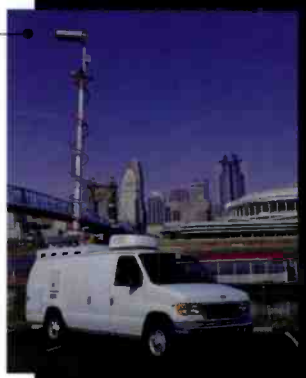
The Harris **ARX-H100** and **ARX-H200** professional ATSC receivers let you monitor digital transmissions from any point in the air chain. These units can decode any of the 18 ATSC formats and signals from all VHF and UHF channels, and also support PSIP and Closed Captioning (CC). The ARX-H200 also provides equalizer tap information and signal-to-noise measurements, and features a TCP/IP remote control interface.

MONITORplus™

This fully integrated plug-and-play transmitter site monitoring solution lets you monitor day-to-day RF signal quality, transport stream integrity and program video and audio signals. The one-rack system includes Harris' ARX-H100 professional ATSC receiver; an 8-VSB transmission analyzer; an HD color picture monitor; a professional 5.1 AC-3 audio decoding and monitoring system; and an MPEG-2 transport stream monitoring system.

DTV M-1

Named *Television Broadcast's* "Best New Product of NAB '99," Harris' **DTV M-1** field-measurement truck is ideal for group owners, community tower operators and consulting engineers. The DTV M-1 provides ATSC and NTSC monitoring for comparative coverage studies and comes equipped with an integrated transmission monitoring system. The vehicle's Navigator - a custom designed software-based control system - automatically captures and logs the results of standard signal information field tests into a database to help you generate complete profiles of your coverage area.



OTHER DTV SOLUTIONS

CHE-H100 ATSC Channel Converter

Harris' **CHE-H100** is the broadcast industry's first frequency-agile ATSC channel processor. The unit upconverts or down-converts off-air signals to any of the standard cable channels (T-7 through 118) and inserts them into cable head-ends. The CHE-H100 also provides the ATSC channel conversion needed by in-house RF distribution systems for monitoring. The CHE-H100's channel processing circuitry uses Surface Acoustic Wave (SAW) filters to minimize group delay and provide superior adjacent channel rejection. Automatic gain control ensures a consistent output level. For simple operation in any application, all input and output frequencies are displayed on a channel-indicating LED.

Digital Audio Solutions

Reproducing digital surround sound to match the quality of high-definition video requires the right equipment for the job. Harris provides a full range of digital audio solutions for television, including HD consoles, hard disk storage systems, source equipment and monitoring systems (pictured) with digital I/Os, and supporting Dolby® 5.1 surround sound. We can also help you upgrade your production facility to handle multiple channel audio for the creation of surround sound. Look to Harris to help you make DTV sound as good as it looks.

TRANSPORT STREAM PRODUCTS

WatchDog™ Transport Stream Monitors

The Harris **WatchDog™** line of ATSC MPEG-2 transport stream monitors provides continuous, real-time analysis and error monitoring of your DTV transport stream. Watchdog's built-in alarm system immediately alerts station personnel of any transmission system failure. Watchdog also provides remote monitoring capabilities via a standard Web browser so it allows group owners to monitor multiple streams from a central location.

Digital Routing Switchers and Distribution Amplifier

Switch between local and network transport steams with the Harris **TRS-12** and **TRS-12R 12 x 1 Routing Switchers**. And, when you have multiple devices requiring one transport stream but no way to loop through inputs to them, rely on the **TSD-310 Distribution Amplifier**.

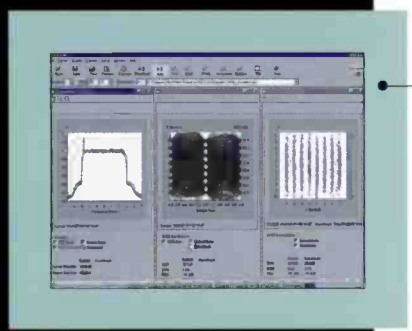
TRANSMISSION

A Complete Line of DTV Transmitters

Harris offers reliability and piece of mind with a full line of ATSC DTV transmitters to meet a station's allocated power needs. The entire line – **Solid State VHF Platinum®CD Series** or **UHF DiamondCD™ Series**, and the **Sigma® CD-II IOT** transmitter for higher power UHF applications – provides coverage ranging from 1.25 to 100 kW average power (5-400 kW peak).

RTAC™

Implemented in the Harris CD 1A 8-VSB exciter and standard in all Harris DTV transmitters, **Real-Time Adaptive Correction** ***(RTAC™)*** system provides continuous and automatic correction for signals generated by Harris ATSC DTV transmitters. By maintaining signal quality at the optimal level or 27 dB or higher continuously, *RTAC* will ensure a television signal is reaching its intended coverage area at all times.



CD-EYE™

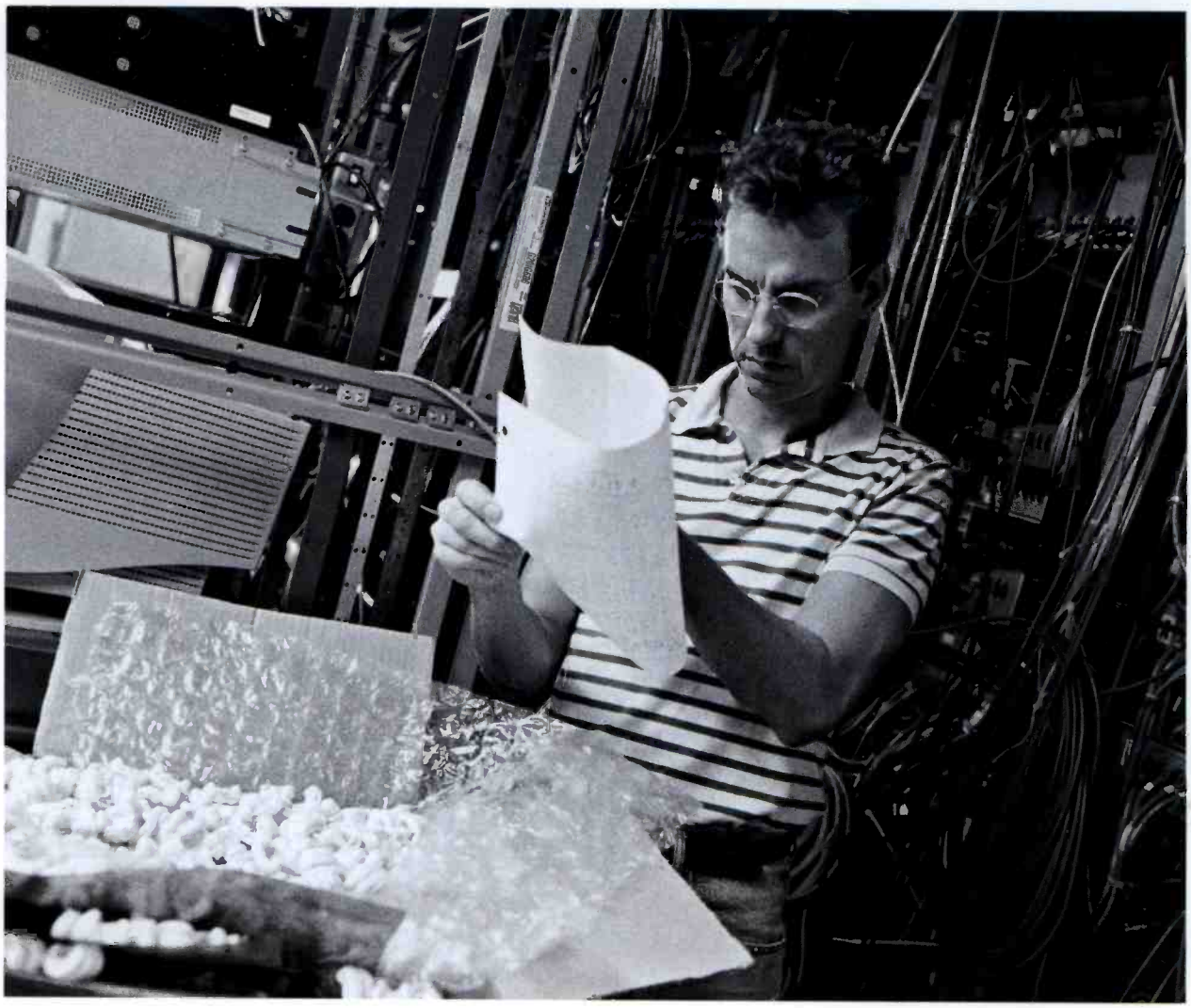
Remote transmission monitoring is as easy as the click of a mouse with Harris' new **CD-EYE™** 8-VSB monitoring software. This PC-based system runs on Win95/98 NT platforms. Designed to connect to the CD 1A exciter and work in conjunction with *RTAC*, CD-EYE accesses information, performs signal analysis and displays it on a PC screen from any remote location. CD-EYE allows you to track key system parameters of your transmitter system over time, identify trends in performance, and head off problems before they occur.

GUI

An intuitive **Graphical User Interface (GUI)** control system is standard on Harris DiamondCD Solid State and Sigma CD-II transmitters, significantly simplifying local and remote transmitter control and monitoring. The GUI provides easy-to-understand information about the transmitter's operating status, and more.

Multichannel DTV Antennas

Check out Harris' family of antennas, including models for DTV that can handle up to five signals simultaneously. Antennas are available for low- to super-power applications with a variety of mounting options.



Technology is only part of what you need to stay on the air.

Implementing a digital system can be a frustrating experience. For many stations, digital technology represents uncharted waters. That's why it's important to have an equipment provider that can do more than sell you boxes. You need a game plan. You need consultation services. You need training. You need installation help. You need Harris.

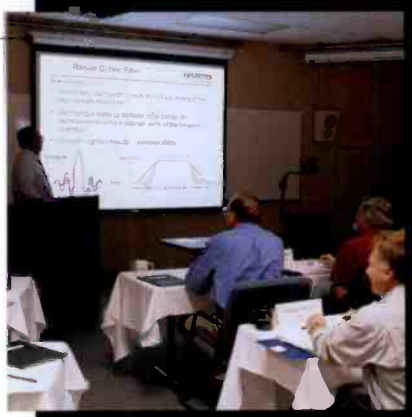
We go beyond product solutions to provide you with a complete range of consultation, installation and training services to help you get, and stay, on-air smoothly and cost effectively.

Systems Design Consultation And Integration

We'll do more than ship equipment to you. Our Systems engineers will work with you to develop a customized solution to fit your needs. Our systems integrators work with virtually all providers of studio and master control equipment, and our installation crews are the most experienced team you'll find anywhere. You can put that experience to work for your station in the areas of facility consulting, budgeting and planning; technical design and documentation; equipment supply; systems integration and commissioning; custom product fabrication; and technical furniture design and fabrication.

DTV Training Solutions

We know that training is critical, so our **Broadcast Technology Training Center** in Quincy, Ill. is offering more DTV training classes than ever. And we've extended our ***SmartPak DTV RF Training Program*** offer, which allows stations to enroll in five courses for the price of three. SmartPak courses include: Intro to HDTV, TV Transmitter Systems and Installation, RF Transmission Fundamentals I and II and TV Transmitter Measurement Workshops. Coupons are valid for one year and can be mixed and matched among station personnel. Visit our Web site for detailed course descriptions and space availability at www.harris.com/customer-service/training schedule.



At Harris, we take our commitment to broadcasters very seriously. That's why we've invested in a new state-of-the-art headquarters that we believe will help us serve you even better. Centralizing our strategic Television, Radio and Systems business units with advanced digital engineering, Harris' recently completed Broadcast Communications Division's headquarters exists for one reason - to speed the development of the next level solutions you need to thrive in today's rapidly changing marketplace.

As Harris continues to move beyond transmission solutions to provide you with complete broadcast solutions, look for the fundamental qualities that made us number one in transmitters to make us your number one total equipment provider and systems integrator:

- Unparalleled reliability and support
- Field-proven products and future-ready technology that work
- Continued commitment to doing what it takes to get you on the air and keep you there

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percent penetration rate that marks the transition's end in a market appears small," the report states.

Cable's track record on carrying the local digital broadcasts in the various markets, as they come on line, has been any lackluster. Despite the work at places like CableLabs and other industry innovators, little has been done to establish standards for the necessary set-top-box converters in spite of the deadline for such standards approaching in middle of this next year.

The CBO concludes DTV will falter without strong must-carry rules for cable from the FCC.

In response to the CBO report, Gary Shapiro, president of the Consumer Electronics Manufacturing Association, urged the FCC to develop must-carry rules for cable.

"The CBO's independent report reaffirms what we have long said: a strong must-carry requirement is critical to the success of digital television." Shapiro said. "The CBO has confirmed that the DTV transition will slow if high-definition television and other new digital services are blocked or down-converted by cable systems. It is essential that these new services are available to all Americans, including cable subscribers.

"Heed the CBO's conclusions and issue a strong must-carry rule as quickly as possible," Shapiro said.

The CBO reports sounded an additional cautionary note. Even with must-carry rules, digital broadcasts could still fall short of reaching the 85 percent mark.

"The remaining 10 percent to 15 percent of television households that are not expected to pay for programming by 2006 make up the group that apparently values television the least," the report notes. "Getting enough of those households to adopt digital TV and so raise the market penetration rate to 85 percent is likely to pose the greatest challenge to completing the transition."

For the full text of the CBO report, see www.cbo.gov. ■

Sony co-founder Akio Morita dies

Sony co-founder and developer of the Walkman, Akio Morita, died in early October of pneumonia in a Tokyo hospital at the age of 78.

Morita established the company as an international consumer electronics powerhouse, introduced now ubiquitous entertainment devices and diversified Sony's holdings.

Morita and the late Masaru Ibuka founded Toyko Tsushin Kogyo (Tokyo Telecommunications Engineering Corp.) in 1946 with about 20 employees. In 1958, Morita renamed the company Sony, in an effort to make the name recognizable internationally. Two years later, Morita moved to the U.S. to establish the Sony Corp. of America and offered company shares on the New York Stock Exchange in 1961, a first for Japanese companies.

Morita is credited with developing some of Sony's most successful products. The Walkman, introduced in 1979, was developed and championed by Morita despite his company's initial reservations. Under his guidance, Sony also developed the Trinitron, the VCR and introduced the Betamax format, which floundered in fierce competition with rival Panasonic's VHS format.

Sony co-founder Akio Morita

With Morita at the helm, Sony established CBS/Sony Group Inc., a joint partnership with CBS, in 1968, purchased CBS Records in 1988 and purchased Columbia Pictures Entertainment Inc. in 1989.

Morita became president of Sony in 1971 and served as the company's chairman and chief executive officer, chairman of the board and honorary chairman. ■

Kennard vows to reshape the FCC

Over the past several months, the FCC Chairman has alluded to making some major changes in the agency that governs our nations airwaves and communications systems. In an address given at the Georgetown University Law Center in early October, Chairman William E. Kennard, says his "New FCC" will be "fast, flat and functional."

Kennard said the FCC has established an "ambitious" five-year agenda designed to promote competition, protect consumers, and give every consumer access to basic and advanced telephony (communications) services. He noted those three basic goals are not all that different from the pillars of the Communications Act of 1934.

FCC Chairman William Kennard

"The new FCC will do this by being ... fast, flat and functional," Kennard said.

To shorten the licensing and filing periods, Kennard said the Commission is making a concerted effort to "streamline" processes by becoming "paperless." The ultimate goal is for the agency to rely solely on electronic filing and licensing.

The future FCC will also become "flatter and more fluid" with smaller and more responsive work units. Congressional approval has been given to the commission's consolidation efforts with agency's new Enforcement and Consumer Information Bureaus. He said that those bureaus would go into operation in the very near future.

When it comes to the rulemaking process, Kennard promises to get rid of the older non-effective rules. "The FCC simply cannot be expected to write a rule for everything. The regulatory process is incremental. The market process is not," he said.

Kennard mentioned other areas relating to interagency mergers and the review process that will also be addressed as part of the new FCC. "I believe we can build an FCC that is fast, flat and functional. Working together, we have laid a good foundation for the FCC in the 21st Century," he said.

For the entire text of Kennard's speech, see the FCC web page at www.fcc.gov. ■

Start-up company offers delivery of video to PCs

Geocast Network Systems Inc., a start-up company, has developed a timely method to deliver digital video and high-quality audio to personal computers, stating that its crossover architecture method combines "the bandwidth and immediacy of broadcast with the customization and control of the PC."

Geocast put together a package that makes timely deliverance of content to PC users. Joe Horowits, chief executive officer of Geocast, says that the Internet's point-to-point architecture was never designed to deliver rich media content to a mass audience. The Internet industry has been trying to catch up to broadcasting by improving infrastructure, with lackluster results.

"By moving beyond the Internet and partnering with leading broadcasters, such as Hearst-Argyle Television, we can make programming with full-motion video and CD-quality sound instantly available to PC users. Our approach doesn't replace the Internet, but rather it frees up the Internet to do what it does best," Horowits said.

Hearst-Argyle Television plans to use the Geocast system at their new digital television stations "to deliver rich-media content to PC users via the broadcast infrastructure." The Geocast approach bypasses the congestion and delays of the Internet, making customized information, entertainment and commerce instantly available to a mass audience of PC users. Under the terms of the agreement, Hearst-Argyle and Geocast will form a long-term partnership in which they will jointly contribute means, bandwidth, content and promotional opportunities, as appropriate to the mix.

Hearst-Argyle Chairman Bob Marbu sees the Geocast crossover architecture as a whole new opportunity for their stations to serve their respective local communities. Marbu suggest that Hearst-Argyle can develop specific programming for the PC user that will help to recoup some of the heavy investment they've made in digital broadcasting.

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Hearst-Argyle owns 22 television stations and have another four under management. The group reaches nearly 18 percent of U.S. households, making it one of the two largest non-network-owned domestic television station groups, as well as one of the seven largest television groups overall as measured by audience delivered.

The venture capitalists behind Geocast have been involved in such successful operations as Sun Microsystems, Ross Stores and Starsight Telecast/Gemstar. Geocast's key executives include John Abel, formerly the executive vice president of the National Association of Broadcasters (NAB); Charlie Jablonski, formerly the vice president of broadcast and network engineering for NBC Television, and Anita Wallgren, former legal advisor to FCC Commissioner Susan Ness.

To balance the mix with computer types, the software development team includes founding members from Netscape (including Tom Paquin), Silicon Graphics and IBM, and individuals from Cal Tech, Stanford and Berkeley. The hardware team, drawn from PMC-Sierra, Intel, and Cyrix, is based in Portland. Geocast has also recruited employees from the ranks of traditional and new media, including broadcasting, satellite, newspaper, online services and cable.

For more information, visit the Geocast website at www.geocast.com. ■

NBC dabbles in convergence

NBC is forming a partnership with a cable network that will blend the networks television offering with promotional efforts on the World Wide Web.

ValueVision's home shopping cable television network will be re-named SnapTV and a companion SnapTV.com Internet shopping service. This is all coming together as the result of strategies and alliances between ValueVision International Inc. and NBC Internet (NBCi). The deal is the result of a proposed merger involving Snap.com, XOOM.com and several Internet assets of NBC.

ValueVision's cable name change, to SnapTV, will be phased in over the next six to nine months. Although the new SnapTV and its companion SnapTV.com network will continue to be owned and operated by ValueVision in coordination with NBCi, it will feature several new entertainment and innovative programming formats that highlight the whole idea of the convergence of television with the Internet.

The Internet shopping service will promote online purchasing along with and supported by streaming video of SnapTV's cable channel. NBCi will become the exclusive direct e-commerce partner for SnapTV, relying on core competencies and e-commerce management systems developed by XOOM.com, a key component of the proposed NBCi merger.

The Snap group and NBC plan a whole campaign of cross promotions where SnapTV is spotlighted in select NBCi Snap.com and on-air promotions on the NBC TV Network.

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The DPS-470 serial digital component AV synchronizer bridges the gap between analog and digital facilities. Preferred by networks, broadcasters and mobile operators around the world, the DPS-470 features 10 bit ITU-R 601 component processing and adaptive comb filter decoding for maximum signal transparency. A built-in TBC and digital test pattern generator round out the features. The optional DPS AS-470 internal audio synchronizer module accommodates up to four channels of analog, digital or embedded SDI audio.

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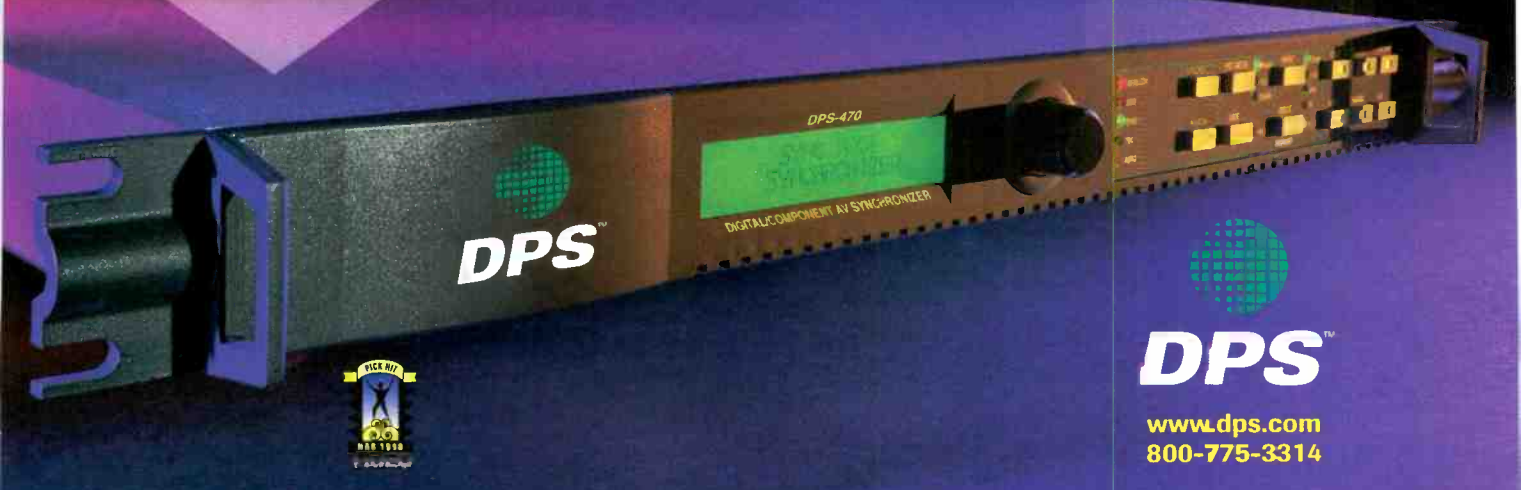

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With Snap.com and XOOM.com, which together rank as the seventh most visited site on the Internet on a *pro forma* basis, will afford an incredible promotional and transactional capability that cut across broadcast television, cable television and the Internet. ■

Stations prepare for satellite carriage

With the nation's lawmakers putting the final touches on the revised Satellite Home Viewer's Act (SHVA), it won't be long before viewers will be able to see their favorite hometown television stations on the direct-to-home (DBS) system of their choice.

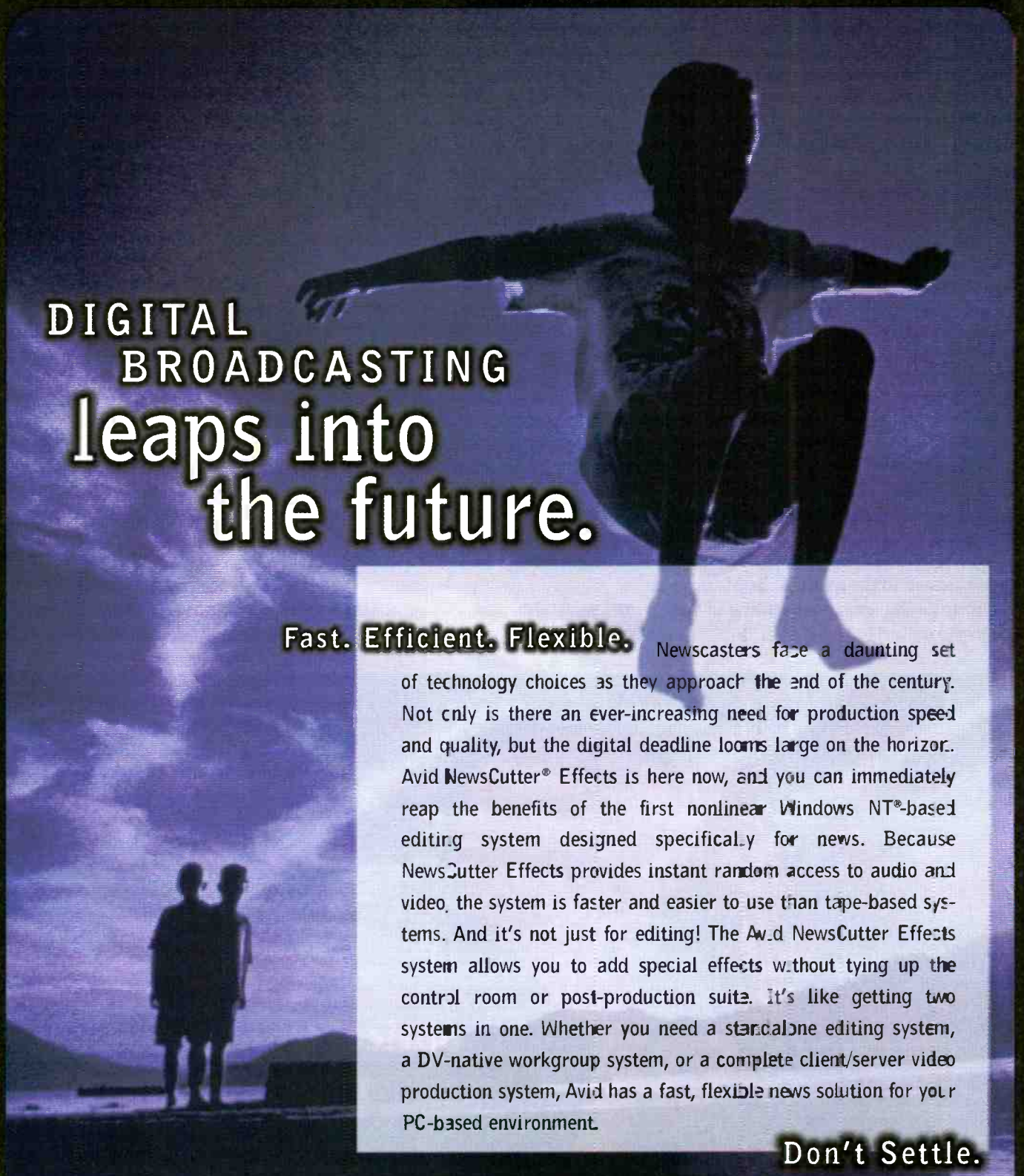
The SHVA will impact every station now and in the future, as it becomes their turn to be carried on the DBS systems. According to Robert Mercer of DirecTV the four major networks in each of the markets selected will initially be carried by satellite TV providers. Unlike cable and the seeming limitless bandwidth of fiber, DBS is limited without impressive compression technology and techniques such as statistical multiplexing. With the successful launch the DirecTV 1-R satellite into the 101° WL orbital slot last month, and by investing in technology upgrades at its two broadcast centers, DirecTV has the additional capacity to extend the delivery of local broadcast network channels.

As there are only two major players in the DBS business, there are serious questions as to how these stations will get their programming to the uplink facilities.

The adoption of the SHVA will also alleviate a burden placed on most local stations.

The adoption of the SHVA will also alleviate a burden placed on most local stations. Gary Stigall, chairman of the San Diego SBE Chapter 36 and senior maintenance engineer at KFMB-TV (CBS), said, "San Diego's network TV affiliates will be among those added to DirecTV's lineup, finally ending the Satellite Home Viewer Act (SHVA) paperwork and phone headache of the past year." Stigall continued, "KFMB (CBS), KGTV (ABC), KNSD (NBC) have all been swamped with calls and letters asking for exemption from the SHVA." The older SHVA supposedly protects the copyrights of local stations from intrusion of signals via satellite within their grade B contour. Stigall did see an interesting prospect in the viewer who would be willing to pay $5 or so extra each month just to see a local station in exchange for not having to maintain an antenna and mast.

The older SHVA has been fraught with problems. "Viewers fume over having to get separate exemptions from each station," Stigall said. Viewers fume over not having the choice to view what they want when they want it. There's no waiver provision



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in the law for recreational vehicles which travel countrywide."

Stigall said he was informed that San Diego would be among 20 markets to be added to DirecTV's fare. "Fiber links from the stations will carry their signals to DirecTV's El Segundo facility," he reported. Most of the early markets will be accommodated on DirecTV's current system of satellites at 101° west, but as the system is filled, the group of satellites at 119° west would be utilized. Viewers wishing to receive both satellite systems would require an elliptical dish.

San Diego is an example of the kind of problems that have manifest themselves across the nation, with a little international spice added in for good measure. The four network stations transmitter sites are scattered in three different directions, KGTV (ABC) and KFMB (CBS) are to the north. KNSD (NBC) is to the east and XETV (Fox) is located to the south in the Mexican town of Tiajuana, with studios in San Diego.

Seemingly, the FCC has not accounted for the obstacles to DTV signals presented by local terrain. "Local canyon terrain sometimes prevents reception even within the grade B contour," Stigall said. "The grade B contour was based on a predictive model from the 1950s, which didn't take into account the terrain. Temecula, for example, is considered within the grade B contour of KGTV and KFMB though shadowed behind ridges at the Riverside county line."

DirecTV plans to provide customers in the next few months with set-top boxes which would decode the digital signals of their satellites and terrestrial ATSC and NTSC, with seamless integration of their channel navigation services and no A/B switch required. Echostar V was launched September 23 to add local programming to the Dish Network's lineup of 500 channels. ■

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Auction results

BY HARRY C. MARTIN

The FCC's first auction of broadcast channels began Sept. 28, 1999, and concluded on Oct. 8, after 35 rounds of bidding. The following were the winning bids and bidders for full-service TV construction permits:

Winning applicants were required to post 20 percent of their winning bids in late October. These applicants will be made subject to petitions to deny in early December. Applications drawing no such petitions will be listed on a public notice as grantable and then granted upon submission by the applicants of the remaining 80 percent of their winning bids.

Market	Winning Bid	Successful Bidder
Virginia Beach, VA	$8,752,000	Winstar Broadcasting Corp.
Manteo, NC	4,373,000	Danbeth Communications Inc.
Tallahassee, FL	2,765,000	Channel 24 Corp.
Rapid City, SD	1,412,000	Rapid Broadcasting Co.
Great Falls, MT	888,000	Winstar Broadcasting Corp.
Missoula, MT	888,000	Winstar Broadcasting Corp.
Roswell, NM	762,000	New Mexico Roswell 21, LLC
Sunvalley, ID	654,000	Marcia T. Turner d/b/a Turner Enterprise
Coos Bay, OR	342,000	Todd P. Robinson
Silver City, NM	320,000	KOB-TV, L.L.C.
Marquette, MI	320,000	Winstar Broadcasting Corp.
Butte, MT	160,000	Winstar Broadcasting Corp.

The winners of new LPTV construction permits were:

New York-Elizabeth	$1,296,000	WKOB Communications Inc.
Tampa/St. Petersburg, FL	509,000	Trinity Broadcasting Network
Tucson/Jaynes, AZ	241,000	Univision Television Group Inc.
Santa Rosa/Lakeport, CA	140,000	Univision Television Group Inc.
San Antonio, TX	120,000	3 Angels Broadcasting Network Inc.
Omaha, NE	118,000	Pappas Telecasting of the Midlands Inc.
Austin/Giddings, TX	80,000	Trinity Broadcasting Network
Fort Myers, FL	60,000	Paxson Communications LPTV Inc.
Tyler/Jacksonville, TX	58,000	3 Angels Broadcasting Network Inc.

New channels for pending Channel 60-69 applicants

The Mass Media Bureau advised that the Commission will set a window filing period for Channel 60-69 NTSC applicants to specify alternative channels.

The Commission re-allocated Channels 60-69 for fixed, mobile and broadcast services and designated a portion of that spectrum for public safety use. This re-allocation was designed primarily to help meet the needs of the public safety services for additional spectrum. In the same rulemaking, the Commission said it would give those applicants with pending Channel 60-69 NTSC applications an opportunity to amend their applications to specify alternative channels below Channel 60 where such channels are available and, if necessary, to modify their sites and/or tower heights in order to eliminate any conflicts with existing NTSC stations or DTV allotments.

The anticipated Channel 60-69 window notice also may provide an opportunity for "freeze" waiver applicants (i.e., those applicants who filed an NTSC application for a community within a freeze zone) to amend their applications to eliminate any conflicts with NTSC or DTV stations/allotments. Affected applicants should begin now to search for a suitable alternative channel.

TV duopoly logjam expected

The Commission's new local TV duopoly rules may create problems in some markets because they require that at least eight separately owned TV stations ("voices") remain in a market before the duopoly is allowable. For example, in a DMA with nine TV stations, two stations might wish to acquire a second station in the market. The grant of the first application, however, would bring the number of TV voices in the market down to the eight-station limit and the second application could not be granted. If both duopoly proposals were filed on the November 16 effective date of the new rules, as can be expected, only one could be granted.

In September, the FCC sought comments on how it should determine the order in which to select among such applications. The favored method is a lottery. Under this procedure, each potentially conflicting application would be assigned a random number by use of one or more forced-air blowers containing numbered ping-pong balls. The applications then would be processed in numerical order, beginning with the lowest file number. ■

Dateline

TV stations in the following states must file their biennial ownership reports on new Form 323 (or Form 323-E for non-commercial stations) on or before Dec. 1: Alabama, Connecticut, Georgia, Maine, Massachusetts, Minnesota, Montana, New Hampshire, North Dakota, Rhode Island, South Dakota and Vermont.

All non-commercial stations must have submitted their DTV applications on or before May 1, 2000.

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

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What is HD?

JERRY WHITAKER, BE CONFERENCE CONSULTANT

The twin benefits of HDTV — increased resolution and wider aspect ratio — have made believers out of many HD skeptics. The value of this "new viewing experience" as it was first described by NHK scientists, has been demonstrated in countless productions, everything from "Monday Night Football" to "The Rose Parade."

However, debates can still be heard over what is "true" high definition. Is it really just 1080-line, 24-frame progressive and its cousin 1080i? Where does 720p fit in to the equation? These issues are examined this month from three different perspectives. First, on the vendor side is Phil Livingston, Panasonic Broadcast & Television Systems Co. On the expert side we have Eric Denke, vice president and operations manager for American Production Service, and Steve Flanagan, vice president of engineering for Post-Newsweek Stations Inc. ■

SEND Send questions and comments to:
jerry_whitaker@intertec.com

EXPERT

Phil Livingston, Panasonic

While HDTV is truly beautiful in the eye of the beholder, it is also the subject of great debate. What constitutes HDTV? Is it the origination? The production? The transmission? The display in the consumer's living room?

Before we count pixels and debate scan techniques, let us consider aspect ratio. The 16:9 widescreen is the first and perhaps the most striking attribute of some DTV and all HDTV in the U.S. To steal a line, "It changes everything." The image composition changes — or it should. The MCU single head shot of the news anchor leaves him or her lost in a 16:9 wasteland. The "two-shot" that never worked in 4:3 looks great in 16:9. The whip pan that brought excitement to sports can bring nausea when the image fills much of the audience's peripheral vision. Why would one raise these issues here? Because if HD images are composed for 4:3 and 16:9 simply "protected" so no unwanted stuff gets into the shot, HD will lose much of its impact. The widescreen image should be composed as such, and those who have used high definition (like the ABC team covering "Monday Night Football") report that the composition is different. Therefore, to be high definition it must be created as a wide aspect image.

Now let's count pixels. Digital standard definition has 720 pixels (Y) per line and 480 lines, and in the studio the active video occupies about 170Mb/s. 1080-line HD has 1920 pixels per line, and uses about 1Gb/s, or five times the data. 720 progressive has 1280 pixels per line, but because all the lines come in one frame the data rate is just under 900Mb/s. This is why the ATSC table shows 1080 and 720 as high definition — all that data represents image detail that will be perceived as high definition. Add to this mix the demand by Hollywood for a 1080-line 24-frame progressive "master" format that would have the resolution of 1920x1080, but with no interlace artifacts. This is definitely HD, and electronic image conversion and 3:2 pull down will allow the creation of any sub-format from that master for distribution.

High definition at the production end may not be the same as high definition at the receive end if for no other reason than the displays will be different.

By the way, will the consumer see a HD image? The issue here is the same one facing program producers and broadcasters. The display device forms the final low pass filter before the viewer's eyes. If the display cannot resolve all the detail in the picture, either due to size (i.e. the surface area is too small) or construction (e.g. the size of the phosphor "dots" in a CRT is too big), then the received image will be only as good as the display can make it. While this may seem obvious, it means that those who wish to judge the various image formats should question the filtering effect of the monitor. Pragmatically, it also means that high definition at the production end may not be the same as high definition at the receive end if for no other reason than the displays will be different. Of course, Panasonic is rapidly developing new display technology like high-performance plasma to mitigate this difference and to assure that the detail captured at the beginning arrives for the consumer.

Lastly, let us not forget audio. Surveys from the earliest days of high defintion show that, given identical displays, consumers think the picture is better when the audio is enhanced. Improved multichannel audio is and should be part and parcel of the HD experience.

To me, high definition means composed and delivered in widescreen with many times more image information carried as faithfully as possible to a viewing device with the best resolution possible. However, I would be remiss if I didn't say that compromises will probably be made in order to send other digital information along with the audio and video that can augment and enhance the viewing experience, and that

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DTV and HDTV are not just about great pictures anymore. I would also be remiss if I didn't say that there will be a significant role for SD images integrated into HD programming. One can easily imagine upconverted news field footage combined with studio production to create an impressive and cost-effective final result. ■

Phil Livingston is vice president, Strategic Technical Liaison, for Panasonic.

VENDOR

Eric Denke, American Production Services

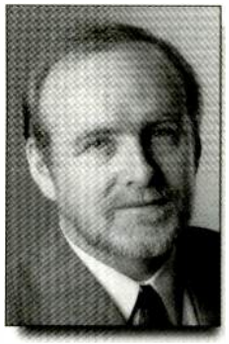
HDTV, bigger is better? Well, I think so anyway. As long as you can get it down the digital pipes that exist today and tomorrow, make the files as big as you can. Digital HDTV is just a sequence of digital picture files anyway. From a production standpoint would you rather have higher resolution or lower resolution files? A printer will tell you that the higher pixel count is always better. As far as the broadcast standards go, let them do what they want. Component digital television, off-air ATSC or whatever, looks great in all of the digital standards including 480i or p. I think the consumer electronics people say that it needs to be at least 720 lines to be considered HDTV. But for production, you want the highest possible frame size. We may even be doing 1080 60p someday, which is the highest of all the DTV standards. But for now 1080i is the best and only solution for post out there.

I am very prejudiced to 1080 24p and 1080 60i. Why would you adopt another production standard that no production is taking place in? Most of the 720p footage you have seen has been 1035i, 1080i HDTV or film and converted to 720p. The only major exception I can think of is "Monday Night Football" with its prototype 720p cameras. How annoying would it be for someone to give us a 720p recording without the existence of a readily available conversion box? Now I would have to dub it over to a 1080 format before I can use it. Imagine the interchange between TV stations in your area. 720p would be like using a PAL camera to shoot and edit for television here in the U.S.

The systems at American Production Services are 1080i and can handle all of the existing 1035i footage. Yes, 1035i was a standard. All of the post production we did on the first few hours of PBS in high definition was actually 1035. This includes "Cringely's Crash Course on DTV" and "Chihuly Over Venice" that were posted in HDTV here at APS Seattle. Currently all of the HDCAM machines we own can convert 1035 to 1080 seamlessly. This is very important because most of the footage that is already out there is 1035, not 1080. Most Sony cameras are now 1080i and make this conversion unnecessary. The point here is that we already have had two so-called 1080 standards already and now are on the brink of a third, 1080 24p.

This fall both our HD suite in Seattle and our new HD facility in North Hollywood will receive our 1080 24p HDCAM machines. The switchable 24p cameras will be available the first quarter of next year. We've recently done post production on a project shot in 1035 60p HDTV and has been taken to 35mm film. It looks great. Our first post-production job in our new LA facility was a feature "film" called "Last Mountain" shot and posted with color correction on HDCAM to be taken to 35mm for release. With all of the possibilities, the "1080" standards for post production are here to stay. ■

Eric Denke is vice president and operations manager for American Production Services.



VENDOR

Steve Flanagan, Post-Newsweek

I was initially critical of ABC's decision to start HDTV programming in 720p rather than 1080i. My observations at that time were that 1080i had a superior picture, equipment availability was a real concern and, because most first-generation sets used 1080i as the native scanning format, allowing the TV to make the final conversion had the potential for vastly differing viewing experiences.

Now with several ABC "Monday Night Football" games behind us I must admit my initial concerns regarding 720p were unfounded. The pictures are very good, certainly far superior to NTSC, even when critically viewed on a 100-inch projection TV. I have not talked to anyone who has seen the pictures (professionals or consumers) who has not been astounded by their quality.

ABC has put considerable effort into the DTV graphics for "Monday Night Football," and it shows. Progressive scanning means graphic elements are crisp and clean, which opens up new possibilities to designers. Overall, the efforts from ABC have been first rate.

720p produces a high-quality picture, capable of creating an "Oh, wow" reaction from anyone who sees it. Will it become the de facto standard? It's far to early to tell, but it will give viewers a great picture, one that will hopefully drive consumers to purchase HDTV sets.

First and foremost, this DTV transition is about picture and sound quality. Sure, there will be exciting future opportunities with datacasting, multicasting and other digital services, but until consumers embrace the DTV technology, those potential revenue streams will likely be small. It's the quality of the pictures that will entice viewers to purchase a new set, and both 720p and 1080i produce an enhanced viewing experience that is superior to anything available in the home to date. As far as this debate is concerned I think 720p is HDTV. ■

Steve Flanagan is vice president of engineering at Post-Newsweek Stations Inc.

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Transition to Digital

Compression concepts, part 1

BY MICHAEL ROBIN

Electromagnetic waves, the preferred medium for transmitting information, have a finite useable spectrum. This has led to a global concern for the standardization of transmission channels. Spectrum standardization provides efficient use and minimal mutual interference for everyone's benefit. Transmission fidelity and the reproduction of visual and aural information are closely related to and dependent on available bandwidth and the manner in which it is used. Over the last 100 years, we have witnessed the development and availability of ever more sophisticated, reliable spectrum-saving transmission methods.

In parallel with transmission systems development, there have been comparable developments in visual and aural information storage. Visual information storage started with photography in the 1820s. Early experiments to simulate movement by projecting a sequence of still pictures culminated in 1890 with the development of cinematography through the joint efforts of Thomas Alva Edison and George Eastman. Audio recording predates the developments in moving pictures; in 1877, Edison developed the phonograph (wax cylinder recording). The following year, Berliner introduced the gramophone (disk recording). Audio was recorded in real time; time compression was neither necessary nor applied. However, due to the primitive recording and playback methods, the recorded frequency range was typically 200Hz to 3kHz. So-called moving pictures introduced a form of time compression by limiting the number of pictures recorded per second to slightly more than the human visual system needed to perceive smooth motion. The 1940s witnessed the development of audio tape recording with several standardized tape/head speed choices and related frequency response and SNR limitations. The 1950s saw the development of the professional VTR using narrow-band FM concepts and rotating heads. This reduced tape consumption while providing reasonable, and ever improving picture quality.

Transmission fidelity and the reproduction of visual and aural information are closely related to and dependent on available bandwidth and the manner in which it is used.

Analog compression

Analog systems offer relatively limited means of data reduction. The types of compression used are often related to human perception characteristics and reflect the technological limitations of the times. Several examples of analog compression schemes follow.

Motion pictures represent movement by projecting a succession of still images. The number of images per second was chosen taking into consideration two human visual system (HVS) characteristics:

- The ability of the viewer to retain or in some way to remember the impression of an image after is has been withdrawn from view. When the light entering the eye is shut off, the impression of light persists for about 0.1 second. Consequently, 10 pictures per second can adequately convey the

FRAME GRAB

A look at tomorrow's technology

ATSC lags behind DVB in total TV household penetration

Digital Terrestial Standards	TV Households (000)	Percent of TV Households
DVB-T	190,263	18%
ATSC	150,600	14%
ISDB-T	44,200	4%
Not Committed	666,795	63%
Total TV Households	1,051,858	100%

Committed to DVB-T are Western European countries, Australia, New Zealand, Singapore and India
Committed to ATSC are US, Canada, Mexico, South Korea, Taiwan, Argentina
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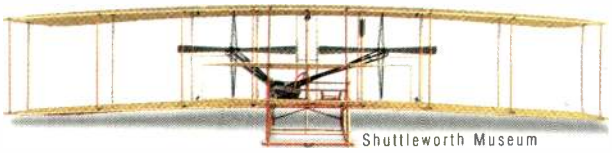

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illusion of motion.

• The HVS requires a picture repetition rate in excess of 10 still pictures per second to reduce flicker. The critical flicker frequency is the minimum rate of interruption of the projected light that will not cause the motion picture to appear to flicker. The perception of flicker varies widely with viewing conditions and picture material. Comfortable viewing requires in excess of 24 pictures per second. For film projection, each picture is projected twice, resulting in a flicker rate of 48Hz.

As a second example, analog double sideband amplitude modulation transmissions (DSBAM) use an allocated spectrum (between 500kHz and 1700kHz) consisting of adjacent contiguous 10kHz transmission channels (9kHz in Europe). This results in a maximum transmitted audio bandwidth of 5kHz (4.5kHz in Europe). This reduced audio bandwidth is effectively an analog compression process based on the technology of the 1920s. It is obtained by reducing the audible spectrum (approximately 20Hz to 20kHz) to 200Hz to 5kHz (4.5kHz), matching (then) available equipment and spectrum management constraints. Because a large portion of the audible audio spectrum is eliminated, the result is a perceptual loss.

Finally, analog television standards make effective use of several widely ignored compression concepts. The final aim is to reduce the transmitted channel bandwidth as follows:

• The total number of scanning lines per picture was adopted taking into consideration the number of vertical details (total number of scanning lines in this case) discernible at an empirically selected distance from the TV screen (6x the picture height). It was determined by experiments that the eye resolves about 572 vertical details under these conditions. North America adopted 525 lines (slightly below) and Europe adopted 625 lines (slightly above) the visibility limit. This choice limited picture resolution based on human vision characteristics.

• Interlaced scanning was adopted to reduce the transmitted bandwitdh. Given the frame rate of 29.97Hz (nominally 30Hz or 25Hz in Europe) the video bandwidth is reduced to one half of what would be needed for a progressive scan. The resulting large-area critical flicker frequency is equal to the field-rate (59.94Hz or 50Hz). Consecutive field line-to-line differences are perceived as interline flicker, mostly unnoticeable by the eye and a small price to pay for the bandwidth reduction achieved.

• Vertical resolution equals 0.7x the number of active lines or about 339 vertical details. Given the 4:3 picture aspect ratio and a requirement of equal horizontal and vertical resolution the optimal video bandwidth equals 4.2MHz vs. the 8.4MHz needed for progressive scanning.

• The FCC allocated transmission spectrum is divided into 6MHz segments (channels). The video transmission mode is vestigial sideband amplitude modulation (VSBAM), i.e. an upper video sideband of 4.2MHz and a lower sideband of 0.75MHz. The audio transmission mode is wideband FM with a separate audio carrier 4.5MHz above the video carrier. Given a 4.2MHz video bandwidth, a full double sideband transmission would have required an 8.4MHz transmitted bandwidth plus an extra 200kHz for FM audio. A progressively scanned picture with an 8.4MHz video bandwidth would have required a 16.8MHz double sideband transmission channel.

• Color information is transmitted using a set of two bandwidth-limited (≅600kHz) B-Y and R-Y signals, each modulating in amplitude an associated suppressed subcarrier of about 3.58 MHz. The reduced chrominance bandwidth reflects the eye's reduced sensitivity to colored picture details. The modulating process is suppressed carrier, double sideband amplitude modulation of two subcarriers in phase quadrature (we might refer to this process as SCDSBQPAM). The selected NTSC subcarrier frequency is 455/2 f_H (f_H=15734.25 Hz) allowing the chrominance information to be frequency division multiplexed (FDM) with the monochrome (luminance) information thus maintaining the baseband spectrum of 4.2MHz.

These methods are effectively analog compression processes that allow the reduction of the transmitted bandwidth. Figure 1 summarizes the analog NTSC compression scheme.

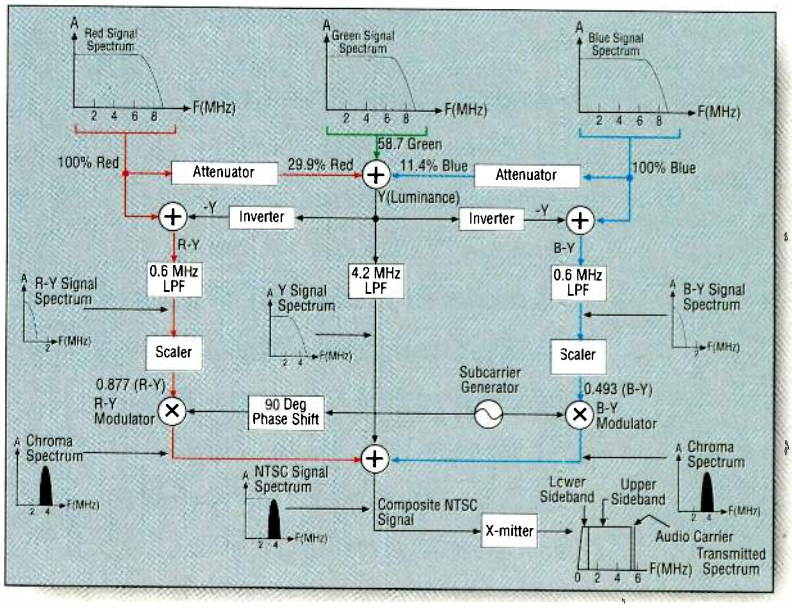

Figure 1. Compression methods used for analog video include interlace scan, bandwidth limiting, multiplexed chrominance information and vestigial sideband transmision.

Digital compression

Conventional analog composite systems compress video information by restricting the bandwidth of the baseband luminance and chrominance signals. These restricted bandwidths reflect the eye's sensitivity to spatial and temporal picture details. Analog component video formats use similar baseband methods, but with slightly wider bandwidths for chrominance signals. The CCIR 601 4:2:2 video format specifies a luminance signal bandwidth of 5.75MHz and a chrominance signal bandwidth of 2.75MHz, slightly below the Nyquist frequencies corresponding to the related sampling frequencies but well above any

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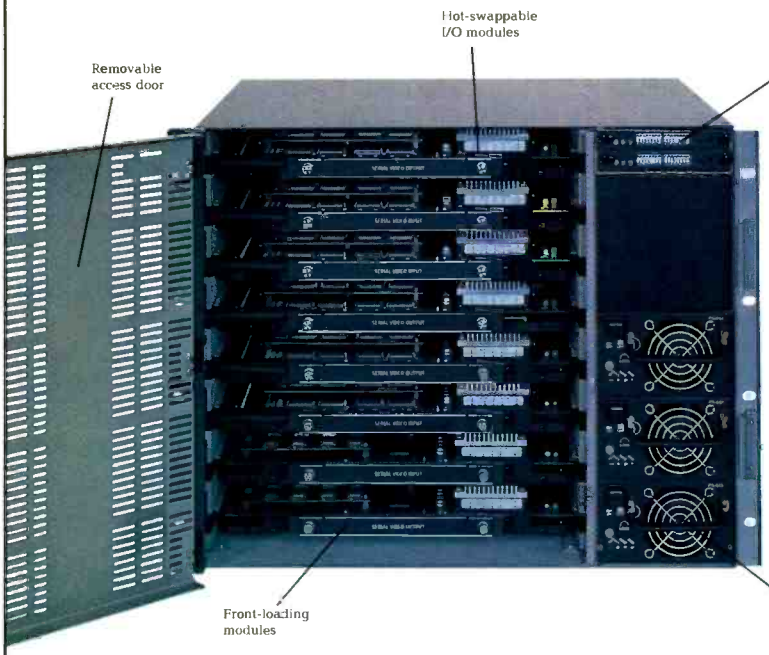

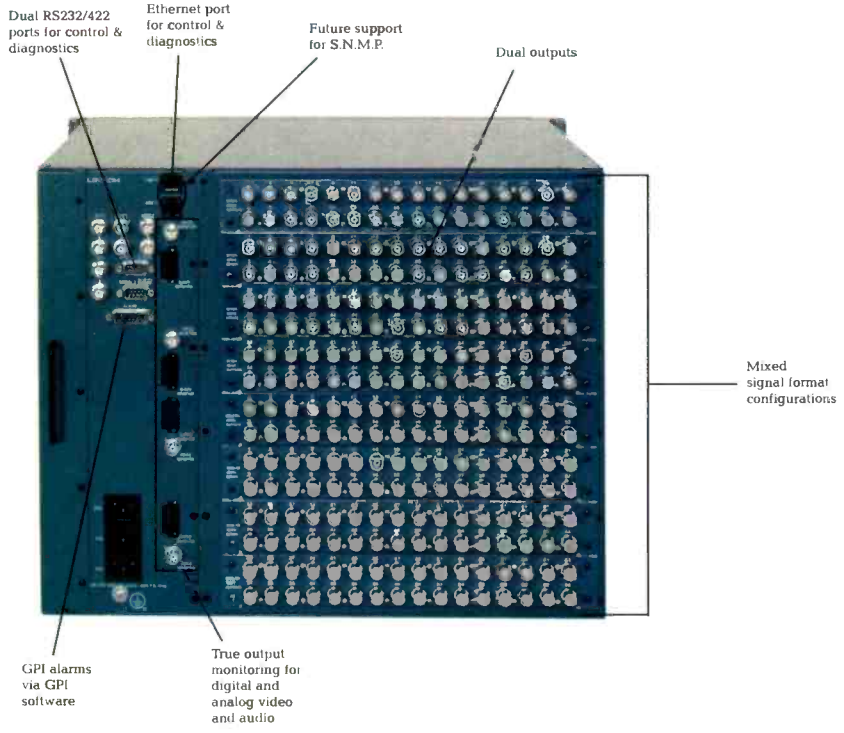

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analog composite signals such as NTSC, PAL or SECAM. After digitization the three component digital signals are time division multiplexed into a 27Mword/s (10bits/word) parallel bit stream and subsequently serialized. The serial bit-rate equals 270Mb/s. While this signal can be comfortably distributed inside a production facility, the high bit rate is unsuitable for transmission purposes or for moderate cost/size digital videotape recorders. Figure 2 summarizes the 4:2:2 encoding process and outlines the component bandwidth limitations and the resulting 270Mb/s serial digital spectrum.

Because the high data rate of 270Mb/s signal is unsuitable for many applications, digital compression is used to reduce the bit rate to an appropriate level. Digital compression systems rely on human psychovisual characteristics and their limitations to remove unnecessary data components in digital video signals.

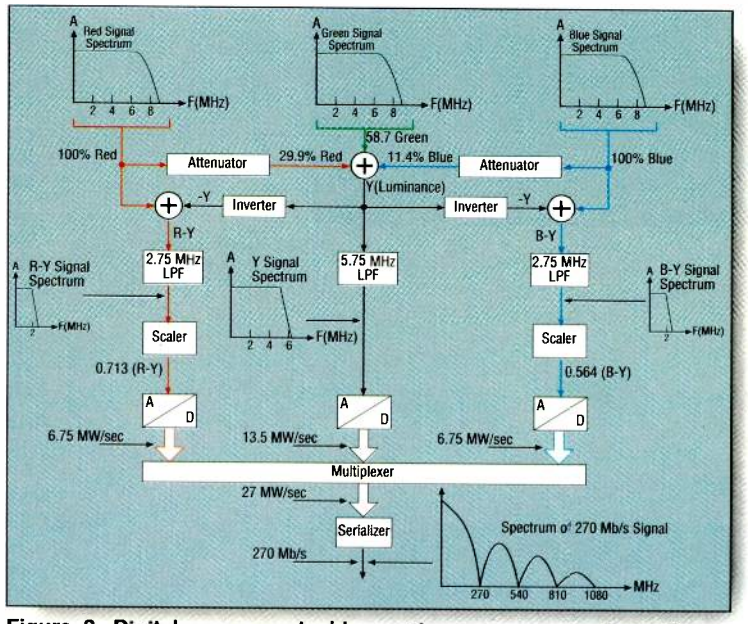

Figure 2. Digital component video undergoes compression prior to digitization. However, less bandwidth limiting is applied to these signals than is applied to analog composite signals.

Video signal redundancies

Redundancy is best described as unnecessary data. Because the data is unnecessary, removing it can reduce the bit-rate without necessarily affecting the picture.

•*Statistical data redundancy:* Most images contain large amounts of identical or very similar pixels. Unchanging picture details repeated pixel after pixel and image after image, constitute redundant information in a data stream. Clever compression systems exploit the fact that identical data need not be repeated and transmitted. The identification of identical pixel values within a frame or a sequence of frames is called decorrelation.

•*Psychovisual redundancy:* Certain picture details are not perceived by the human visual system (HVS). These picture details can be altered (i.e. reducing the number of bits per sample) or removed, thus reducing the data rate, and will result in imperceptible errors in the reconstructed picture.

•*Entropy:* Entropy is best described as the unpredictable information within a picture that needs to be preserved to properly reconstruct the original. Reducing the bit-rate below the entropy value results in lost information.

The human visual system

Video signals are ultimately decoded and displayed for human observers. The human eye, in conjunction with the brain, constitutes a well-developed imaging system. It can operate under a wide range of light intensities, recognize colors and perceive picture contrast as a function of picture detail (spatial frequency) and light intensity. Picture width and height, as well as the viewing distance, determine the perception of picture detail. Human visual acuity depends on:

Background luminance: Visual acuity increases with the brightness level up to a limit of 340cd/m² (candelas per square meter or about 100 foot-lamberts).

Luminance/chrominance contrast:

•Picture details are visible only if there is a significant difference between them and the background (high contrast).

•The eye's sensitivity to luminance detail is higher than its sensitivity to chrominance detail.

•Contrast sensitivity varies with the temporal frequency of the picture, i.e. flicker becomes perceptible at high brightness levels.

Because of HVS perception characteristics, image redundancies in the spatial and temporal domain can be removed and not noticed. Several types of redundancies are taken into consideration by compression systems to help reduce the bit rate.

Spatial redundancies:

•Spatial frequency sensitivity: High frequencies (fine picture details) are less visible.

•Texture masking: Errors in textured regions are difficult to see.

•Edge masking: Errors near the edges are difficult to see.

•Luminance masking: Visibility threshold increases with the background luminance.

•Contrast masking: Visibility of one image detail is reduced in the presence of another.

•Noise frequency: The HVS has a low sensitivity to high frequency noise

Temporal redundancies:

•Temporal frequency sensitivity: Below 50 Hz flicker effects become noticeable.

•High brightness levels increase the flicker perception

•Spatial frequency content: Low spatial frequencies reduce the eye's sensitivity to flicker.

With a solid foundation of how video signals are assembled, as well as an understanding of how we perceive the images produced by those signals, next month we will explore how the amount of data used to transmit images can be reduced through compression. ■

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

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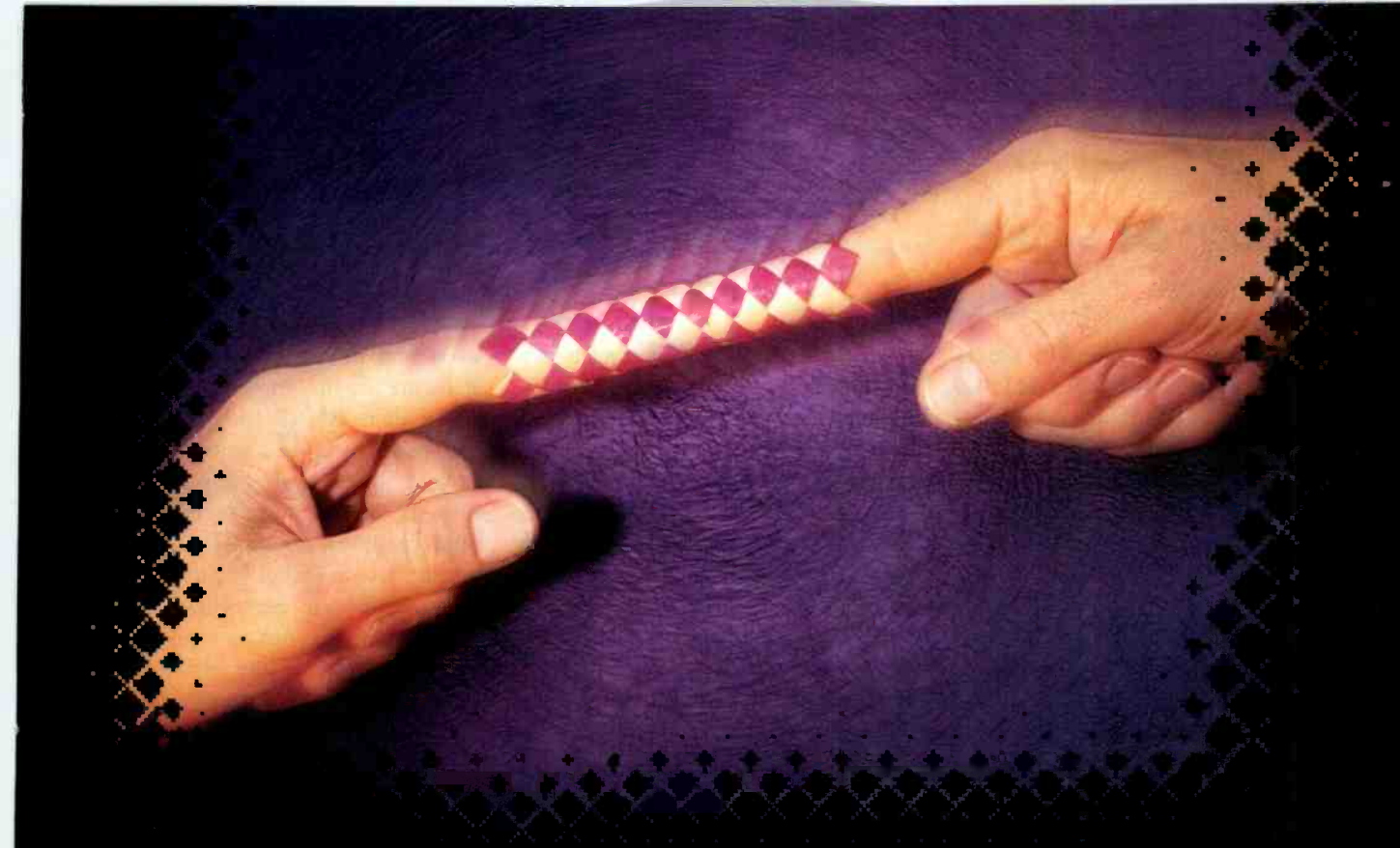

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Windows NT update

BY BRAD GILMER

Most television engineers are familiar with Windows NT 4.0. Some use it for desktop applications, while others have seen it used as the operating system (OS) for file servers, graphics devices, and a host of other products. This month's column looks at changes in the newest NT release.

What's in a name?

The most obvious change between NT 4.0 and NT 5.0 is that there is no NT 5.0. In July 1998, Microsoft announced NT 5.0 would be renamed Windows 2000 Professional. Microsoft says that Windows 2000, sometimes called W2K, takes the best of NT and Windows 98 and combines them into a single product. While Windows 2000 is based upon the NT 4.0 kernel, it leans heavily on Windows 98 for device support, power management and user interface design.

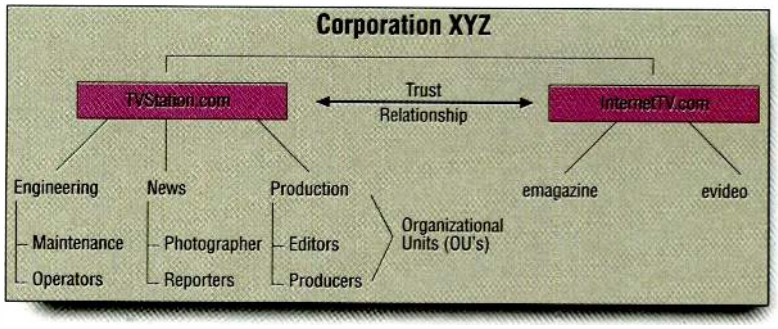

Figure 1. Active Directory allows network resources to be organized along the same lines as the business.

Your favorite new goodies in Windows 2000 will depend on how you use your computer. My personal favorites are plug-and-play as well as the ability to start and stop services on the fly. I regularly configure new computer systems with all sorts of strange devices. Trying to get devices to respond under NT 4.0 brought back some none-too-pleasant memories of struggles with device drivers in DOS systems. Rebooting after each configuration change, especially when devices are not responding, can take a lot of time. Another key feature for system configuration is a safe boot mode similar to Windows 9x. Once again, this can help expedite getting a new system up and running.

Some users will love InteliMirror. This new feature allows users to take their own preferences and user environment with them wherever they log into the network. Of course, this will only be offered on systems that use a Windows 2000 server. However, it can be appealing in a broadcast environment to have a user such as a system administrator or maintenance person be able to log on anywhere in the network and have the same screen with the same preferences and applications.

In the past, MS operating systems have been criticized for the lack of a true file system such as NetWare's Network Directory Services (NDS). Microsoft's answer in Windows 2000 is Active Directory. As the new directory service for Windows 2000, Active Directory stores information about resources on the network and provides the services necessary for administrators to assign shared devices such as printers and shared storage. Active Directory also provides administrators with a way to centrally organize, manage and control access to network resources in very large systems. Administrators will be able to organize users and resources according to the structure of the company. Organizational units (OUs), such as engineering, production and news can be arranged in a tree/branch configuration. Personnel, such as editors and photographers, can be assigned to the appropriate branches in a tree. If trust relationships are established between related domains such as tvstation.com and internettv.com (see Figure 1), then rights and access to resources are granted according to this trust relationship. Active Directory may not make much difference in small companies, but within large organizations, it will make it much easier to add new users and resources.

Microsoft is continuing to integrate the Web into its operating systems. Windows 2000 includes something called Active Desktop. Active Desktop allows you to display Web-based information on your desktop. For example, with a full-time Internet connection, a stock ticker could be continuously displayed on your desktop, your favorite website could be used as a background, or a video window could play a news channel in the background while you do your day trading.

For those of you who have looked for clustering from Windows products, it will be included in Windows 2000 Advanced Server and Windows 2000 Data Center Server. Both of these products include server clustering and load balancing, a critical item in high-availability systems. These systems utilize multiple servers sharing a single system image. Should one of the systems go down, the others pick up the load. Performance may slow, but critical operations continue to function. Windows 2000 Servers will sup-

Windows 2000 will run only on Intel x86 machines.

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port three separate technologies for their clustering solution - High-Availability Clustering, TCP/IP Network Load Balancing and Dynamic Load Balancing.

Security has been improved in the new version of Windows. In response to criticism of NT 4.0's security, Microsoft has substantially beefed up the security offerings in Windows 2000, including the following:

- Encrypted File System (EFS): EFS allows users to encrypt files, directories or an entire hard disk. This may provide peace of mind to mobile computer users who travel with sensitive information on their laptops.
- Public Key Infrastructure (PKi): PKi allows users to encrypt public communications such as email and other Internet-based exchanges in a secure environment.
- Kerberos: Kerberos is a widely available public domain authentication protocol. The protocol is used by some programs to verify that the user should be granted access to protected data
- Virtual Private Networks (VPN): VPNs allow for encrypted private communications across public networks. VPNs are typically used in Internet applications to allow remote authorized users to access private Intranets and company databases.
- SmartCard Technology Support: SmartCards have been used for some time to control access to television programming and private data. New peripheral support will be primarily via the Universal Serial Bus (USB) and IEEE 1394 (Firewire). The Firewire interface is particularly interesting given that it is already included in many video devices. Microsoft reports that Windows 2000 will have the most extensive peripheral support program ever, with more than 6500 devices tested for compatibility.

A new concept that has found its way into both Windows 98 and Windows 2000 is Device Bay. Device Bay is an architecture that enables adding and upgrading peripheral devices without opening the chassis and without turning off or rebooting the PC. Device Bay also enables peripheral devices to be easily swapped between platforms. TV receiver modules are among the devices that can be implemented through Device Bay.

For users who run NT 4.0 on non-Intel machines, you may be surprised to learn that Microsoft has dropped support for these systems in Windows 2000. NT 4.0 runs on not only Intel x86 machines but also on Reduced Instruction Set Computing (RISC) -based processors as well, such as the DEC Alpha, MIPS and the IBM/Motorola PowerPC. Windows 2000 will run only on Intel x86 machines.

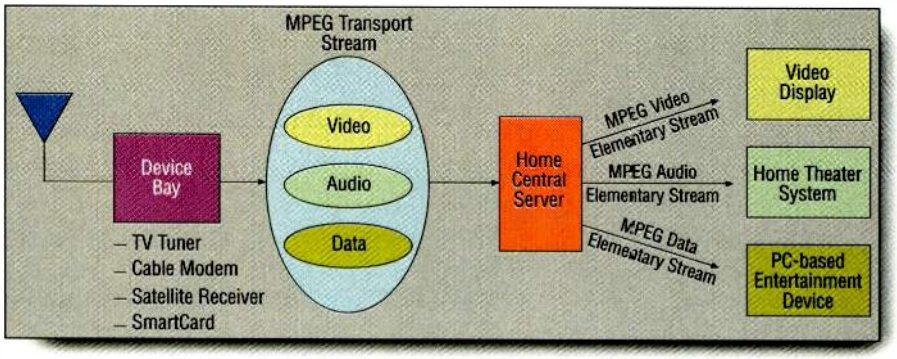

Figure 2. Possible architecture for use in future home networks. MPEG transport streams from the Device Bay would be decoded into elementary streams by a central server and then routed as needed.

While an official list of hardware requirements for Windows 2000 is not available, beta testers report that a 166MHz processor is the bare minimum, and that while Windows 2000 will run with 32MB of RAM, performance is quite poor. A minimum of 64MB is recommended. If you want to see if a particular computer or device is Windows 2000 compatible, check Microsoft's compatibility site at www.microsoft.com/isapi/hwtest/hcl.idc.

Microsoft and television

So what is Microsoft's vision for television? It seems clear that Microsoft is gunning for the traditional television set market. After all, the consumer market for televisions and audio systems has always been huge. No doubt, Microsoft would enjoy a piece of this market. What follows is my interpretation of the Microsoft strategy.

Microsoft is looking toward a time when there is a network in the home. This network (could it be IEEE 1394?) will serve as the backbone for video, audio and data. A central server will separate different streams and route them to the appropriate peripheral. An MPEG transport stream would serve as the overall transport wrapper, carrying content from the provider to the home. A central server would then decode the transport stream into the various elementary streams for video, audio and data, and then send them to displays, home theater systems and PC-based entertainment devices (see Figure 2). Windows 2000 will have a DV codec built into the software allowing DV compressed video and audio to be decoded and displayed directly on the PC.

Windows 2000 also supports DirectShow, a replacement for Video for Windows. DirectShow enables playback of compressed video and audio content. Several compression formats are supported, including MPEG, Apple QuickTime, Audio-Video Interleaved (.avi), .wav and both Video for Windows-based capture and WDM-based (Windows Driver Model) capture. DirectShow contains provisions for routing a stream's data flow using something Microsoft calls a filter graph.

Active Desktop, discussed previously, allows video and audio to be streamed directly to the desktop. Couple this with built-in Smart Card support, support for 1394 Firewire networking and the external Device Bay to hold TV tuners, cable modems and satellite receivers and you start to get a picture of how Windows 2000 moves Microsoft forward. By the way, while all this is new to the NT world, Windows 98 already supports DirectShow, Active Desktop and Device Bay. ■

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

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Potholes along the road to digital

BY STEVE EPSTEIN, TECHNICAL EDITOR

Dr. Digital,
I just read your August column about component video levels. It brought up a similar question that I have about converting from NTSC composite to CCIR 601. Within our (mostly) digital facility, we have a U-matic deck that we occasionally use for record and playback. The U-matic's TBC output is converted to SDI using a Leitch DEC-6801 card. The DEC-6801 has a switch for setup/no setup. Regardless of the setting of this switch, the digital output still has setup. We can get rid of the setup by cranking it down on the TBC but that doesn't seem like the correct answer. I know that there is no setup on a digital signal. Shouldn't the DEC-6801 remove the setup? I have found the same thing to be true when going from analog component (with setup) to digital. For that matter, there is setup on the digital outputs of the Ikegami CCUs that we installed. It would seem to me that the pedestal should be set at the zero base line, but I'm not sure. In general, the transition to digital has been relatively easy, but these little nagging questions haunt me. Your comments would be greatly appreciated.

Paul A. Fox
Senior Systems Engineer
Snader Systems Group
Redwood City, CA

Good question, there are a lot of these little nagging details regarding video signal conversion, and not all of them even involve digital. Unfortunately, there are no easy answers — if there were, we would all have agreed on the "best" video standard instead of ending up the today's standards smorgasbord. Much of the reason for setup is historical. When transmitting NTSC, a sync tip at –40IRE represents 100% of the output power. The zero IRE baseline is 75 percent of the output power. For transmitters, a black picture represents a significant load. Early transmitters had trouble dealing with this and setup (typically set somewhere between five and 12IRE) was a way to reduce that load. Setup also made it easier on early receivers that did not have DC restoration circuits and left a little breathing room between video and baseline. When video crossed the baseline into the sync area, it wreaked havoc on much of the early television equipment.

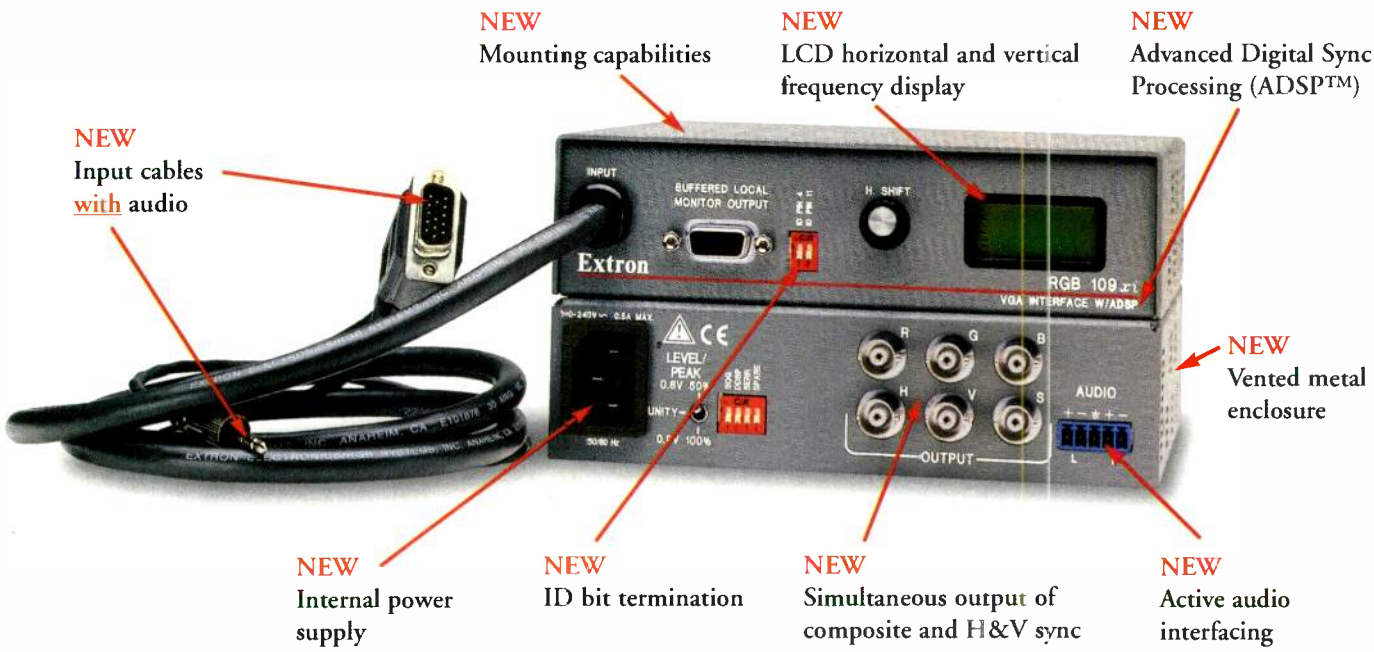
Setup is not used in all video standards. Manufacturers build their equipment for use worldwide, which is the reason you have the setup/no-setup switch (NTSC in North America has setup whereas NTSC in Japan and PAL do not). Some decoders (including the Leitch DEC-6801) clip luminance below 7.5IRE, other decoders do not, which brings up another interesting point — not all decoders handle the conversion in the same manner. Within closed systems, the rules can be bent. Systems with setup (7.5IRE) have a range of 92.5IRE from the blackest blacks to the whitest whites. That range can be improved by more than eight percent if setup is removed and the blackest black is reduced to zero IRE. For instance, to provide some additional definition in the black robes worn by a local church group, the camera setup levels were reduced to 2.5IRE. This improved the picture on their closed-circuit systems, and because they weren't broadcasting, the reduced setup was not a problem. Another common use of a blacker than black signal of zero IRE is for alpha (key) channels in production operations. Both of these instances bring up potential problems for converters that do not digitize luminance information below 7.5IRE.

You are correct, analog composite does have setup, and digital component does not. Converting from one to another is best accomplished by removing the setup from the analog signal. When the digital signal is converted back to analog, the setup must be reinserted. However, before making a quick decision, consider whether you use any signals that have luminance information below 7.5IRE. Will that information be useful/useable once it is converted to digital if you reference 7.5IRE to the equivalent of 0mV for digital video? There is some headroom in the digital signal, but there is no guarantee that your encoding/decoding equipment will pass it faithfully.

Doing signal conversions properly throughout a facility requires that you understand the signals involved and the equipment doing the conversion. This means putting setup in where it belongs and taking it out where it does not. Typically this also means scaling the signals as needed. At each conversion point, signal degradations are likely. Your best bet is do as few conversions as possible, and when you do one, do it as accurately as possible. Try to keep the production process as pristine as possible – convert input signals as needed to the house format, do the production, and when you are through, convert to whatever format is needed for distribution. This problem is not new. People that built composite suites and produced on Betacam formats lost a lot of signal quality because they did a composite/component conversion each time the signal went into and out of the decks.

By the way, on those Ikegami CCUs, you might check the chroma levels on the color-difference outputs. Because the Y channel has setup, the outputs might be configured for Betacam levels, which include increased chroma level.

As always, comments and questions are encouraged, drop me a note at *drdigital@compuserve.com.* ■



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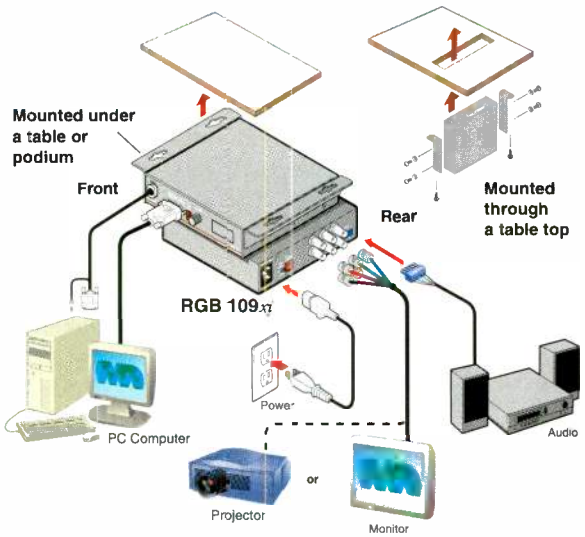

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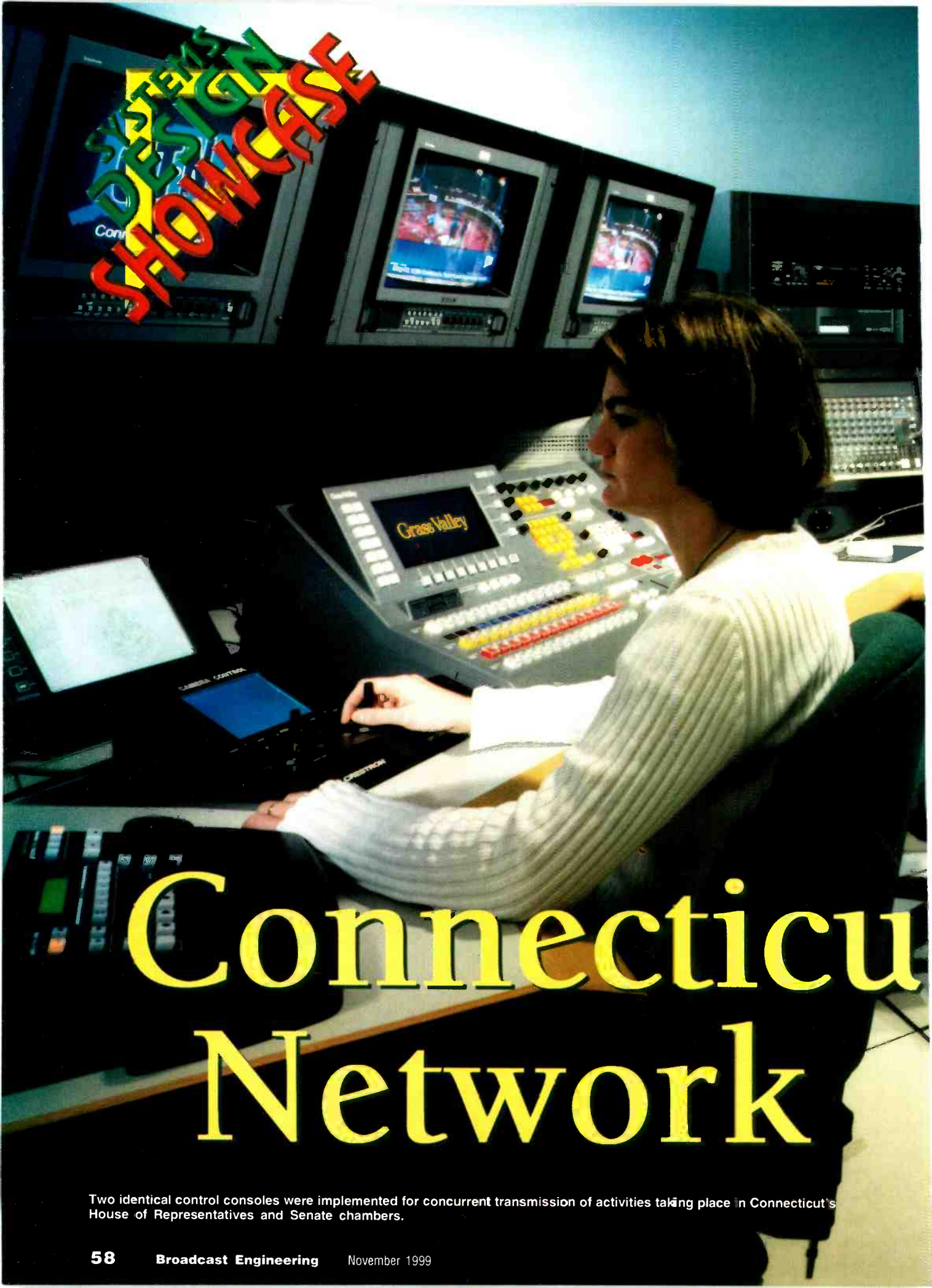
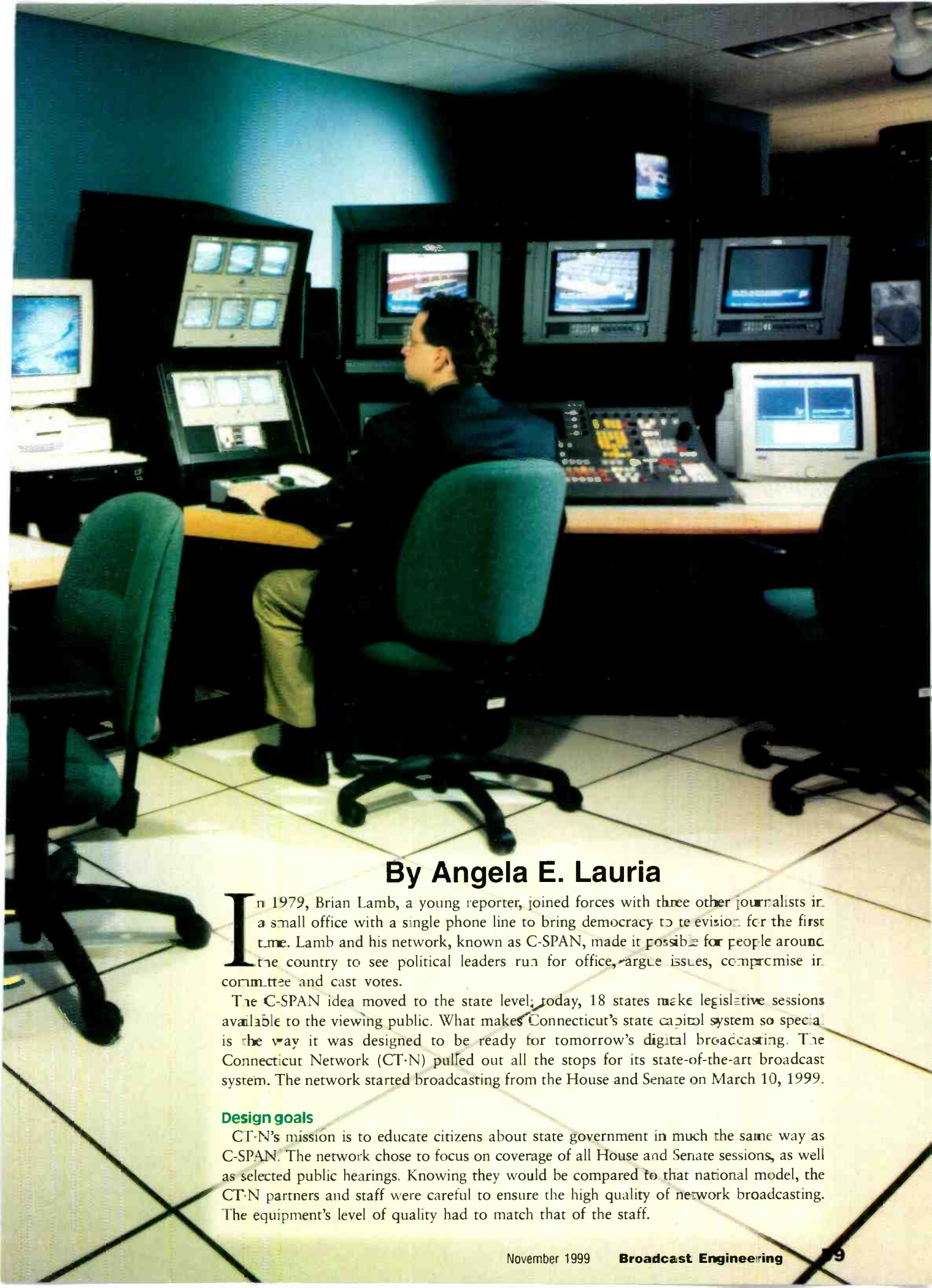


Connecticu Network

Two identical control consoles were implemented for concurrent transmission of activities taking place in Connecticut's House of Representatives and Senate chambers.



By Angela E. Lauria

In 1979, Brian Lamb, a young reporter, joined forces with three other journalists in a small office with a single phone line to bring democracy to television for the first time. Lamb and his network, known as C-SPAN, made it possible for people around the country to see political leaders run for office, argue issues, compromise in committee and cast votes.

The C-SPAN idea moved to the state level; today, 18 states make legislative sessions available to the viewing public. What makes Connecticut's state capitol system so special is the way it was designed to be ready for tomorrow's digital broadcasting. The Connecticut Network (CT·N) pulled out all the stops for its state-of-the-art broadcast system. The network started broadcasting from the House and Senate on March 10, 1999.

Design goals

CT·N's mission is to educate citizens about state government in much the same way as C-SPAN. The network chose to focus on coverage of all House and Senate sessions, as well as selected public hearings. Knowing they would be compared to that national model, the CT·N partners and staff were careful to ensure the high quality of network broadcasting. The equipment's level of quality had to match that of the staff.

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Connecticut Network

The most important design goal was to create a broadcast facility that was prepared for the future.

Problems

To put the technical side of the project together, the fledgling network turned to HB Communications, a North Haven-based company that has been dealing in systems integration for 53 years. HB is one of the largest audio/visual resellers in New England and works with corporate, educational and parochial clients.

CT·N uses Sony Betacam SX decks for multiple sequential recording.

The state legislature granted $1.4 million to get the project off the ground. Nearly $1 million of the start-up money was spent on equipment, with good reason; it was important that the equipment not be obsolete in a few years. HB Communications worked with Connecticut Public Television to carefully analyze future trends before making equipment suggestions.

CT·N will not have to count solely on the state. Its non-profit organization status allows the network to seek private donations. Public donations can also supplement the money that comes from the state, which approved initial budget allocations.

In January 1999, with the financial issues decided, the project moved into high gear. Because the legislative session ended on June 9, the network had to be up by early March in order to create the necessary momentum. March 10 was slated as the opening day and, while not every cable was pulled at that point, CT·N met its goal. Since that day, CT·N has originated a 24-hour-a-day signal.

Solutions

HB Communications designed a system that is ready for tomorrow's digital broadcasting. All switching and distribution is compatible with serial digital signals and will work with 4:3 and 16:9 formats.

The system currently consists of 10 Sony DXCD30WSL cameras and 10 Crestron CPC-CAMI network-connected, remotely controlled pan-tilt units with lens control. Three cameras were installed in the House of Representatives and four in the Senate. The remaining three cameras were mounted in a large hearing room in the legislative office building.

The cameras are broadcast quality and incorporate helpful features such as skin detail correction and automatic tracking white balance (ATW). ATW will compensate for changing light conditions throughout the day. The cameras are also switchable between 16:9 and 4:3 formats. Currently, nine more hearing rooms are being wired to support the portable Sony DNV-5 Betacam SX digital docking recorder.

All the cameras sit on robotic devices and are operated from a central location in the legislative office building that is equipped with two control panels. They are controlled by the Crestron CPC-2000, which has dual joystick controls for pan-tilt and lens control with preset positions and touch screen control. This eliminates the need of a camera operator in the room, making filming less intrusive. In the future, triax cable can be added to provide access to more sophisticated camera operations and setup.

For recording and archival purposes, HB Communications selected three Sony DNW-75 BetacamSX broadcast digital VTRs. Each recorder is capable of recording 188 minutes without changing videocassettes.

HB Communications choose tapeless technology for the video server, ensuring that CT·N can produce a state-of-the-art viewing experience.

Grass Valley Group's PDR324D recorder player records MPEG-2 with 72GB of storage, and two output channels allow the freedom to broadcast live, on a delay or tape a session for playback later.

Two identical systems are in place making it possible for two control panels that work independently of each other to allow the server to broadcast one session while recording another. For example, if a session starts at 3:50 p.m. and broadcasting is set to start at 4 p.m., the operators can start the broadcast on a 10-minute delay while recording the session as it happens. Since the two control panels function independently, the server can broadcast one session while recording another.

Design team list

Rich Gibbs, director of broadcast systems, HB Communications Inc.
Dave Spiro, senior design engineer, HB Communications Inc.
Gary Peck, engineer, HB Communications Inc.
David Fazzina, system programmer/Crestron Code, HB Communications Inc.
Vinnie Natter, installation team, HB Communications Inc.
Tom Ollson, installation team, HB Communications Inc.
Dave Gassira, installation team, HB Communications Inc.
Paul Giguere, project manager/production, Connecticut Network
Jay Whitsett, CPTV, engineering operations, Connecticut Network
Eric Connery, legislative liaison, Connecticut Network

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Connecticut Network

The HB Communications' installation included the engineering, cables in the control room, connectors, as-built drawing, panels and patch systems. The state provided fiber optic links, trunk cables and the cable installation. HB Communications provided final connections and cable specifications as well as all custom programming for camera positions and switching.

A member of the CT·N staff sets the playback schedule of the Grass Valley Profile.

For the past seven months, CT·N aired live and live-to-tape House and Senate sessions of the Connecticut General Assembly, selected legislative and executive branch public hearings, seminars, awards ceremonies and other public events linked to current public policy issues. CT·N is aired on cable-fed Community College Instructional Television (CCIT) channels throughout Connecticut each weekday from 4 to 8 p.m. and from midnight to 8 a.m. Currently, CCIT is seen in 60 percent of Connecticut households with cable service.

The network plans to meet its goals of going beyond broadcasting only the legislative branch. Year-round coverage of the executive branch, including state commissions and agencies, has begun. Broadcasting the state Supreme Court and hearings before the court will begin soon and three fixed robotic Sony DXCD30WSL cameras may be added to the courthouse in the future.

CT·N sees unlimited potential for education. With such advanced technology, the facility is an ideal training ground for technical college students. As such, CT·N wants to tie operating the different facets of the network into the schools' curricula.

The network can also be a powerful teaching tool for students in grades kindergarten through high school. What better way to teach government to school-age children than with first-hand viewing?

Along with the educational impact, there is an important societal function for the Connecticut Network. The channel gives people a chance to be connected to their state government at exactly the time in history when government's role is shifting back down to the state level.

For more information about Connecticut Network, go to www.ctn.state.ct.us. For more information about HB Communications, go to www.hbcommunications.com. ■

Angela E. Lauria is an industry consultant based in Washington D.C. Chris Griffiths and Amy Pemberton contributed to this report.

Equipment list

House of Representatives:
3 Sony DXCD30WSL digital processing widescreen 16:9, 4:3 switchable color cameras
3 Crestron CPC-CAMI network-connected remotely controlled pan-tilt units with lens control

Senate Chambers:
4 Sony DXCD30WSL digital processing widescreen 16:9, 4:3 switchable color cameras
4 Crestron CPC-CAMI network-connected remotely controlled pan-tilt units with lens control

Hearing Room 2C:
3 Sony DXCD30WSL digital processing widescreen 16:9, 4:3 switchable color cameras
3 Crestron CPC-CAMI network-connected remotely controlled pan-tilt units with lens control

Recording System:
3 Sony DNW-75 BetacamSX digital recorder/player
1 Grass Valley PDR324D Profile digital recorder player MPEG-2 with 72GB of storage, 2 I/O channels, simultaneous recording and playback

Duplication:
3 Sony SVO2000 SVHS recorder/players for duplication

Portable System:
1 Sony DNV-5 Betacam SX digital docking recorder for use with DXC-D30WSL

Control:
2 Grass Valley Model 1200 component digital production switcher 4:2:2:4 digital video signal processing, 16 inputs, E-Mem system, fully compatible with 16:9 picture formats, with I/O modules
1 Grass Valley SMS-7000 32x32 I/O component digital routing switcher with redundant power supplies, control and interface for existing Horizon routing switcher, 4 XY control panels
1 Tektronix Sync and Transcoder System including genlock master sync, video delay distribution, source timing modules, video DAs, 270Mb monitor DAs, 270Mb to NTSC encoder 10 bit, 270Mb to NTSC encoder 8 bit, NTSC to 270Mb decoder
2 Pinnacle Write Deko broadcast character generators with data monitors
2 Crestron CPC-2000 dual joystick controls for pan-tilt and lens control with preset positions and touchscreen control
8 Nova ASD-2S analog composite to SDI transcoder with frame sync
6 Panasonic WV-BM503 Triple five-inch monochrome monitors to view camera and tape sources
6 Sony PVM-14M2U 14" Trinitron monitors to view preview, line and character generator
1 Sony PVM-20M2U 19" Trinitron monitor to view CPTV feed and test
1 Sony BKM-101C SDI input module for PVM-20M2U
2 Tektronix 1740 Waveform monitor/vectorscope for analog test
1 Videotek VTM-203 digital/analog test system
1 Videotek SVGA-17RK rack mounted monitor for VTM-203
2 Mackie MS-1402-VLZ audio boards

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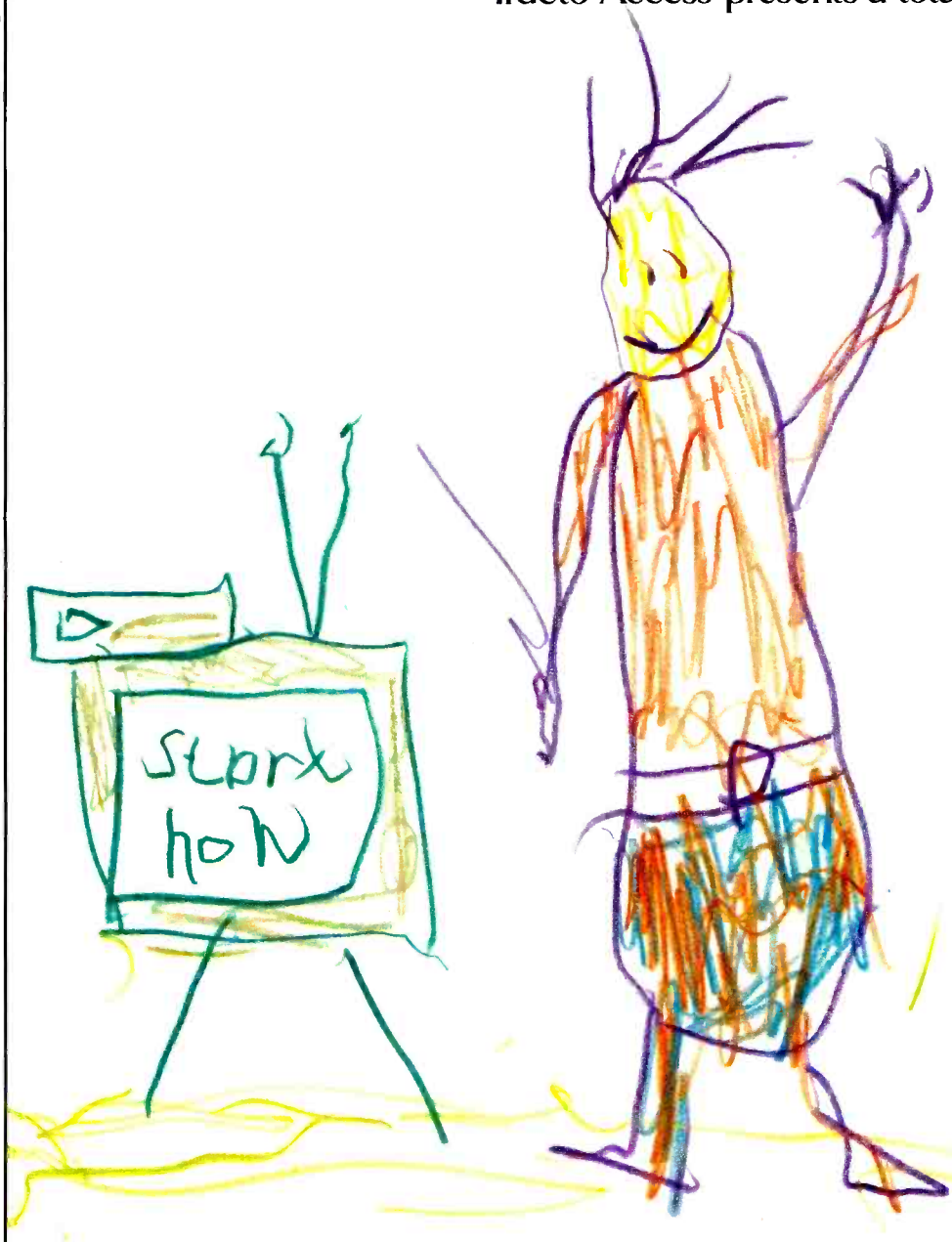

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Transmission & Distribution

Lightning protection

BY DON MARKLEY

While this particular subject has been treated in the past on these pages, it seems that the word never quite gets around. Station after station can be found where the tower is grounded with a single #10 wire connected to a single ground rod. This is usually justified either by saying "That's the way it has always been done,"or by adopting a glazed look in the eyes, much like a deer staring at headlights. Just as that deer may well be facing its doom, an inadequately grounded tower and transmitting facility is inviting major damage.

This problem has been addressed effectively by many of the cellular companies. They normally build a cage around their building and then ground that cage at multiple locations using either multiple ground rods or large, chemically assisted grounding conductors. The broadcast industry, while in existence far longer, seems to delight in defying the forces of Mother Nature with minimal grounding systems.

Periodically, a strike will defy all the protection devices and circuits and run rampant through your equipment anyway.

Towers and lightning

Towers themselves act as a wonderful attraction for lightning strikes. AM towers routinely utilize static drain chokes to reduce or eliminate the buildup of charges on the tower. Those chokes are normally assisted by a lightning gap at the base of insulated towers. The gap is typically adjusted to the point where full modulation at the rated power will not cause an arc. The antenna tuning unit is normally connected to the tower through a lead having at least one loop to create a small amount of inductance. The purpose of that inductance is to encourage any lightning strikes to travel across the ball gap into the ground system, rather than going into the antenna tuning unit. A further lightning deterrent is the use of a capacitor in the output leg of the tuning unit. The capacitor attempts to block the current flow from the lightning. The small loop works on the principle that the rise time of the lightning strike is very fast, creating a large impedance in the lead even though its actual inductance is small. This all helps, especially since the ground system around AM towers is extensive and offers a very low impedance to dissipate the energy involved in the lightning strike.

TV and FM towers do not usually have the advantage of such a ground system. Some stations have taken the unusual step of installing a ground system consisting of 100 or more radials, each over 100 feet long, around the tower just as though it were intended for AM. While efficient, it is a bit of overkill. The idea is good, but an adequate system, one which is less elaborate, can be built.

In the early 1960s, a paper was published in the IRE Transactions by a plasma physicist concerning the magnitude of the energy involved in lightning strikes and the resulting voltage gradient around the base of towers. The gist of that article was that a path was needed to dissipate

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Program	Total Streams served	Total visitors	On-air rating
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Clinton video	700,000	170,000	4.1
Ms. Universe Pageant	20,000	81,600	8.0
CNN Operation Desert Fox	130,000	49.2 million	2.2
JFK Jr. Tragedy	2.4 million	n/a	1.4

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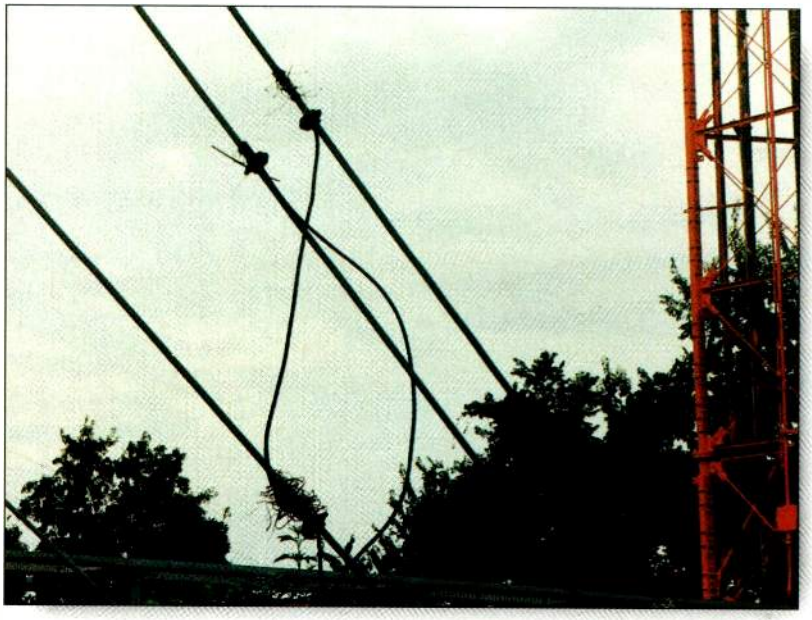
the energy into the ground that would reduce that voltage gradient. In other words, the high current involved, coupled with a high resistance path, caused high voltages to exist between points along the ground such as from one end of the transmitter building to the other. Those high voltages caused very high currents to flow in the equipment and wiring which might be in that building with attendant damages. The article made some recommendations as to how to reduce that effect.

To better understand the concept of voltage gradient along the ground, think of a cow standing next to a tree struck by lightning. The cow is killed when the lightning strikes the tree, but not by being hit directly. The problem is that the voltage measured along the ground between the cow's feet is very high. This causes a current to flow through the cow between its feet, killing the cow. Two solutions to this problem exist. Either teach cows to stand with their feet very close together (somewhat difficult) or reduce the rate of change of voltage along the ground, which is probably a little easier.



Guy wires and towers should be grounded to dissipate lightning strikes rather than allowing the dissipation path to run through the transmitter.

A ground system that works

An excellent broadcast engineer of that era, Jack Moffet (now deceased), drew upon the points of that article and developed a ground system which he recommended to his clients. That method has been brazenly copied by this author and has been found to work very well for broadcast facilities. To start, at least four ground rods, each at least eight feet long, are driven around the base of the tower. They are connected together in a ring around the base and all of the rods are also connected to the tower with either copper strap or large (#4 or bigger) copper wire. Then at least eight radials of #4 or larger copper wire are buried out 50 feet from the tower where they are again connected to eight-foot ground rods. All connections are hard soldered or welded with the single exception being the connections to the tower, which can be bolted via large lugs. The same type of ground system is then installed at each guy point. All transmission lines on the tower must be well grounded to the tower at or near the base.

This system is not intended to keep lightning from striking the tower. Instead, it is designed to reduce the harmful effects of the lightning strike by dissipating the energy harmlessly along a low resistance and reactance path spread over a large area. It works well, as has been proven by the author in multiple installations.

The other half of the problem is keeping the lightning from striking in the first place. Toward that goal, different systems, which claim to reduce or eliminate strikes, are on the market. These consist mainly of devices to install on top of the tower or top mounted antennas that are claimed to dissipate static buildups into the atmosphere harmlessly, thereby avoiding actual strikes. Do they work? Based on claims by their manufacturers, they are the end of the problem. Based on the experiences of many of their users, they certainly help. The analysis of the manner in which they perform ranges from a lot of hand waving to some seemingly scientific explanations. Regardless of just how they may be claimed to work, the results in the field do appear to support a significant reduction in strikes. Using these devices seems to be a good idea.

Regardless of the device placed on the tower/antenna system, remember the words of Mark Twain. In looking at works which were built to control the Mississippi river, Twain said, in effect, that man had never built anything that the river wouldn't run over, tear down and laugh at. Lightning protection devices, including grounding, fall into that category. No matter what is put on the tower, there will still be some lightning strikes. Those strikes have to be dissipated as harmlessly as possible. This still calls for the type of ground system previously described. Obviously, the system described here is not the only one, but it is one that works.

The final irony of the whole thing is that Twain's words still apply even with pin cushions on the tower and a great ground system. Periodically, a strike will defy all the protection devices and circuits and run rampant through your equipment anyway. The only solution to those occasions is lots of spare parts and a paid up insurance policy. ■

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

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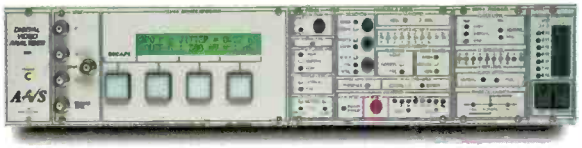

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DVD progressive video vital to rapid acceptance of HDTV

BY MARSHALL GOLDBERG

Of the many consumer audio and video formats released in the last decade, DVD-Video has been the biggest winner, and it looks like DVD is here to stay. Other formats, such as Laserdisc, VHS-C, Digital Video Camcorders, MD and DAT, have enjoyed less enthusiastic reception.

Where's the quality difference?

What's really interesting about DVD-Video is just how good its quality can be. Of course, DVD players can be plugged into any TV set as easily as a VCR, resulting in better video quality. More importantly, home theater enthusiasts can experience incredible results with widescreen, digital, projection and high-definition TV sets and get similar audio improvements. It's this potential, which is only today being exploited by the enthusiast crowd, that will ultimately replace VHS tape with DVD.

NTSC-formatted DVDs have a resolution of 720x480 pixels. VHS, with a bandwidth of about 3MHz, produces substantially lower resolution, and many consumers can notice the difference. With progressive DVD playback technology, a DVD can produce a DTV-quality image that exceeds the capability of the best analog television sets.

When the DVD-Video specification was created, its designers realized that most DVD titles would be mastered from film. Because film is created at a rate of 24fps, they decided that the DVD player itself would add the additional 6fps to match the 30fps display rate of TV, in order to save space on DVD discs. All DVD players manufactured for NTSC support this, using 3:2 pulldown. During 3:2 pulldown playback, the 6fps are added by duplicating one field of video for every other frame. This is illustrated below, where 'O' refers to the odd field, and 'E' refers to the even field. Typically, two of these fields, interlaced together, compose one frame of video.

Frame Number: 1 2 3 4 5 6

Fields Played: OEO EO EOE OE OEO EO

The field duplication described here is used for virtually all VHS tapes as well as movies mastered for TV broadcast, and it is the process that best converts film's 24fps rate to TV's rate of 30. What's different in DVD, however, is that the final portion of the frame rate conversion is performed by the player itself. This means that higher-quality DVD players can play two adjacent fields of video as a single, high-resolution frame, as such:

Frame Number: 1 2 3 4 5 6

Fields Played: OE OE OE OE OE OE

This produces true resolution of 720x480 pixels, non-interlaced, at 24fps. Progressive DVD players can decode at this resolution and then use interpolation to increase both the pixel resolution and the frame rate to match the characteristics of the display. This is significant, because many high-performance displays, such as LCD and plasma, have one specific native resolution. By scaling the video in the digital domain, much better interpolation is possible, and a very high-quality RGB signal can be sent to the display.

Progressive DVD is not limited to NTSC either. DVDs mastered for the PAL standard are also laid down at the rate of 24fps, and progressive DVD players can also output this content progressively. This gives PAL DVDs an advantage. With a progressive player, PAL DVDs offer higher resolution, but the same frame rate as DVDs made for NTSC. Of course, not all DVDs contain progressive source.

If a DVD title was created from a video source, then the adjacent fields cannot be combined into a frame, because video cameras capture fields of video every 1/60 of a second. Combining two such fields would cause motion artifacts and blurring. Instead, for this type of footage, progressive DVD players will either switch to an interlaced output mode, or else they will play each field individually and use line doubling to resize each field before displaying it.

Today's products

Until recently, progressive DVD technology was limited to only a few models of computer-based DVD players. While there were chip sets available, they were not (until recently) widely available to consumers. Once they were, many enthusiasts quickly devised methods for connecting these outboard systems to to their home theater systems. This fall, several DVD standalone players contain the technology, and both Toshiba and Panasonic have announced the availability of progressive DVD players.

To video enthusiasts, it is clear that DVD and especially its progressive implementation bring substantial improvements to the quality of home video. Yet, if you judge DVD by its video performance alone, you're not getting the complete picture (so to speak). The audio capabilities of DVD are also formidable. In particular, the Dolby Digital format brings theater-like 5.1 channel surround sound into the home, which truly completes the home theater experience.

As new digital and high-definition TV sets come to market (at decreasing prices) expect to see more consumers making the leap to this technology. More consumers will soon begin to realize the visible and audible benefits that DVD-video provides. Coupled with a widescreen HD set and surround sound audio, DVD is unbeatable in terms of video and audio quality. ■

Marshall Goldberg is director of Product Marketing for Sigma Designs.

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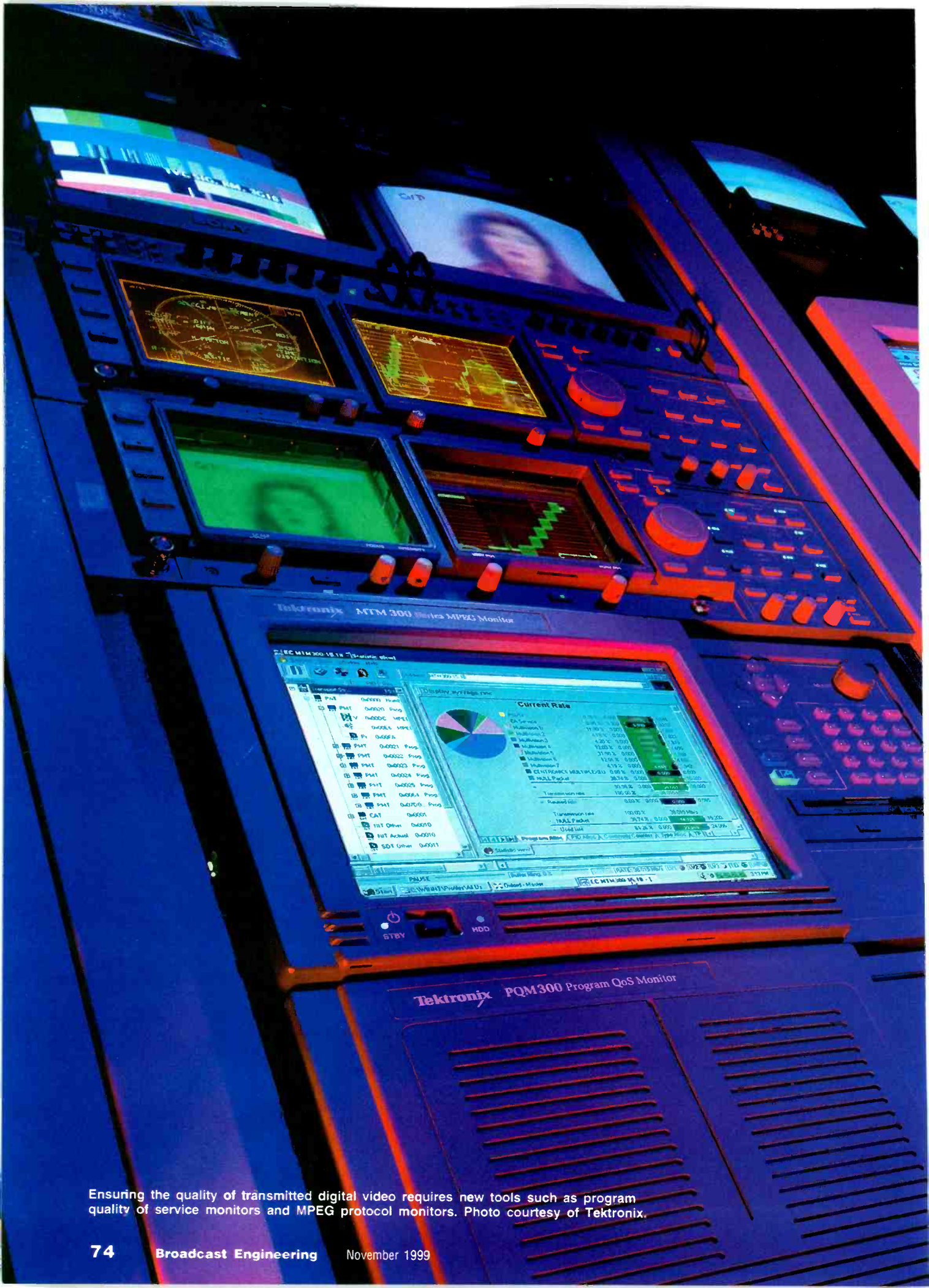
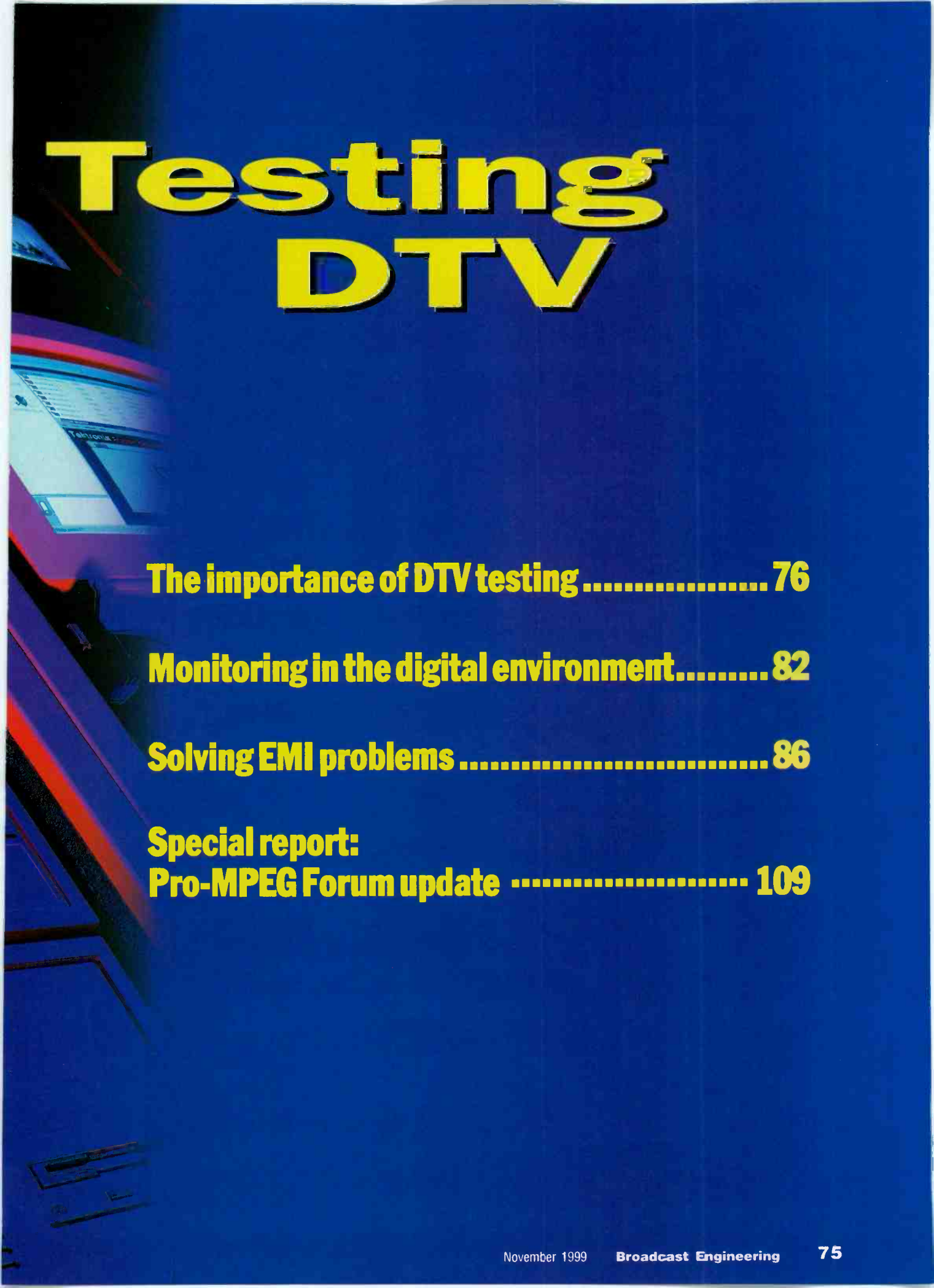
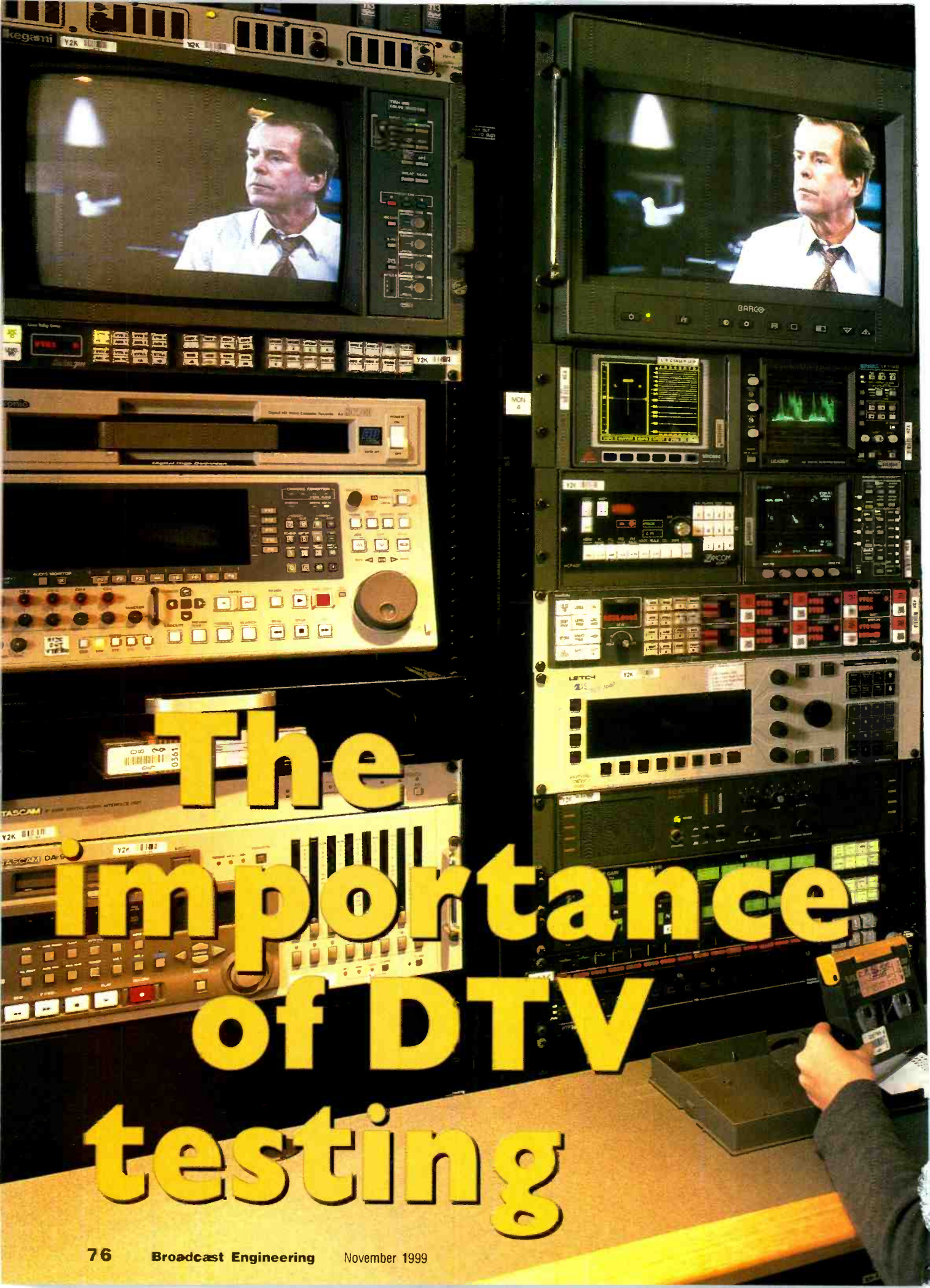


Ensuring the quality of transmitted digital video requires new tools such as program quality of service monitors and MPEG protocol monitors. Photo courtesy of Tektronix.



Testing DTV



The importance of DTV testing

The transition to digital brings with it a variety of new testing procedures and equipment. Scopes for monitoring digital signals are taking their places alongside traditional analog equipment. Photo courtesy Leader Instruments.

By Kenneth Hunold

Television is joining the CD, DVD, and other consumer electronic entertainment media in the march to digital production, distribution, and transmission. For every consumer technology there is often a professional line of equipment developed to provide content for it. Digital television is no exception. Implied ads for DTV say that "It's digital. It must be good." Producers and users assume that digital will make things easier and better. After all, with digital, it either works

DTV testing

perfectly or doesn't work at all.

The challenge for engineers in digital facilities is learning how to look into the failed digital signal to determine why the signal suddenly went away. This can be a tall order, considering that once a signal fails, there is no easy way to determine where the problem might be. Rest assured that new types of test equipment will be taking their place alongside (but not necessarily replacing) your traditional analog broadcast test equipment.

From spectrum analyzers to bitstream analysis

Ever since entertainment moved beyond the projected motion picture image, engineers have had to find other ways to look at signals in their electronic form. For the most part, oscilloscopes of various designs were used. Many forms of transmission make use of the spectrum analyzer to see the spectrum of the signals of interest. It is important to note that today's modulation systems, even the so-called digital modulation systems, still use analog methods to convey digital program data. As such, spectrum analyzers and many other analog measurement devices are still useful, and in some cases are required for troubleshooting digital broadcast systems. Although it is no longer a requirement to look for the individual audio and video carriers of NTSC systems, spectrum analyzers are very effective in ascertaining why a particular digital broadcasting system may not be working — either from a signal strength or signal quality perspective. And without a spectrum analyzer, it is difficult to align satellite or terrestrial links.

Where the spectrum analyzer would traditionally be used to identify whether there were any information carriers in the transmitted signal, MPEG compression analyzers have come into use to help decipher the incoming bitstream. MPEG (Moving Picture Experts Group) compression uses packets, program IDs (PIDs), and tables to organize the transmitted data. An MPEG analyzer allows these elements to be inspected, much like the analog carriers of earlier transmissions were. If a video or audio program were to suddenly disappear, an MPEG analyzer could be used to determine whether the program ID associated with a particular service is still in the datastream.

The data rate used to represent a signal within an MPEG datastream is an important parameter. These analyzers provide information and statistics about the data rate of the signals being transmitted. Often these analyzers include a way to store datastreams for further evaluation and inspection. In some cases, this feature is broken out as a separate product, creating what is known as a bitstream player. These bitstreams are often available in different transport formats such as SMPTE 310M, DVB-ASI, 8VSB, and others. A key specification to be aware of when evaluating one of these bitstream players is the type of interfaces supported.

MPEG compression has almost become ubiquitous for video signals. As might be expected, there is a trade-off between perceived picture quality and the amount of data used to describe the picture. In general, as the data rate goes down, the perceived picture quality also goes down. However, the absolute data rate is not always the determining factor. Some of the MPEG parameters, the MPEG levels (image resolution) and profiles (compression algorithms) can affect the perceived quality, even at the same data rate.

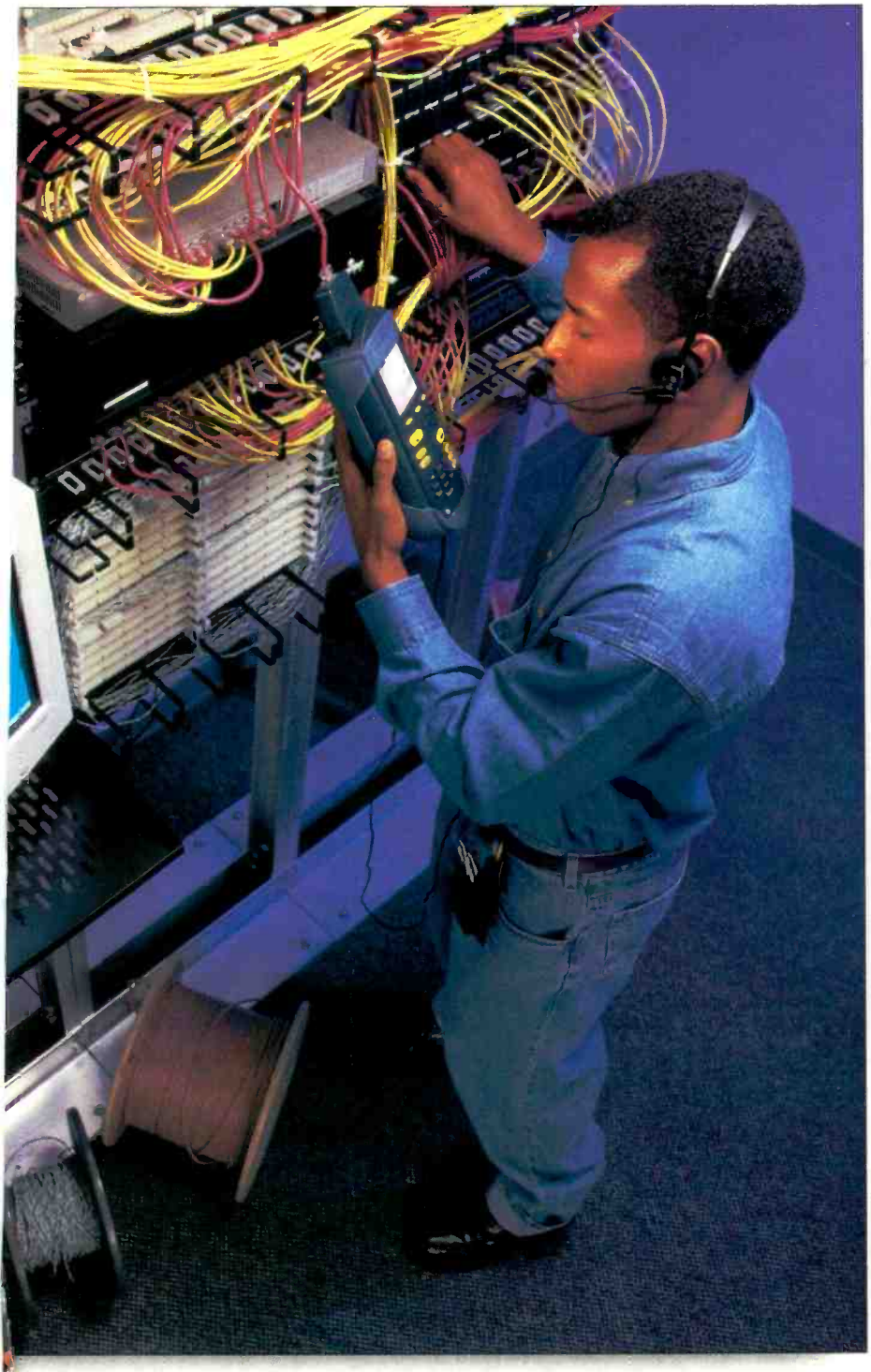
Some manufacturers have developed test equipment specifically designed to objectively quantify what has usually been a subjective evaluation of picture quality.

Some manufacturers have developed test equipment specifically designed to objectively quantify what has usually been a subjective evaluation of picture quality. These products use algorithms to model the Human Visual System (HVS) and are designed to objectively evaluate the data that represents the picture. Some are off-line test systems that compare the result of a compression process with the origi-

nal signal. Of course, this requires that the measurement device knows about the original, either by acting as the generator, or having a copy of the generated signal stored in memory. These devices can be further broken down into units that will analyze a signal in real time and units that record the compressed signal and analyze the result in non-real time (usually longer) for more detailed analysis. Some models analyze the MPEG bitstream directly, while others decode the video and look for artifact signatures.

Often MPEG analysis tools are used in the authoring process for DVDs where compression parameters can be fine-tuned for the best picture quality at a given bit rate. When time allows, these compression parameters are tweaked for optimum results, and the program is then mastered for duplication and release. Live broadcasts do not typically allow as much control of the compression process, because of differences in the program types (talking heads vs. fast action sports.) In these cases, a more conservative approach is used that works well with differing types of program material.

Compressed audio signals appear to have avoided the need for such elaborate testing, although test equipment certainly exists to break the signal down into the frequency domain to look for changes in the noise floor (often an indicator of compression effectiveness). Typically, audio signals are still subjectively tested, rather than objectively tested by most users.



As LANs become an increasingly important part of broadcast facility infrastructure, network testing becomes a higher priority for broadcast engineers. Photo courtesy Wavetek Wandel Golterman.

Interface checks

An area where audio and video signals have received an equal amount of attention is their different digital interface formats. Even though the audio and video sample values themselves are relatively immune to inadvertent changes, it is important to test the interfaces to see if they are properly formatted and conform to SMPTE specifications.

In video signals it is important to check the CRC codes (EDH, or SMPTE 165) to ensure that the proper data has been received. It is also important to remember that, unlike some computer network systems, the SDI interface can only indicate errors. There is no mechanism to request that the errored data be re-sent. The interface signal amplitude, rise and fall times, jitter, and eye opening must all be checked to ensure compliance with SMPTE 259, and to ensure compatibility between different pieces of equipment conforming to the standard. Error reporting varies greatly across available products, as does price, so it is important to understand your needs relative to each application. Audio, time code, and other information can be embedded in the SDI bitstream, and so it is important to be able to check for their presence.

Audio signals must similarly be checked for interface integrity. Improper implementation of status bits is still the most often the reason for the failure of one device to record the

output of another. Second on the list is improper bitstream synchronization. Digital audio signals need to be synchronized to a common reference, just as video signals have always been. Otherwise, the results can include pops, clicks, and mutes.

If the AES interface is used for data transmission, additional considerations for the interface are required. Because using the AES interface for data requires the received data to be identical to the transmitted data, it becomes necessary to check the digital audio path for devices that may change the sample data values. A key issue is the number of bits used to represent each data sample. If the data signal uses 20 bits/sample then the transmission, or more likely, the recording medium must be able to process at least 20 bits per sample. If fewer bits per sample are used then the sample data values will be truncated. Even though the interface will work just fine, the payload data will be useless.

Don't forget the analog side

Of course, analog test and measurement equipment is not going to disappear. Audio and video signals are still acquired in the analog domain. Even digital audio and video signals start and end their lives as analog signals. Technology is simply changing the point in the signal chain where these signals are converted to digital, moving the point earlier in the signal chain, closer to the original transducer (microphone diaphragm or CCD chip) and increasing the number of bits used to describe each sample.

Analog test sets for video and audio are still needed to test the necessary A/D and D/A converters used in today's hybrid facilities. Even in facilities that are designed to be all digital there is still (or at least should be) a great deal of analog I/O required for monitoring the digital signals. Certainly devices exist for monitoring the digital signal, but they almost universally contain D/A conversion stages to convey these digital signals to our still largely analog senses. For these applications, the usual complement of test equipment is still used. Again, the ultimate destination for this material is as a format that we can see and hear.

Analog test sets for video and audio are still needed to test the necessary A/D and D/A converters used in today's hybrid facilities.

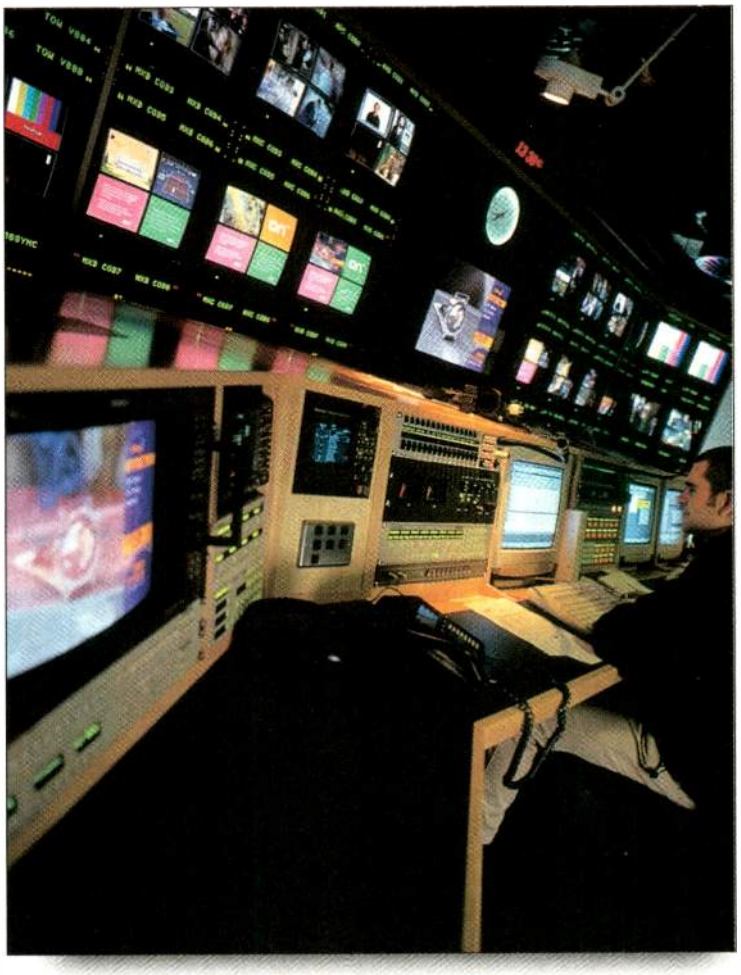
Because of the amount of compression used to reduce the data rate of the digital video signal for broadcast, there is an issue of compensating for the time that the compression system takes to do its job. This is often referred to as latency. It takes time to determine what is going to be thrown away (or hidden.) A similar, but not as severe process is also required for the audio signal. This results in a delay that is usually shorter than the video delay. Of course, the video and audio signals likely occurred at the same time, so ideally the signal should also be displayed to the viewer at the same time. This requires that the shorter delays must be padded to match the longest delays so the signals are synchronized upon display.

This is not a simple process, and it is made even more difficult because of the GOP structure of the video picture, where the individual frames are sent in an order different than the display order. Frames are rearranged and processed in the decoder. Time stamping the audio and video elements helps, but they can still end up being out of sync. To correct this requires the tools to measure the audio-to-video-delay. Several vendors are beginning to offer solutions to this problem.

Engineers, like those at ONdigital, must learn to use new methods and tools when testing DTV systems. Photo courtesy Snell & Wilcox.

An idea that originally grew out of the desire to reduce the amount of equipment carried into the field is a product that is often called a *rasterizer*. Rasterizers were originally built to allow vector type displays (such as the aptly named vectorscope) to be seen on a conventional (raster scan) video monitor. This product class has evolved to include various front-end devices intended to be viewed on inexpensive, high-quality displays. The display of choice seems to be the computer VGA display, or any of its higher quality extensions (SVGA, XGA, etc.)

An operational advantage to such systems is the ability to combine the functions of many measurement devices on a single display. Unfortunately, the NTSC video monitor quickly runs out of resolution, and the normal composite video decoding circuitry further limits the usefulness of such a monitor for this purpose. On paper, the VGA display appears to be the equivalent of an NTSC display (with its 640x480-pixel display format.) But, because it is designed as a component display, it is not limited by the filters required for decoding the color information, as in NTSC. As the resolution of these displays has gone up, and the price has gone down, the VGA monitor has become an extremely attractive solution for displaying multiple types of instruments on a common display. Applications have sprung up to display a combination of waveform, picture, vector, audio, and soundscape images. Depending on the size of your facility and the nature of your work, these monitoring solutions could save precious rack space (as well as equally precious dollars) on test and measurement equipment.



Everyone involved, including operators, will need to become familiar with monitoring the variety of signals and systems for multichannel DTV/HDTV broadcasts. Photo courtesy Snell & Wilcox.

Cabling and beyond

An area where the RGB component video monitors masquerading as VGA monitors has caused problems is in the area of color component transcoding. Both the standard definition Rec. 601 sampling format and the scaled-up versions for 720- and 1080-line HDTV systems use sub-sampling of the color difference components to reduce the data rate of these uncompressed interface links (SMPTE 259 and SMPTE 292 for serial SD and HD transmission respectively.)

For these color difference component systems to coexist with RGB displays, component transcoders are required. Also, any component system introduces the possibility of inter-component delay errors. These delays should be checked so that HDTV systems do not lose any of their superior resolution due to inter-channel delay problems.

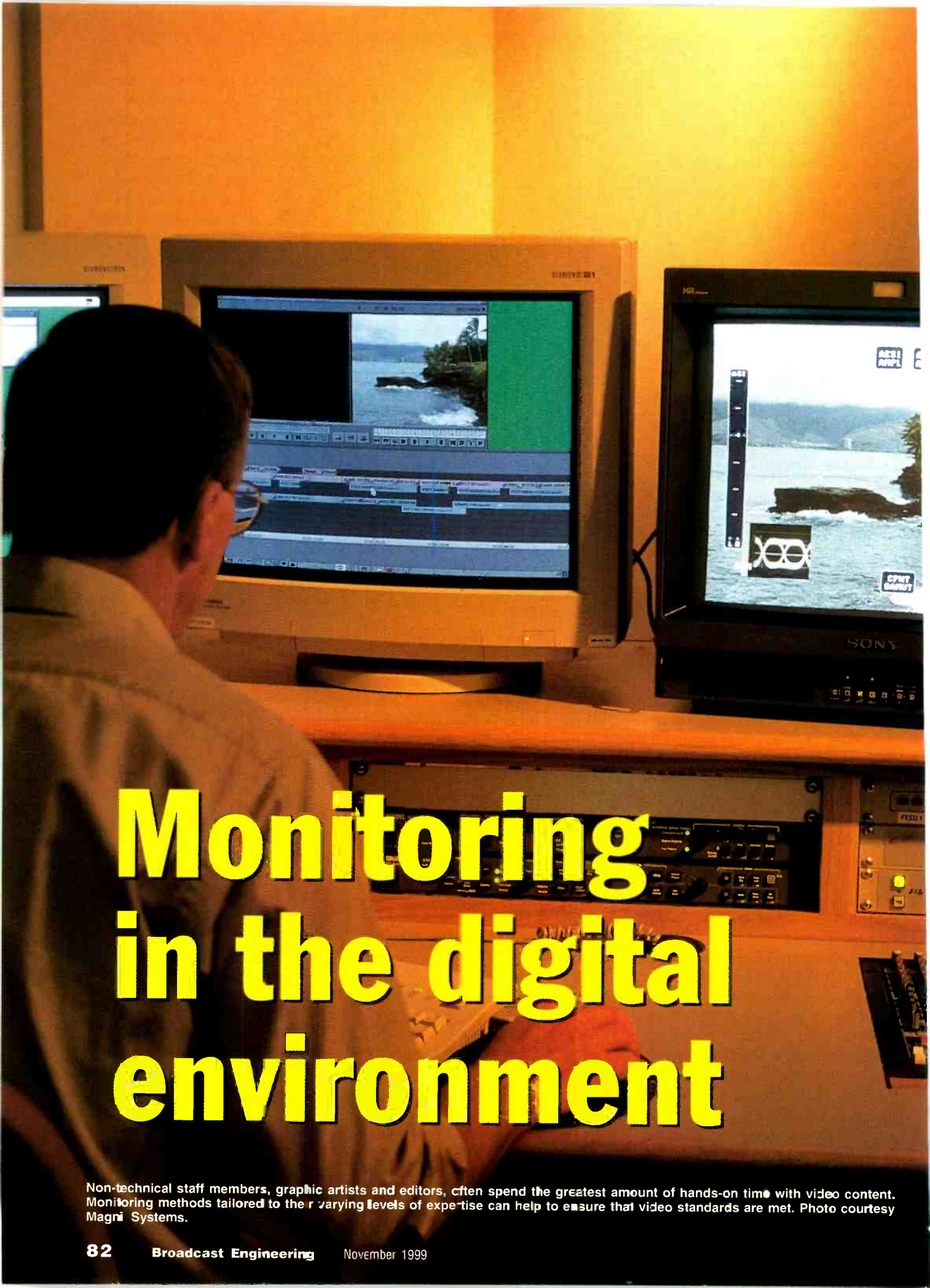
As the data rates required in broadcasting increase beyond 1Gb/s, copper cable is reaching its limit for long-distance, large-scale distribution. Serial HDTV signals reach their limit with coax at about 100M, and SDTV signals can't go much more that 300- to 400M, depending on the type of cable. As the desired distances increase, and as the data rates of these paths also increase, fiber optic cable is becoming more viable as an interconnection medium. Fiber is being used in both inter- and intrafacility links, especially when large volumes of data need to be transmitted either across town or across the country.

Familiar test equipment functions that were used for copper systems are now being used on fiber circuits. Optical Time Domain Reflectometers (OTDRs) are being used to troubleshoot fiber circuits for connection problems in much the same way as conventional TDRs were used on coaxial cable. Obviously the physical units are different, but the function is largely the same.

There is no doubt that systems today are more powerful and more reliable than they have been in the past. But it is also true that the more powerful the system, the more powerful the test equipment needs to be to support it. It has been said here more than once — don't be lulled into a false sense of security by thinking "Don't worry, it's digital." Digital systems have hastened the end of some forms of routine operating procedures, but they have more than made for it in the complexity of the new test equipment required.

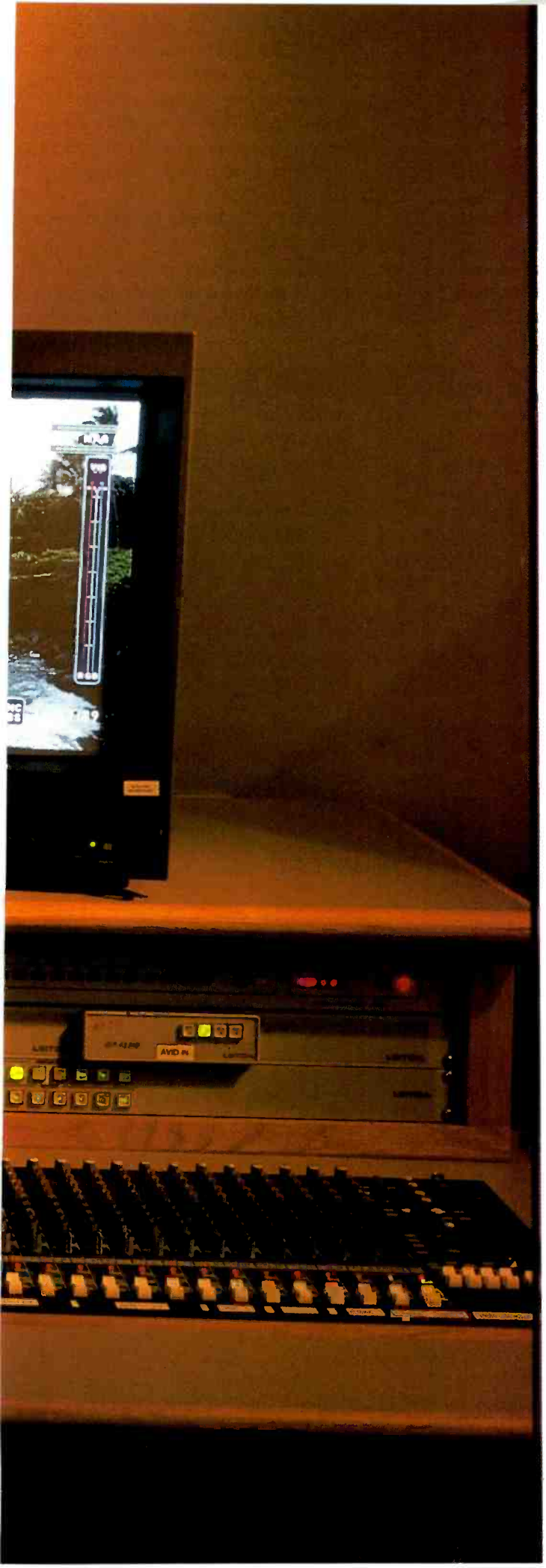
With any technology change you remove some old equipment from your tool kit, but you replace it with more complex devices. You never end up with an empty toolbox, no matter how hard you try. ■

Kenneth Hunold is a broadcast applications engineer for Dolby Laboratories, San Francisco.



Monitoring in the digital environment

Non-technical staff members, graphic artists and editors, often spend the greatest amount of hands-on time with video content. Monitoring methods tailored to their varying levels of expertise can help to ensure that video standards are met. Photo courtesy Magni Systems.



By Ted Gary

Within the broadcast industry, two trends are placing unprecedented demands on video engineers and video monitoring equipment. First, the digital transition has increased the breadth of technical information that must be understood and managed. In addition to the traditional analog technologies, video engineers must also understand digital and HD technologies. Second, the convergence of video and computers is changing all phases of video and post production, including animation, multimedia content creation, nonlinear editing, computer-generated imaging and character generation. As a result of the growth in PC-based video systems, broadcast facilities have many non-video users creating and editing video content. These users, who may have positions as video editors or graphic artists, are trained to create aesthetically pleasing work. However, they may not understand that their work must adhere to video standards. Engineers are often called upon to support these creative professionals and train them to use monitoring equipment, ensuring that standards are met.

Typically, members of the engineering staff are asked to selecting serial digital monitoring equipment for the entire broadcast facility. Because of their own technical proficiency they may select equipment that is easy for them to master but too difficult for non-technical users to operate. Given this mix of users, it is critical that serial digital monitoring equipment possess a high level of capability and functionality. But it is equally important that the equipment is usable by the full range of intended users, reducing training time and support demands placed on the technical staff. More importantly, it increases the likelihood that the monitoring equipment will be used as intended, not ignored.

Potential serial digital problems

While serial digital signals are inherently more reliable than analog signals, the potential for problems still exists. The serial digital interface is, in essence, a digital representation of component analog signals. SDI, which is also known as the digital transport layer, may be thought of as analog information contained in a digital wrapper. It is therefore useful to consider potential problems as falling into one of two categories: errors in the digital wrapper (transport layer) or errors in the analog video content that become apparent when the digital signal is converted to component and/or composite formats.

Several factors need to be considered when looking at the SDI signal, among them:

Input signal strength: A common cause of errors is signal strength degradation arising from long cable lengths. Assuming high-quality connections, cable lengths of less than about 350M generally provide error-free operation. If cable length extends beyond this parameter, error rates rapidly increase. If someone unsuspectingly inserts a 10M cable in the path, errors can cause serious problems, if not complete failure.

Monitoring digital

Jitter: Jitter is basically a variation in the frequency of the clock that is derived from the serial digital signal. (see Transition to Digital, September 1998) Small amounts of jitter have no adverse impact upon the clock derivation and subsequent signal recovery. However, when jitter reaches unacceptable levels, the signal cannot be reliably recovered, making jitter a critical signal parameter. Eye patterns are often used to show jitter, as well as overall signal quality. However, eye patterns require a knowledgeable operator to properly interpret them. If a non-technical operator inadvertently views an eye pattern that is not normalized, the signal may look poor but can be reliably recoverable.

Gamut errors: Gamut defines the range of allowable colors that can be represented as legal video signals. (see "Gamut: An old problem with several new faces," p.106, September 1999) When a color is illegal, it is referred to as a gamut error. Gamut errors are rarely the result of improperly calibrated cameras. More often, they result from digitally generated content, such as character generators and DVE applications. The gamut of legal colors varies for different video formats. For example, a given color may be legal in the component format, but invalid when encoded into NTSC or PAL.

Error Detection and Handling: Excessive cable length, noise, improper terminations and poor connections may cause bit errors in the digital data. A bit error is one or more bits in a data value that change between the source and the receiver. These errors in the transport layer may have a direct impact on the analog signal content: a single bit error may seriously degrade the picture or sound. Even if single bit errors are not seen in the resulting picture, they may provide early warning. Major distortion of the picture or audio is possible if the transmission path is further degraded. SDI's error detection and handling (EDH) mechanism allows a serial digital system to perform self-monitoring and reporting of bit errors, provide downstream visibility of the error and to determine where it occurred.

The video content contained in the serial digital interface is a digitized form of component video. At some point, the serial digital signal will be decoded into component and even composite video. Therefore, it is important to monitor the decoded component and composite video, as well as the serial digital signal. Table 1 includes a list of the parameters that should be monitored to minimize video signal problems.

Essential monitoring function and form

Monitoring equipment should provide the capability to check for problems in both the digital and analog domains. However, the form in which the information is presented to the user is equally essential. Video engineers may be able to examine an eye pattern to determine signal strength and jitter, however, graphic artists cannot be expected to do the same. Neither can a graphic artist be expected to know if a 400mV SDI signal is good or bad. Non-technical users require qualitative information because quantitative information such as that presented in millivolts or nanoseconds may not have much meaning to them. Qualitative information is similar to what is shown on a car's dashboard, telling the user if a problem exists and, if so, where.

The key signal parameters discussed below must be monitored, and the information should be presented in quantitative and/or qualitative form to ade-

Monitoring video signals in a mixed format environment

Application	Measurement
Studio timing	
Digital	Jitter
Component	Horizontal reference timing, Y, R-Y, B-Y relative timing, Sync amplitude
Composite	Horizontal reference timing, Burst reference phasing, SCH phasing, Color framing, Blanking width, Burst amplitude, Sync amplitude
Transcoding	
Component to Digital	Peak video, Gamut
Digital to Component	Peak video, Y/R-Y/B-Y Amplitude and Relative timing
Component to Composite	Peak video, Peak luminance, Y Amplitude, RGB Amplitude and Phase, Y/C delay
Composite to Component	Peak video, Y/R-Y/B-Y Amplitude and Relative timing
Routing	
Digital	Jitter, Error rate, Signal strength, Eye opening, Video/Audio signal presence
Component	Peak video, Y/R-Y/B-Y Amplitude and Relative timing, Frequency response
Composite	Peak video, Peak luminance, Noise, Luminance to chrominance Delay/Gain, Pulse to Bar ratio, K-2T factor, Differential chroma Gain/Phase, Frequency response
STL (FM routing)	Peak video, Peak luminance, noise, Luminance nonlinearity
Content generation	
Camera	Peak video, Peak luminance, Average Picture Level, Camera setup
VTR	Peak video, Peak luminance
Character/Image Generation	Gamut, Peak video, Video amplitudes
Processing	
Digital	Peak video, Peak luminance, Gamut, Transcodes correctly to all formats
Component	Peak video, Y/R-Y/B-Y Amplitude and Relative timing, Frequency response
Composite	Peak video, Peak luminance, noise, Luminance to chrominance Delay/Gain, Pulse to bar ratio, K-2T factor, Differential chroma Gain/Phase, Frequency response, Red/Green/Blue Phase and Amplitudes

Table 1. Items regarding signal parameters that must be monitored within a mixed format environment.

quately accommodate the differing technical background of a variety of users.

Input signal level: At the most basic level, the operator must know if the serial digital signal's input level is sufficient for it to be recovered. In addition to level, the non-technical operator must know the cable length margin that remains before the proverbial digital cliff is encountered. If little margin remains, cable segments must not inserted. Thus, it is necessary for monitoring equipment to report the signal strength and the margin remaining until the signal strength falls to unrecoverable levels. The most useful qualitative representation of signal level is typically in the form of gauges or bar charts.

Jitter: Monitoring equipment should analyze the jitter and also present the information in quantitative and qualitative forms. Operators, especially non-technical ones, need simple graphical information, such as gauges or bar charts, indicating if jitter is approaching unacceptable levels. Such information does not require a high degree of operator expertise because it is easy to interpret. Video engineers may want to see jitter information displayed in nanoseconds or in unit intervals, or they may just want to examine an eye pattern display.

Gamut: A serial digital monitoring product should check for gamut errors in all three formats (RGB, composite and Y, R-Y, B-Y). Checking for gamut errors in only one or two formats can result in nasty surprises later on, such as having a tape rejected. The limits that define legal colors (signal levels and number of adjacent out-of-limit pixels) should be user adjustable to allow for a tolerance margin.

Additionally, serial digital monitoring products should do more than alert users that a particular color is illegal. They should also highlight the exact source of the illegal color and the format(s) for which the color is illegal. Highlighting gamut errors as they occur is analogous to having a spell checker that highlights spelling errors when they are typed. Highlighted information is very useful because it presents detail about an error condition that is easily and quickly seen and understood.

Audio levels: Although not required in all situations, serial digital monitoring equipment should detect the presence and levels of embedded audio. This notifies the operator if audio is expected but not present. Monitoring equipment should also decode the audio signal into analog or AES signals for monitoring purposes, obviating the need for another monitoring instrument just to monitor audio.

EDH: Serial digital monitoring equipment should monitor EDH data and report any errors. Some users need to be alerted if any errors occur. Others may only need to be alerted if the error rate exceeds a predetermined level. Therefore, the error rate threshold that triggers a user alert should be adjustable.

Component/composite monitoring

It is possible to have a high-quality SDI signal, but to have a poor video signal once it has been decoded into component. For example, the B-Y to Y timing could be out of spec due to errors in the serial digital encoding/decoding. Therefore, it is necessary to monitor component and composite signal parameters. Such monitoring should include waveform and vector displays and quantitative measurements for parameters, such as sync amplitude, peak video, and RGB amplitude and phase. Without this capability, one risks having a high-quality serial digital signal that contains low-quality content.

Exception reporting

Users performing operational monitoring typically need to monitor only a few parameters on a continuous basis. However, additional parameters must be reported on an exception basis. To use the automobile dashboard example again, many drivers only monitor speed and fuel level on a continuous basis. However, they want to be notified if temperature, oil pressure, or other exceptions occur. The SDI parameters needing continuous reporting are input signal strength, jitter and perhaps audio. Parameters that should be reported only when exceptions occur include gamut errors, EDH errors and problems with analog levels/timing. Exception reporting should be flexible enough to alert users with pop-up icons and/or alarm closures. Of course, the users must be able to disable reporting of exceptions on a parameter by parameter basis.

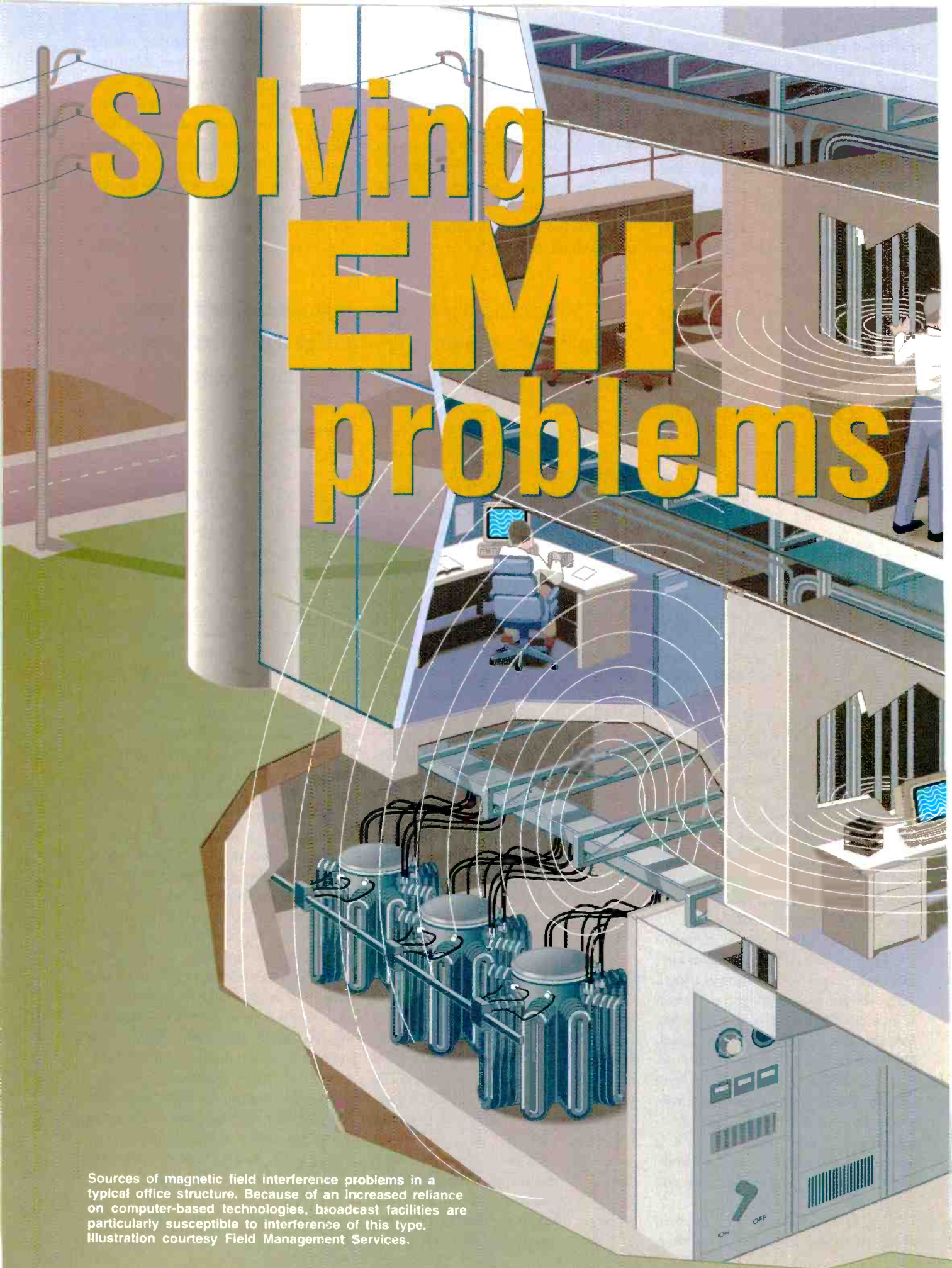
In some cases, monitoring must be performed while operators are not present. In such cases, automated status reporting is required. Log files are the answer to this requirement, especially if users can select the individual parameters to be logged. Log files can be used to document system status on a scheduled basis. For example, complete status information can be appended to a log file every 30 minutes. Alternately, only error conditions may be stored in the log file. Status reporting can be a real help to the video engineer because it can be easily set up to monitor the quality of operations, such as tape duplication.

Without monitoring component and composite signal parameters, one risks having a high-quality serial digital signal that contains low-quality content.

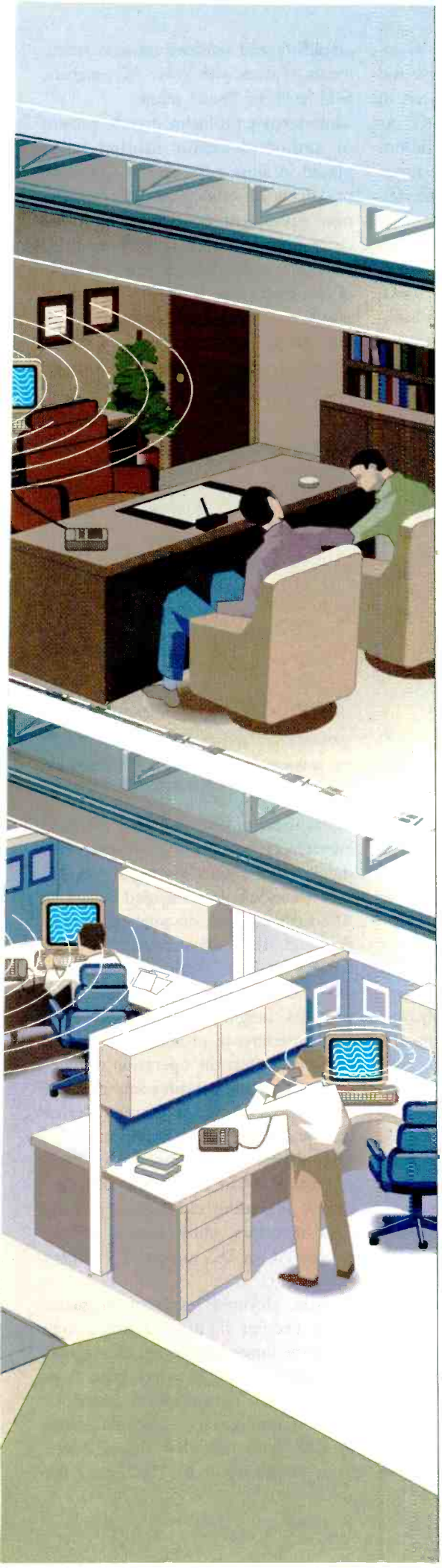
Video monitoring by its nature requires analysis of technical data. While many users of monitoring equipment are technically savvy, many that could benefit from monitoring equipment to improve video quality do not use it because of the technical barrier. For basic SDI monitoring, the burden to overcome this technical barrier should be placed on the monitoring equipment itself, not on the user. That is, the equipment should analyze the data and present it in an easily understood format. The DOS vs. Windows comparison illustrates this point. DOS-based computers could perform most tasks. However, many potential computer users could not master DOS. Windows lowered the technical barrier and made computer usage a reality for a new category of people. Video monitoring equipment must do likewise. ■

Ted Gary is vice president of marketing for Magni Systems Inc., Hillsboro, OR.

Solving EMI problems



Sources of magnetic field interference problems in a typical office structure. Because of an increased reliance on computer-based technologies, broadcast facilities are particularly susceptible to interference of this type. Illustration courtesy Field Management Services.



By Jon W. Munderloh

When reports of wavy or jittery images on monitors or an audible hum in an audio system are received, maintenance engineers scramble for an explanation and a solution. Grounding systems are meticulously checked and inspected, yet the monitor distortion remains or excessive audio hum persists. Broadcast engineers and technicians are generally knowledgeable about the equipment interference problems often associated with electronic grounding issues or external environmental sources (RF, microwave, radar systems, etc.). However, few engineers and technicians are aware of interference that may be caused from elevated low frequency magnetic field conditions.

AC and DC magnetic fields

Equipment interference in a technical facility may be caused by elevated levels of either alternating current (AC) magnetic fields or by direct current (DC) magnetic fields in a building's interior. A wide variety of equipment interference problems can occur when levels of either type of magnetic field are excessive.

AC magnetic fields are a natural consequence of distribution and use of electricity. At 60Hz — extremely low frequency (ELF) — the electric and magnetic fields generated by an AC circuit operate independently. In other words, it is possible to reduce or eliminate one without materially affecting the other. However, at radio frequency (RF) and higher, a fixed relationship exists between the electric field and the magnetic field. A reduction in the magnetic field also results in a reduction in the electric field.

AC electric fields are generated by voltage and are measured in volts/meter while magnetic fields are caused by current flow and are measured in milliGauss (mG). At ELF or power frequency, electric fields emanating from an AC circuit are quite easy to shield, as nearly all standard building materials will substantially reduce the electric field strength. Conversely, ELF magnetic fields are extremely difficult to reduce. At 60Hz power frequency, AC magnetic fields pass relatively undiminished through nearly all common building materials, including lead.

Elevated ELF magnetic field conditions are normally present in areas adjacent to high-current carrying conductors. Typical high-current sources in commercial buildings include electrical equipment rooms and closets, utility substation and transformer vaults, distribution bus ducts, wire ducts and feed conduit. Electrical transmission and distribution lines passing near the exterior of a building may also create elevated magnetic field conditions in a building's interior. In some instances, the source of elevated ELF magnetic fields in a building may not be readily apparent. Wiring errors in a building's AC power system, even in low-current distribution circuits, can cause substantial ELF magnetic field conditions to exist in large areas of a building. Such wiring errors including improper ground-to-neutral connections and crossed-neutral conductors, can create *net current* conditions wherein all of the current in a circuit is not returning via the same path. Because the strength of an ELF magnetic field is directly proportional to the amount of current flowing in the source circuit, fluctuations in the use of power during the day or seasonally, can cause changes in elevated magnetic field conditions. With this type of temporal variation, it is not uncommon for an equipment magnetic field interference problem to appear intermittent.

Static or DC magnetic fields commonly occur in nature. The earth

Solving EMI problems

has a natural static magnetic field that, depending on location, will range from 400 to 500mG. DC current flow in subway or train rails, elevators and battery-based power systems may also generate DC magnetic fields. Powerful magnets associated with MRI and NMR medical magnetic imaging systems typically produce elevated levels of DC magnetic fields. As a consequence, structural and reinforcing steel members in commercial building structures can become magnetized as a result of containing such equipment over a length of time. Placing it in a strong external DC magnetic field that will essentially capture and align the magnetic domains in the material can magnetize structural steel. Steel can also become magnetized by putting strong DC currents through the material such as grounding welding equipment to structural steel during construction.

Common magnetic field interference problems

The dominant problem associated with elevated magnetic field environments is interference with computer or Cathode Ray Tube (CRT) video display monitors. Screen interference caused by magnetic fields is of two categories: AC magnetic fields that can cause the image to jitter on a display, while DC magnetic field monitor interference problems are manifested as stationary image tilt or color purity problems (changes or blotches of color in various areas of the screen). Thresholds for computer monitor interference will vary by different magnetic field intensities, depending upon the type, size, make and model of the monitor. In general, CRTs are much more sensitive to AC magnetic fields than to DC magnetic fields. Many CRT's will exhibit signs of image jitter interference when placed in external AC magnetic field conditions of 10mG and most will be unstable in fields of 30mG. Some high-end large screen graphics monitors tend to be much more sensitive and interference will often be noticed at thresholds as low as 3 to 5mG. As ambient AC magnetic field conditions in most commercial buildings range from 1 to 4mG, the chances for interference with such monitors is high.

Typical DC magnetic field interference on CRT's can be observed in magnetic fields as low as 1000mG, (500 to 600mG above the Earth's background DC field) with increasing interference as DC magnetic field levels increase. Although relatively infrequent, residual, elevated DC fields in buildings can be in the range of 2 to 5000mG.

The installation of shielding is often required to reduce elevated magnetic field levels in areas containing sensitive equipment. Photo courtesy Field Management Services.

A wide variety of audio equipment may experience interference problems when located in an elevated AC magnetic field environment. Most notably, sensitive preamplifier sections of professional and broadcast audio mixing consoles may experience increases of audible 60Hz hum or lower signal-to-noise when located in areas with elevated AC magnetic field conditions. Such hum and increased signal-to-noise conditions are created by the induction of an interference voltage at 60Hz in sensitive components of analog audio amplifiers. Similarly, sensitive or poorly shielded microphones and musical instrument audio pick-up transducers can experience undesirable levels of 60Hz hum when used in environments with elevated levels of AC magnetic fields. Professional musicians have long been aware of this phenomena in performance venues and have learned to shift or orient amplifiers and sensitive musical instruments to areas with lower AC magnetic field levels or "null" points.

Interference problems may be present in audio/video/data cabling when placed in close adjacency to conduits, bus ducts or other electrical distribution equipment containing high AC current conductors. ELF magnetic fields naturally emitted from such conduits or bus ducts may be sufficient in magnitude to induce troublesome levels of interference AC voltage on adjacent signal cabling. The potential for such interference is markedly greater when signal cable runs closely parallel AC power conduits for extended distances. Although not well documented or understood, there have been numerous reports of interference in CPU and digital equipment when placed in elevated AC magnetic field environments. Such interference problems have been known to affect the operation of high-speed CPUs and certain computer disk drives. Loss of data in increased error rates and slower transmission speeds of LAN digital signal networks are typical results. Most equipment manufacturers, including companies making CRT monitors, unfortunately do not publish AC or DC sensitivity levels for equipment.

Lastly, elevated levels of magnetic fields present in archive areas may affect the long-term storage of magnetic media including magnetic tape, floppy disks, etc. Typical specifications for magnetic storage media, including floppy disks and hard-disk drives, range from about 6000 to 10,000mG for

magnetic field levels in the frequency range of 0Hz (DC) to 700kHz (which includes the power-frequency of 60Hz). Below 6000mG data corruption on storage media is typically not observed as reported by hard-disk drive manufacturers.

Dealing with EMI problems

Resolving equipment interference problems due to the presence of an external magnetic field source is often difficult and expensive. In some instances a choice may have to be made between eliminating the source of a magnetic field or minimizing the interference effects of the source magnetic field. The first step in identifying and resolving a suspected magnetic field interference problem is to locate possible magnetic field sources and to measure magnetic field intensities in the area of concern. A gauss meter, which can range in cost from several hundred to several thousand dollars, can be used to measure magnetic fields. Different instruments are required to measure AC and DC magnetic field values and directions. Prior to purchasing such measurement equipment, it may be preferable to contact the local utility company and request magnetic field measurement assistance. Many utilities have an EMF specialist who will provide initial magnetic field measurement services at no cost. If a sizable problem is identified, such as an audio/video equipment room located above or immediately adjacent to a major electrical service room, it may be prudent to engage the services of a professional engineering firm. A specialized and experienced engineering firm can conduct a detailed assessment of the problem and evaluate possible solutions. If the source of interference is an AC magnetic field, three general strategies may be considered to mitigate the problem: increase distance, decrease the magnetic field strength or shielding.

Magnetic fields decrease in strength at increased distances from the source. It may be possible therefore, to simply move or relocate affected equipment away from a magnetic field source until interference problems are minimized or eliminated. This solution may be effective, for example, in instances where a monitor is near a transformer or electrical panel, but this effort may prove ineffective if the source is a transmission line passing outside the building. In certain instances, it may be possible to decrease the magnetic field strength from a source by implementing electrical modifications to increase natural cancellation of opposing conductors. In the instance of magnetic fields caused by net current electrical circuit conditions, dramatic reductions in magnetic field levels typically result as a consequence of correcting wiring errors that create net current conditions. As a third possible solution, consideration may be given to shielding the affected equipment, the source of magnetic fields or the area in which the affected equipment is located. In the case of monitors, special external shields made of permeable materials that attract magnetic fields and provide an alternate path around the monitor are available from a number of manufacturers. Shielding large areas such as an electrical room or an entire space containing sensitive equipment is generally difficult to implement and should be designed and installed by an experienced and qualified magnetic field shielding engineering company.

High-current electrical components such as transformers and distribution equipment generate large magnetic fields in adjacent areas. Photo courtesy Field Management Services.

Monitor interference from external AC magnetic field sources may be minimized by two additional possibilities. In some computer systems, it is possible to set the vertical refresh rate of the monitor to 60Hz power frequency without serious compromises to the image quality. However, resolution of the monitor may be reduced and in almost all cases, cure of the jitter problem will be at the expense of increased flicker from area lighting. If the external AC magnetic fields are strong, setting the refresh rate to 60Hz will not remove all jitter interference. As a second possibility, it may be acceptable to replace CRT monitors with LCD monitors. LCD monitors are generally not affected by external magnetic fields. However, quality and system compatibility issues should be considered prior to purchase of a replacement LCD monitor.

In instances where monitor interference is from a DC magnetic field, it may be possible to degauss the affected monitor to temporarily restore color purity or install a shield around the monitor. If the source of DC magnetic fields is from a structural steel building member that has become magnetized, it may be necessary to consider degaussing the magnetized steel to permanently eliminate the interference DC magnetic field. Degaussing removes residual magnetism from steel objects.

In new facility construction projects, consideration should be given to careful design of electrical facilities such that high-current carrying equipment is not located adjacent to areas that may contain sensitive equipment. Documenting AC magnetic field conditions at a proposed project site prior to design and construction may insure that passing transmission lines or nearby utility electrical facilities won't present a problem. It may also be a good idea to measure DC magnetic field levels near all structural steel members during building construction. If excessively high values of DC magnetic field levels are present due to magnetized steel members, it is much more feasible and cost effective to degauss while such steel members are exposed and accessible. ■

Jon W. Munderloh is vice president and senior technical consultant for Field Management Services, Los Angeles. He has more than 15 years experince in the broadcast industry.

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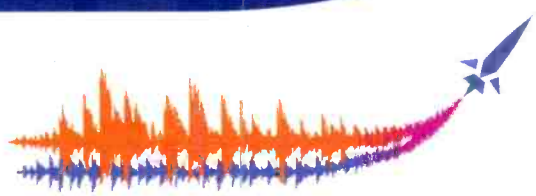

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Applied Technology

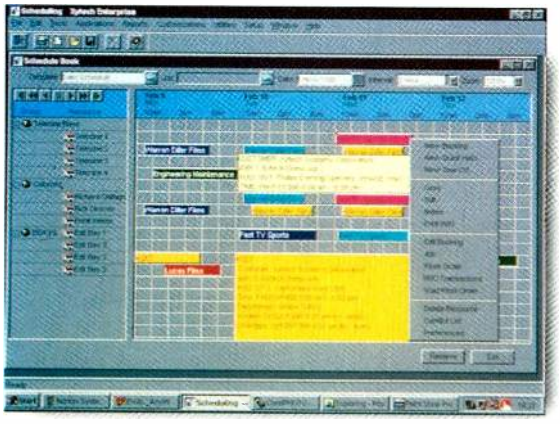
Xytech's FMS and Enterprise scheduling systems

BY ROGER KLECKNER

Today's broadcast facilities are under constant pressure to do more with limited resources. While individual staff members or departments may have their own scheduling systems, there is currently no way to coordinate scheduling information from across an entire network. Some stations try to coordinate by the paper and pencil method, commonly know as "the big book." This works well, but the scope is limited; only one person can access and update the book at one time. As anyone in broadcast knows, events can change several times a day, causing a nightmare in coordinating staff equipment and use.

Electronic scheduling systems built specifically for the broadcast industry are the answer to keeping busy facilities on track and on time. FMS and Enterprise are designed for the sophisticated needs of broadcasters. The advantages provided by these systems include more that just staff scheduling; they coordinate scheduling and equipment, as well as room and service cost/use. The feature list includes bidding programs that can project profitability before the work even starts, as well as tracking all resources used during each work segment. The systems also allow managers and producers to track progress during each stage of a project. Updates, changes and confirmations to a project can also be e-mailed or paged directly from the system to the individuals involved.

Xytech's FMS and Enterprise are essential in solving facilities' immediate problems by incorporating better scheduling practices that interface with other industry-standard technologies.



Xytech's Scheduling Module permits online scheduling and conflict checking for an unlimited number of resources.

Customizing for a database

When clients attempt to build their own systems, they have a knowledge base of one. Companies often try implementing incomplete systems, leading to trouble with cost issues. Off-the-shelf scheduling software has hundreds and even thousands of hours of input, design and development behind it. It is less costly to work with a company that understands the basic concepts of broadcast scheduling and is willing and able to customize as necessary.

Features and benefits

FMS is an intuitive, simple-to-use integrated facility management application designed for broadcast facilities needing a computerized scheduling and billing system. FMS is fully networkable, and allows multiple users access to a shared calendar scheduling system that monitors the use of equipment, rooms and people. Managers can generate standard paper work orders or go paperless by tracking the use of resources from their screens. Accurate invoices can then be generated within minutes of the session's end. Additional financial, statistical and usage reports come with the system, allowing operation managers to access a facility's status. FMS runs on industry-standard SQL databases such as Microsoft Access and SQL Server, Sybase, SQL Anywhere and Oracle.

Enterprise

Enterprise is a much broader and more robust integrated management system for larger broadcast facilities. It is more versatile and comprehensive, with modules that are sold a la carte to meet the needs of each individual facility. Additional modules are available for equipment rental, job management, tape tracking, timecard, duplication and data warehousing. It supports a fully integrated SQL accounting system along with other industry-standard applications that run all aspects of an entire facility or a cluster of facilities. Xytech supports a large number of project managers to help with customizations and integration. Enterprise also runs on industry-standard SQL databases. ■

For more information on Xytech's FMS and Enterprise systems, circle 451 on the Free Info Card.

Roger Kleckner is president of Xytech Systems, Burbank, CA.

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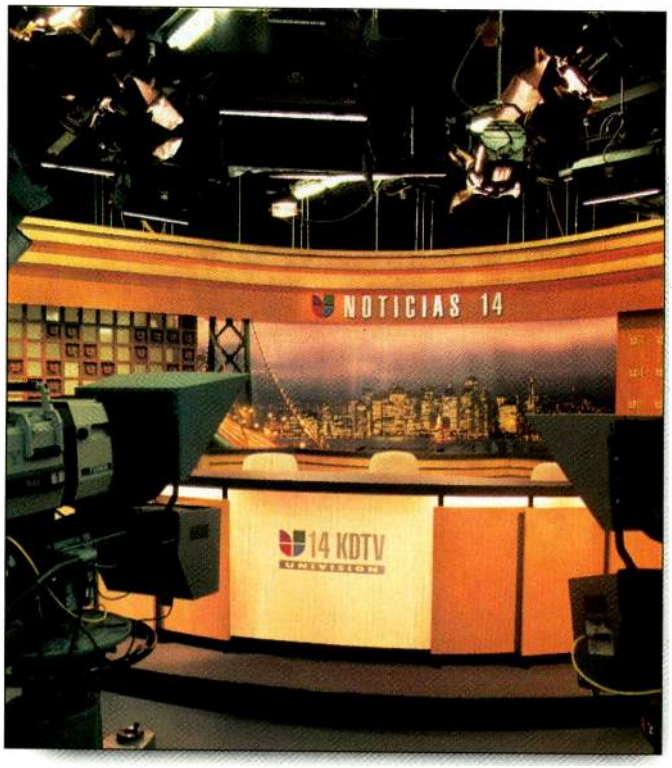
Applied Technology

Belden Wire & Cable Company's MediaTwist

BY STEPHEN H. LAMPEN, WITH ROBERT WYATT, MARCI MEARNS, JACK ANDRESEN AND MICHAEL LAPORTE

When Univision, KDTV-Channel 14's parent company, decided to build a new TV broadcast facility, the company had no idea that its cabling infrastructure would make broadcasting history. KDTV-14 is the first TV studio to rely entirely upon unshielded twisted-pair technology. A single unshielded twisted pair cable (UTP) — Belden MediaTwist — was successfully installed here for a multitude of applications, including analog audio, digital AES/EBU audio, analog video, digital video, RGB video and RS-422 machine control.

KDTV, a Spanish-language broadcasting station, serves the Hispanic community in San Francisco's Bay Area and is the fourth largest such station in the nation. The time was right to update the cable plant since the station was moving to a new location.



Univision's KDTV-Channel 14 is the first broadcasting facility to incorporate Belden MediaTwist UTP technology for critical analog and digital audio/video applications, as well as RGB video and machine control.

Why MediaTwist UTP?

Belden MediaTwist is an UTP cable designed and constructed to support multiple applications, including audio, video, data, machine control and telephone using the four-pairs to carry any of these signals.

Belden MediaTwist is an unshielded twisted pair (UTP) cable designed and constructed to support multiple applications, including audio, video, data, machine control and telephone.

In the audio/video community, a key concern, of course, is cable leakage. Since MediaTwist is unshielded, Belden sought to allay this concern by testing the product with Sony 270Mb/s, 135MHz serial digital equipment at the Underwriters Laboratories facility in Northbrook, IL. Not only did MediaTwist pass stringent tests intended for coaxial cable, but it also was awarded a Class A Certification for Digital Devices.

Previously, UTP cabling was primarily used for computer LANs. MediaTwist, however, expands UTP applications into areas once dominated by coax, shielded or fiber optic media. The reason is that its design and manufacturing processes result in a four-pair cable with extremely uniform dimensions and internal physical spacing, as well as structural stability.

MediaTwist construction features four bonded, twisted pairs in a crescent-shaped housing. Since balance is key to UTP performance, it is critical for each conductor of a twisted-pair be a mirror image of the other. By bonding the pairs and locking them into place, the cable achieves this balance and is able to maintain uniform spacing between conductors even through the rigors of installation. The result of this non-traditional UTP design and construction is superior electrical performance characterized by improved signal strength and accuracy, as well as stable impedance for greater clarity and reliable transmission.

Because of these enhanced performance characteristics, MediaTwist cable is currently being used in a wide variety of multimedia applications, including telephone, fax, modem, machine control, high-speed telephone and data links (e.g. S56,

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1. Title of publication: *Broadcast Engineering*
2. Publication No.: 0007-1994.
3. Date of filing: Sept. 27, 1999.
4. Frequency of issue: Monthly, except semi-monthly in June and December.
5. Number of issues published annually: 14.
6. Annual subscription price: FREE TO QUALIFIED.
7. Location of known office of publication (street, city, county, state, ZIP code): Intertec Publishing Corp., 9800 Metcalf Ave., Overland Park, Johnson County, Kansas 66212-2215.
8. Location of the headquarters of general business offices of the publisher (not printers): Intertec Publishing Corp., 9800 Metcalf Ave., Overland Park, Johnson County, Kansas 66212-2215.
9. Names and addresses of publisher, editor and managing editor. Publisher: Dennis Triola, 9800 Metcalf Ave., Overland Park, KS 66212-2215. Editor: Brad Dick, 9800 Metcalf Ave, Overland Park, KS 66212-2215. Managing Editor: Tom Cook, 9800 Metcalf Ave., Overland Park, KS 66212-2215.
10. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) PRIMEDIA Inc., 745 Fifth Ave., New York, NY 10151.
11. Known bondholders, mortgagees and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (If there are none, so state): None.
12. Tax Status: has not changed in preceding 12 months.
13. Publication Title: *Broadcast Engineering*
14. Issue date for circulation data below: September 1999.

15. Extent and Nature of Circulation	Average No. Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
a. Total No. Copies Printed (Net Press Run)	38,663	39,126
b. Paid and/or Requested Circulation		
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2. Paid in-county subscriptions	0	0
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f. Total Free Distribution (Sum of 15d and 15e)	3,166	2661
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i. Total (Sum of 15g, 15h)	38,663	39,126
j. Percent Paid and/or Requested Circulation	91.5%	93.0%

16. Publication of Statement of Ownership will be printed in the 11/99 issue of this publication.
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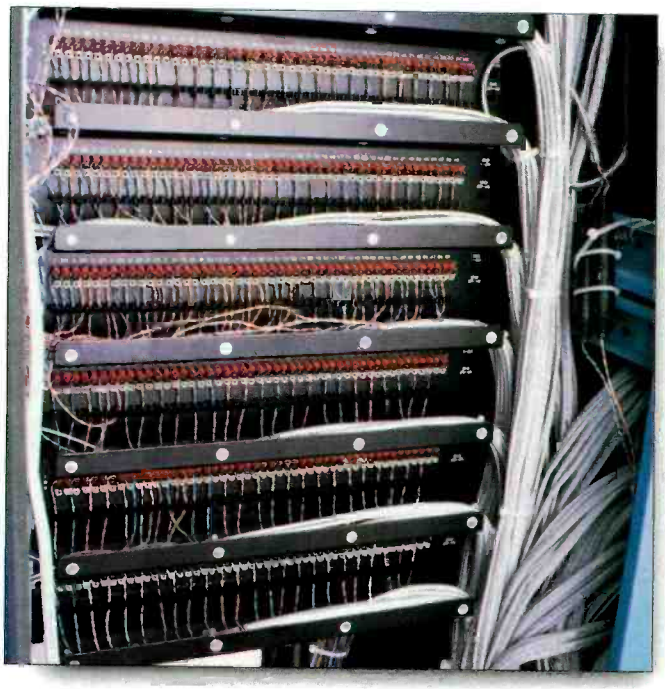

In addition to video applications, Belden MediaTwist is used for KDTV-14's analog and digital video. MediaTwist cable can be punched down easily on this ADC panel, and with no ground wire, the problem of ground loops is eliminated.

ISDN, T1, DS3, ATM, Ethernet, Token Ring), plus analog and digital audio and digital video. With its installation at KDTV-14, MediaTwist's versatility now extends to high-quality broadcast video applications.

The KDTV installation required 26,000 feet of MediaTwist cable for diverse applications that include analog and digital (AES/EBU) audio, analog and digital video, RGB video (which splits the video signal into its component parts), broadband cable TV, and 10baseT and 100baseT data networking.

In addition to MediaTwist, 56,000 feet of Belden DataTwist 350 were installed for voice and data infrastructure, and 12,000 feet of serial digital coax were laid for critical video within the master control racks.

The balun challenge

Once KDTV made the decision to employ MediaTwist, the project's main challenge was finding a way to match the signal format to the cable. Since most video signals are formatted for coaxial cable, a solution had to be devised to make MediaTwist work in KDTV's environment.

A balun is a device that matches balanced to unbalanced signals. In this case, a manufacturer was asked to create a balun that would both impedance match and transform unbalanced coaxial video to MediaTwist's balanced twisted pair system. The quality of the balun is a significant part of the whole system. Although the manufacturer, ETS, designed state-of-the-art digital audio baluns for Belden and its customers, the company had never been called upon to make the quantum leap in balun quality required for TV transmission.

Poised for the future

With the new station now up and running for more than a year, KDTV is satisfied that the transition to digital technology will be accomplished quickly and easily. Currently, the station is using a combination of analog and digital signals, but with MediaTwist's open architecture, KDTV is confident that it will not have to change cabling as the industry moves to full digital transmission.

Ease of migration into multimedia applications was one of the strongest drivers behind Belden's development of MediaTwist UTP cable. Open architecture and standard, non-application-specific interfaces are changing the face of the computer industry — and the same transformation is starting to happen in broadcasting. ■

For more information on Belden's MediaTwist cable, circle 452 on the Free Info Card.

Stephen H. Lampen, Belden Wire & Cable Company; Robert Wyatt, KDTV-Channel 14; Marci Mearns, Brill Electronics; Jack Andresen and Michael LaPorte, Energy Transformation Systems.

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The workhorse VTR

BY KENNETH HUNOLD

Videotape recorders are a staple in broadcast stations and other facilities worldwide. VTRs were one of the first broadcast applications of digital video technology. Video recording is an application where the ability to make nearly lossless recordings of events has particular significance. As good as professional analog video recorders have become the advantages of digital VTRs are immediately apparent.

To ensure compatibility with other recorders, and to allow the interchange of program material, many of the digital videotape formats have been standardized through SMPTE. Also, manufacturers have developed other proprietary formats.

NTSC television is a composite video signal where color and luminance information is encoded into a single signal. This entire signal can be converted to a digital signal and recorded digitally onto videotape. The D-2 and D-3 formats are both composite videotape formats. When fitted with analog inputs and outputs, these recorders can be drop-in replacements for analog VTRs such as one-inch C-format and ¾-inch U-matic recorders.

Because most professional video cameras use three pick-up devices (one each for red, green, and blue color information) it was observed that a VTR that recorded those signals separately, as opposed to combining them into a single signal such as NTSC, could provide a higher quality system for production use. As it turns out, VTRs do not record the individual red, green, and blue signals but rather a different format of (still three) component signals. A process was created whereby the three primary colors were converted to a different format in which one signal represented the brightness of the signal (usually referred to as the luma component) and the two other signals represented the difference between the luma signal and the red (R-Y) and blue (B-Y) signals. This component format allows the color difference signals to be sampled at a lower rate than the luma signal, as represented by the familiar notation 4:2:2 where the color difference signals are sampled at half the rate of the luma signal. The conversion from RGB to Y (R-Y, B-Y) is a lossless, linear process and similar to the NTSC Y, I, Q signals. The D-1 VTR was the first component digital VTR, and it was the first digital VTR to be standardized by SMPTE.

Even though analog VTRs are recognizable by their artifacts, there has not been a "retro" movement to return to analog recording anytime soon.

Oddly enough, these two types of digital recorders share a common serial digital signal interface. SMPTE 259M is a serial digital interface standard that operates at different data rates for different formats. The interface operates at 143Mb/s for composite digital signals, 270Mb/s for component digital systems, and a third rate of 360Mb/s for widescreen component digital signals.

Perhaps because the popular SMPTE standard allows digital signals to be carried over familiar coaxial cable rather than bulky 25-pin cables, it became easier to build and implement equipment that was based on the component digital format. This takes advantage of the superior multigeneration production performance, which is due to the elimination of the composite encode/decode process rather than just the digital recording process alone. This led to the development of the other families of digital VTRs, which are all component digital VTRs.

All of these VTRs recorded four channels of audio, which has also been digitized. Some VTRs included a "cue track" of analog audio, recorded either for redundancy or for ease of editing. Early on, it was much easier to "scrub" an analog audio track than it was to play back a digital track at slower or faster speeds than normal.

Joining the D-1 format, which uses 19mm wide tape, was the component digital D-5 format, with ½-inch wide tape. Up to and including the D-5 format, all of the VTRs recorded uncompressed video signals. As time went on it was discovered that digital compression could be used to reduce the amount of data required to represent a picture, allowing digital recording on systems that did not have the ability to record the uncompressed signal. Additionally, digital compression could be used to increase the recording time of a tape cassette or to reduce the size of the recording media, enhancing portability.

Digital Betacam was an extension of

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the popular analog Betacam format and used a similar-sized tape. Digital Betacam uses a mild form of compression that allows component digital data to be recorded on the smaller size tape.

A few years ago, all of the major consumer electronic equipment manufacturers were developing a standard for the home video cassette market. This format was originally called DVC but has since been shortened to DV. As many of the consumer manufacturers also have professional equipment divisions, they took advantage of the standard to develop their own professional extensions to the DV format to make it more appropriate for professional use. DVCPRO (soon to be D-7), DVCam and Digital-S (now standardized as D-9) are all based on the consumer DV compression standard and share similar (but not the same) tapes. The formulation of these tapes is different to allow some of the unique features to be used. On these machines the chroma signals are sampled at one-fourth the luma sample rate, so these machines are said to use 4:1:1 sampling. The number of audio channels varies but generally these audio signals are not compressed, except for differing bit resolution and sample rate.

Returning to the interface signal momentarily, because these signals are compressed, they do not require the full capacity of the 270Mb/s interface. A variation of the 270Mb/s interface has been developed called SDTI, which allows compressed data to be "mapped" into the 270Mb/s interface. This allows compressed signals to be transported in their compressed format between devices, similar to the "dub" connector on U-matic and analog Betacam VTRs. This process also avoids a decompress-compress generation, improving quality. Another feature of SDTI interface is that it can allow for either multiple channels of compressed video to be transmitted at the same time, or for a single channel of video information to be transmitted faster than real time, allowing for a high-speed dub connection.

What about the future? Even now the D-5 and Digital Betacam formats and/or transports have been improved for HDTV recording as HD-D5 and HDCam. Even the DV-based formats such as DVCPRO and Digital-S have been enhanced and will soon offer HD recording on these formats as well.

A format of particular interest to the film/video post-production industry is the 1080p 24fps HD format. This format will allow programs that have been shot in film to be posted electronically in their native frame rate. Alternately, these 24fps cameras could be used for electronic cinematography when the temporal response of the 24fps camera is to be preserved. It is also worth noting that many of these new formats will include up to eight channels of audio at selectable bit resolutions.

Video recording seems to have avoided the debate of which technology is better analog or digital. Even though analog VTRs are recognizable by their artifacts, there has not been a "retro" movement to return to analog recording anytime soon. Because of its different formats (some would say it was in spite of these different formats) digital recording itself has a bright future ahead. Users are free to pick the format that makes the most sense to them and protects their video library, preserving the future of their video assets into the next millenium. ■

Kenneth Hunold is a broadcast applications engineer for Dolby Laboratories Inc. in New York.

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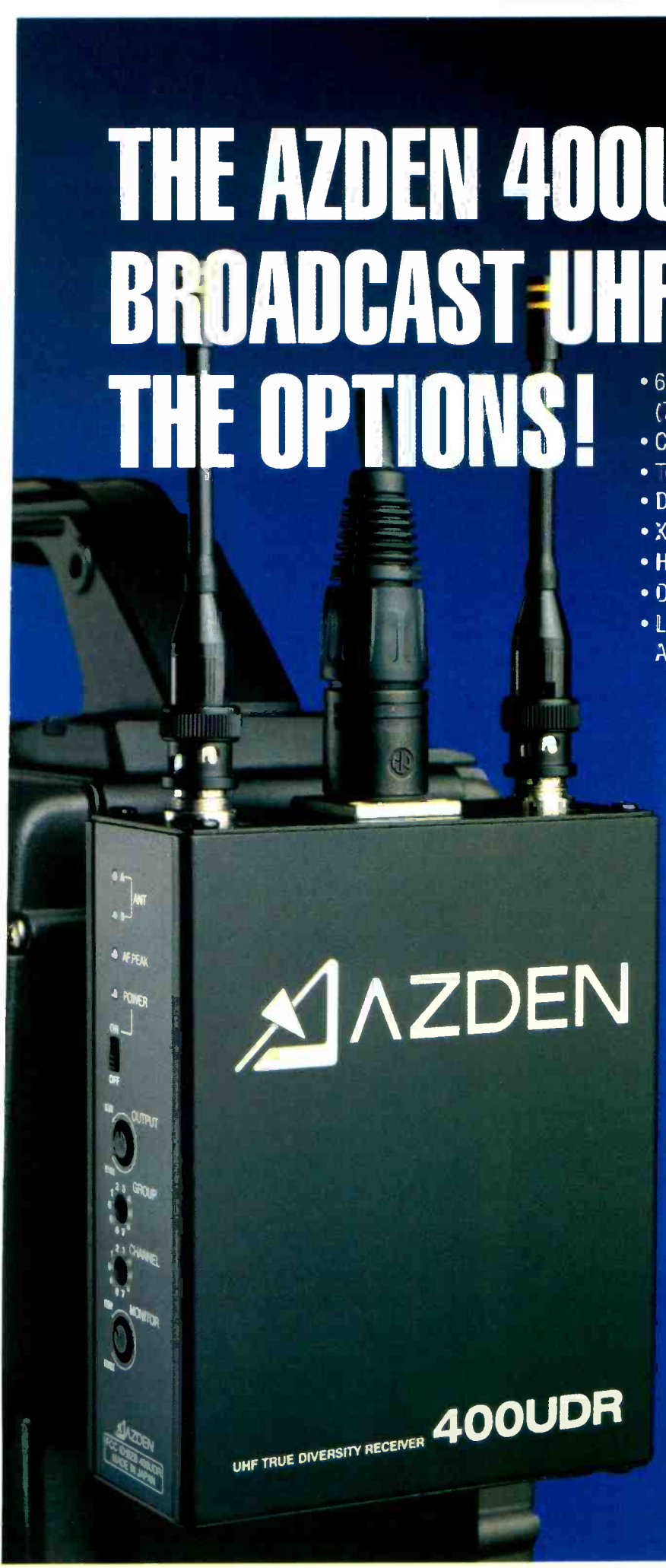

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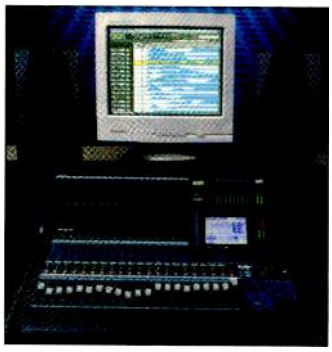

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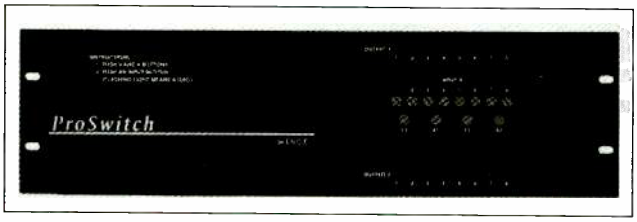

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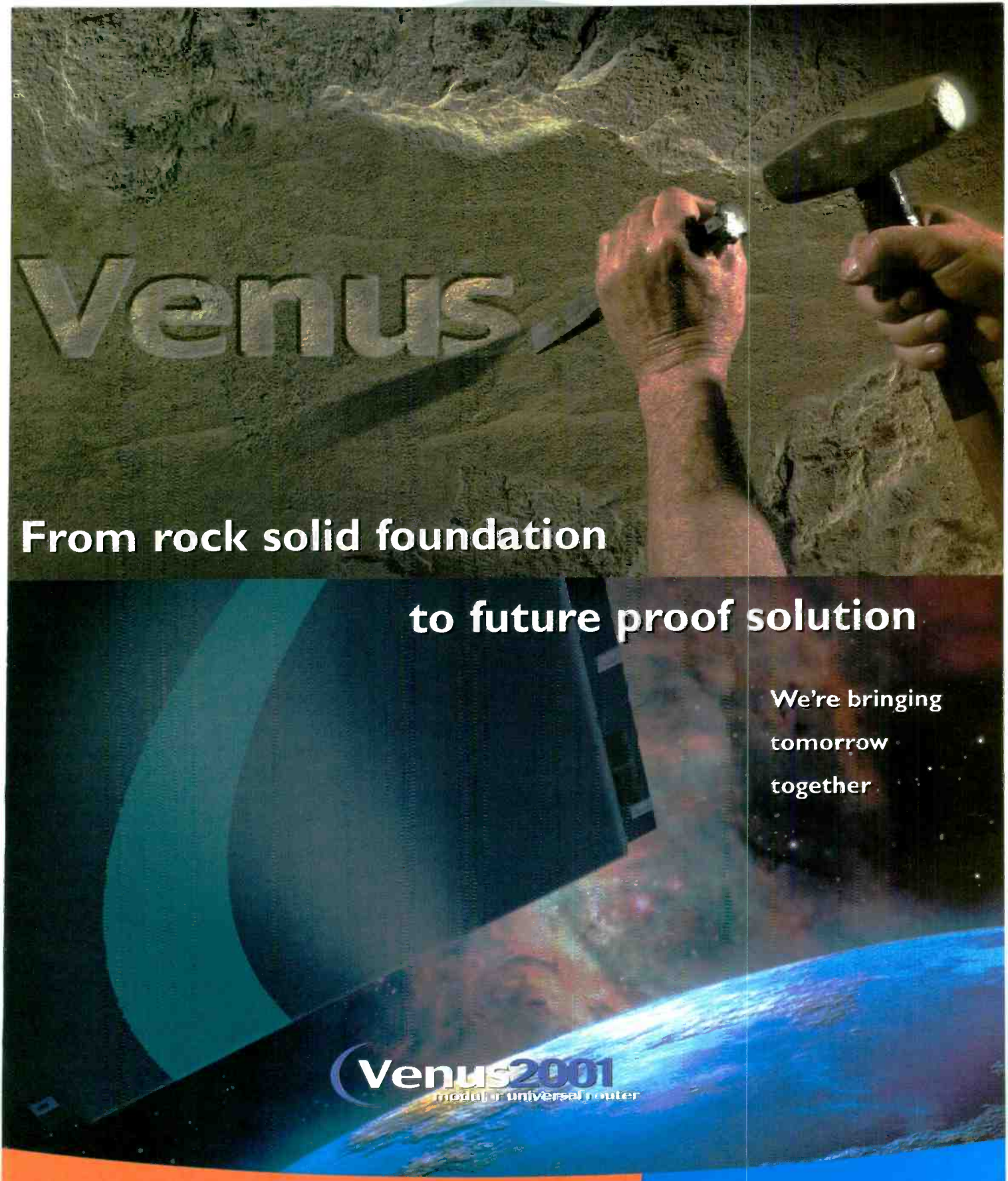

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On the cover

With DTV, MPEG compression systems are finding their way into the entire broadcast change, from acquisition to the final links to the viewer, ATSC transmission. Photo courtesy courtesy of IMMAD ECVS, Systems Integration

The Pro-MPEG Forum

By Dr. Nick Wells

Ensuring the success of MPEG.

Within the studio, the use of compression offers many advantages. Compression enables the efficient use of servers and networks that provide convenient and wide access to source and archived material. Also, server-based architecture enables efficient editing and automation within production and playout. Consequently, many manufacturers now offer professional acquisition, production and distribution equipment based around the MPEG-2 compression standard. Manufacturers chose MPEG-2 because it:

- Is an open, international standard;
- Provides excellent compression efficiency;
- Is flexible, with modes specifically designed for the professional environment; and,
- It offers the possibility of using a consistent standard throughout the production and broadcast chain.

Compression has made the use of disk storage and playback systems, such as these video servers at KOMO-TV, cost-effective. Photo courtesy Grass Valley Group.

Although using the new digital compression standards brings great flexibility, there are some inevitable difficulties associated with interoperability between equipment from different manufacturers and with consistency of approach to the implementation of such new and complicated standards.

The Professional MPEG Forum (Pro-MPEG Forum) was established in July 1998 as a means through which manufacturers could meet to agree upon and test interoperability points and interfaces. Naturally, this endeavor must necessarily meet the requirements of the end users who, for this reason, also participate in the Forum.

The Pro-MPEG Forum is not a formal standards-making committee. It exists to provide a bridge between new standards and practical, interoperable product implementation. These standards derive not only from the MPEG committee, but also from organizations such as the European Broadcasting Union (EBU) and SMPTE.

A work in progress

Current technical work of the Forum is based around:

- Agreeing upon operating points for MPEG in the professional environment;
- Agreeing upon file formats and wrappers for MPEG file interchange; and
- Addressing MPEG interoperability over wide area ATM networks.

The operating points work (in conjunction with requirements) should develop into defining recommended architecture and practices, with the aim of clarifying a subset of systems/architecture that should promote interoperability and maintenance of technical quality.

Technical quality can be maintained in an optimum way by the consistent use of MPEG-2 throughout the production and broadcast chain, and through the intelligent use of transcoding between different flavors of MPEG-2. The Forum will tackle interfaces and architectures allowing optimum transcoding.

The file interchange work should develop common standards for control and practices for carrying metadata. Interoperability in both these areas is necessary if the potential of MPEG-based production and distribution equipment is to be realized. High definition also is an important area where the compression efficiency of MPEG can bring huge advantages in production.

As operating points and interfaces are agreed upon, it should be possible to define a set of tests that can be used sensibly to confirm interoperability at different parts of the system. The specification and test group will cooperate with test-equipment manufacturers, to specify a selection of tests and to encourage production of suitable test equipment. Finally, although there is a tendency to concentrate mainly on video issues, audio is never forgotten and is included in all the Forum's specifications, tests and trials.

Successful first year

The Pro-MPEG Forum has just completed a successful first year of work with significant interoperability demonstrations at NAB, Montreux and IBC. Technical work is proceeding well, and this work should prove beneficial to the entire broadcast and production industry. The Forum's website, which carries news of meetings, documents, and future plans, is at www.pro-mpeg.org. ◆

Dr. Nick Wells is with the BBC and also serves as Pro-MPEG Forum chairman.

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What does it mean to broadcasters?

By Gordon Castle

Interoperability for broadcasters is a must.

Compression has become a compelling and enabling technology over the last few years, and it has been used effectively to reduce transmission and storage costs. But it also has been an area of competition and complexity. Manufacturers have used compression as a way to offer better features, performance and cost. Its complexity often has required proprietary use of compression in systems such that the use of this technology was fairly restrictive and generally confined within a single manufacturer's approach. This resulted in considerable problems for the broadcaster. Broadcasters want to take advantage of the new capabilities and efficiencies, but they don't want to give up the flexibility of interoperability they enjoy with uncompressed video.

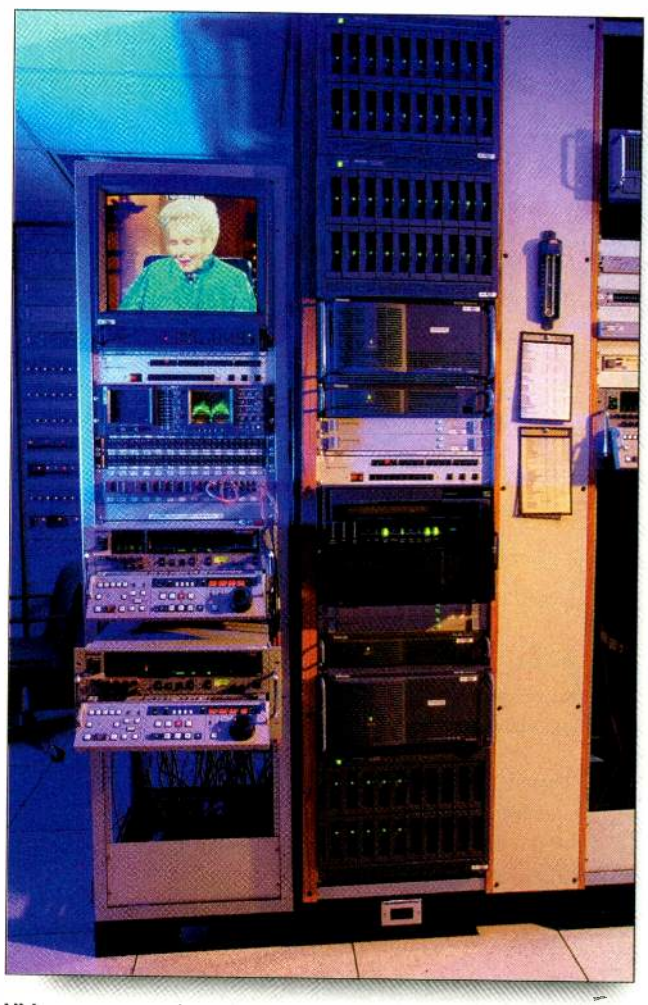
Additionally, as broadcasters and production companies have started to work with more systems that use compression inside an uncompressed facility, issues of cascading quality loss have become a serious concern. The goal of compression is to provide efficiency within the product or transmission stage with minimal loss. Unfortunately, this has not extended throughout the system, nor has it addressed how many times compression would be used in the production chain.

Lately broadcasters have been putting together plans about their future production facilities. Due to recent changes in competition and distribution, the need for more flexible and efficient production systems is growing. Production systems will need to leverage the advantages of compression, servers, nonlinear editing and automation. In this new design, work flow and process chains are less defined — and the need to share and move media more dynamically is a heightened concern. Compression and digital technology is the obvious answer, and the need for interoperability is of paramount importance.

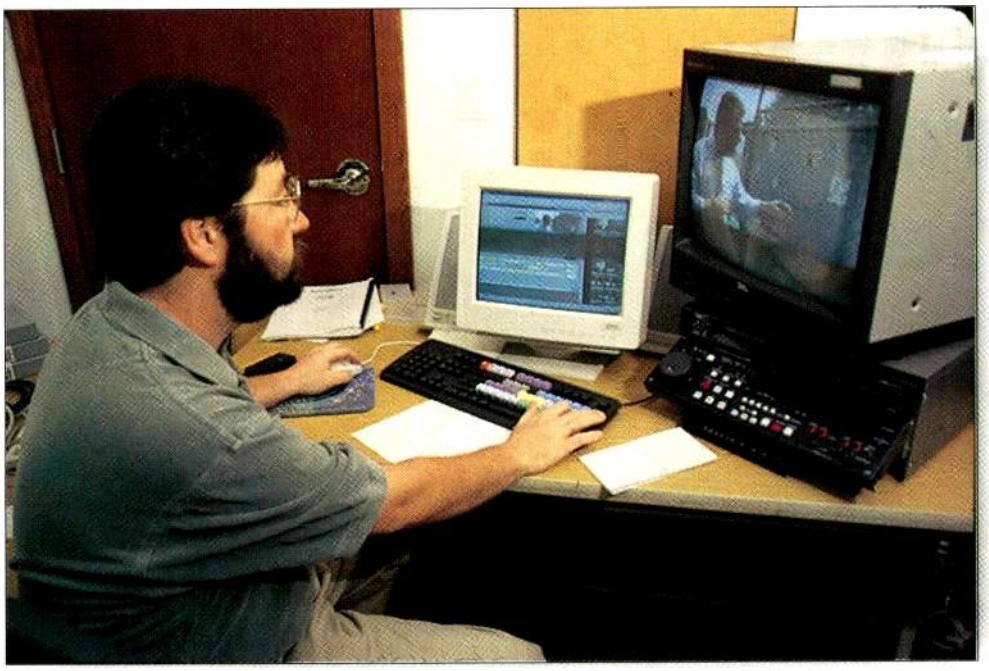
At CNN, we took a long look at where we were and where we wanted to go, and we set a course on building a compressed, digital, nonlinear production plan. At the Forum, we can discuss our future technology plans with other users and manufacturers and, together, prioritize our areas of work. As the end users of future technologies, our views and needs are motivating. The Forum meetings have been attended by a wide range of international users, including the BBC, CBC, CBS, CNN, EBU, Fox, France 3Fuji TV, IRT, NHK, NOB, NRK, PBS, RAI, SRG and Tokyo Broadcasting, and all have had the opportunity to voice their requirements and priorities.

The input from users is facilitated in the Forum within the requirements group. This group provides two important functions. First, it facilitates user input and helps prioritize manufacturer tasks and issues, taking vendor questions from the other working groups, adding clarity to the needed solutions and suggesting optimum interoperability improvements. Second, the group is developing future global requirements for compressed production solutions.

End users envision the use of compression as an enabling technology needed for the production system design of the future. In these future systems, all levels of media — from text to HDTV with ancillary data — will move easily and freely throughout the system without any user intervention. Audio and visual media will be extended to everyone, enabling users to



Video servers using MPEG compression are now found side-by-side with tape machines in broadcast facilities such as KOMO-TV. Photo courtesy Grass Valley Group.



Development of new production systems and the interoperability required of them is one of the top goals of the Pro-MPEG Forum. Photo courtesy Vibrint Technologies.

be more creative and efficient. Defining the requirement for these future systems (and those that will be used during the transition) is a difficult task and one in which user input is required for success. Many broadcasters use the Forum sessions to help define questions they need to ask of their own companies in their future planning exercises.

A practical example of the Forum's interaction is the requirement for users' servers from different manufactures to exchange compressed video with no quality loss. In past Forum sessions, users and manufacturers have worked together to define the detailed requirements, which has led to a demonstration of servers exchanging data in their native, compressed format. The lessons learned in creating these demonstrations with real-world user input will greatly accelerate the development of standards. Other global issues under discussion are requirements for predictable quality loss in the production system, partial file transfer, standards for indexing, efficient use of satellites and file formats standards for removable media. To the broadcaster, these are essential considerations for future systems planning.

Broadcaster opinions

The Forum provides an opportunity to learn more about MPEG and future equipment developments, which is important to business and system planning.

"The Pro-MPEG Forum gives me a chance to learn about MPEG in order to be able to make a decision at a later stage if we want to use MPEG-based equipment in TV production, comments Reidar Otto Johnsen, producer/director at NRK TV, Norwegian Broadcasting. "Another (and no less important issue) is that Pro-MPEG is the only forum where broadcasters and the equipment industry can get together and actually design the future MPEG protocols and equipment. We as broadcasters do tell the industry what we want and how we want to work, they tell us what's possible and what's impossible, and usually we go for the impossible."

There are many areas outside of the physical compression of media about which broadcasters are concerned because they involve the implementation of new equipment. Issues such as control, audio, media management and metadata all are hot topics and are regularly discussed in the Forum. These new systems add capability and complexity to the production facility; every area is affected, although many have not been directly addressed in the past. To achieve a working equipment capability, the manufacturers must create new solutions. In many cases, this new technology requires broadcasters to create new workflow plans; therefore, they need to work with the manufacturers to establish new solution-driven paradigms.

Per Bohler agrees. "We want to see alternatives in production systems, as our company is in the middle of the process of rebuilding its facility and moving from an analog world to a digital one," he says. "The essential requirement for any new system is flexibility — and the work of the Pro-MPEG Forum will be of great benefit to broadcasters in this regard."

The Forum attracts experts from the manufacturer community. Special speakers also are invited to the meetings. Topics such as bit splicing, long GOP editing and transcoding are areas of active development. Keeping current with the technology is difficult, but the Forum is in a position to help. Broadcasters need a much deeper technical understanding today, as these issues continue to affect their planning and future operations.

Development of new production systems and the interoperability required of them is one of the top goals of the Forum. To the broadcaster, this is one of the key advantages of participating. The Forum is one of the few places — if not the only place — for broadcasters and users to come together in an atmosphere of no competition and with the direct goal to find better ways to work together. Rapid technology advances mandate the need to change interoperability options, and the Forum has a charter that will increase the odds of success.

In addition to attending quarterly Forum meetings, end users can participate in end-user seminars at Forum events such as NAB and IBC. This is an excellent opportunity to provide input on all future work. To be put on our mailing list, visit the Forum's website at www.pro-mpeg.org. ◆

Gordon Castle is vice president of research and development at CNN.

Choosing compression parameters

By David Brooks

MPEG's flexibility is key to diverse applications.

The Pro-MPEG forum gives manufacturers and end-users the opportunity to learn about MPEG and future equipment developments. Photo courtesy of IMMAD ECVS, Systems Integration.

At the higher data rates that the MPEG-2 4:2:2 profile pro vides, excellent multigeneration performance is possible even without use of temporal predictive coding. MPEG is the obvious choice to meet practical constraints on storage costs and transmission efficiency. At more modest data rates, the efficiency of MPEG's long group of pictures (GOP) based on temporal predictive coding allows MPEG to maintain program quality despite storage and transmission constraints. To realize the potential of MPEG-2 throughout the TV broadcast chain, interoperability issues must be addressed, and compression parameters must be carefully chosen.

Facing the challenge

The Pro-MPEG Forum established a working group to focus on compression interoperability and compression parameter choices. One of the challenges that the group faced was balancing flexibility with simplicity in choosing compression parameters for professional TV applications.

If professional TV facilities were self-contained units with no external constraints on bandwidth or data rates, the simplest choice of compression parameters would be appropriate. These idealized, self-contained facilities could choose MPEG 1-only coding, perhaps at a fixed data rate, and never even consider the implications of temporal predictive coding.

Actual facilities, however, often do not have this luxury because they may use fixed data-rate public networks, have limited bandwidth terrestrial and satellite channels, and often face a variety of conflicting storage and transmission requirements. Public networks, including DS3 at 45Mb/s and E3 at 34Mb/s, can be used to greatest advantage with long-GOP coding. With even lower data rates associated with some terrestrial microwave links for ENG, long GOP coding is essential. In many facilities, all of these different paths are possible compressed program sources.

Whenever different types of compression are employed, operating with different data rates and different GOP structures, it is necessary to consider interactions between different compression parameters. To combine different parts of the TV signal chain (each with its own unique constraints), TV systems must be based on principles that will optimize resulting program quality. One simple rule-of-thumb might be to employ I-only coding at a fixed data rate, except where higher efficiency is absolutely required.

An alternative approach might be to leave compressed streams with their original compression parameters wherever possible, changing to a different data rate or GOP structure only when necessary. In typical broadcast scenarios, this latter approach provides improved image quality today and the opportunity to take advantage of emerging compressed stream transcoding and processing technology. In fact, the joint SMPTE/EBU task force recognized this approach in its compression report.

With these considerations in mind, the Forum is taking two steps to promote interoperability of MPEG and other compressed video equipment in professional TV applications. First, the Forum has written a code of practice that defines key interoperability ranges. For each of these interoperability ranges, the necessary compression parameters are specified to ensure proper interface functionality between equipment from different manufacturers. Second, a companion document will examine application-

specific requirements and recommend appropriate operating parameter choices. The combination of these interoperability specifications and application-specific parameter settings will facilitate design and application of flexible MPEG-based professional TV equipment.

Interoperability ranges

The specification of interoperability ranges addresses a variety of different requirements by focusing on appropriate bit rates and GOP structures for different application areas. The Pro-MPEG Code of Practice specifies:

- Interoperability ranges with constrained bit rates and GOP structures.
- Spatial alignment of coded images.
- Preferred SDTV image size.
- Preferred chrominance format.
- Bit-stream parameters for random access and editing.
- Use of 48kHz-sampled digital audio.

Five interoperability ranges (see Figure 1) are defined to cover both HDTV and SDTV, using I-only coding as well as temporal predictive coding. In the case of I-only coding, there is a specification for the net video data rate and an additional specification on the maximum size of any individual frame of compressed video data.

Interoperability Range 1 is for general SDTV applications. It covers SDTV coded at up to 50Mb/s and may use temporal predictive coding.

Interoperability Range 2 is targeted at SDTV editing. It covers SDTV coded at up to 50Mb/s, using no temporal predictive coding. Additional constraints to the size of each individual I-frame apply.

Interoperability Ranges 3A and 3B are for general HDTV applications. Both cover HDTV coded at up to 80Mb/s and 175Mb/s, respectively, and may use temporal predictive coding.

Interoperability Range 4 is targeted at HDTV editing. It covers HDTV coded at up to 50Mb/s, using no temporal predictive coding. Additional constraints to the size of each individual I-frame apply.

MPEG without fear

Decoders that comply with the Pro-MPEG code of practice will be capable of spanning the entire applicable interoperability range. Users who wish to select encoding parameters unique to their specific requirements will be able to do so with confidence. Within any interoperability range, decoders from a variety of manufacturers will properly process encoded bitstreams from different manufacturers. Specific operating parameter choices will depend on the individual application requirements, including editing capability, storage capacity, contribution feeds and distribution/emission bandwidth.

Bit rates: variable or constant?

Some devices such as disk recorders have the capability to deal with bursts of data. These devices can take advantage of variable bit rate (VBR) compression by allowing data rates to increase when necessary to improve quality and decrease with easier content to improve efficiency. These devices sometimes are referred to as providing constant quality operation.

Other devices inherently operate with data rate set to a fixed value. With these constant bit rate (CBR) devices, there will be some picture-quality variation. The quality variation will be a function of picture complexity. If data rates are sufficiently high, these variations can be imperceptible. The ease of processing CBR streams is attractive in some cases.

The MPEG standards consider CBR compression to be a constrained version of the VBR compression. Recognizing this relationship, the Forum has specified interoperation in a VBR environment. Encoders may be set to operate with either VBR or CBR outputs. Decoders shall be capable of accepting either VBR or CBR inputs. If any device requires CBR operation, that device can pad an incoming VBR signal up to and constant bit rate internally, but must remove this padding at its interoperable output interface.

This approach will allow the best benefits of both VBR and CBR operation.

A big step forward

The Forum's work is a significant step in promoting interoperability of MPEG and other compressed video equipment in professional video applications. Faced with diverse — sometimes even conflicting — user inputs, the Forum has been careful to avoid over-simplification of compression parameter issues. To address both the relatively simple requirements of self-contained facilities, as well as the more general case involving public networks and terrestrial and satellite links, the Forum has provided a code of practice on MPEG-2 interoperability ranges. This will ensure proper interface functionality between equipment from different manufacturers and will leave users the flexibility to optimize specific compression parameters to their own individual requirements. At last, professional broadcast TV systems now can realize the promise of MPEG.

In parallel with Forum activities, SMPTE has a group working on compression technology issues. The Forum is cooperating with this SMPTE effort. To take full advantage of the Forum's expertise, the code of practice on MPEG-2 interoperability ranges has been provided to SMPTE as a proposed standard.

Although the Forum's initial work represents a significant step toward interoperability, there is more work to be done. Many of the topics are not unique to MPEG but rather apply to promoting interoperability of any compressed video equipment. Future work will include:

- Timing issues in the compressed domain.
- Transcoding between streams.
- Interoperability with DV compression.
- Compressed video on data networks

The Forum is prioritizing this work based on user requirements, and it will be addressing these issues in future meetings.

A companion document to the code of practice on interoperability ranges already is being drafted. It will examine application-specific requirements and recommend appropriate operating parameter choices for a variety of applications. ◆

David Brooks is head of planning and coordination with Snell & Wilcox.

MPEG-2 file interchange

By Mark Ostlund

Moving MPEG as files, not as streams.

Historically, most video was transferred as video streams or on tape. Now, it is expected that content distribution will take place on WANs and LANs — for good reasons:

- Content can be distributed with no loss of quality, minimizing quality checking and retransmissions.
- Network costs can be minimized with temporally encoded MPEG; you pay only for the bandwidth needed. Bandwidth vs. cost tradeoffs are made between the amount of content transferred and transfer speed requirements.
- Content on-demand improves the production process.
- Networked facilities bring operational efficiencies with reduced tape handling and automation.

MPEG in files

Compressed file interoperability is a major issue. Prior to standards and recommended practices, manufacturers must introduce equipment using proprietary file formats. Files exchanged within a single manufacturer's equipment interoperated, but not between other manufacturer's. Although it may be possible to transfer a file from equipment using standard IT networks and protocols, the applications cannot use the file once it arrives because it is in an alien format.

Stream	File
• Bounded quality, unidirectional	• Synchronous delivery (guaranteed timing)
• Paced timing in multiples (1x, 4x)	• Push only
• Guaranteed quality, bidirectional	• Asynchronous delivery (delay insensitive)
• Any desired delivery time	• Push or pull

Table 1. The four categories of video streaming and file transfers

While file transfer using standard IT networks and protocols may work, applications may not recognize transferred data because it is an alien format. To prevent the same incompatibilities that have existed with other compression systems, the Pro-MPEG Forum has taken on the task of evaluating and recommending MPEG file interchange formats for a variety of broadcast applications.

Though MPEG is a well-defined standard, how MPEG files are stored is only now getting serious attention. To prevent incompatibilities that plagued other compression systems, the Forum is evaluating and recommending file interchange formats for major broadcast applications.

File interchange work in process

A Pro-MPEG working group (WG) was established to identify issues surrounding multivendor interoperability in exchanging files of MPEG-2 content. The group identified the primary problem as interoperability in file transfer applicatons where MPEG-2 content is exchanged. To leverage technologies, considering physical interfaces and transport protocols, the primary concern is file interchange versus file transfer.

To begin this work, the Forum is reviewing proposals on file interchange formats and will publish recommended practices on their usage. Key goals for evaluating proposals for interchange formats include:

- A common way of encapsulating and accessing metadata across both simple and complex applications.
- Application access to essence containers (PS, TS and CP as files, and ES to achieve a lowest common denominator of interoperability). This allows applications that may not be able to parse the wrapper and metadata to still have access to the MPEG data.
- Ease of translation to native file formats to support streaming, editing and exchange.
- Compression format independent wrappers that preserve metadata across transcodes between compression formats — e.g. transcoding an intraframe encoded file for editing to a temporally encoded file for distribution or on-air playout.
- Support for random access and partial file transfers, e.g. moving a sports or news highlight without transferring the whole original file.
- Support for access/use before completion of transfers — e.g. start play or edit a file before transfer is finished.
- Suitability of interchange formats as archive formats.

Different applications in broadcast have different requirements for metadata. The WG prioritized requirements for file interchange format (required, desired and possible). It also formed an *ad hoc* group to specify a minimal set of required and optional metadata to be encapsulated in the file wrapper for each application. Example: Metadata needed by an editor is different from that required for distribution or archiving. Templates will specify constraints on video/audio essence and essence containers for each application. The *ad hoc* group is defining sample templates under guidance from the Operating Ranges WG. It is taking the rich MPEG-2 feature set and recommending subsets appropriate for different applications. A baseline set of interoperability and compliance guidelines is anticipated to be the natural outcome of this work.

Beyond file interchange formats and application-specific templates, there are other issues: multicasting, streaming over IP networks, and others related to protocols and quality of service. The goals are to give broadcasters the rich capabilities of MPEG and interoperable, multivendor MPEG file exchange. ◆

Mark Ostlund is strategic business manager for Pinnacle Systems.

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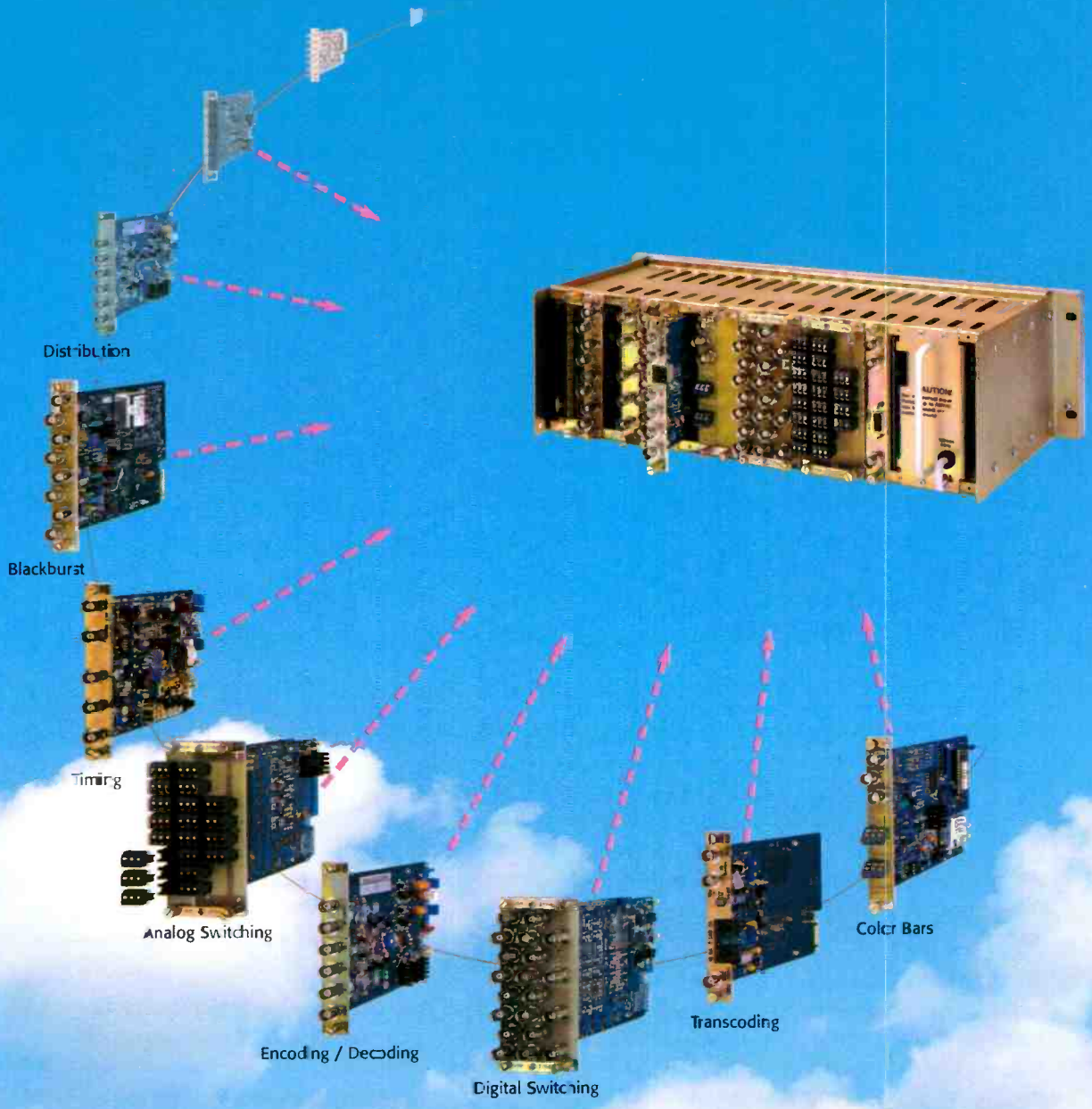

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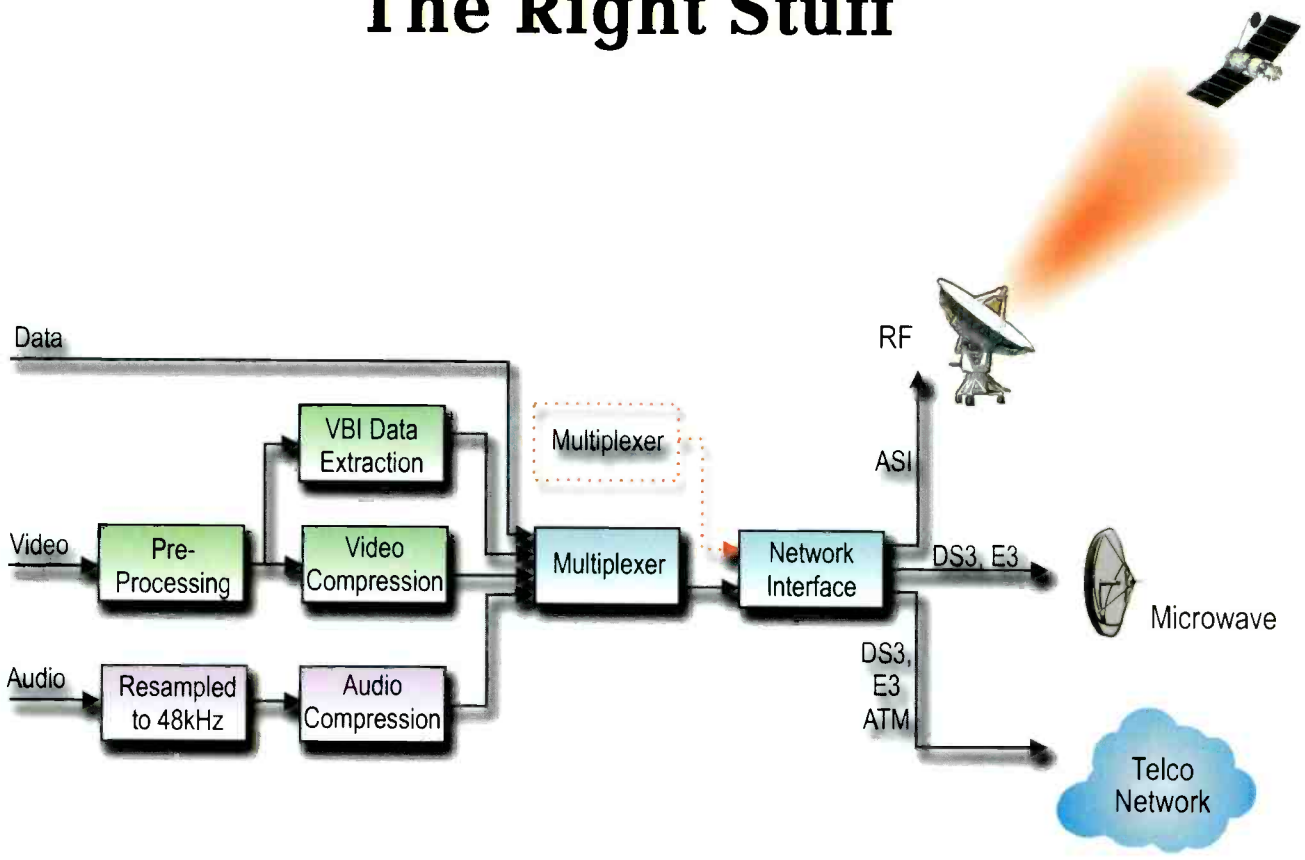

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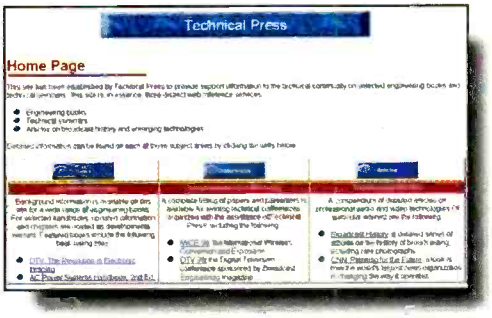

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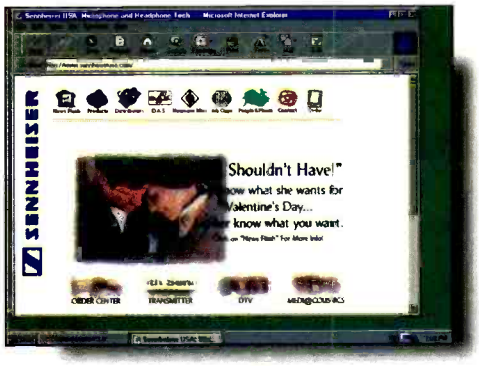
Technical Press is a web-based reference site that supports more than a dozen video engineering books, including *DTV: The Revolution in Electronic Imaging*. Also available are articles on digital video technologies and applications, and a detailed series on the history of broadcast engineering.



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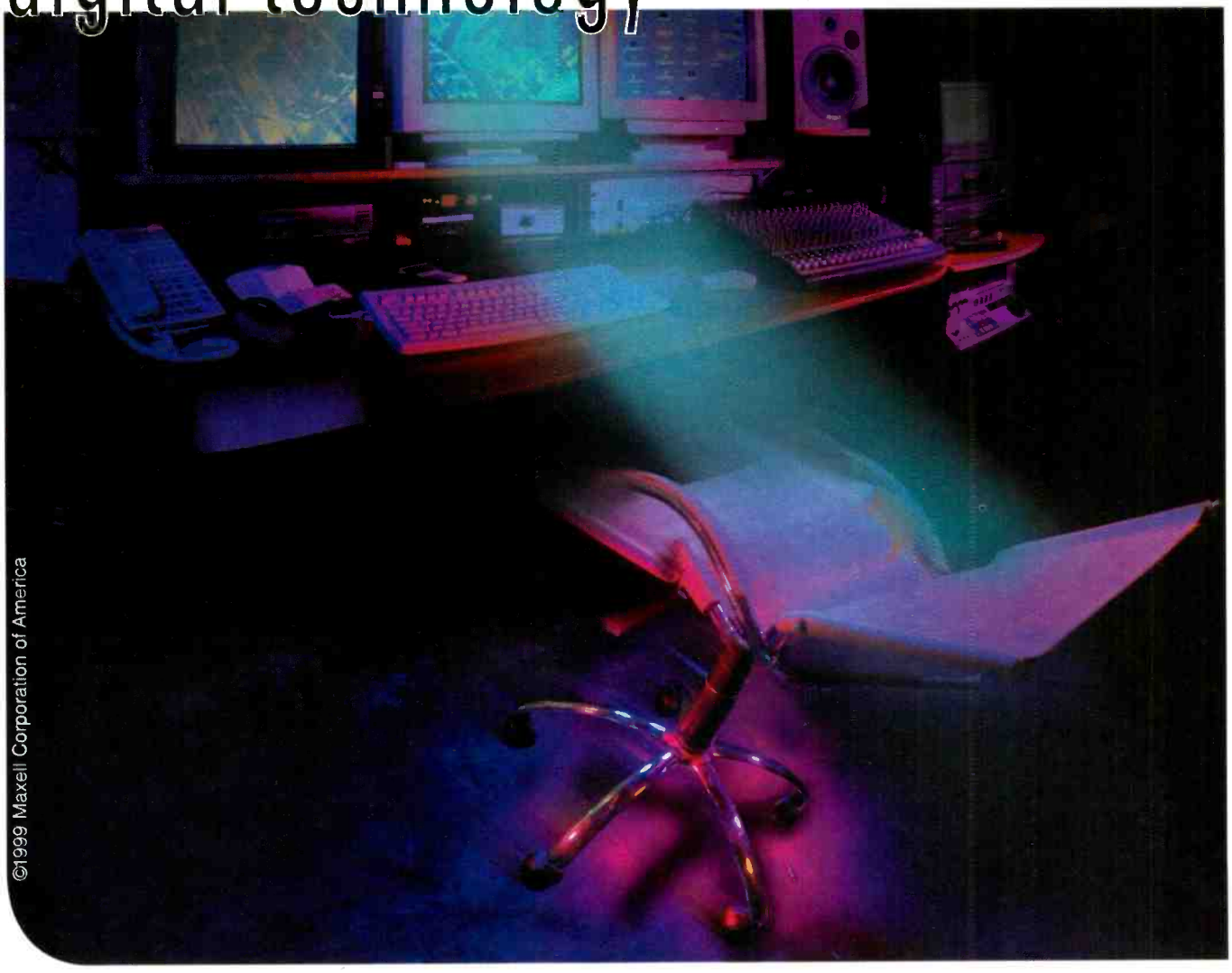

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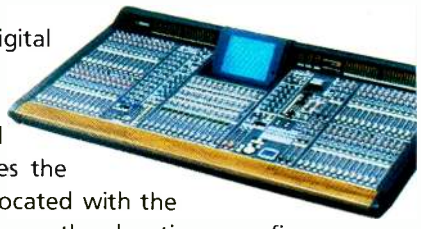

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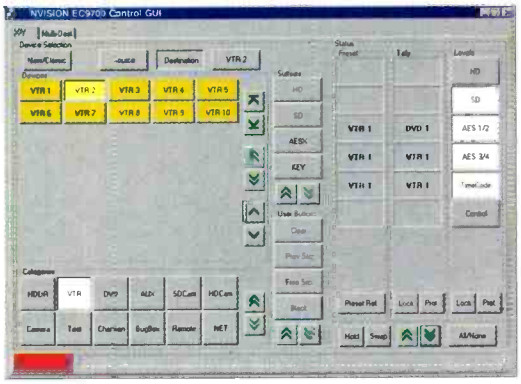

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Fast Multimedia 601: this nonlinear editing suite edits in real time with two video, one titling and eight audio channels; analog and digital interfaces let users work with the video device of their choice; features unlimited number of video, overlay and title tracks, editors for DVEs, wipes, keying, color effects and filter effects and integrated title generator for still, roll and crawl titles in real-time; 800-249-FAST; 425-354-2002; fax: 425-354-2005; www.fastmultimedia.com

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Circle (158) on Free Info Card




Digital disk recorder

Accom APR Attache: this digital disk recorder features a choice of either 8-bit or 10-bit video recording resolutions, standard PreRead with Accom's Non-Destructive PreRead for concurrent play/record operation; has over 30 minutes of uncompressed digital video and audio storage; 650-328-3818; fax: 650-327-2511; www.accom.com

Circle (382) on Free Info Card

PC-based stills store

AVS Graphics International StillBank: a low-cost, entry-level PC-based stills store operating on Windows 98 or NT platforms; produces full broadcast quality pictures (32-bit output) in bitmap format; image importation is possible from simple disks and CD-ROMs to network and Internet importation; 801-975-9799; fax: 801-975-0970; www.avsg.co.uk

Circle (389) on Free Info Card

Miniature electric field probe

Holaday Industries HI-6005: this miniature electric field probe weighs only 80 grams and occupies a space less than 12cm in diameter; optical coupling to a variety of readout options makes this new probe suited for a wide range of field monitoring applications; 877-HOLADAY; 612-934-4920; fax: 612-934-3604; www.holadayinc.com

Circle (383) on Free Info Card

Digital to analog converter

Viewgraphics HDView: this digital to analog converter and HD signal generator automatically detects and converts a broad range of HD formats including all 1080 and 720 standards; accepts uncompressed 4:2:2 HD serial digital video and produces broadcast quality HD analog output; also provides an independent HD signal generator that can be used as a studio-grade HD master sync generator; 650-903-4900; fax: 650-969-6388; www.viewgraphics.com

Circle (385) on Free Info Card

Audio signal analyzer

Channel D Corporation Mac the Scope, Release 3: this audio signal analyzer and precision signal generator software adds a burst mode to the signal generator, plus deep time record averaging and triggering; these features enhance Mac the Scope's impulse response measurement capabilities for reverberation and loudspeaker testing applications; 732-933-9388; fax: 732-933-9389; www.channld.com/mts.html

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Circle (160) on Free Info Card

Aspect ratio converter

Axon Digital Design ARC-3000: this 19-inch, 1RU unit offers quality, optimized conversion for post-production and broadcast applications; all major controls and presets can be accessed via the unit's control panel, which includes a comprehensive jog dial rotary encoder; up to 16 pre-sets, including horizontal scale, horizontal pan, vertical scale, vertical tilt, GPI output selection and output timing, can be stored in the nonvolatile memory; +31 13511 6666; fax: +31(0)13511 4151; www.axon.nl

Circle (387) on Free Info Card

Palm-size test instrument

Neutrik AG Minilyzer: this palm-size test instrument continuously measures audio levels as RMS or peak levels, absolute or relative to a definable reference with selectable units; the accurate frequency measurement, with high resolution of 100ppm gives additional functions and acts as the base for distortion measurement; +41-75-237-2424; fax: +41-75-232-5393; www.neutrik.com

Circle (388) on Free Info Card

Broadcast monitor

Sony BVM-D: this monitor series shares the same quality, modularity and installation flexibility as the current BVM-E/F and G series; automatically decodes a very wide range of scanning frequencies without the need for an external scan converter; have a built-in capability to display 480i/p, 575i, 720p and 1080i input signals; 800-686-SONY; fax: 201-930-4752; www.sony.com/professional

Circle (390) on Free Info Card

NT PC-based GUI application

Chyron MAPP EDL Media Browse: this NT PC-based GUI application allows journalists to search MAPP's database to find the material they need and then browse frames marking in and out points; the application generates a thumbnail of the material and puts the "in" thumbnail in a scratch pad; edits can be generated from any number of different clips; 516-845-3871; fax: 516-845-3888; www.chyron.com

Circle (391) on Free Info Card

Database management system

Columbine JDS Systems Inc. Material Manager: this software system provides complete management functions in the preparation of material for transmission in a broadcast operation; oversees all material management functions of a station through one central database; includes an integrated Librarian module that manages the physical storage of material and a MediaBase module for direct recording of segment times from VTRs; 303-237-4000; fax: 303-237-0085; www.cjds.com

Circle (392) on Free Info Card

Network management system

Tiernan Communications TDMI: this network management system provides an extensive range of features that enable configuration, control, monitoring and status reporting to meet the needs of digital TV systems for contribution, distribution and broadcast applications; provides features to support systems elements such as Conditional Access Systems, PSIP Injection and I/P message encapsulation; 800-323-0252; 858-587-0252; fax: 858-587-0257; www.tiernan.com

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Uninterruptible power supplies

Warner Electric STABILINE SW Series: this uninterruptible power supply protects sensitive electronic equipment in commercial, industrial and broadcasting applications; configured with load segments that are sets of output receptacles that can be turned on and off individually by using Power Management software; this permits the user to conserve battery power by turning off non-critical loads while providing backup power to essential equipment; 800-787-3532; 860-585-4500; fax: 860-582-3784; www.warnernet.com/sev_main

Circle (400) on Free Info Card

TASCAM MM series graphical interface

TimeLine Vista ViewNet Audio: this interface features a graphical project view screen and allows networked control of all setup parameters and operations for TASCAM's MMR-8 and MMP-16 modular multitrack units; can be run on Windows 95, 98 or NT, Macintosh or UNIX-based systems; multiple instances of ViewNet Audio can be used on the same network to provide control of more than 100 MM Series machines; 760-761-4440; fax: 760-761-4449; www.timelinevista.com

Circle (453) on Free Info Card

Video assist transmitter/receiver

OpTex VA1394: this microwave product is a low-budget, video assist transmitter/receiver that works on the license-free frequency of 1394MHz; the transmitter and short whip antenna supplied is very small and will fit easily onto any TV or film camera; will transmit a line-of-site live color picture directly across a studio floor or film set to the receiver up to a distance of approximately 1000 feet/500m; greater transmission distances are possible by using higher gain antennae at the receiver end; +44 181 441 2199; fax: +44 181 364 9235; www.optexint.com/optex

Circle (454) on Free Info Card

Switch controller

Dielectric Dual Switch Controller: this switch controller will allow local or remote control of two independent switches; is designed to operate with one or two of Dielectric's 50,000 Series Coax Switches; features push button selection, local LED to show path connection, 12- or 24V DC, transmitter tellback and Dummy load connections; 800-341-9678; 207-655-4555; fax: 207-655-7120; www.dielectric.com

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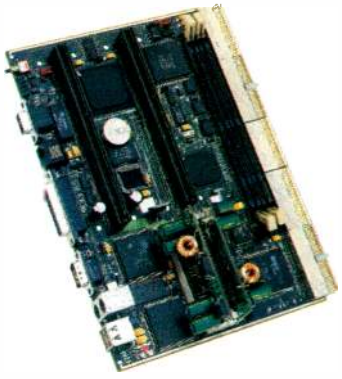

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Circle (166) on Free Info Card

Data drive

Sony GY-8240 DTF-2: this data drive offers five times the data storage capacity and twice the data transfer rate of DTF-1 and provides users with a choice of capacity, transfer rate and price; supports a sustained data transfer rate of 24MB/s (192Mb/s) and a burst rate of 40MB/s; DTF data tape cassettes continue to be available in large and small sizes; 800-686-SONY; fax: 201-930-4752; www.sony.com/professional

Circle (500) on Free Info Card

Now Shipping

Encoders and decoders

Dolby Laboratories Dolby E Multichannel audio coding: designed to ease the transition from two-channel to multichannel audio; the DP571 Dolby E encoder and DP572 Dolby E decoder enable producers and broadcasters to distribute up to eight channels of audio, as well as Dolby Digital metadata, via a single AES/EBU pair, two audio racks of a digital video tape, digital audio tape or video server; 800-33-DOLBY; 415-558-0200; fax: 415-863-1373; www.dolby.com

Circle (394) on Free Info Card

Digital videocassettes

Sony BetacamSX line of digital videocassettes: these six-minute digital videocassettes are for news, electronic field production and post production; available in small shell with six, 12, 22, 32 and 62-minute lengths and large shell in 64, 94, 124, 184 and 194-minute lengths; 800-686-SONY; fax: 201-930-4752; www.sony.com/professional

Circle (395) on Free Info Card

Video editing system

Avid Technology Express Version 2.5: this digital nonlinear editing solution incorporates Avid's Meridian video subsystem; is for a Macintosh platform; features two streams of real-time color correction; 16:9 widescreen support; soft-edged drop shadows; batch re-import of graphics; 800-949-AVID; 978-640-6789; fax: 978-851-0418; www.avid.com

Circle (396) on Free Info Card

Digital recording console

TASCAM/Teac Professional TM-D4000 Digital Recording Console: offers the end-user a recording and mixing console based on TASCAM's technology employed on the larger TM-D8000 console; has 32 mono and two stereo inputs, feeding eight buses; features six aux sends, four-band EQ and full dynamics on each channel; 323-726-0303; fax: 323-727-7635; www.tascam.com

Circle (397) on Free Info Card

Video editing system

Sonic Solutions DVD Fusion: this system creates DVD projects directly from Macintosh-based Avid, Media 100 and QuickTime video editing systems; allows video editors to transcode their video editing projects into DVD-compatible video and audio streams and then author interactive DVD titles using this content; 800-225-1656; 415-893-8000; fax: 415-893-8008; www.sonic.com

Circle (398) on Free Info Card

Distribution amplifier

Rane Corporation DA 216a: this amplifier offers assignable outputs; Input A, B or both are now independently assignable to each of the 16 outputs; provides 16 mono or eight stereo discrete balanced outputs from one or tow balanced mic or line-level inputs; 425-355-6000; fax: 425-347-7757; www.rane.com

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Circle (167) on Free Info Card

Compact mixer

Mackie Designs 1642-VLZ PRO: this mixer features 16 channels (eight mic/line, two mic/stereo line and two stereo line), 10 new studio-grade XCR mic preamps, 48V phantom power, 16 high-headroom line inputs (four stereo pairs, eight mono), eight TRS channel inserts, and is rack mountable; 800-898-3211; 425-487-4333; fax: 425-487-4337; www.mackie.com

Circle (456) on Free Info Card

seamless switcher w/6 HR-inputs

Analog Way Graphic Switcher: this switcher is a seamless switcher with six high-resolution inputs; it cuts, fades and mixes instantaneously between six high-resolution sources up to 1600x1280, with no synchronization dropouts; scales the inputs to a VGA, SVGA, XGA.2 output format and works with staging live events, conferences, exhibitions and conventions; 212-269-1902; fax: 212-269-1943; www.analogway.com

Circle (457) on Free Info Card

Tripods

Bogen Photo 3046 and 3051 Series: these tripods now incorporate a third leg extension section that increases the maximum elevation of both models without sacrificing minimum height; the 3046 model has a maximum height of 89.4 inches and a minimum of 30.3 inches and the 3041 model extends to a height of 85.5 inches with a minimum of 17 inches; 201-818-9500; fax: 201-818-9177; www.bogenphoto.com

Circle (458) on Free Info Card

DVD authoring solution

Blossom Technologies DaViD Suite: this suite can be installed on any Windows workstation in minutes; includes a PCI-based MPEG-2 encoder and infrastructure and interactive navigational programming, data capture and decision making, multiple audio and sub-picture channels, 98 VOB tracks, and 99 chapters per track; 305-266-2800; fax: 305-261-2544; www.blossomvideo.com

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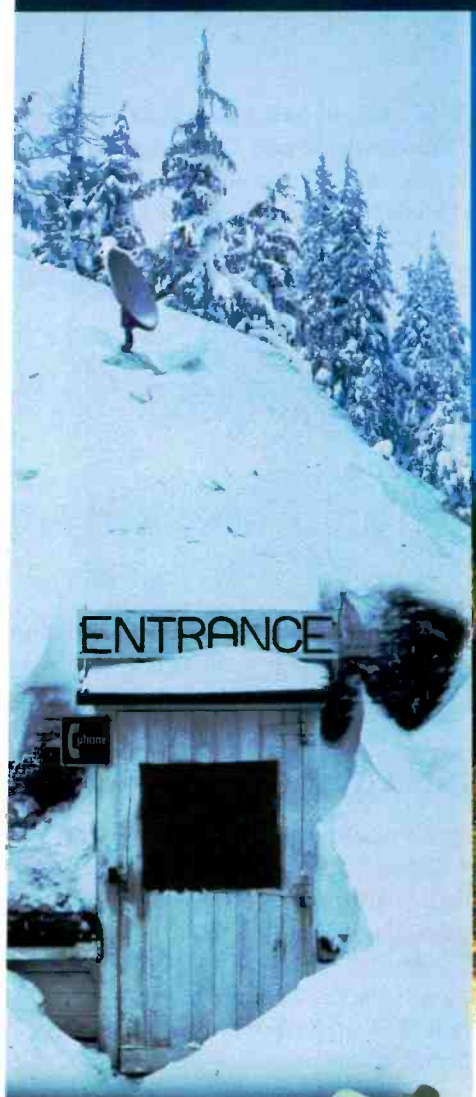

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Circle (168) on Free Info Card

Business highlights from broadcast and production

BY SANDRA FERGUSON, EDITORIAL ASSISTANT

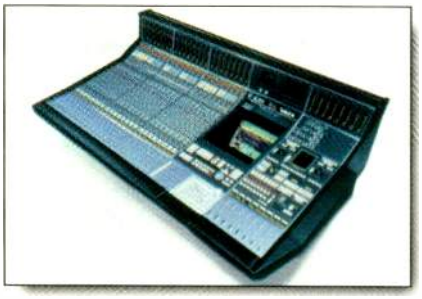
Harris recently unveiled its new Broadcast Communications division's headquarters, located in Deerfield Township, northeast of Cincinnati.

Grass Valley Group announced that Galaxy Latin America LLC agreed to purchase multiple Profile XP Media Platform units for use at the California Broadcast Center in Long Beach.

Paxson Communications will install Magni's AVM-510T automated video monitoring system in 27 stations for its network, PAX TV.

Itelco was selected to supply DTV transmitters to all USA Broadcasting owned and operated stations.

Canal+ will use Leitch's VR400 Series video servers for all of Canal+'s program and commercial playback operations. GlobeCast Northern Europe chose Leitch to supply and implement a multilevel, multiformat routing system.



Crawford Audio installed a 24-fader Solid State Logic Avant console as part of its new 350,000-square-foot facility. Sony Pictures will install Solid State's Avant for its newly constructed Stage 4.

KOMO ABC 4 in Seattle chose Quantel's INSPiration for its new digital facility.

Acrodyne signed a contract with Sinclair Broadcast Group to install a complete turnkey system at KDNL-DT, Channel 31, in St. Louis.

CBS Newspath purchased a complete end-to-end system from Tadiran Scopus.

Cornerstone Television selected Panasonic's DVCPRO50 as its house tape format.

AMS Neve announced the following activity. Gold Sound in Southfield, MI, installed a 16-fader Logic 3 and 24-track AudioFile. Walt Disney Studios installed an 88-fader, three position Digital Film Console in its Dubbing Stage A. Sound on Sound purchased a 48-fader, 176-path Capricorn digital audio console. The AudioFile SC made its debut at AES '99. Fox TV affiliate WITI-TV purchased a 48-input Broadcast Television Console. HBO Studio Productions recently purchased three AudioFile SC hard disc editing/recording systems and one 48-fader frame DFC audio console. Videosonics in London placed an order to upgrade all of its 14 AudioFiles to AudioFile SC systems. Grand Central Sound Recording Studios in the U.K. will upgrade its four existing AudioFile systems to the new AudioFile SC. Bristol-based Broadcast Film & Video ordered two 32-track AudioFile SCs and will upgrade two existing M16 systems to AudioFile SC16s.

Screen Shot

Sony and the Discovery Channel team up to produce *Discovery Channel Eco-Challenge* in HD

In what will be the world's largest remote HD production to date, the Discovery Channel and Sony have teamed up to produce this year's *Discovery Channel Eco-Challenge* in digital high-definition.

Using Sony's HDCAM digital camcorder equipment, 19 camera crews will capture 216 participants as they compete for 12 days under extreme conditions in the world's toughest Expedition Race, the *Discovery Channel Eco-Challenge*, in Patagonia, Argentina. The Discovery Channel's camera crews will use Sony's HDCAM one-piece camcorders to shoot the multi-sport event on foot, from helicopters and boats fixed with Wescam, a gyro-stabilized camera, taking advantage of the format's high mobility and flexibility. Sony will also provide technical support.

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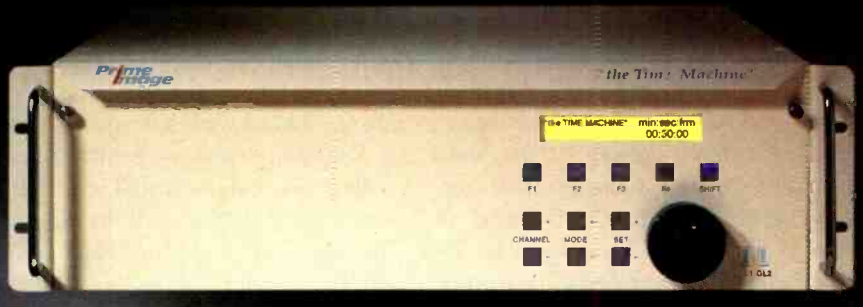

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San Antonio's Texas News Network (TXN) recently integrated Sony's NewsBase news production system.

NBC selected Canon as the exclusive lens supplier for its Olympic Game coverage through 2008. New Century Productions equipped its first digital truck with Canon lenses, including PJ70x, J55x, J21ax7.8 BWRS and J9ax5.2 BWRS lenses.

Vibrint announced that 7NBC, WHDH-TV in Boston, recently installed two NewsEdit systems.

Continental Electronics signed a preferred manufacturer agreement with Hubbard Broadcasting for the purchase of digital TV and radio transmission equipment.

Inscriber announced that it will provide Orad's CyberSet with the capacity for realtime display of live data within the virtual studio environment. Orad announced that its CyberSet O virtual set system is being used by Black Entertainment Network to provide virtual environments for four BET-produced TV series.

USA Broadcasting will install six channels driven by Louth automation systems at its new facility, Station Works, in Ontario, CA.

Omnibus Systems will enter into a partnership with Omneon Video Networks in which Omneon will be licensing Omnibus software development tools.

Soundtracs installed its DPC-II digital consoles in New York's Lower East Side, a post production facility.

College Graphics, the new company established by Pixel Power, sold its first Clarity HD graphics system to HD Vision.

1999's Scientific and Technological Advancement Awards were recently announced by The National Academy of Television Arts and Sciences. Emmy categories and winners include: Development of Lens-Line Prompting System — TelePrompTer Corp.; Development of DVD Technology — Matsushita Electric Corp. of America, Philips Digital Video Systems, Toshiba America Consumer Products, Warner Home Video and Dolby Laboratories; Generation and Protocol Analysis of MPEG-2 Transport Streams for Equipment Evaluation and Operational Monitoring of a Digital Television Transmission System — Hewlett Packard, Tektronix, THOMCAST and Sarnoff Corp.; Statistical Multiplex of DTV Signal — General Instrument; Development of a Distribution System for Sound with Television known as Sound-in-Syncs — British Broadcasting Corp; First Full-Time Distribution of TV Network by Satellite Transmission — Home Box Office and Canadian Broadcasting Corp.

WQLN-TV in Erie, PA, purchased 14 JVC D-9 (DIGITAL-S) tape machines. JVC is endorsing the ATTO FibreBridge and the ATTO ExpressP-CI FC Fibre Channel host adapter as compatible products for JVC's Windows NT-based TimeGate nonlinear editing platform.

Philips will deliver its CleverCastPC Data Broadcasting System to American Multiplexer Corp. in Sunnyvale, CA, for its satellite-based Multimedia delivery platform.

Sierra Design Labs was acquired by da Vinci Systems Inc., a subsidiary of Dynatech Corp.

IBM recently announced a development agreement with Virage to integrate Virage's VideoLogger and AudioLogger products into IBM's media asset management solution. Avstar announced that it has teamed with Virage to add intelligent indexing, search and browse capabilities to the Avstar Media Browse System.

Carlton Television purchased four Artel UTAH-300 routers and one UTAH-200.

Xytech and Quantegy entered into an exclusive agreement in which Xytech's software will be the standard inventory application for Quantegy products.

Manta Sound recently purchased five SADiE ARTEMIS Digital Audio Workstations.

The CBS Evening News with Dan Rather recently had its first broadcast using ENPS, AP's Electronic News Production System.

People

Leitch announced the promotion of Thomas M. Jordan to senior vice president, strategic relations.

Jack Feeney

Jack Feeney recently joined Videotek as vice president for sales and marketing.

Sigma Electronics appointed Barry Gardner as international sales manager.

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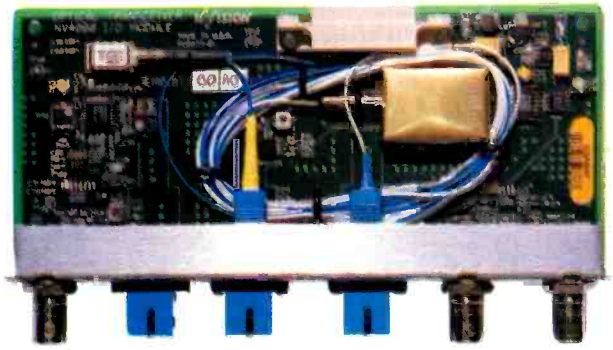

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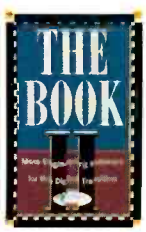
3. NVISION uses industry-standard HD and HD-SDI signal formats.



360 Systems recently appointed Brian James as western regional sales manager.

Anthony Gargano was recently appointed as CEO of AgileVision LLC, a new company formed by Sarnoff and Mercury Computer Systems.

Studer AG of Regensdorf, Switzerland, promoted Studer North America vice president Michael Tapes to senior digital product manager.

Geoff Calver

Geoff Calver was recently hired as sales and marketing director for SADiE. ■

Screen Shot

ABC's *Sports Night* revamps with Trinity system

ABC's sitcom, *Sports Night*, wanted to enhance its visual qualities to match or exceed that of real shows like *ESPN* or *Fox Sports*. Its solution was to revamp the set with a Trinity system, which is now used to produce the on-air graphics, titles, special effects, editing and switching for the internal sports show. The show's challenge is that the crew has to create two shows for every episode; there is a 22-minute filmed show and a 22-minute video 'show-within-the-show.' Now with a fully functional TV studio on the sound stage and over 100 video and computer monitors synced for film cameras, the producer thinks *Sports Night* has the most technically complex and capable set-up in the business.

The GALLERY

Laughing is living well

BY KARE ANDERSON

Opportunity is often inconvenient, isn't it? The past two weeks of my life have been filled with the kind of opportunities that must be "character-building" and may one day be funny. They include a tense scene featuring our office staff circling around a suddenly and stubbornly silent computer as if it were the community hearth gone cold, to another scene with a non-stop talking insurance specialist with a dire case of foot odor as a seatmate on a much-delayed, cross-country flight.

Where to turn to avoid thoughts of mayhem and murder? Why, to humor, of course. At the best and worst or in-between (boring) times, humor is what gets us through and brings us together.

USAdvertising senior copywriter, Frank Visco, once wrote (tongue-in-cheek) that, "One should never generalize." At the risk of generalizing, a 1999 MIT study reported that people demonstrate humor in one of three ways:

1. Divisive: humor that is insulting to or about others.

Example:

In 1988, a music reviewer wrote in the newspaper, *Record Mirror*, "Few people know that the CIA is planning to cripple Iran by playing the Bee Gee's *ESP* album on special loudspeakers secretly parachuted into the country."

There are exceptions. For example, some apparently divisive humor is often unifying because of the near universal view of the institution you are knocking, especially when you use the institution's own words to poke fun. For example, "Please provide the date of your death." is an actual quote from an IRS letter that a reporter received.

Caution: even with friends who you think will understand, divisive humor can hurt. As an anonymous humorist once wrote in a list of "Rules of Combat," "The only thing more accurate than incoming enemy fire is incoming friendly fire."

2. Unifying: humor where you make yourself and/or the situation the center of the joke. Such self-deprecating people build trust.

Examples:

My friend Sylvia's mother gave this toast at her 60th birthday party: "Time may be a great healer, but it's a lousy beautician."

"I had an IQ test. The results came back negative." — anonymous saying

Or the human condition:

"God pulled an all-nighter on the sixth day."

3. Absence of Humor: appears to have no sense of humor.

This kind of person prefers to focus on doing the task, being good and/or other "productive behavior."

Here are some of the findings from the MIT study. Divisive humor is often the funniest, at least at first because, in making fun of someone else, we can feel superior. Plus some of the funniest lines are insulting. Yet, like a scalpel, they cut fast and deep inside even the thickest skin. Adalai Stevenson once said, "He who throws mud gets dirty."

Unifying humor was the most surefire way to break tension or conflict. People who used this kind of humor were more likely not to keep agreements than people in the other two categories. People who exhibited no humor at all were more likely than people in the other two categories to be most harsh and unforgiving in their judgements of others and more likely to see the world in "right/wrong" categories, thus the least able to be accepted as team players.

Some of my favorite kinds of humor are when people can juxtapose two apparently unlikely images to make a point. In a tense meeting where I was attempting to coach the engineers in a company on how to describe their complex wireless portal product to potential investors in an understandable way, their usually patient lawyer finally broke the tension by saying, "I'm as confused as a baby in a topless bar."

Some of the most genuine ways to inject humor into your daily life are by looking at situations as theatre. Alan Funt's classic TV show, *Candid Camera* and subsequent knock-offs of that show can give you ideas.

The theatre rules? Each person could give three attributes to another person in the group. For example, one time I was to be a very shy, kindergarten teacher who was raised in a small North Dakota town the same night another person was designated as a rich, playboy law student from a rich old-line Philadelphia family. You can imagine the scenes that unfolded. These days you can watch Drew Carey's hilarious improv show, *What's My Line, Anyway* and learn some new rules to create your own spontaneous "live theatre." I've found that those evenings offered unforgettably fun ways to let stress roll away and see new sides of friends I thought I knew well.

For more ways to bring humor into your life, here are some fun resources:

Speaker's Library of Business Stories, Anecdotes, and Humor by Joe Griffith

Using Humor for a Change:101 Clever Ideas to 'Lighten Up' the Workload by Scott Friedman (303-671-7222) ■

Kare Anderson is a speaker and author.

SEND Send questions and comments to: kare_anderson@intertec.com

High Definition Birthday

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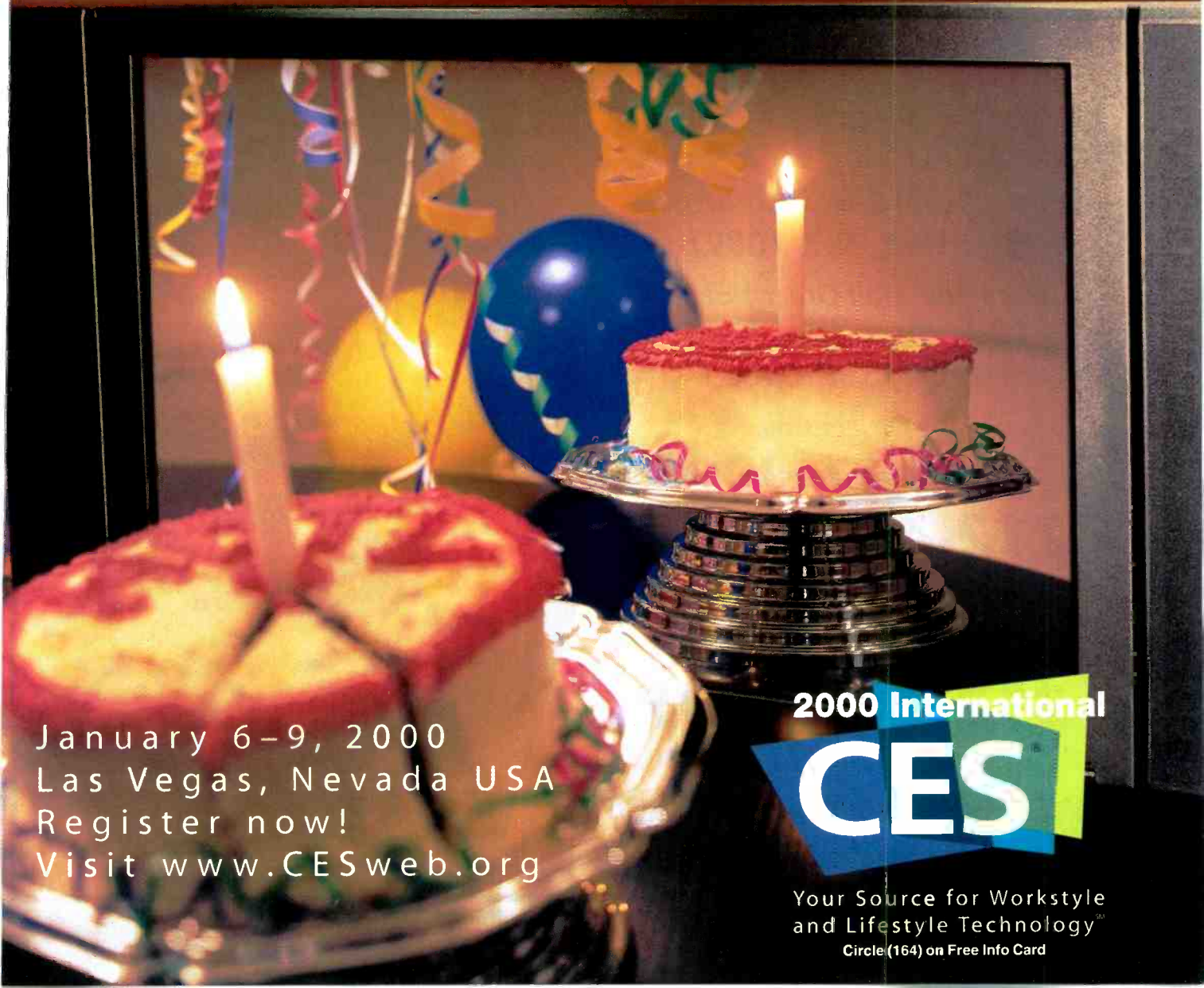

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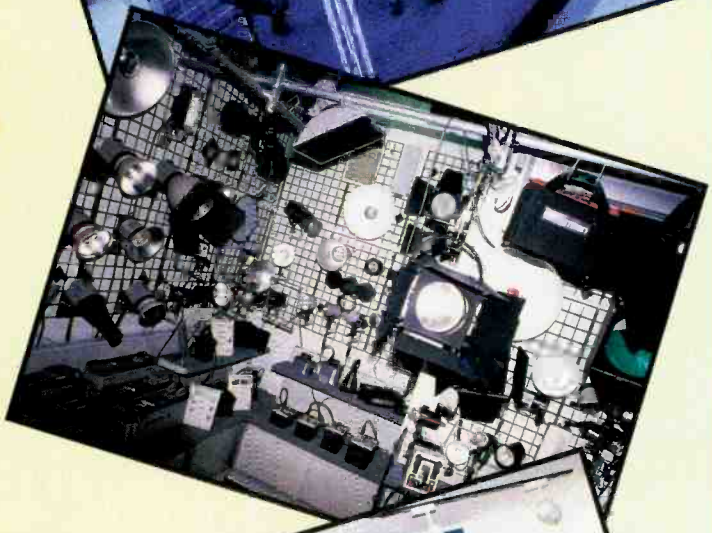

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QUICK DIAL 74

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 -3dB 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-20/40 DVCAM Player/Recorders

The DSR-20 and DSR-40 are versatile DVCAM VCRs with compact chassis and a variety of convenient functions for recording, playback and simple editing. They feature Auto Repeat Playback, Power-On Recording/Playback, multiple machine control interfaces and i.Link (IEEE1394) input and output. And, of course, they offer the stunning image and sound quality inherent to the DVCAM format.

i.LINK

- They both offer i.LINK ((IEEE1394) input and output. In addition, in the "Digital dubbing including TC Copy" mode, full information of video, audio and time code of the original tape can be copied to another tape. Especially useful when making working copies of the original.

Inputs and Outputs

- They provide a full range of analog video inputs and outputs for integration into current analog-based systems. They both offer composite and S-Video input/output, while the DSR-40 (only) offers a component output as well. The DSR-20 is equipped with analog audio inputs and outputs (RCA), the DSR-40 with RCA inputs and XLR-balanced output. These connections in combination with their i.LINK interface allow a smooth transition to an all digital system in the future.

Record/Playback Functions

- Automatic repeat function for repeated playback. After reaching either the end of the tape, the first blank portion or the first index point, the DSR-20/40 automatically rewinds the tape, then starts playing back the segment again.
- They are capable of searching for Index Points, which are recorded on the tape as "in-point" marks every time a recording starts. They can also search for photo data recorded on a DVCAM cassette by the DSR-200A/300/PD-100, or where the recording date has been changed.

Reference Input

- External sync input enables synchronized playback with other VCRs. Especially important in A/B Roll configurations. In addition, the DSR-40 only allows adjustment of H-sync and SC phase via the menu.

Control S Interface

- The DSR-20/DSR-40 have a Control S input allowing control via the optional DSRM-20 Remote Control.
- The DSR-20 adds a Control S output connector allowing two or more (up to 50) DSR-20s to be daisy-chained and controlled from one DSRM-2C.

DSR-20 Only

- The DSR-20 can be powered by AC or DC.
- Equipped with Control L interface, the DSR-20 can perform simple Time Code-based editing when connected to another DSR-20 or other similarly equipped VCRs/cameras.
- In addition to Control L, the DSR-20 also incorporates an RS-232 interface for remote control of basic VCR functions from a PC.
- Supplied with the RMT-DS20 Wireless Remote for control of basic VCR functions.

DSR-40 Only

- Equipped with an RS-422A interface, the DSR-40 can perform as the editing player in A/B roll or cut editing system.
- It also has a simple recording function which can be controlled either manually or via its RS-422A interface.
- The DSR-40 is not equipped with a synchronization capability, the editing accuracy is performed by pre-roll and play.

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 at 32kHz (12-bit 4 channel).
- Equipped with Control L, capable of SMPTE Time Code based accurate editing even without an edit controller. Built 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.

QUICK DIAL 74

Panasonic

Broadcast & Television Systems

AG-EZ1 3-CCD Digital Video Camcorder

$1695

- Digital recording delivers 500 lines of horizontal resolution with no noise (S/N ratio is 54dB).
- 10:1 power and 20:1 digital zoom lens. Both zooms are adjustable in four speeds (3.5-15 sec.) For extreme close-ups the lens can focus up to 1/4" from the subject.
- Audio is also digital, using PCM (Pulse Code Modulation) for quality that rivals CDs. Choose between two-channel 16-bit recording or two sets of 12-bit stereo with the second set reserved for uses such as narration.
- Huge 1.5" 180,000 pixel color viewfinder provides 400 lines of resolution and displays all automatic and manual functions on demand.
- Variable speed shutter from 1/60-1/8000 of a second.
- Built-in SMPTE time code generator.
- Digital Electronic Image Stabilizer (DEIS) compensates for jittery videoespecially when the digital zoom is employed.
- Digital Photo-Shot lets you record a still-frame (or six seconds, while audio continues as normal). 290 still pictures can be recorded on a single 30-minute tape.
- Three ways to easily find previously recorded scenes:
  - TopScan plays back the first few seconds of each segment, providing a handy way to review an entire tape.
  - Record/Review rewinds the camcorder and plays the last 10 seconds of the last recorded scene.
  - Indexing encodes the first scene shot on a given day, to quickly find the starting point of each day's shooting.

NEW!

JVC

GY-DV500 1/2-inch 3-CCD Professional DV Camcorder

The world's first DV camcorder designed from the ground up for professional ENG work, the GY-DV500 combines the convenience and cost-effectiveness of Mini DV with the performance and features you need. It incorporate three 1/2-inch CCDs for superior picture performance (equivalent to 750 lines of resolution) superb sensitivity of F11 at 2000 lux and minimum illumination of 0.75 lux (LoLux mode). Ruggedly constructed with a rigid diecast magnesium housing providing the durability professionals crave, the GY-DV500's compact design and light weight (lesss than 11 lbs. fully loaded) makes it extremely portable. Additional features like the menu dial and Super Scene Finder assure ease-of-use and shooting flexibility, while the IEEE1394 and RS-232 interface allow integration into various non-linear and post-production systems. A professional camcorder in every sense, the compact, lightweight GY-DV500 redefines acquisition for corporate, educational, cable and broadcast production, as well as wedding videography and multimedia applications.

Professional Specifications

- Applies JVC's DSP with advanced 14-bit video processing to bring out more natural details, eliminate spot noise, accurately reproduce dark areas, and restore color information in dark areas.
- Three high-density 1/2" 380,000 pixel IT CCDs ensure the best possible image quality.
- CCDs are equipped with advanced circuitry to virtually eliminate vertical smear when shooting bright lights in a dark room. Ensures efficient light conversion with a sensitivity of F11 at 2000 lux.
- CCD Defect Correction function evaluates white defects with the lens closed and then stores their addresses in memory. When the camera is turned on, the data is sent to the DSP for storage and real-time correction.
- Black Stretch/Compress function ensures accurate reproduction of black areas on the screen. Advanced color matrix circuits give even difficult images a very natural appearance.
- Multi-stream parallel digital pipeline processing at 40 MHz creates an ultra-smooth gamma curve, calculated using a true log scale algorithm. The result is a dynamic range of 600% to accurately reproduce fine details and colors in shadows or highlights.

Professional Performance

- When activated, the Lolux mode increases sensitivity with almost no increase in noise. Lolux lets you capture high-quality video footage with excellent color balance at just 0.75 lux minimum illumination.
- Multi-zone iris weighting system gives priority to objects at the central and lower portions of the picture for accurate auto exposure under any condition, even if a bright subject moves into the picture.
- Adjustable gamma for adjusting the "feel" of the picture according to taste. Adjustable detail frequency for setting picture sharpness for a bolder or finer look.
- Viewfinder status display uses characters and menus to diplay selected information, including audio indicator, tape and battery remaining time, VCR operation and warning indicators. Camera settings and setup parameters can also be checked at a glance. A built-in menu dial lets you quickly navigate through the viewfinder menu.
- Highlight Chroma Processing maintains color saturation in highlights. The result is natural color reproduction, even in bright highlight portions of the picture.
- Smooth Transition mode ensures a smooth transition with no jump in color or light level taking place when manually changing gain or white balance settings.

Professional Audio

- To complement its superior video performance, the GY-DV500 offers outstanding digital PCM sound. You can choose between two 16-bit 48-kHz channels or two 12-bit 32-kHz channels with a dynamic range of 85 dB.
- In addition to camera mounted mic, has two XLR-balanced audio inputs with 48v phantom power and manual audio control. Phantom power can be switched off when not in use.
- Side-mounted speaker lets you monitor audio in playback and recording modes without headphones. The speaker also delivers audible warnings.

Compact and Lightweight

- Measuring 10-7/8 x 9-11/16 x 5-1/8 the GY-DV500 amazingly enough is almost half the size of the GY-X2B. Weight is carefully balanced for ease of use in an ENG environment and extended shooting.
- Consumes less than 20W of power, eliminating the need for cumbersome & heavy, large-capacity battery packs.

Automatic Functions

- Full Auto Shooting (FAS) mode for point-and-shoot ease of operation. You simply zoom and focus. Activating the Full Auto Shooting sets the camera to the Auto Iris Mode, even if the lens is set to manual. Automatic video-level control (ALC) is also activated, along with Extended Electronic Iris (EEI) and Full Auto White, which provide both variable gain and variable shutter. Shoot continuously from a dark area to a bright area without changing Gain, Iris or ND filter.
- ALC (Automatic Level Control) with EEI (Extended Electronic Iris) for continuous shooting in all light levels — no need to switch gain settings or ND filter.
- Continuous Auto Black (CAB) circuit assures perfect Black Balance in a changing environment without having to interrupt shooting.
- Accu-Focus activates the electronic shutter for approximately ten seconds, forcing open the Iris. As a result, the depth of focus is minimized, and the lens can be focused quickly and precisely.

Conveniences

- Time code and index IDs allow frame accurate non-linear editing and mastering on standard formats with quick easy access to any target point.
- LCD display system let you switch or set functions, while referring to the counter or the on-screen display. Mode selection and initialization are also available via the menu display. Back-lit display supports shooting in dark areas.
- Back tally lamp lights to let you know that the camera is entering the Record mode. It flashes during the transition to the Record mode and when an error is detected in the camera.
- Variable Scan function allows flicker-free shooting of computer monitors. Shutter speeds can be set from 1/60.5 to 1/196.7 of a second in 255 increments to precisely match the scan rate of the monitor.
- Tape/Battery Remaining indicator means you always know exactly how much tape and battery power remains.

anton bauer

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 view-finder 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

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.

STEADICAM VIDEO SK

Steadicam Video SK2

Incorporating the same design principles as its larger Oscar and Emmy winning Steadicam cousins, the Video SK 2 is designed for cameras weighing from 9-19 lbs. Far more compact and less complex, the complete SK2 system --sled, stabilizer arm and vest- weighs a mere 21 lbs. and fits neatly into the trunk of a car.

Balancing is easier than ever and a single battery operates both camera and Steadicam. In fact, the SK2 is the only Steadicam simple enough to be operated without workshop training. A comprehensive instructional video will have you up and running in hours. But make no mistake, the lightweight Video SK2 performs like a true heavyweight.

Shoot on the move effortlessly, without cranes, booms or dollies. The sled-mounted monitor offers a crystal-dear picture, so your eyes are no longer glued to your camera's eyepiece. And with the weight spread comfortably over your torso you can shoot on the run, climbing stairs or even from a moving vehicle. With one smooth tracking shot capture what used to require five or six setups. An optional low-mode bracket can further enhance your creativity. Whether you shoot commercials, industrials or documentaries, the SK2 lets you offer more flexibility that ever before. If you can imagine a shot, you can shoot it more efficiently, more economically and more creatively than with any other other equipment.

GLIDECAM

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.

QUICK DIAL 74

sachtler Tripods and Fluid Heads

DV Systems—Digital Support for Every Budget

Today's compact digital cameras require light, fast and highly versatile camera support systems. Starting from the DV2 all the way up to the DV12, Sachtler has a solution tailored for just about every conceivable digital camera package available today. All feature Sachtler's patented counterbalance system and Touch and Go wedge plates. And all except the DV2 feature sliding camera platform to ease in the balancing of your camera.

DV2 System

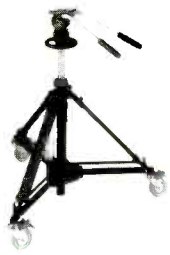
- The smallest head of the Sachtler's line.
- Sachtler Touch and Go quick release with automatic camera lock and safety lever/drop protection
- One step of dynamic counterbalance
- Frictionless leak proof fluid damping with one levels of drag
- Vibrationless vertical /horizontal brakes
- Built in bubble for horizontal leveling
- Single Stage 75mm tripod DA 75 Long
- Lightweight floor spreader SP 75

This system (0210) consists of:
Fluid Head (DV-2), Long Tripod (DA 75), floor spreader (SP 75)

DV4 System

- Sliding balance plate
- Touch and Go quick release with automatic camera lock and safety lever/drop protection
- One step of dynamic counterbalance
- Frictionless leak proof fluid damping with one levels of drag
- Vibrationless vertical /horizontal brakes
- Built in bubble for horizontal leveling
- Single stage 75mm long tripod DA 75
- Lightweight floor spreader SP 75

DV4 System (0410) consists of:
Fluid Head (DV-4), Long Tripod (DA 75), floor spreader (SP 75)



DV4XD System

Same as the DV4 PLUS —

- Five step of dynamic counterbalance
- Five step of vertical and horizional drag

DV4XD System (0610) consists of:
Fluid Head (DV-6), Long Tripod (DA 75), floor spreader (SP 75)

DV8 System

Same as DV6 PLUS — • Greater load capacity

DV8 System (0810) consists of:
Fluid Head (DV-8), Long Tripod (DA 75), floor spreader (SP 75)

DV12

Same as DV8 PLUS — • Great Load Capacity • Fits 100mm tripods

QTV

15" and 17" On Camera Prompters

The 15" and 17" On Camera prompter is the industry standard and designed for use with any camera, for any application. The high contrast, high resolution monitor, created by QTV, is the result of state of the art components and design. The monitor permits a much greater degree of tilt because of its cutaway feature. Its VPS Eyeline feature superimposes copy over the camera lens, enabling the reader to maintain maximum eye-to-eye contact. It's easy and comfortable to read. QTV's On Camera prompter will make sure the talent has clear access to the prompter. The 17" model has a viewing area of 123 sq. inches, 39% more than the 15" model. The 15" On Camera prompter is also available in a free standing pedestal model, which can be utilized both in the studio and in remote situations.

MVP-12

The MVP-12 incorporates QTV's latest design technology for studio and EFP prompting. The MVP-12 features the most advanced circuitry for a prompter of this size. Fully self-contained, it offers high brightness and high resolution that ensures unmatched ease of readability for the speaker. The MVP-12 is powered by AC or OC current utilizing the Sony type NP-1 or Anton Bauer 13-14 volt batteries, allowing on-location as well as studio prompting. It weighs only 19 lbs. including the quick release roller plate for fast mounting and balancing. Below the lens mounting is utilized resulting ideal counter balancing for ease of operation.

MVP-9 Mini Videoprompter

The MVP-9 mini videoprompter is designed for use with smaller cameras and small spaces. The same level of performance is achieved as the larger CRT based units but in a smaller configuration that is powered by AC or DC current (as above). Created for the new generation of smaller, lighter cameras, the MVP-9 weighs only 17 1/2lbs and both the monitor and camera mount set up quickly and easily. As with the other units the VPS Eyeline feature assures maximum eye contact with lens while easily raeding the script. It packs up very tightly, making it easy to take anywhere

SONY

PVW-2600/PVW-2650/PVW-2800

Betacam SP 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.
- 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-2650 Only

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

PVW-2800 Only

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

800 SERIES 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.

PROFESSIONAL VIDEO TAPES

QUICK DIAL 71

FUJI

Professional Grade VHS

PG-30	2.39	PG-60	2.39	PG-120	2.79

Broadcast Grade VHS Box

BGR-30	3.29	BGR-60	3.99	BGR-120	4.49

H471S S-VHS Double Coated

ST-30	6.69	ST-60	7.49	ST-120	7.69

M221 Hi 8 Double Coated

Metal Particles				Metal Evaporated	
P630HMP	4.99			E630HME	7.69
P660HMP	6.29			E660HME	10.19
P6120HMP	8.29			E6120HME	13.59

M321SP Metal Betacam (Box)

05S	11.99	10S	12.49	20S	12.99
30S	14.99	60L	24.95	90L	39.95

DP121 DVC PRO

12M (Med.)	7.49	23M	8.79	33M	10.99
63M	19.99			64L (Lg.)	22.50
94L	30.99			123L	39.99

maxell

Hi8 Metal Particle (XRM)

P6-120 XRM	6.99

Broadcast Quality Hi8 Metal Particle

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

P/I PLUS VHS

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

HGX-PLUS VHS (Box)

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

BQ Broadcast Quality VHS (Box)

T-30 BQ	3.89	T-60 BQ	3.99	T-120 BQ	5.99

BQ Professional S-VHS (In Box)

ST-31 BQ	6.79	ST-62 BQ			6.99
ST-126 BQ	7.45	ST-182 BQ			13.99

Betacam SP

B30MSP	13.49	B60MLSP	19.99	B90MLSP	29.95

Panasonic

Mini DV Tape

AY DVM-30	6.49	AY DVM-30 (10 Pack)	ea. 5.99
AY DVM-60	7.99	AY DVM-60 (10 Pack)	ea. 7.49
AY-DVM80	12.99	AY-DVM120	20.95

DVCPRO

AJ-P12M (Medium)	6.99	AJ-P24M	9.99
AJ-P33M	11.19	AJ-P66M	19.49
AJ-P66L (Large)	20.99	AJ-P94L	29.99
AJ-P126L			38.95

SONY

Hi-8 Professional Metal Video Cassettes

P6-30 HMPX	4.59	P6-30 HMEX	7.99
P6-60 HMPX	6.49	P6-60 HMEX	10.99
P6-120HMPX	8.49	P6-120HMEX	14.99

PR Series Professional Grade VHS

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

PM Series Premier Grade Professional VHS

T-60PM	3.99

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

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

MQ Master Quality S-VHS (In Box)

MQST-30	7.49	MQST-60	7.79	MQST-120	7.99

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

KCS-10 BRS (mini)	8.69	KCS-20 BRS (mini)	8.99
KCA-10 BRS	8.19	KCA-20 BRS	8.69
KCA-30 BRS	9.60	KCA-60 BRS	13.39

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

KCS-10 XBR (mini)	8.79	KCS-20 XBR (mini)	10.59
KCA-10 XBR	9.29	KCA-20 XBR	10.69
KCA-30 XBR	11.99	KCA-60 XBR	15.69

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

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

BCT Metal Betacam SP Broadcast Master (Box)

BCT-5M (small)	12.29	BCT-10M (small)	13.09
BCT-20M (small)	13.29	BCT-30M (small)	13.99
BCT-30M (small) (50 Pack)			ea. 13.49
BCT-30ML	18.99	BCT-60ML	21.99
BCT-90ML			27.95

Mini DV Tape

DVM-30EXM w/Chip	12.99	DVM-60EXM w/Chip	17.99
DVM-30EX "No Chip"	11.99	DVM-60EX "No Chip"	13.99
DVM-30PR "No Chip"	7.99	DVM-60PR "No Chip"	9.99

Full Size DV Tape with Memory Chip

DV-120MEM	24.99	DV-180MEM	26.99

PDV Series Professional DVCAM Tape

PDVM-12ME (Mini)	15.25	PDVM-22ME (Mini)	16.25
PDVM-32ME (Mini)	16.99	PDVM-40ME (Mini)	15.99
PDV-94ME (Standard)	33.49	PDV-124ME (Standard)	37.99
PDV-184ME (Standard)	44.95	PDVN-64N	24.95
PDVN-124N	31.95	PDVN-184N	39.95

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FUJINON ENG LENSES

While ENG camera technology evolves faster and faster, delivering ever higher performance in ever small bodies, it has been increasingly difficult for lens manufacturers to improve quality while keeping size and weight to a minimum until recently. With Aspheric Technology (At2) Fujinon has succeeded in manufacturing superior quality lenses that are both smaller and lighter than lenses of conventional spherical design. From the widest angle to the highest telephoto, Fujinon's broadcast hand-held style lenses offer unparalleled features and performance. In fact, they are so advanced and so optically superb they will reshape your thinking about how well a lens can perform.

Fujinon's broadcast hand-held lenses feature the very latest in optical and mechanical design, and manufacturing techniques. New EBC (Electron Beam Coating) reduces flare and improves contrast, while AT2 Aspheric Technology improves corner resolution and reduces chromatic abberation. And all except the 36:1 Super Telephoto offer the exclusive "V-Grip" and Quick Zoom.

A15X8EVM Standard Zoom Lens

A versatile performer in a compact package, offers AT2, Inner focus, Quick Zoom and the "V-Grip" 7495.95

A20X8EVM Standard /Telephoto Zoom Lens

Combines additional focal length with AT2, inner focus, Quick Zoom and the "V-Grip" 11,499.95

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, their a total solution for real-time 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 OLE objects, iNFiNiTi 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

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 III- 450 MHz Processor
- Matrox Millenium II AGP 4MB WRAM display card
- 128MB 10ns 168-Pin (DIMM) S-DRAM
- IBM 10GB IDE System Drive
- Seagate Barracuda External 9.1GB SCSI-3 ultra-wide capture drive
- Adaptec AHA-2940U2W 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" (1280 x 1024) monitor (0.27mm dot pitch)
- Microsoft MS Mouse • Focus 2001A keyboard
- Avid MCXpress for Windows NT • Windows NT 4.0 operating system
- 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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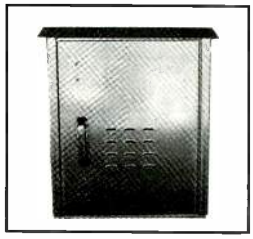

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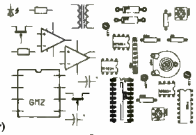

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TV Maintenance Engineer - Maintenance engineer with successful experience in 2 or more of the following areas: R.F. systems, Beta tape, ENG/SNG operation and repair, computer networking. Quantel, Avid, and/or file server experience a plus. Applicants should have 3-5 years maintenance experience in a top 100 market, be able to work all shifts, lift 25 pounds, and have excellent driving record. KTVI/FOX 2 is a Fox 0 & 0 that produces an exciting live news product during every shift. A motivated individual, ready to move up and join our Fox 2 technical team should make immediate contact by sending resume and letter to: KTVI/FOX 2, HUMAN RESOURCES DIRECTOR, 5915 BERTHOLD AVENUE, ST. LOUIS, MO 63110. An Equal Opportunity Employer.

MOBILE SATELLITE NEWS DRIVER: Position available for experienced driver to operate a mobile satellite news gathering vehicle. Main responsibilities include editing audio-video for playback on Beta SP equipment, preparation of video & audio signals, and troubleshooting and maintenance of system and vehicle. Must have AA degree in communications plus 2 yrs related exp with KU uplinks along with a CDL. Must also be well organized, able to meet deadlines, & have working knowledge of technical areas affecting Uplink equipment. Send resume to: P.O. Box 9052, Bethpage, NY 11714 EOE

Discovery Communications, Inc., a recognized leader in the media industry, has the following openings in our 24/7/365 broadcast facility located in Miami.

Assistant Engineering Manager, Systems

This position requires hands-on maintenance as well as employee supervision and training. The systems engineering staff is responsible for the maintenance and support of all master control and post-production suites as well as core equipment. We are looking for a self-motivated team player with a minimum 10 years' systems experience including significant experience in a digital environment. Ability to diagnose to component level, familiarity with test signals and equipment. Minimum of 3 years' supervisory or management experience. Excellent communications skills, both written and oral a must. SBE certification and/or general class license a plus. Degree in electronics/computer systems required. Military or related experience may be substituted for degree. Spanish and/or Portuguese a plus.

Systems Engineer

Part of a team of engineers responsible for, but not limited to, the preventive and corrective maintenance of all television equipment in regards to the Television Center. Minimum 3 years' systems experience including significant experience in a digital environment. Ability to diagnose to component level, familiarity with test signals and equipment. This is not an IS position. SBE certification and FCC general class license strongly preferred. Degree in electronics/computer systems. Military or related experience preferred. Spanish or Portuguese a plus.

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PWPL delivers products to over 9,000 subscribing organizations and many more individual professionals in the following industries: Automotive, Law Enforcement, Professional Security, Fire/EMS, Banking, Healthcare, and IndustrialServices.

Candidates should have a minimum of five years experience in broadcast engineering and excellent bench trouble shooting skills. Also, a strong understanding of Audio, Video, RF, Digital Television, Computers/Networking, Mechanical, Systems Levels Troubleshooting and System Implementations. FCC General Radio License and/or SBE Technologist Certification are preferred.

Please mail, fax or e-mail your resume with cover letter and salary history to: Primedia Workplace Learning, Attn: Rodney Murray, 4101 International Pkwy, Carrollton, TX 75007. Fax to (972) 309-4382 or E-mail: rodneym@eng.pwpl.com. Please visit our web site at www.pwpl.com. EOE

EIC/Uplink & Maintenance Engineers

COME PLAY WITH OUR TOYS!

Think you know QVC? Think again. Sure, we're a cable shopping channel, but we're also one of the largest live TV studios in the world. Picture yourself providing engineering support to a 160,000 sq.ft. all-digital facility, 6 production studios, a 150 seat studio theatre, and live remote broadcasts (not to mention working on Sony 7000 series video switchers, Hitachi 2600 studio cameras, ADC DV600 series fiber optic link with new MCL MX9000 series HPAs, Peak Everest graphics system running on multiple SGI Onyx 2 computer systems!) Sound fun?

If you've got Broadcast Engineering experience and think you have what it takes to play in our league, then contact us today. Forward your resume to: **QVC, Inc., Human Resources - AB/BE/ENG, 1200 Wilson Drive at Studio Park, West Chester, PA** 19380. **Fax:** (610) 701-1150. We are located just outside of Philadelphia in a highly rated suburban area. Visit our website at www.qvc.com. Equal Opportunity Employer. Drug Free/Smoke Free Work Environment. Pre-employment drug screening required.

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IMMAD ECVS, a division of AZCAR Technologies Incorporated, a public company trading as AZZ on the Toronto Stock Exchange, is one of the largest combined independent system integration companies and is a world leader in Broadcast Systems Integration. We are a dynamic company poised for significant growth in the exciting conversion to digital television. With plants in Markham, Ontario, and Boonton, New Jersey, IMMAD ECVS is looking for Project Managers and Engineers who want to be part of our successful team and challenged by digital television.

Project Management
Broadcast Systems Integration

Qualifications include: Industrial Engineering and/or Electrical Engineering skills set, knowledge or keen interest in TV broadcast systems, strong interpersonal and communication skills, and an excellent financial skill set. APMI accreditation a plus.

Senior and Mid-level Television System Engineers

The senior Engineering candidate should have the following: a E.E. and/or P. Eng., a strong background in Television engineering, financial and management skills at the project level and a have a working knowledge of AutoCAD.

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Broadcast Engineers

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BROADCAST ENGINEERING is edited for corporate management, engineers/technicians and other management personnel at commercial and public TV stations, post-production and recording studios, broadcast networks, cable, telephone and satellite production centers and networks.

SUBSCRIPTIONS: Non-qualified persons may subscribe at the following rates: United States and Canada; one year, $55.00. Qualified and non-qualified persons in all other countries; one year, $70.00 (surface mail); $130.00 (air mail). Subscription information: P.O. Box 12937, Overland Park, KS 66282-2937.

BROADCAST ENGINEERING (ISSN 0007-1994) is published monthly (except semi-monthly in May and December) and mailed free to qualified persons by PRIMEDIA Intertec, 9800 Metcalf, Overland Park, KS 66212-2216. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canada Post International Publications Mail (Canadian Distribution) Sales Agreement No. 0956295. POSTMASTER: Send address changes to *Broadcast Engineering*, P.O. Box 12902, Overland Park, KS 66282-2902. CORRESPONDENCE: Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2216 Phone: 913-341-1300; Edit. fax: 913-967-1905. Advert. fax: 913-967-1904. ©1999 by Intertec Publishing. All rights reserved.

EOM

Broadcast quality video ... again?

BY PAUL MCGOLDRICK

We brought it on ourselves by never creating a real standard. Nevertheless, I was beginning to finally think that we had seen the last of the term "broadcast quality." You can argue every which way what it means, but, in reality, it boils down to whatever the worst standard has been, or is being, transmitted anywhere in the world. And I've seen some awful video out there.

For any reasonable human, broadcast quality should be something that has a construction conforming to the RS-170A drawing of synchronizing signals, along with some video information above blanking, good dynamic range and some reasonable resolution without obvious picture distortions, interference or freezing frames.

"I am amazed that a country where people drive to the corner postbox has chosen a digital TV system that does not allow mobile reception."

So across my desk comes a press release carried on Business Wire: "Sandpiper Networks launches service to provide broadcast-quality streaming media to AOL members." Is there any rhyme or reason given in the release to justify the BQ tag? None; it is totally gratuitous. Sandpiper is in the business of selling a service, *Footprint*, which distributes major Web networks' content from about 400 servers worldwide. Strategically placed, those servers avoid many of the Internet's hottest bottlenecks. But does it make the speed of content delivery any faster than your dial-up, cable or xDSL modem connection is capable of? Of course not.

That is not to say that true high-quality (I cannot bring myself to use the dreaded terminology) video streaming will not be available on the Internet — but not on the Internet connection most have today.

Internet2, which is a five-year project, will interconnect about 160 universities and bring the Internet back to the exclusive club that it was before the Web exploded onto the market. The University Corporation for Advanced Internet Development has spent $500 million on developing the 2.4Gb/s Abilene fiber backbone in partnership with Cisco Systems, Indiana University, Nortel and QWest Communications. Most of the universities are connected through 20Gb/s points of presence at strategic hubs around the country.

Internet2 went live in February 1999. Although the results of the work on using the additional data speed will not arrive on my desktop soon, things will trickle down as more commercial companies are tied in to the new network to bolster and take advantage of the research opportunities available. So far, the 20 or so industrial participants include 3Com, AT&T, Cabletron, Cisco, IBM, Microsoft and Nortel.

As is obvious to those of us in broadcasting, a 2.4Gb/s network is more than enough bandwidth for any video standardized to date. It was not unexpected that one of the first projects demonstrated over Intenet2 was the carriage of DTV. The main proponents in the demonstration were the University of Washington (in Seattle), Stanford University (Palo Alto, CA) and Sony. Different videostreams were transmitted, but the most significant — for broadcasters — was the extremely successful transmission of 20-minute segments of DTV and HDTV material at the magic speed of 270Mb/s.

None of the participants seem to doubt that a commercial version of Internet2 could exist within five years. The project manager of the University of Washington's ResearchTV project, David Richardson, has been quoted as saying, "The goal of the project is to use Internet2 as a real future delivery mechanism for the broadcast industry." If there was ever a reason for terrestrial broadcasters to get nervous, here we have it. In five years the terrestrial services better be extremely well established in the public's eye — or else Internet2 will be added to the existing satellite and cable threats.

As an across-the-ocean insult, adding fuel to the concerns and divisions over the choice of 8VSB for terrestrial broadcasting, Nokia demonstrated a three-in-one, portable digital TV receiver called DVB@Air to U.S. network executives. The device can be used to watch DVB digital TV, it can surf the Internet, and it can make telephone calls — all on the move. Even with the rather fancy algorithm ICs that minimize dynamic multipath effects for a fixed location, it seems extremely unlikely that 8VSB will ever be practical for a moving receiver. A Nokia VP, Helmut Stein, commented, "I am amazed that a country where people drive to the corner postbox has chosen a digital TV system that does not allow mobile reception." Ouch.

Maybe, in that sense, terrestrial DTV in this country will never be "broadcast quality," and I will have to spend my time instead chasing down other abusers of broadcast terminology. The multiple perpetrators (in the computer-centric part of our society) of the misuse of Y, U, V may be a very good place to start. ■

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

SEND Send questions and comments to: paul_mcgoldrick@intertec.com

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