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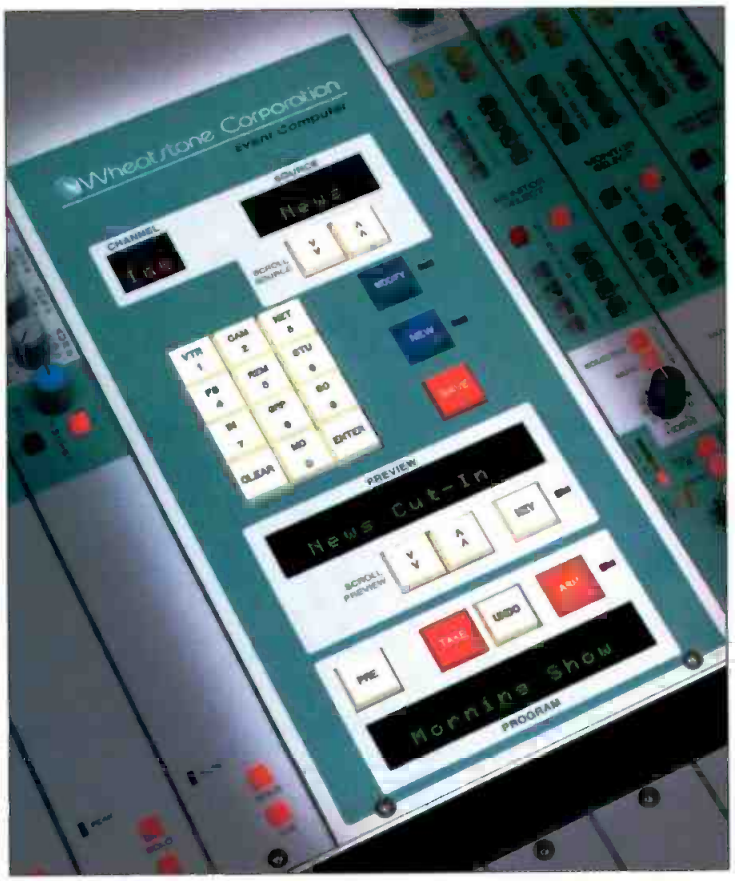

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Features

Beyond the Headlines

Digital Handbook

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Panasonic Broadcast President Warren Allgyer (left) and Capitol Broadcasting CEO Jim Goodmon (right)

Congratulations and thank you WRAL-TV!

DVCPRO HD

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ON THE COVER: Today's broadcast and production facilities require an increasingly sophisticated array of test equipment. Shown on the cover are some of Tektronix's T&M solutions; MTS300 MPEG multi-standard test system, the MTM300 MPEG multistream transport monitor, the AVDC100 Audio Video Delay Corrector and the WFM1780 and 1781 waveform and vectorscopes. Photo courtesy Tektronix.

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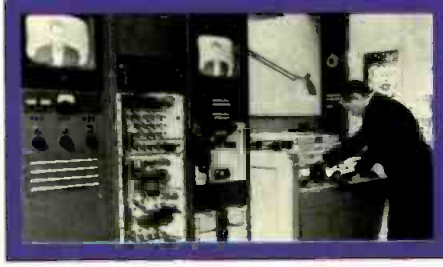
Broadcast ENGINEERING

FREEZE FRAME

A look at the technology that shaped this industry.

First VTR tape-delayed broadcast

In May 1984, *Broadcast Engineering* celebrated its 25th anniversary with an in-depth review of broadcast history. In one article, we discussed the history of videotape recording. The photo below illustrated the world's first tape-delayed broadcast. The photo shows a West Coast network facility playing back, on a three-hour delay basis, a famous program. Name the month, year and network involved in the tape-delayed broadcast. If you know the program, a bonus prize will be awarded. Selected correct entries will receive a *Broadcast Engineering* T-shirt. Submit entries marked "Freezeframe" to: editor@intertec.com. All entries due by Dec. 31, 2000.



Editorial

I want my HDTV

Boy, did I kick over a hornet's nest with my August editorial "Kill the 8VSB Frankenstein." From some of the e-mail I received, you'd think I was going to take away everyone's HDTV set. (The few that there are!)

I knew the editorial was going to upset a lot of people. What surprised me, however, was the number of consumers, but few broadcasters, that provided feedback. I really enjoyed the comments, both supportive and critical. For those that took me to task: I haven't changed my mind. 8VSB is still the biggest reason DTV hasn't been successful. If we'll just dump 8VSB, we can put the DTV train back on its tracks.

Apparently, the August editorial was posted to a home theater enthusiast website, so the consumer types were first to respond. These guys came after me with a vengeance. Collectively they shouted, "You're just trying to take away my HDTV!" Unfortunately, most couldn't separate the technological facts from their emotions.

Some critics claimed I was paid by Sinclair to write the piece. I wasn't. Some claimed I was a propaganda machine for the broadcasters who don't want DTV. I'm not. Others claimed I made up the material. Fortunately, I didn't need to. The truth about 8VSB is bad enough. From the letters, it's obvious that consumers equate HDTV to DTV. These guys didn't buy their receivers for "digital" they bought them for HDTV.

On the other hand, many of these consumers aren't stupid. They know about the 8VSB/COFDM controversy. And, it's obvious that it is their experience that forms their opinion. In other words, they may not be studied in the technology, but at least they've experienced it.

These consumers have made an investment in DTV and they are staunch supporters of keeping DTV technology *as it is*. They are quick to criticize the networks and local stations for not promoting HDTV and for not creating more HDTV programming.

These folks are passionate about their hobby and some have spent heavily on it. As one writer said, "I have $6000 invested in HDTV equipment, and I intend on getting my money's worth out of it." However, its important to realize that today's HDTV/DTV consumers are but a microscopic cell of the total TV audience. Clearly, anyone who suggests any change that could delay this technology risks being labeled a heretic.

Fellow broadcasters responded quite differently to my editorial. These professionals, to a writer, admitted that COFDM was at least a strong candidate technology, if not the outright best methodology for DTV. These fellows obviously were more familiar with the technology so they often quoted dBs and coverage areas. However, there is one very interesting point to note: Not one broadcaster respondent admitted to owning an HDTV receiver.

That's a disappointing fact. Why doesn't our own leadership invest in HD? In fact, I've never met a chief engineer who'd bought his own HDTV set.

By the way, I'll bet you dinner in DC that our fearless FCC leader Kennard hasn't invested in HDTV either. If he's so pro-DTV, why doesn't he pony up $6000 for his own set? Then he could watch standard TV delivered by cable and DVDs because digital broadcasting isn't carried by cable.

I will give the consumer guys credit. They love their hobby and they've invested their own money in it. So maybe that does give them something the rest of us don't have, the right to vote. The problem is, they're still voting for a loser.

Brad Dick

Brad Dick, editor

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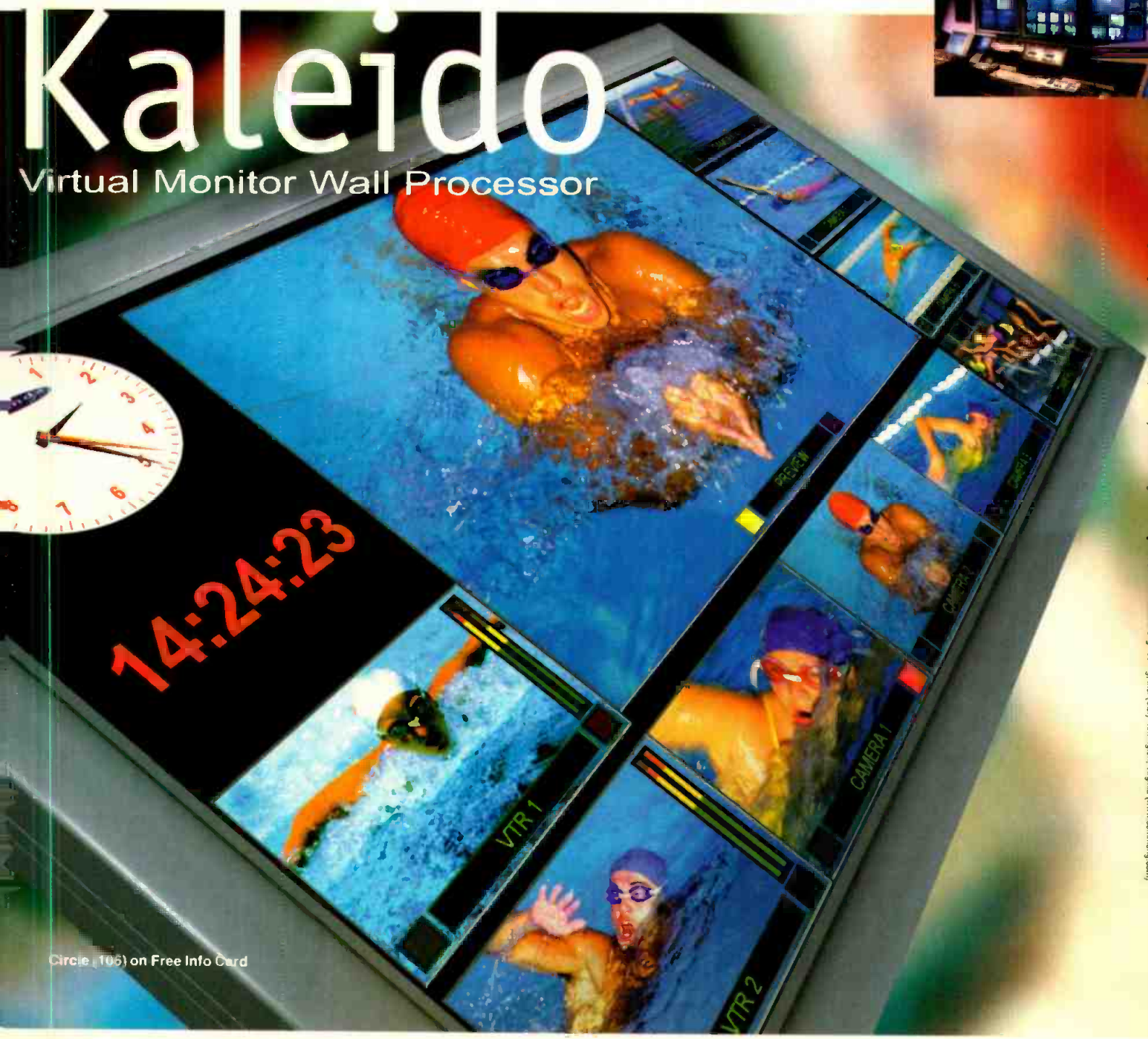

◆ Photographed at the WETA/Washington, D.C., Master Control provided by broadcast designer and integrator, Communications Engineering, Inc. (CEI) Newington, Virginia (www.commeng.com)

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Reader Feedback

Not surprisingly, the August editorial, "Kill the 8VSB Frankenstein," drew a lot of comment. Most respondents came from two camps: consumers and broadcast professionals. If we measure response on emotion, the consumer guys win hands down. The more measured, considered opinions came from those in the trenches. Here is a selection of the feedback from both camps. For an up-to-date presentation of the comments received on this topic, go to www.broadcastengineering.com and click "Reader Feedback." We'll continue this discussion next month.

BRAD DICK, EDITOR

Sir:

Your article is one of the most irresponsible, slanted and obvious attempts at negative propaganda I have ever read. 8VSB works and works the way it is intended, to provide digital coverage similar to analog OTA coverage. I have been a digital viewer since early 2000 and can report excellent performance by my first generation RCA DTC 100 on all local DC-area stations. It outperforms my satellite dish even in heavy rainstorms. This is, once again, just another slanderous attempt by a "journalist" operating with a hidden agenda to help kill the HD/DTV movement.

Knowledgeable and informed readers of this article recognize your agenda is not concerned with facts but misinformation. It is wholly designed to spread untruths and operate with a hidden agenda set forth by a company that owns many TV stations who would like to provide services not intended for with the free bandwidth given to them by Congress. It would rather cheat the American people of the financial gains recognized by paying for bandwidth to provide for datacasting services. That, sir, is called propaganda in my book.

WAYNE HARRELSON

Dear Editor:

The only reason for implementing COFDM is for datacasting (especially for mobile receivers). Most consumers now receiving DTV are only interested in high-definition video. This is the original intention of DTV and the way it should remain. The continued debate between COFDM and 8VSB, the continued foot dragging by some broadcasters and the broadcasters not advertising their HDTV channels is holding back the progress of HDTV. 8VSB works and does its job very nicely, but only if you turn on the transmitter!

BOB LYONS

Editor:

Mark Simon's (Rohde & Schwarz) presentation of COFDM at the Pittsburgh regional SBE meeting made the point for me. Particularly interesting is the concept of hierarchical modulation. He presented a scenario that allows transmission of a highly fade-resistant datacasting signal for mobile applications at 4Mb/s and moderately multipath resistant signal for HDTV at 13Mb/s on the same 6MHz channel. This is certainly the way to go for mobile apps. Technically, I was sold, but I could see broadcasters were not.

I feel broadcasters would have a better chance of defending their turf if they develop related broadband applications for mobile use and thus fought for market share. I would like to see Broadcast Engineering address this issue.

TOM AMMONS
WQED

Editor's note:

For an excellent tutorial on the legalities of datacasting and other non-traditional applications, see the July 2000 issue of Broadcast Engineering, "Datacasting: Is it Legal?" *by Mitchell Lazarus.*

Brad:

About a year ago you and I discussed 8VSB and COFDM. I took the position then that receiver technology would eventually solve the problems of 8VSB, and I referenced radar receivers as an example of technological solutions. That may still be a viable position for fixed-point reception, but the world is not standing still and neither are receivers. I think I have seen the light and am now a believer that we should move to COFDM immediately or see the opportunity for datacasting gobbled up by rapidly evolving LMDS and third-generation cellular technology, leaving broadcasters out in the cold.

At this point it is obvious that by insisting on the 8VSB standard, the FCC is pushing a rope. The more than 1300 broadcasters who are not in the top markets will never see a return on their investment in digital transmission equipment if they must rely only on the already established revenue streams, and they recognize this. Digital transmitter sales are down and show no signs of an immediate uptick. The FCC holds the key to the future of digital TV and datacasting, and they need to listen to the voices of industry soon.

At this point it is obvious that by insisting on the 8VSB standard, the FCC is pushing a rope.

JOHN ALLAN
VICE PRESIDENT OF MARKETING
CPI/EIMAC

Mr. Editor:

I question how much personal experience you've had at your home with DTV via 8VSB. I'm in the Detroit area (five DTV stations on the air) and I get

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absolutely perfect reception on every one of the stations (15 to 20 miles away). My antenna is a spool of solder plugged into the antenna input!

You can publish all the garbage you want about 8VSB. The fact is that it works. I have $6000 invested in HDTV equipment, and I intend on getting my money's worth out of it.

MIKE MIJAL
CANTON, MI

Editor:

I'm a member of the AVS Forum, and I know you have received several highly passionate responses from others that have reacted negatively to your column regarding the killing of 8VSB. I don't have time to be long-winded on this, but did want to say that while I don't think 8VSB is as dead a technology as you indicate, I also see the positives of COFDM and the circular argument that exists here.

My antenna is a spool of solder plugged into the antenna input!

When all is said and done it isn't going to matter at all which standard is superior if this argument continues, because it is killing HDTV. What matters is that a strong, decisive action is taken to decide ultimately which standard will provide the best overall service. Even though I am purchasing an 8VSB modulator (DishNetwork's add-on module), I will happily turn this over in favor of COFDM if it will settle the argument and get content on the air. Without content, forward thinking from broadcasters and active public awareness campaigning, the HDTV format will die ... and both arguments will end. Who cares about 8VSB vs. COFDM then?

JIM A. KOSINSKY
DIRECTOR OF MEDIA SERVICES
CONCORDIA MEDIA PRODUCTIONS
RIVER FOREST, IL

Editor:

Thanks for the editorial! You said it all. I trust you saw the COFDM over-the-air demo at NAB2000? I did and asked the question that many people did: "Where is the 8VSB over-the-air demo?" The answer was: "It (8VSB) can't be received in the convention hall." I hope everybody from the Hill down to the customers at the local Video Kingdom hear your message.

JERRY L FUEHRER
KHGI-TV
KEARNEY, NE

Editor:

As a user of DTV I completely reject the assertion that 8VSB does not work. In my experience, since the purchase of my system in January, I have very rarely had problems receiving 8VSB modulated signals. In fact the two most receivable signals in the Boston area are the two stations that represent ABC and NBC. The CBS affiliate is on the air, but not getting a signal to its allocated broadcast area.

There were two other stations that started broadcasting at full power and I have no problem receiving them. But the point is, when these stations come up to full power and their antennas are at their specified height, you can receive these stations with minimal outside antenna systems.

I don't believe that broadcasters/networks can do everything. It is a prescription for mediocrity, which they are pretty close to now. Do you really think that they can be any good at datacasting? The broadcasters and networks hit mediocrity some time ago and don't seem to want to use HDTV as a road back to superior programming.

The programs I have seen on HDTV, no matter what the source, have all been breathtaking. This is the single biggest improvement in media quality since the advent of the audio CD. To all that worked on this standard I say "bravo," "well done" and "keep up the good work." Anything as new as this standard will always be a work in progress. Nothing is perfect, but this standard comes pretty close. This standard is completely usable for what it was intended. To the people who strive to change it into something else, I say get lost and let us viewers enjoy the quality of the ATSC system.

Patrick Joy with his 8VSB receiver

PATRICK JOY
GENUITY.COM

Editor:

In my suburban location, 8VSB works perfectly. However, you should be aware that I can't get a decent NTSC signal here. In fact, none of my neighbors get a good NTSC signal around here either and we're only 30 miles from the World Trade Center.

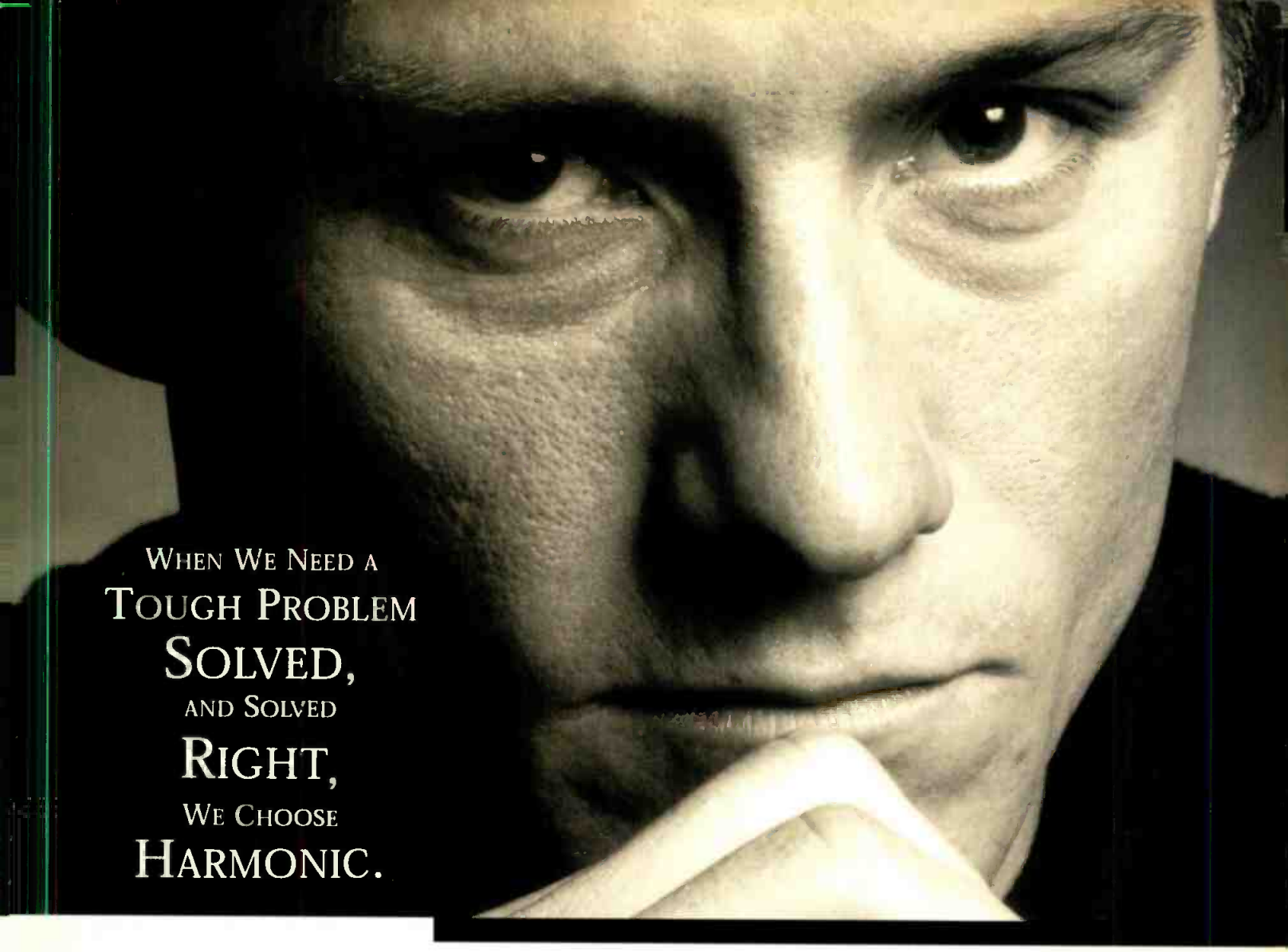
In Manhattan today, most people cannot get NTSC without terrible multipath. So, they are not any worse off with the proposed 8VSB standard.

So if the goal is (I thought) to replace NTSC by 2006, 8VSB works fine. To delay this implementation on the grounds that some newer system might be better in two years time seems odd to me. In any technological field there will always be something better available if we just wait a little while. The investments already made would be lost and we'd be back to NTSC for an extra couple of years for no long-term gain.

However, we do know that CODFM is better for chargeable mobile services. The whole rationale behind giving broadcasters free spectrum was that they would operate on a free basis and in the public interest. Any debate, therefore, should revolve around the question of whether the bandwidth given by the American people to the broadcasters should be optimized to generate profits for the broadcasters or to provide service to Americans. If the broadcasters want to provide chargeable services, then they should participate in an auction of the bandwidth. This CODFM nonsense is just a cynical ploy on their part to enhance their revenues. And you have fallen for it.

ROSS SALINGER

Send reader comments to: editor@intertec.com



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News

Record-setting remote strikes

BY LARRY BLOOMFIELD

You've got 10 minutes or less to strike all your television equipment, and get it out of the way. Now this might be a piece of cake for an ENG crew, but for a full multicamera remote production van and crew with lights and all, it is a real challenge. Challenge or not, that's the way it is Monday nights, this season, before the Monday Night Football game.

The Home Shopping Network (HSN) got the idea of doing an hour show prior to each of the Monday Night Football (MNF) games from the stadium where the action is about to take place. Obviously it takes a bit of time to set up the cameras, mics, IFB and other paraphernalia necessary to do a complete show, but getting all that gear out of the way in a matter of minutes has to be something for the *Guinness Book of World Records*.

With plenty of "remote" outside broadcast (OB) experience, it didn't take long for the folks at PMTV and HSN to ink a multiyear deal with the NFL to broadcast the HSN pre-game show before every MNF game.

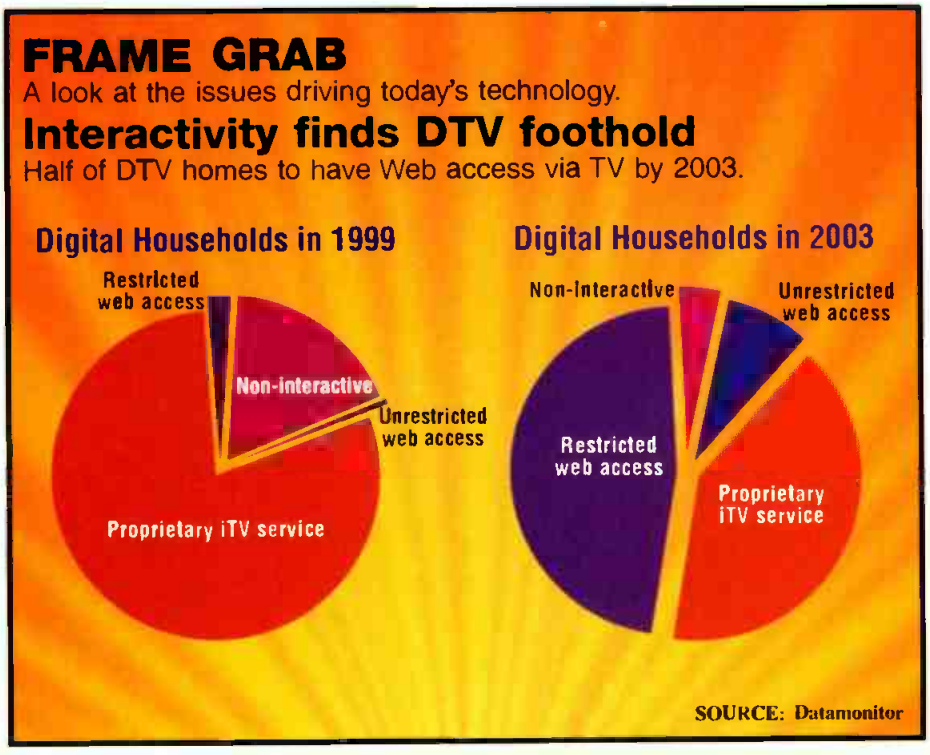
PMTV meets this kind of a challenge with a production truck, lighting truck and a satellite uplink truck for each of the broadcasts, where only a minimal amount of copper, coax and fiber need to be laid prior to each broadcast. The audio, two-way communications, including IFB and intercom, along with microphones, are all wireless, as are their "G-Cam" and blimp camera.

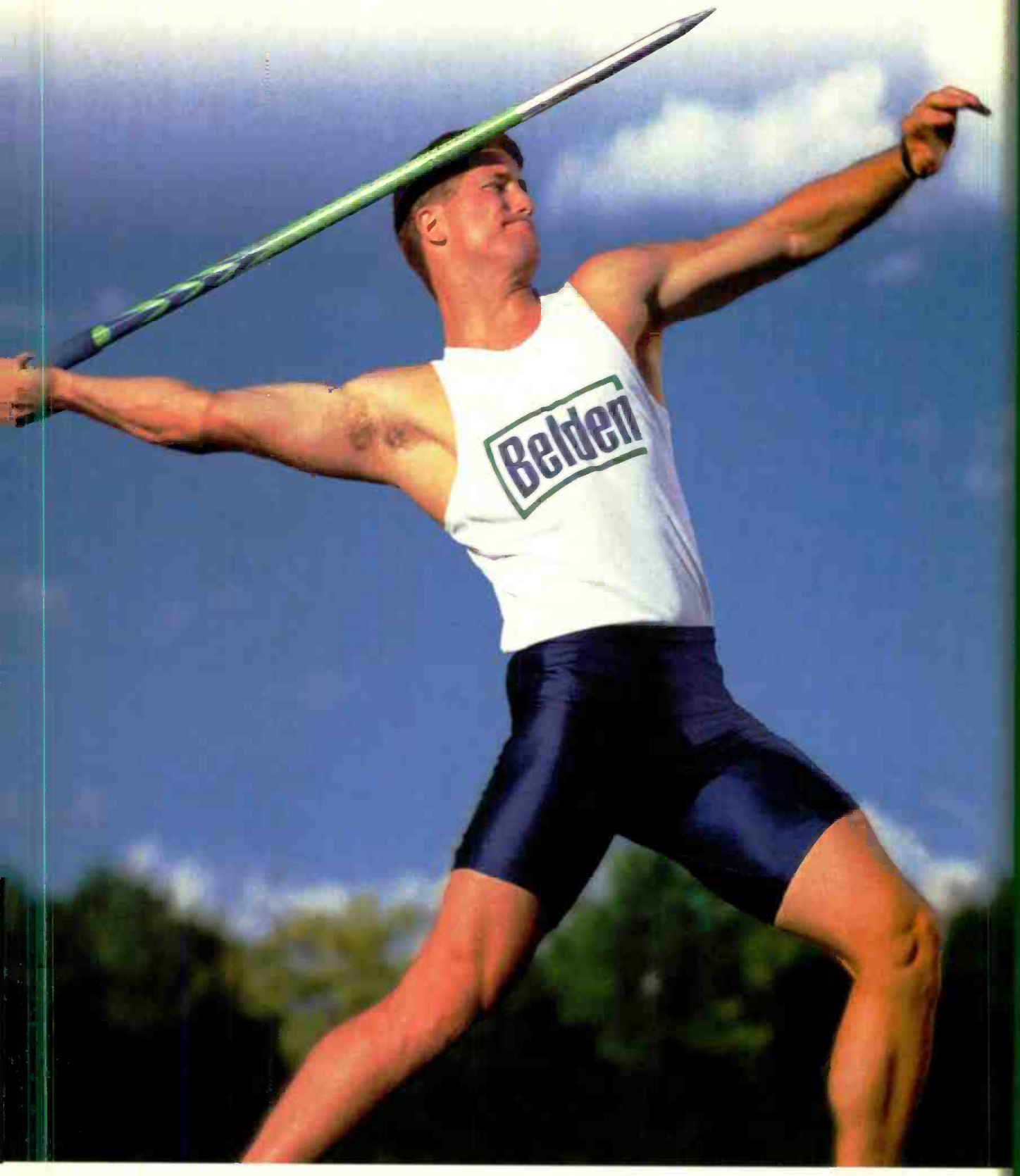
It takes 30 people on the field to strike the show in the allotted time, which is between four to seven minutes.

Spearheading this weekly project is PMTV's Kevin Tully. "The show airs every Monday night from 8 to 9 p.m. at the venue for Monday Night Football," Tully says. "We use three hard cameras and one handheld on the set, all on triax, plus one wireless 'G-Cam'. The G-Cam is fired on 7GHz to a receiver and has full two-way communications," Tully explained, "for a total of five cameras, plus a camera in a blimp, which makes six." The five truck cameras, three "hard," one handheld and the one 7GHz G-Cam are all Ikegami HL-55s. The lens complement is three 55:1, one 14:1 and one wide angle.

All the video sources feed a GVG 300 switcher with 24 inputs and three M/E buses. In addition to the cameras, a Chyron iNFiNiT! with 230MB Bernoulli storage capability and three frame buffers, an Abekas two-channel A-53 DVE with warp and an Abekas two-channel A-42 still store feed the switcher. There are three Sony BVW 75 Beta SP VTRs and controllers for recording and playback, and to keep all this video in time, there are six frame synchronizers.

Tully said, "There are up to four high-power wireless microphones with high-power IFB for talent, plus eight wireless intercoms in use, with everything backed up on hard wire. However, we rely on the wireless." Other equipment provided by PMTV includes 16 wireless RF Sennheiser mics operating between 674- and 698MHz, and a PL system consisting of three systems that have a base and four packs each. These operate in the 457- to 494MHz frequency range. In addition, the audio man will have a pair of shotgun mics and a Digicart II with a Bernoulli





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PMTV engineers prepare for an hour-long broadcast prior to a recent Monday Night Football game in Kansas City.

storage capability.

Any video operator knows that lighting can make or break a show. PMTV doesn't leave this to chance either; they bring their own. Tully said: "We use six HMI Lights with ballast. Each is a balanced blue light that is 575W.

"It takes 30 people on the field to strike the show in the allotted time, which is between four to seven minutes," Tully said.

Home Shopping and PMTV leave nothing to chance. Not only do they have a Ku band uplink via PanAmSat to HSN, but there is also a backup fiber feed from the stadium to HSN.

The crew travels on Saturday, sets the show up and edits tape on Sunday. On Mondays they create the open and close, do the show and strike. Tuesdays are travel days for all, followed by a few days off, for the lucky, before they begin all over again on Saturday. ■

FCC issues rules on DTV set labeling

The FCC recently adopted rules for the labeling of digital television (DTV) receivers to ensure consumers will be informed about the capabilities of digital TV receivers to operate with cable television systems.

In the Report and Order, the Commission issued specifications for three categories of DTV receivers.

The first is Digital Cable Ready 1, a consumer TV capable of receiving analog basic, digital basic and digital premium cable television programming by direct connection to a cable system providing digital programming. A security card or Point of Deployment (POD) module provided by the cable operator is required to view encrypted programming. There is no 1394 digital connector or other digital interface. This device does not have two-way capability using cable facilities.

The second is Digital Cable Ready 2, a consumer TV receiving device that in addition to the features of the Digital Cable Ready 1 sets also includes the 1394 digital interface connector that may be used for attaching the receiving device to various other consumer appliances. Connection of a Digital Cable Ready 2 receiver to a digital STB may support advanced and interactive digital services and programming delivered by the cable system to the set-top box.

The final label is Digital Cable Ready 3, a consumer TV receiving device that in addition to the features of the Digital Cable Ready 1 sets is capable of receiving advanced and interactive digital services by direct connection to a cable system. The Commission notes design specifications still need to be determined for this category. Because of this, the FCC will keep the record open in this proceeding, giving them the option of incorporating these specifications into its rules at a later date. The FCC also requires the cable and consumer electronic industries to report to the Commission on the continuing development of technical standards for the Digital Cable Ready 3 receivers.

The Commission's reporting requirements are supposedly consolidated into a single reporting timetable which, beginning Oct. 31, 2000, is required every six months thereafter until October 2002.

Copy protection

This labeling issue also briefly touches on another difficult issue: copy protection. This issue was raised in the labeling Notice of Proposed Rulemaking, but it relates only to navigation device rules. In response to this issue, the FCC said, "For that reason, the copy protection licensing issue is incorporated in the Further Notice of Proposed Rulemaking and Memorandum Opinion and Order/ Declaratory Ruling in the navigation devices docket." This decision also states that the navigation device rules permit some amount of copy protection to be included in commercially available navigation devices.

It is also interesting to note that no mention was made of USB ports on digital TVs in the FCC Release, in spite of some recent talk about the possible demise of Firewire.

The use of the phrase "digital television receivers" in the FCC release is confusing in that no mention is made of displays. This whole approach tends to blur the line between receivers, set-top boxes and the actual display device.

CEA response

Consumer Electronics Association President and CEO Gary Shapiro responded to the FCC announcement of a labeling system by saying, "While we would have preferred a multi-industry consensus on this issue, and are uncomfortable with a federal agency mandating labels for our products, we recognize that the Commission had a mandate to establish clear labels to minimize consumer confusion."

With respect to the copyright issues raised by the FCC and the proposed ruling in its cable navigation devices proceeding, Shapiro said, "We are pleased that the Commission in its actions appears to recognize that consumers maintain reasonable home recording rights in the digital age. We maintain, however, that the FCC has no legal authority to grant CableLabs permission to mandate copy protection schemes in the Dynamic Feedback Arrangement Scrambling Technique (DFAST) license.

"We hope that the Commission's actions in this area will not limit the usual and customary home recording rights of consumers," Shapiro said. ■

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CBS does HD

In what appeared to be an eleventh hour move, Panasonic stepped in to underwrite the HDTV broadcasts of the majority of CBS's primetime programming for the upcoming 2000-2001 television season. Because CBS appears to be the only network to be taking HDTV seriously, this goes a long way in preserving the HDTV presence by at least one network into the American home.

Panasonic is taking over the sponsorship after Mitsubishi, which underwrote CBS's HDTV broadcasts last season, backed out earlier this summer. The sponsorship covers all but one of CBS's 18 primetime entertainment programs. "Walker – Texas Ranger" is the only entertainment show not in the HDTV lineup. CBS will also be broadcasting selected CBS Sunday and Wednesday Night Movies in HDTV.

The majority of the lineup, which features 14 hours of weekly programming on 17 of CBS's primetime entertainment series, will be broadcasting in 1080i. "Diagnosis Murder," meanwhile, will be acquired on high-definition video in 1080/24p, rather than 35mm film, the traditional acquisition medium for episodic television.

All of this effort will be broadcast on 31 of CBS's owned and affiliated stations currently broadcasting in digital, covering approximately 45 percent of the U.S. By the end of the year, CBS expects to be transmitting digital programming from 39 stations, reaching approximately 56 percent of the U.S.

This is Panasonic's second major HDTV sponsorship in the past two years. Last season, the company sponsored the HD broadcasts of ABC's Monday Night Football and the 2000 Super Bowl. ABC has decided to abandon the HDTV version of Monday Night Football. ■

Technical Emmys honor engineering advancements

BY LAURA COLLINS, EDITORIAL ASSISTANT

The National Academy of Television Arts and Sciences (NATAS) held its 52nd Annual Scientific and Technical Advancement Awards ceremony on Oct. 3 in New York, with 27 Emmys awarded for achievements in video conversion, video and audio compression, and picture quality analysis, as well as virtual imaging and advanced battery technology.

NATAS developed the award in 1948 to honor companies, scientific or technical organizations, and individuals for technological developments significantly impacting the television industry through innovation and improvement upon existing methods.

Bob Agnes, vice president of the Video Business Unit at Tektronix, accepts an Emmy for the company's achievements in picture quality analysis at the NATAS awards ceremony on Oct. 3.

A committee of experts drawn from the manufacturing and user sides of the industry narrows the search for significant contributions to a handful of promising technologies, which vary from year to year. They, and representative products and services, are evaluated at NAB to determine winners in each category.

At this year's ceremony, Panasonic and Snell & Wilcox were honored for their contributions in the area of video format up/down image conversion with color, space, film, television and audio compensation. These developments led to products such as Panasonic's AJ-UFC1800 Universal Format Converter and the Premier range of up-, down- and cross-converters from Snell and Wilcox.

The Centre Commun D'Etudes De Telediffusion Et Telecommunications (CCETT), the Institute for Rundfunktechnik and Philips Consumer Electronics were awarded Emmys for the development of Musicam or MPEG Layer II audio bit rate digital two-channel compression systems.

Six companies received awards for pioneering development of compression plug-in cards used in nonlinear editing systems or video servers to bring full motion, broadcast quality video to desktop computer systems. Winners in this category include Pinnacle Systems, Matrox Video Products Group, Vela, Media 100, Digital Processing Systems and Avid Technology. Advances in this area have led to the development of products such as Vela's Argus and CineView MPEG-2 encoders and decoders, and DPS' PVR digital disk recorder. Orad Hi-Tec Systems received an Emmy in the category of "Implementation of Real-time Virtual Imaging for Live Events on Television," for virtual advertising and sports broadcasting enhancement technology used in its IMadGINE and CyberSport products. Other recipients in the category included Symah Vision, Princeton Video Image, Fox Sports and Sportsvision.

Snell & Wilcox, DirecTV and Philips Broadcast were awarded for developments in preprocessing technology allowing them to deliver high-quality baseband video over digital compressed transmission systems at low bit rates.

Anton Bauer, Frezzolini Electronics and Cine Sixty were honored for their achievements in the category "Development of Advanced Battery Technology for ENG/EFP."

Tektronix, Sarnoff Corp., Rohde & Schwarz, KDD Media Will and the Institute Fuer Technische Universitaet received recognition for pioneering development of picture quality analysis equipment, specifically, to provide objective measurement of digital picture quality.

The advancements in technology represented by this year's awards, and the products and services built on these advancements, have had a substantial effect on the transmission, recording and reception of television. They offer more efficient conversion between video formats, compression technology that

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brings broadcast quality video to desktop computer systems, preprocessing technology that enables higher quality images to be transmitted at lower bit rates, and equipment that assists broadcasters in evaluating the picture quality they are providing to viewers. Broadcasters will continue to devise better, faster and more efficient methods of bringing content to viewers. ■

DTV conference planned

The seventh annual Digital Television seminar, Digital Television 2000, will be held Dec. 6-8, in the Hyatt Regency Grand Hall in Atlanta. The event is sponsored by *Broadcast Engineering*, in cooperation with *Video Systems* and *Millimeter* magazines.

DIGITAL TELEVISION 2000
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The conference schedule offers an in-depth look at converting from analog to digital on Wednesday, covering issues including format decoding, signal processing and noise reduction, and facility infrastructure, as well as MPEG and DTV antenna technology. Conference attendees will also have the opportunity to tour CNN's and Crawford Digital's facilities.

Events on Thursday will begin with a keynote address by Charles Jablonski, senior vice president of network engineering and operations for Geocast. Speakers will discuss issues related to building a digital facility, including DTV and ATSC standards, handling metadata, digital routing in a multichannel environment, automation and media management, and linking systems with IP technology. Other topics will include datacasting, HD storage and playout, and HD production systems.

Thursday night, proponents of 8VSB and COFDM will have a chance to defend their respective reception modulation schemes in a special "DTV Shootout" moderated by Michael Silberglied of Silverknight Productions. The discussion will offer participants the latest reception data and results, and the opportunity to explore problems and solutions for DTV reception.

On Friday, engineers will have the chance to take an in-depth look at the entire Webcasting process, from content generation through playback, during a special day-long Webcasting/streaming session. The session will begin with the basics of streaming and initial concerns such as selection of formats, pre-production and encoding. It will also offer broadcasters a guide to selecting a service provider and actually building a Web facility, as well as a live demonstration of the entire process. Friday's session will end with a look at the future of the industry presented by *Broadcast Engineering* editor Brad Dick.

Video Systems and *Millimeter* will offer production sessions on Friday over networking and serving the non-broadcast HD market.

For more information, see www.dtvconference.com. ■

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FCC Update

New regulatory initiatives for TV

BY HARRY C. MARTIN

In three separate actions the FCC has moved to standardize or expand reporting requirements relating to the public interest obligations of TV broadcasters. Here is a summary of the three initiatives:

DTV stations' obligations to children. The FCC is seeking comments on the following issues related to children's TV in the digital age:

- How the children's core educational programming processing guideline should be applied to DTV broadcasters;
- Whether the guideline should apply only to free broadcast services or also to pay services, and whether a three-hour guideline is sufficient in light of the additional program capacity made available by digital technology;
- Whether the Commission's policies regarding pre-emption of core programs should be revised in view of the greater programming flexibility available to DTV broadcasters;
- Whether children's programming advertising limits and policies should apply to both free and pay program streams;
- How these rules and policies should be interpreted in light of DTV's interactive capabilities;
- Whether the Commission should revise its definition of "commercial matter" to include interruptions such as certain program promotions; and
- How to address the issue of airing promotions for age-inappropriate movies or TV shows in programs viewed by children.

Comments on these issues will be due in late November or early December.

Quarterly reports on children's programming. The FCC has amended its rules to permanently require commercial television broadcasters to file with the FCC Children's Television Programming Reports describing their children's educational and informational programming as they are prepared. Under the Commission's 1996 order implementing the Children's Television Act, commercial TV stations were required to prepare and place in their public inspection files quarterly reports on their children's educational programming, but the four quarterly reports could be filed with the Commission jointly once a year.

These reports identify the educational and informational programs aired by the station over the previous quarter and the days and times these programs were regularly scheduled, the age of the target audience for each program, the average number of hours per week of core children's programming broadcast, and plans for the next quarter.

In its recent order, the Commission made a number of revisions to the quarterly report to make the information contained in the form clearer and more useful. The FCC also asked whether broadcasters should be required to make their quarterly reports accessible through their websites.

Standardized quarterly reports. In a notice adopted in September, the FCC tentatively concluded that television broadcasters should provide information on how they serve the public interest in a new standardized format on a quarterly basis. The disclosure form would be maintained in the station's public inspection file in place of the currently required issues/programs lists and be placed on the station's or a state broadcasters' association's website.

- *Types of disclosures.* The FCC is seeking comment on what program categories should be included on the standardized form. The FCC proposes including a "catch-all" category to ensure that the form enables broadcasters to reflect any public interest programming they aired that does not fit into one of the specified categories. The Commission also is seeking comment on how licensees should inform the public about their provision of closed-captioned and video described programming.
- *Ascertainment revisited.* The FCC invited comment on whether a licensee should provide a narrative description on the standardized form of the actions taken in the normal course of business to identify its community's programming needs and interests. The Commission also sought comment on whether activities such as organizing community events or awareness campaigns should be listed on an attachment to the form and considered in assessing whether the licensee has served the public interest under the Communications Act.
- *Public inspection file.* The FCC tentatively concluded that licensees must place a paper copy of the standardized disclosure form in their public inspection files each quarter and retain those forms until final action has been taken on the next renewal application.

Comments on these proposals also will be due in late November or early December. ■

Dateline

Annual EEO Public File Reports must be placed in the public files and on the websites of stations in the following states on or before Dec. 1: Alabama, Colorado, Connecticut, Georgia, Maine, Massachusetts, Minnesota, Montana, New Hampshire, North Dakota, Rhode Island, South Dakota and Vermont.

All commercial TV stations must complete construction of their DTV facilities by May 1, 2002. For NCE-TV stations, the deadline is May 1, 2003.

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

Send questions and comments to:
harry_martin@intertec.com

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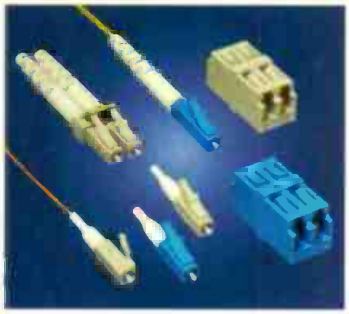

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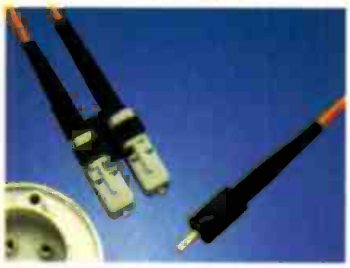

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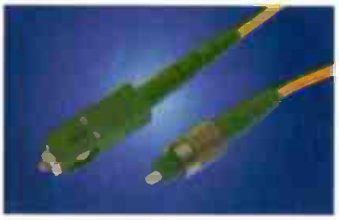

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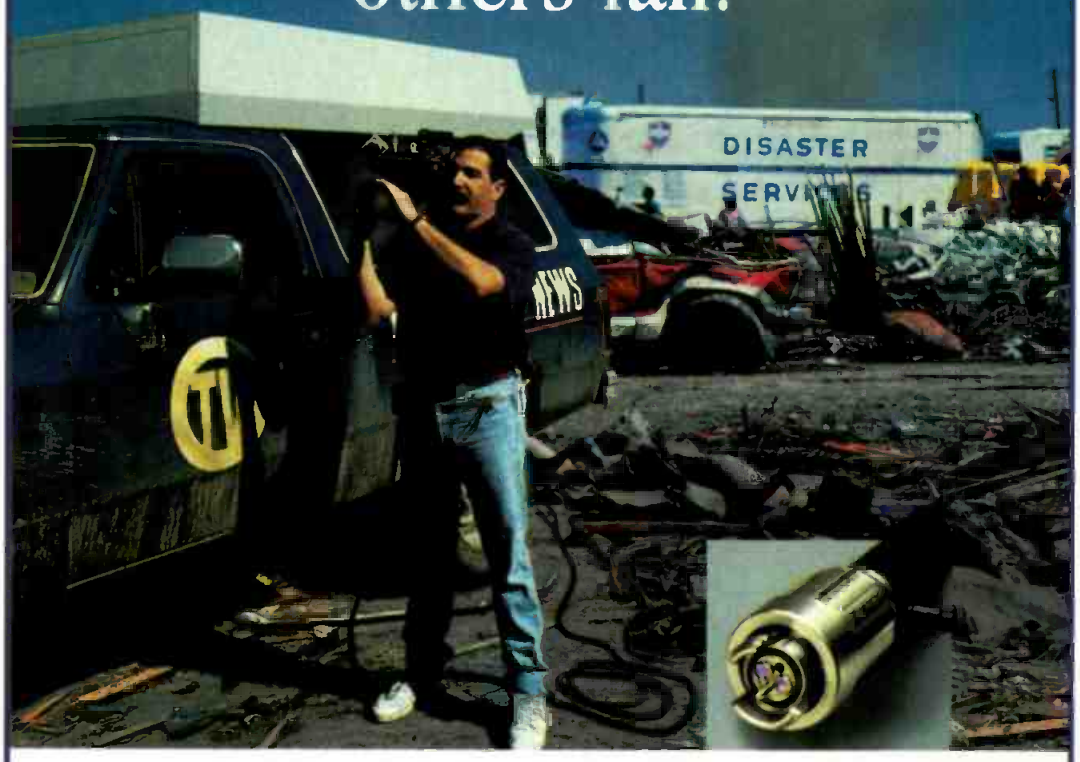

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Bob Wilson, Pinnacle Systems

There is much controversy today about viable advertising models of any kind for the Internet. Advertising revenues that can be directly attributed to video streaming from any source on the Internet are virtually nonexistent. Being an advertising driven industry, it is not surprising that while most broadcasters have excellent websites, few have deployed video streaming as part of their Web strategy. Given a strong revenue stream, few seem compelled to venture out into the streaming world.

Some of the most popular websites focus on sports, weather and news, with data showing that almost 100 million viewers in a single month visited websites focusing on those topics. This is precisely the content best created and kept current by broadcasters. And the most compelling way to enhance the viewing experience is to deliver broadcast quality video to those web viewers. Today's snail-paced 56K modem connections are not up to the task of broadcast quality video streaming. However, the rapid deployment of broadband connections (DSL and cable modem) will make this a common experience for most dedicated Internet users over the next two to five years.

Why make a streaming investment now? As broadcasters know, changing the viewing habits of an audience is an expensive task once patterns are established. Just look at the cost of gaining share in any local market against the reigning news leader. Internet "viewing habits" are being established right now. Building brand awareness and loyalty now is relatively cheap compared to what it will cost once broadcast quality video streaming is common place. Broadcasters need to stake their claim on the new content delivery channels available on the Web AND add their unique brand identities. Broadcasters' brands are dependent on delivering high-quality, video-based content. Streaming is an imperative if your brand is to survive the coming deployment of broadcast-quality video over the Web.

The next few years will see a period of experimentation and rapid shifts of momentum as new kinds of models are deployed. Fortunately the costs of streaming are a very small fraction of the cost of a DTV transmission system, so early adoption of video streaming comes with a small relative investment. The more focused an audience, the better chance of attracting ads. Local broadcasters may have the big advantage as streaming takes hold and they do what they do best: match local viewers to local suppliers. Packaging ad messages (and ad rates) that run on TV and are enhanced by the Web video message which links viewers easily to the advertiser's website for further information seems to be a natural extension of current business models. Helping advertisers build video-enabled sites is another service broadcasters offer to their ad agencies and their clients.

Building experience, audience loyalty, advertiser awareness and improving a broadcaster's brand all add up to streaming now and not later. Those who carefully select their streaming initiatives now will be rewarded with stronger businesses in the years ahead. ■

Bob Wilson is president of Pinnacle Broadcast Solutions Division, Pinnacle Systems, Inc.

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Transition to Digital

MPEG editing

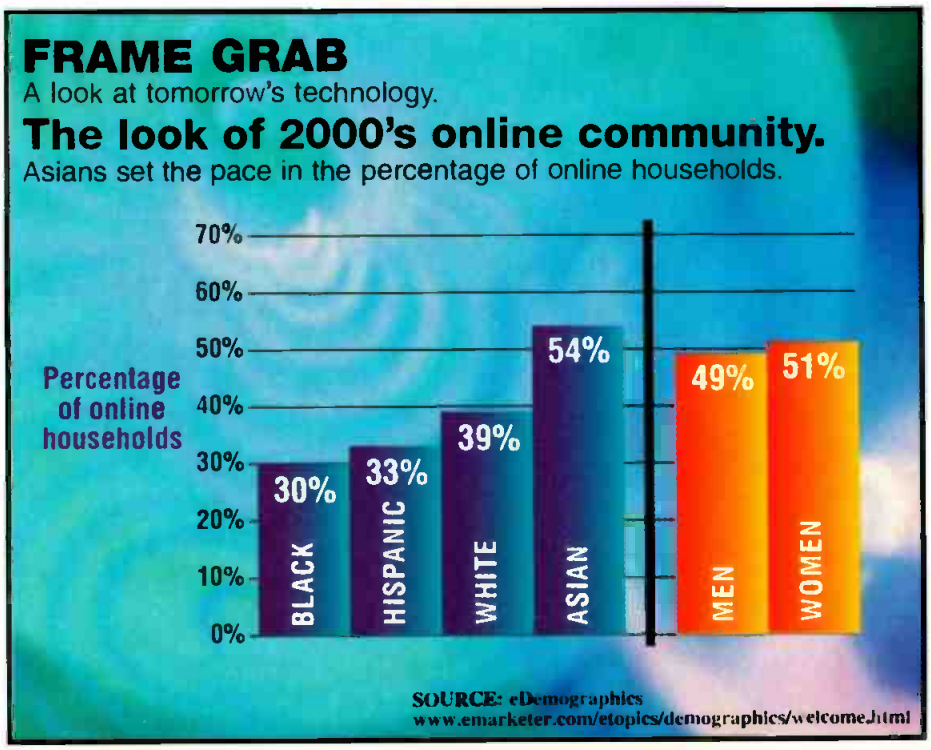
BY MICHAEL ROBIN

North American (FCC) and international (ITU) spectrum management concerns resulted in the analog television on-air channel allocations and transmitted bandwidth with regional flavors (NTSC/6MHz, SECAM/7MHz and PAL/8MHz). This created certain transmission-related constraints resulting in the frequency division multiplexing of luminance and chrominance aimed at best utilizing the available transmission channels.

The original development of analog television was based on the concept of direct, real-time, on-air transmission of live programs including occasional films. Most of today's television production is unthinkable without editing the original picture sequences. With the exception of sports, there are very few live programs on-air. Generally speaking there are several types of operations that fall under the category of editing such as live switching, cross fading (mixing), various types of DVE operations, caption insertions and . Digital timebase correctors removed some of the splicing irregularities but resulted in horizontal non-linear editing. The transmission-oriented analog television standards are quite inadequate for editing and multigeneration signal processing. Originally video was edited by physically cutting tape, a process which today we would call non-linear editing. The later introduction of electronic linear-editing depended on copying rather than cutting the material. Early VTR editing techniques very often resulted in unacceptable chroma shifts at the splice-point picture shifts at the splice point. This was because the time base corrector tried to maintain chrominance subcarrier continuity in a four (NTSC) or eight (PAL) field sequence. In North America, the problem was identified and solved by updating of the NTSC standard to SMPTE 170M and the introduction of the SCH concept. For awhile, everything seemed to work just fine. Along the way the old 2" QUAD and 1" Helical VTRs were replaced by component analog VTRs, such as Betacam and MII. This helped remove certain tape editing difficulties as no subcarrier was recorded but the multigeneration accumulation of impairments remained.

Like its early predecessors the analog transmission standards, MPEG-2 is transmission oriented.

In the 1980s the component digital standard known as 4:2:2 made inroads. At this time the first digital VTR, the D1, appeared on the market. The availability of peripheral digital equipment proliferated with the standardization of the 270Mb/s bit-serial digital signal distribution known as SDI. Today, competitively priced digital studio production equipment is replacing analog video production equipment. Studio-type digital equipment can operate at the full bit rate of 270Mb/s with few, if any, constraints. Full bit-rate (D5 format) or lossless compression (Digital BETACAM) VTRs are entrenched and provide high quality editing and transparent mul-



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tigeneration recording. In this environment, compression is a choice not a necessity. There are, however, two cases where compression needs to be considered.

• Getting these signals out of the studio through distribution or transmission links: Here spectrum availability and cost impose constraints that can only be addressed by using compression.

• Portable newsgathering equipment: Portability and miniaturization requirements dictate the use of compression.

The same technology that made digital processing of full quality video possible also made compression techniques practical and affordable. The MPEG-2 compression system, with its toolkit approach, is an answer to these constraints. MPEG-2 uses interframe encoding for the high compression ratio required by reduced transmission bandwidths. Also available are low compression ratios with excellent signal quality for post-production. However, like its early predecessors the analog transmission standards, MPEG-2 is transmission oriented. It was designed with a single-pass process in mind and not for multigeneration processing and editing.

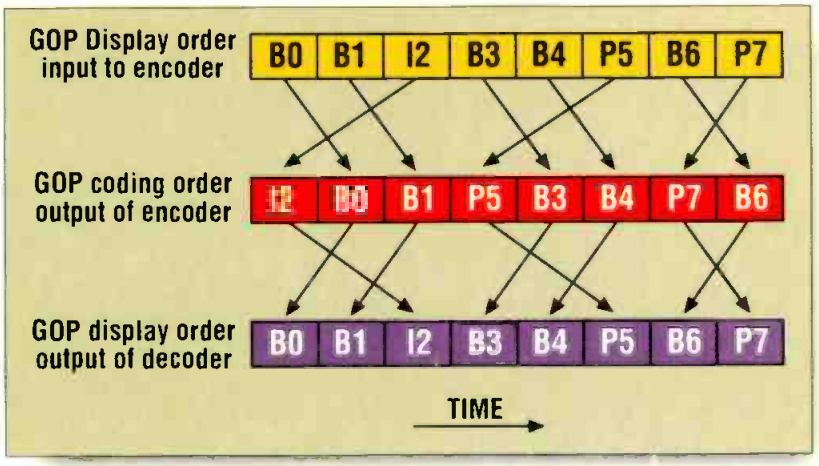

Figure 1. Relative timing of IPB frames.

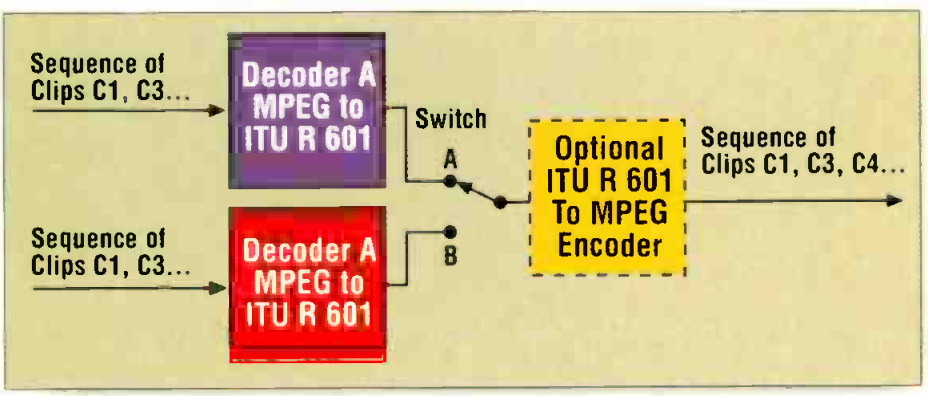

Figure 2. naive editing as used in some disk-based servers. Each output channel has two MPEG decoders, each with its own buffer. While Clip 1 is being played out of decoder A, Clip 2 is being decoded by decoder B and stored ready to be played on demand.

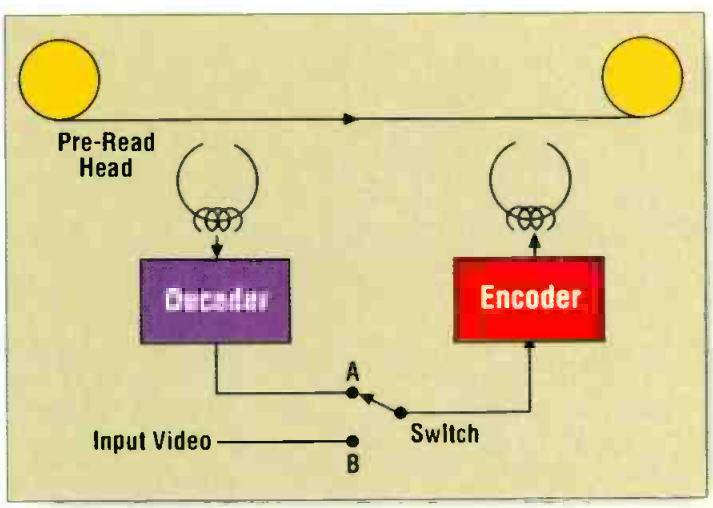

Figure 3. Restricted MPEG-2 insert editing system.

The nature of the problem

MPEG data streams are characterized by three types of pictures:

• I (intraframe encoded): I frames are independent and need no information from other pictures. They contain all the information necessary to reconstruct the picture.

• P (predicted): P frames contain the difference between the current frame and a previous reference I or P frame. If the earlier reference frame is removed as a consequence of editing, the P frame cannot be decoded. P frames contain about half the information of an I frame.

• B (bidirectionally predicted): B frames use differences between the current frame and earlier and later I and/or P reference frames. B frames contain about 1/4 the information of an I frame. Bidirectional coding requires that frames be sent out of display sequence. This allows the decoder to reconstruct the later B frames. For display, the sequence has to be rearranged in the decoder. Figure 1 shows the relative timing of the I,P,B frames making up a group of pictures (GOP) at the input of the encoder, the output of the encoder and the output of the decoder. B frames need to be re-ordered so that future frames are available for prediction, causing a delay.

Different applications use different GOP structures to achieve the desired compression ratio. Typically, the longer the GOP, the higher the compression ratio. Long GOPs are found in MPEG-2 applications for transmission and distribution. The maximum permitted length of a GOP is 15 frames. I, P,B GOPs end with a B frame, which has two reference frames: a previous P frame and the future I frame. I, P, B GOPs are therefore referred-to as open GOPs.

Signal manipulations of MPEG transmission streams are generally limited to switching of signal sources in a master control room and are referred to as splicing. VTR or disk server handling of MPEG produc-

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tion streams, are referred-to as editing. Editing consists of replacing a recorded sequence on tape with another sequence (clip) coming from an alternate source. The new sequence is inserted starting with its own reference I frame substituting for the original I frame. This creates a problem with I,P,B open GOPs. Since the B frame is the result of a forward as well as a backward prediction, substituting the I frame with a new I frame that is unrelated to the previous B frame disrupts the sequence.

Two simple solutions

Seamless frame-accurate editing of compressed video is most easily accomplished with the use of short and closed GOP structures. A closed GOP does not contain frames that make reference to frames in the preceding GOP. Longer GOP structures can be edited by decoding and re-encoding or by transcoding to shorter GOP structures. There are two relatively simple solutions to the MPEG editing problem:

- Naive cascading: Naive cascading consists of decoding the MPEG-2 compressed signal to the ITU.R 601 level, performing the required operation in the uncompressed domain and then re-encoding back to MPEG-2. The intermediate processing might be a switch or some other effect. The frame must be fully decoded to have access to the basic pixels. Figure 2 shows the conceptual block diagram of naive editing as used in some disk-based servers. Each output channel has two MPEG decoders, each with its own buffer. While Clip 1 is being played out of decoder A, Clip 2 is being decoded by decoder B and stored ready to be played on demand. Switching of clips is made in the digital video domain resulting in seamless cuts. While switching problems are eliminated, the decoding/encoding process introduces a certain amount of picture degradation. In a typical operational configuration there are likely to be several cascaded decoding/encoding processes resulting in a concatenation effect.
- Restricted MPEG-2: Here the concatenation problem is avoided by restricting the compression process to a limited subset of MPEG-2 so that frame-accurate editing can be performed. A typical case is the Sony SX system. SX records an IBIBIB GOP structure. Each B frame is the result of a forward prediction (from the previous I frame) and a backward prediction (from the next I frame). It is therefore dependent on both surrounding I frames. If one of the reference I frames is substituted by a new I frame, as a result of editing, the B frame cannot be completely reconstructed. To avoid this, the B frame immediately preceding the newly inserted I frame, at the edit point, is reconstructed using only the information from the previous I frame. It effectively becomes a P frame, which Sony calls a BU (unidirectional) frame. The original open GOP is effectively replaced by a closed GOP. This is achieved by using a pre-read playback head whose output is decoded and used to generate a BU frame which is switch-selected and recorded on tape, replacing the originally recorded B frame. After the BU frame is inserted, the switch returns to the input video source. The result is a seamless edit. Figure 3 shows the conceptual block diagram of the insert editing process. Figure 4a shows the original IBIBIB sequence recorded on tape. Figure 4b shows the edited sequence. The newly created frame is referred to as the B'U3 and all new frames are identified with a prime sign. ■

The same technology that made digital processing of full quality video possible also made compression techniques practical and affordable.

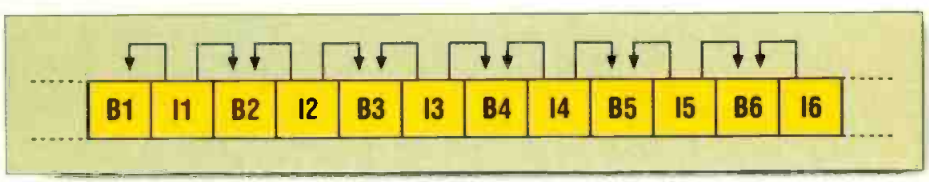

Figure 4A. Original BIBIBIBI sequence recorded on tape.

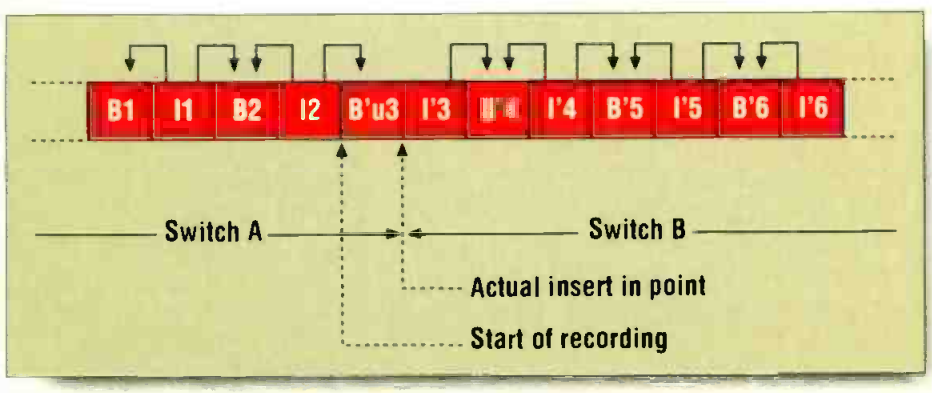

Figure 4B. Edited sequence showing unidirectional B'u3 frame followed by inserted signal.

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

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Set-top boxes

BY BRAD GILMER

Quick, answer this question: After your signal leaves the antenna, what device receives it at the other end? If you answered "a television," you are both right and wrong. A television may be used to view the signal, but in about 80 percent of U.S. households, a demodulator at a cable television headend receives the signal. The signal may be downconverted to an IF frequency, and then upconverted and multiplexed with a number of other signals and fed to the consumer's television. Frequently, the device that is used to tune to different signals is a set-top box (STB). The STB may also be required to access special services that are not available through the TV.

STB basics

In the very early days of cable, all cable channels were in the normal VHF television spectrum. It was not long, however, before cable systems ran out of capacity. In a bid to increase channel capacity, cable systems put additional television channels in the superband – the frequencies between VHF and UHF stations. Of course, TV tuners at the time were unable to tune to these frequencies. To resolve the issue, cable systems provided the customer with a STB. The box contained a downconverter that would tune all conventional VHF television channels and the additional superband. The output of the STB was VHF channel 3 or 4.

As time went on, the cable market became more sophisticated. Cable companies began providing tiers of subscription service. STBs began to employ descrambling technology. At first these were simple schemes involving sync stripping, but later they included complex digital scrambling algorithms. In recent years, STBs have taken another turn. The WebTV STB allows the viewer to interact with television programming using Web-based technology. Replay and TiVo both allow viewers to selectively record and playback programming. PC tuner cards turn PCs running special software into advanced viewing devices.

I never thought much about STB technology until becoming involved in a project that allowed viewers to select different subtitle languages for display on their TVs. While subtitling technology has been around for some time, at the time of this project, subtitling in Asian languages using computers had not been implemented, due in part to the extremely large number of characters in some Asian languages.

Important factors in set-top box design are low shipping weight, tariff costs, few if any moving parts and security.

As part of this project, we learned a great deal about set-top box technology: Cost is everything. In addition to cost, other important factors in STB design are low shipping weight, tariff costs, few if any moving parts and security (both electronic and physical).

Cost is king

In our industry we frequently find that a manufacturer is reluctant to make changes to their product unless a key customer demands it. This is because the profit from the sale of a custom system rarely pays for the custom development. Sometimes, manufacturers do customize their product to suit a customer's need — automation systems for example. But in the set-top box world, cutting costs is the key to making products successful. For this reason, customization is out of the question. Unless you are buying hundreds of thousands, or millions of units, expect to get a standard product. This is not bad, as it helps manufacturers take advantage of volume production and it helps you as the customer save money.

During our subtitling project, we had extended discussions with a number of STB manufacturers. The technical solution for handling the over 40,000 characters of one variant of the written Chinese language seemed simple — add memory. The STB manufacturers agreed that, technically, there was no problem adding the memory required. However, they pointed out that the additional memory would make the box financially impossible. This is hard to fathom until one looks at the number of potential set-top box sales there could be in the Chinese market. There are more televisions in China than in any other country in the world. If boxes manufactured for China are on the ragged edge of profitability, and if the volume of boxes sold into this region absorbs a majority of the manufacturing capacity of a set-top box company, that company may suffer significantly from incorporating a costly technology into the box.

At the risk of this becoming Economics 101, you might wonder why the manufacturers cannot simply increase the price of the box to compensate for the cost of additional components. The reason is the market is price sensitive. Most STB purchasers negotiate for thousands if not hundreds of thousands of boxes per contract. These negotiations put incredible pressure on manufacturers to keep prices as low as possible. If a manufacturer adds a $1 part, it is unlikely that they will be able to get an additional $1 in revenue because of the extremely competitive nature of the business.

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Important STB considerations

Another factor to consider is shipping weight. STB manufacturers and STB purchasers are very conscious of shipping weight. Why? STBs are shipped more often than you would think. They are shipped from manufacturing centers offshore. They are warehoused by the vendor and then shipped to the purchaser. The purchaser then has them shipped to various cable outlets and perhaps retail centers. The boxes may then be shipped from the cable company to the user and, finally, the user may ship a defective unit back to the cable company for repair. That is a lot of shipping. When the boxes have a low per-unit cost, shipping costs become a part of the total cost equation, especially when purchases can be in the hundreds of thousands of units. The design mandate is, "make it light." This is simple to understand once you see the problem, but it is not something we would normally consider.

International tariffs are also a significant consideration in STB design. STBs are used all over the world, not just in the U.S. Different governments have different tariff structures, some of which are very strict. It is not unusual for some companies to impose a tariff on a STB that exceeds the value of the STB itself. It can be difficult for manufacturers to address this problem because tariff regulations are different the world over.

Cable companies have incorporated security features into their STB designs for years. STBs have traditionally incorporated hardware security, software security or both. Hardware security can consist of special screw heads on boxes, special labels that if broken void the warranty on the boxes and, in extreme cases, systems that detect whether a box has been opened. When the box is opened, vital components in the box are rendered inoperable. Software security is a topic unto its own. Security has moved from simple sync scrambling and carrier trapping to digital audio scrambling to complete digital signal scrambling and beyond.

In all cases, cable system operators and STB designers are between a rock and a hard place. On one hand, security features should be strong enough to keep the cable systems from losing revenue. On the other hand, remembering that cost is king, security features must be inexpensive to implement. Cable operators do not mind spending substantial amounts for system security at the head-end because that is typically a one-time charge. Expensive security features implemented in the STB are paid for every time the operator purchases a box. Some ingenious security schemes have been developed even though cost constraints are severe.

Today, set-top boxes can have multiple processors, hard disks, memory and modem connections.

On another note, perhaps the label should say, "no serviceable components inside." In the world of consumer products, the cost to repair a device may frequently approach or even exceed the purchase price. Have you priced the repair of a consumer VCR lately? The same situation exists for STBs. STBs are not designed for in-depth troubleshooting. Usually they consist of a single PC board. If the box does not work and the problem is not a switch, replace the PC board. Some large STB purchase contracts specify that the manufacturer is responsible for warranty replacement of the STB for the life of the unit. In most cases, even though the STB may be sent back to the manufacturer, it is discarded. Why throw out an STB which may only suffer from a broken switch? Because the manufacturers have had years of experience repairing STBs. On average, they know exactly how much time it will take for a technician to locate a problem and fix it, and they know exactly how much the replacement parts will cost. If the average cost to repair the product exceeds the cost of a new unit, the old unit is discarded.

Set-top vs. computer

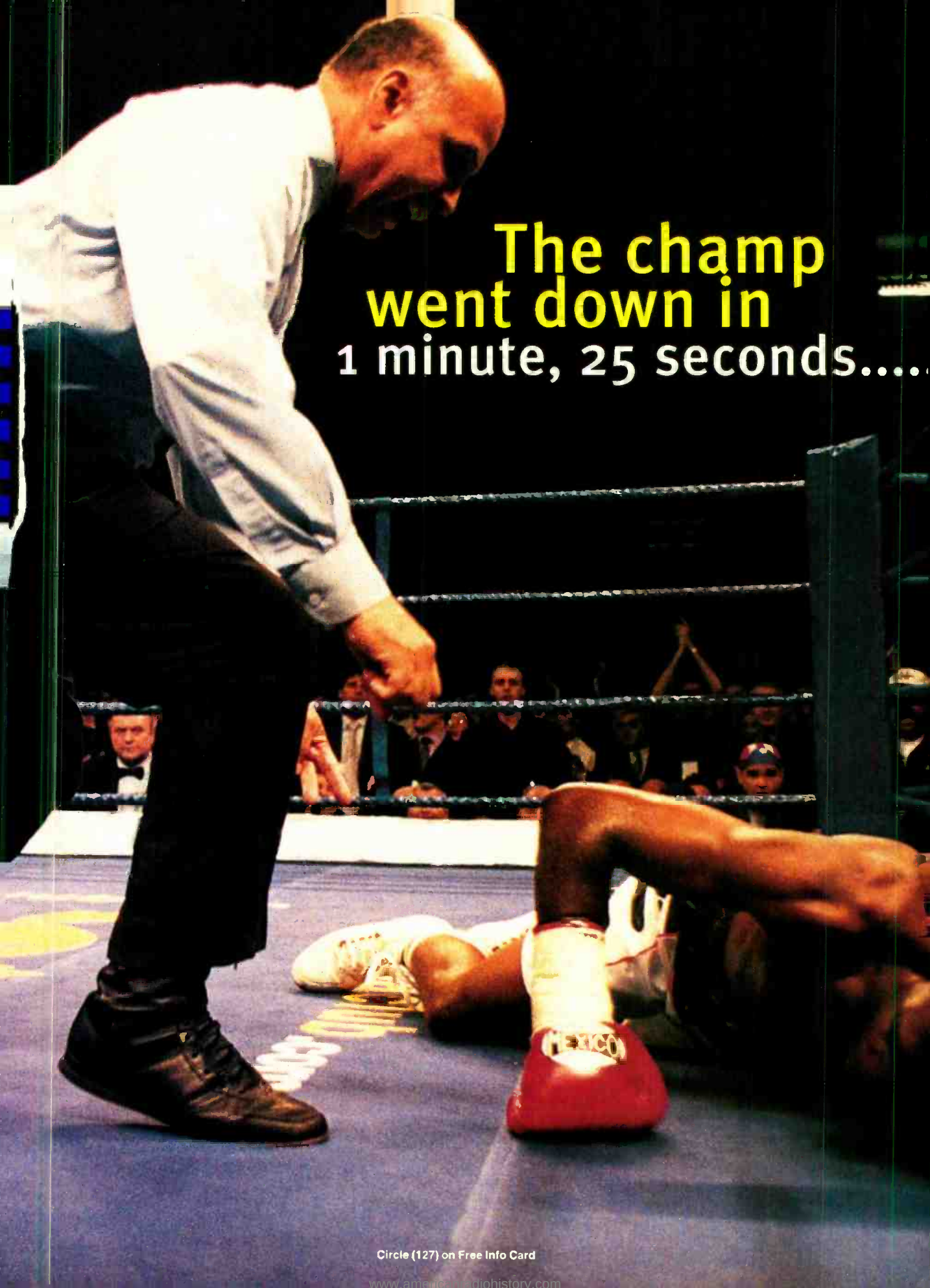
You might wonder, what is the difference between an STB and a computer? The short answer is not much. In the early days, STBs included a tuner and perhaps some descrambling circuitry. It was not long before STBs started to incorporate microprocessors. These processors provided enhanced security and billing technology. Today, set-top boxes can have multiple processors, hard disks, memory and modem connections. Operating systems include embedded systems programming languages, Windows CE and the many variants of UNIX.

What about the cost issues raised earlier in the article? Manufacturers are constantly pressed between incorporating more functionality in their boxes and holding down costs. As the price for major components such as hard disks and memory fall, manufacturers are able to incorporate these into their designs without driving the cost of the STB through the roof.

Programming STBs is an art in itself. In the past, memory prices were so high that programs were optimized to be as small and efficient as possible. Most programs were written in machine code, or perhaps assembler. As memory prices fall, the requirement to make software as compact and efficient as possible is decreasing. In any case, the conventional STB software program is much more tightly coded than the typical desktop application.

Most of this article focuses on issues surrounding traditional STBs, but new STBs such as WebTV, Replay and TiVo are bound to change the rules. These boxes cost substantially more than conventional STBs. The design rules for these boxes are different. Costs of critical components such as memory and hard disk storage continue to fall at incredible rates. Several years ago, there was much talk in the industry of the "killer app," the application that was going to drive a huge spike in computer/television/STB sales. While the search for the killer app goes on, one thing is clear: The economics of STBs are changing and the complexity of STBs is increasing dramatically. ■

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



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Ask Dr. Digital

How long is too long?

BY STEVE EPSTEIN

As a floating engineer on a sports truck, we have several pieces of "specialized" equipment, including an Abekas (now Accom) A42. We rely on this still store and need quick, economical repairs. We have spoken to Accom and they are unwilling to support it at the level we need. Although they do not charge for phone support, board exchanges average about $3000 and turn-around times range from several hours to next day, making it a little tough on us during live events.

To make matters worse, Accom has no plans for an A42 replacement. From what I have found, neither does anyone else. What I think is needed is a device with a 1GB hard drive, two frames of RAM and a removable drive for bicycling stills between trucks and stations. Can this be done for $35,000 to $40,000?

Wayne Cooke
National Mobile Television

At first glance, I would think that there are several devices that could be adapted to fit the bill, however, most would not include the removable drive for bicycling the stills. At the same time, it would need robust software and quick response to meet the demands of live events, not to mention the tortures of constant movement on the interstates. Any manufacturer wannabes out there interested in that challenge?

Getting back to the question at hand, I checked with Accom to get their read on the situation. Here is what they had to say:

The A42 Still Store, introduced in 1983, was the very first product from Abekas Video Systems. Abekas was sold to Scitex in 1995. When Accom acquired the assets of Scitex Digital Video in 1998 we decided that we would support all of the older Abekas products for as long as possible. Remember that many of the older Abekas products like the A42 have been out of production for almost a decade, and Abekas has changed ownership twice in that time.

As with all Accom products, and as is a generally accepted practice in the industry, technical support for the A42 is on a board-exchange basis. We may not succeed 100 percent of the time, but our objective has always been to provide overnight board replacement service. By providing overnight board exchange, customers can be assured of the fastest turn-around time possible when they have problems. Given the low volume of boards involved, providing a parts-only or "by-the-hour" repair service is not financially feasible and would be much too slow for most users.

Accom's award-winning service department offers board exchanges at prices that recover the costs of support — otherwise support would be out of business and there would be no support for any of our customers. We also believe that our prices are in line with the general price levels in the industry for comparable products.

Our customers are extremely important to us, whether they buy new equipment or need service on older products. Accom's goal is to continue to support its products as long as replacement parts are available and boards can be repaired. We do this for the oldest products, even when a "later & greater" model is currently for sale. We don't believe that any other company within the industry can match Accom's record in supporting products that are no longer in production. The Abekas brand name is highly regarded in the broadcast community, and Accom is working to maintain the Abekas reputation for product quality and service for all of our products, old and new.

Harris Rogers
Vice President, Marketing
Accom

Well that response was a bit more promotional than I had in mind, but Harris makes some good points, including the fact that Abekas went out of business long ago. I think everyone agrees that some support is better than nothing. How many software companies (including Microsoft) are no longer supporting versions that are only a fraction as old as the A42? As part of the research for this piece, I looked through several 10-year-old issues of BE. Abekas was one of the only companies that advertised in those issues that is no longer around. The truth is broadcast has had it very good for a long time.

The truth is broadcast has had it very good for a long time.

Unfortunately, most broadcast manufacturers can no longer compete with the computer industry's commodity products and pricing. Why design a custom keyboard that costs $500 when you can buy a PC keyboard for $5? A decade ago, Newtek sold thousands of Toasters for one-tenth the price of dedicated video hardware. Today, much of Toaster's sophistication is available in products that can be bought for one-tenth of the price of the Toaster. Reliability, extensibility and other aspects of these products may be reduced, but so are the prices. The world has changed. If you really want the level of support that was available 10 years ago, are you prepared to pay the price? Ten years of buying cheaper and faster products from the computer industry equates to a resounding NO.

If you have a question or comment, drop me an email at: drdigital@compuserve.com.

Steve Epstein is a freelance technical consultant based in the Midwest.

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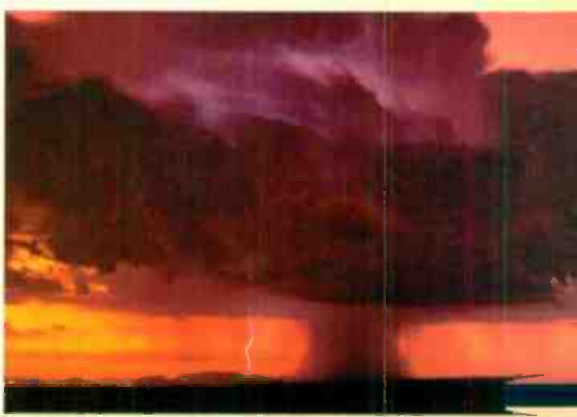
AccuWeather: Custom Weather,

Good ideas are one thing, quality implementation and execution make them happen. Recently, AccuWeather entered live television broadcasting by offering WeatherTeam and WeatherTeam Live. The concept, which originated in October 1998, is to allow local TV stations and networks to outsource or supplement weather show production. AccuWeather prepares custom-designed weather shows and delivers them via satellite or fiber for live or delayed airing. A station or network can also have round-the-clock access to an expert meteorologist for live coverage of severe weather events.

More than 85 meteorologists, 50 graphic artists and support personnel work in AccuWeather's 8200-square-foot operations room, shown above. The wall in direct camera view received royal blue paint and a "weather center" sign in order to serve as the backdrop for weather talent.



by Jay Mathieu

Custom Broadcast

The idea of a custom-designed weather show attracted MSNBC, which tapped AccuWeather to be its weather content provider. This meant that, in addition to a completely automated weather graphics system for hourly updates, AccuWeather would provide live coverage via satellite of any breaking weather news. WeatherTeam was born.

AccuWeather had to build the service from the ground up. Constructing the studios and master control and specifying the uplink antenna were the first orders of business.

AccuWeather called upon Synergistic Technologies Inc. (STI), headquartered in

nearby Pittsburgh, for help. STI plays a pivotal role in AccuWeather's success in the broadcast industry. Working under a tight deadline, STI designed the production and satellite uplink systems.

At the same time, AccuWeather worked with MSNBC producers to determine studio and camera shot specifics. Creating a system that would serve any and all TV stations and networks, domestic and international, proved to be a formidable task. Further complicating the program, AccuWeather decided to provide analog as well as digital service, originating from a serial digital source. The studio and graphic treatments had to be carefully planned as well, because not all affiliates would choose to make use of the same style presentation.

A 16-input Grass Valley 1200 serial component digital production switcher is the keystone of master control. Inputs to this switcher include two Panasonic DVCPRO and one Sony Beta SP tape machine. Two VueTech jog/shuttle controllers and a Panasonic edit controller remotely operate these inputs. Sources also include two Sony DXC-D30WS digital cameras, two UltraGraphix ULTRA and two UltraGraphix Animator Weather Graphics Systems. The weather graphics systems are proprietary to AccuWeather, built on SGI-02 and PC technology respectively. The intercom system is a PL-Pro Master Station from Clear-Com.

A Wegener DVT-2000 MPEG-2 video transmitter encodes segments digitally, while a Miteq VM-100R video modulator processes analog transmissions. A remotely controlled Andrew 4.5-meter antenna with redundant 350W amplifiers and upconverters transmits the feeds. The antenna has "fast-track" capabilities, providing the capability to switch from one satellite to another in a short period of time. AccuWeather often jumps from satellite to satellite, delivering weather reports rapidly. Two Wegener Unity 4000 MPEG-2 IRDs and one Drake ESR 1255 Earth Station Receiver are also in place for confidence monitoring.

Using a Leitch up/down timer, AccuWeather will typically generate shows that range from 30 seconds to three minutes or more. Certain AccuWeather affiliates will sell two minutes of advertising to be used with a three-minute weather show, filling a five-minute block. Others will insert the WeatherTeam show during the local newscast, use the service when its weather talent is on vacation, orbroadcast 30- to 60-second weather updates during commercial breaks.

It was decided that MSNBC would utilize AccuWeather's 8200-square-foot operations room as the backdrop for the weather talent. The operations room is home to more than 85 meteorologists, 50 graphic artists and many support personnel, including editors and customer service representatives.

> AccuWeather often jumps from satellite to satellite, delivering weather reports very rapidly.

The operations room replicates a newsroom setting, which grants a certain sense of urgency that would not be achieved with traditional blue or green chroma key presentations.

The anchor desk is located in the center of the operations room, with a Fujitsu 42-inch Multisystem Plasmavision display monitor for weather graphics positioned just behind the talent. AccuWeather's own UltraGraphix ULTRA Weather System creates state-of-the-art weather graphics and animations seen on this screen. A typical segment consists of a combination of talking-head camera shots and full-screen graphics. A Chyron Codi Sketchpad telestrator embedded in the anchor desk is directly in front of the talent. This 13-inch touch screen allows the meteorologist to draw on the video for illustration and emphasis.

Environmental changes were necessary. The existing operations room was not particularly photogenic. Its white walls and a 21-foot high ceiling did not make for appealing television. To remedy this, the wall in direct camera view received royal blue paint and an 18" x 4" weather center sign. STI called in Vincent Lighting to contribute its expertise in the difficult task of lighting the set area of the operations room. Designed exclusively for MSNBC and NBC affiliates, the set left AccuWeather with the task of building

Master control for AccuWeather's WeatherTeam and WeatherTeam Live segments is equipped with a 16-input Grass Valley 1200 serial component digital production switcher.

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AccuWeather

another set to serve additional WeatherTeam and WeatherTeam Live customers. A second set offered different views and camera angles.

Soon after AccuWeather began serving MSNBC with breaking weather news, CNBC contracted for a similar live service. Many local stations, most without news programming, also turned to AccuWeather. These stations see the service as a way to generate advertising dollars without the expense of production and staff. Many network news programs acquire reports from AccuWeather during newsworthy weather events.

A mix of digital and analog feeds originates from AccuWeather, dependent upon customer requirements. Customers can book the satellite time on the transponder of their choice, or AccuWeather will arrange for the windows.

In September 1999, AccuWeather accepted the challenge to provide weather broadcasts to Paxson Communications. AccuWeather delivered custom weather shows for PAX stations in the top 15 markets and three regionally syndicated shows to be aired by the remaining affiliates. PAX wanted the shows to be in three segments, allowing room for sponsorships. Each show would fill a five-minute block, which would include three minutes of weather and two minutes of advertising. At 11 p.m. on weekdays, PAX planned to push back network programming for five minutes and insert the sponsored weather block.

PAX wanted multiple segments, and they wanted them to be fully produced at AccuWeather. There would be no post-production responsibilities passed on to the affiliates. AccuWeather purchased a Spencer Technologies stillstore to place lower-thirds and the PAX First LOCAL Weather banner. The Spencer 2000 overlays 32-bit Targa files onto the video, utilizing the file's alpha channel.

PAX also wanted the camera shot to be different from anything else that was currently being done by AccuWeather. They wanted the talent to be standing beside a big-screen monitor, rather than sitting at an anchor desk. For this, AccuWeather implemented a Mitsubishi VS-50603 50-inch monitor. The final shot consists of the monitor with the talent at screen right and an overhead banner with the PAX First LOCAL Weather and affiliate logo.

Two UltraGraphix Animator Plus Graphics Systems, developed and sold by AccuWeather, are used to compress the time required to create the weather shows for individual markets. The AccuWeather broadcast meteorologist can jump back and forth between computers. While one system is in use, the other is automatically generating the next city's show. By the time the on-screen talent is ready to move on to the next city, the graphics are up-to-date and ready to go. A simple pushbutton switcher is used to move between the two systems.

The PAX weather blocks incorporate a combination of camera shots and full-screen graphics. While the meteorologist is off screen, he can use the telestrator on either desk to draw the screen graphics. The PAX shot takes place between the two sets, so either telestrator is handy during the presentation.

AccuWeather broadcast meteorologists typically do not use prompters, but the lengthy sponsor tag lines inserted before and after each PAX segment required installation of a Q-TV MVP-12 prompter running WinCue Pro software. The beginning and end of each segment has voice and music, rolled into affiliate-specific audio intros and outros.

The massive amount of time-sensitive material to be delivered required a full-time MPEG 28Mb simplex video circuit. Triumph Communications of New York provided the complete end-to-end fiber installation and provides continuous support of the video service. This gives AccuWeather a direct, always-on, connection to the PAX NOC in Clearwater, FL. By employing the fiber link to deliver PAX weather programming, AccuWeather is able to make use of the satellite uplink in other ways. While feeding the PAX shows, AccuWeather can also be covering a hurricane on MSNBC.

Video broadcasting manager Jay Mathieu oversees AccuWeather's television and Internet broadcasts.

> White walls and a 21-foot high ceiling did not make for appealing television.

Today, AccuWeather applies a variety of techniques to deliver weather content to its customers. Continual growth and added capabilities allow AccuWeather to keep up with today's demand for weather in the broadcast industry. Most recently AccuWeather confronted the profound effect that convergence will have on the broadcast industry by broadcasting on the Internet via streaming media. This groundbreaking capability presented a whole new set of technological challenges. ■

Jay Mathieu is manager of video broadcasting at AccuWeather.

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Transmission & Distribution

Tower lighting

BY DON MARKLEY

We all are aware of the regulations concerning the care and feeding of tower lights. A recent article described both the actions that must be taken to notify the applicable powers that be concerning lighting failures and the requirements for their repair. However, the existence and logic concerning such lights still seems to be a mystery to some.

When a tower is planned, one of the initial pieces of paperwork is to file FAA Form 7460-1 with that agency. That form is a Notice of Proposed Construction and is used to initiate the formal study to determine if a tower is possible at the desired location and height without causing a hazard to air navigation. The filing is not always necessary. The Rules and Regulations contain the criteria to determine if such notification is required. If the tower is under 200 feet AGL and is not near any aeronautical facilities, it does not need to be lighted or marked, nor does the FAA have to be notified. That means that construction can proceed, if no FCC Construction Permit is required, without concerns about hazards.

Watch out for proposed facilities

There is a kicker here. The requirement concerning aviation facilities includes those facilities which have been planned and for which notification has been filed with the FAA. Without a bit of a study, it is sometimes difficult to know just where such facilities may be proposed. Unless it is obvious that no airport facility could possibly exist in the vicinity of the tower (hills away from town, etc.) file the form. Remember, an aeronautical facility can be other things than an airport. For example, the FAA is a bit touchy about transmitters located near their navigation or communications facilities. Filing is acceptable insurance and covers your back just in case something has been missed. If notification is not necessary, the FAA will return the form with that notation and you can proceed without worry.

The forms are filed with the area FAA office that is responsible for your state. The form and the name and address of the appropriate office are available from the FAA website (www.faa.gov). On the form, you can indicate the type of marking and lighting that would be preferred, including "none" for short towers. Again, if notification is not necessary, no marking or lighting will be required. By the way, the term "marking" refers to painting the tower with the customary seven stripes of international orange and white. All painted towers now have seven stripes of equal width with the top and bottom being orange.

Environmental organizations have become largely resistant to strobe lights at night.

If the FAA determines that your notification was necessary, they will perform the study to determine the possible impact of the tower on aeronautical navigation. This will include the approaches to area airports, which also considers all instrument approach, departure and missed approach paths, proximity to airways and proximity to Visual Flight Rules (VFR) flyways.

A VFR flyway is anything that pilots may elect to use as a navigational aid in times of marginal flying conditions. If over noncongested areas, a pilot may legally fly at 500 feet above the ground. During marginal flying conditions, when the ceiling is over 1000

FRAME GRAB

A look at consumer side of DTV.

Broadcast's eyeshare dwindles

Broadcast TV's share of "eyeball" hours declined despite an overall increase in time spent in front of a video display.

	1996	1997	1998	1999
Broadcast TV	980	926	884	840
Cable/Satellite	587	635	678	846
Home Video	49	50	56	57
Video Games	26	36	43	48
On-Line	16	28	74	97
Total	1,658	1,675	1,735	1,888

SOURCE: CEA- www.cea.org

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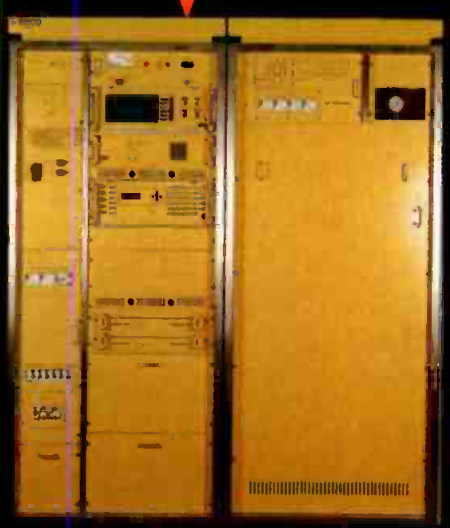

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feet above ground and the visibility is three miles or more in controlled airspace, a pilot may elect to follow a road, river or railroad that he may know will guide him to a desired location. If the proposed tower is not over 500' AGL, the tower will not normally be considered to have any impact on such visual flight rule flights. Anything over 500 feet AGL will automatically be considered to be a hazard if within two miles of a VFR flyway and will require circularization to all concerned parties for comments. The two-mile margin accepts the fact that pilots have learned to stay to one side of such flyways. If they fly right down the middle, they run the risk of meeting another equally stupid pilot coming the other way.

Assuming that everything goes well with the FAA study, a Notice of No Hazard will be issued. The cute part here is that the FAA determination of whether or not a proposed structure would be a hazard is their opinion and acts to recommend to other agencies whether a tower should be approved. As an opinion, it is not subject to review in the courts. That is to say, if you receive a determination that a tower is a hazard, the FCC will not issue a construction permit. You are done at that site unless you make changes and reapply.

If a determination of no hazard is made, the FAA will recommend the desired lighting and marking. On many structures, the proponent is given the choice of either strobes or conventional (red) lights with painting. The FCC, when issuing the construction permit (if any) will often give that option to the applicant. Where no construction permit is required, as in those cases where a company is going to build a tower simply to lease space to others, the owner can rely on the FAA determination to pick the lighting and/or marking scheme.

Strobes vs. conventional lighting

There was a period of time when strobes were considered to be the lighting plan *du jour*. Every tall structure was specified with high-intensity white lights. There was only one little problem with this scheme of things – the citizenry screamed like mad. It turns out that many people don't like looking out at strobes at night. During the day, such lights seem to be largely acceptable. But, at nighttime, a large portion of the populace finds them to be offensive. As a result, elected officials started getting lots of complaints. That resulted in cries of protest to licensees, the FCC and the FAA. The outcome was a tempering of the use of high-intensity strobes or medium-intensity strobes for shorter towers.

Many building codes now require that towers have either red lights and paint or dual lighting systems that use red lights at night.

It was also thought for some time that high-intensity strobes aided aeronautical safety by making the towers more visible to pilots at night. It was later shown in some studies that the advantage was not as great as originally thought. It seems that pilots would fixate on avoiding a big strobe lit tower and miss other structures that had red lights. In other words, they would be so careful to watch out for the strobe lit tower that they were in danger of hitting other towers. They might be congratulated for missing the 2000-foot tower and only hitting a 1000-foot tower. Certainly, such pilots felt much better for their actions.

An additional reaction to the one time mass shift to high-intensity lighting has been the modification of building codes in many areas. Elected officials are highly responsive to complaints from the residents of their districts who vote for them. As a result, many building codes now require that towers have either red lights and paint or dual lighting systems that use red lights at night. Many broadcasters prefer such a system as well. They don't have the expense of maintaining the paint on the towers and they avoid the complaints of those who live in the vicinity of their towers.

One other major factor has become involved in tower lighting schemes: Environmental organizations have become largely resistant to strobe lights at night. There is a strong argument that such lights are hazardous to birds that may reside in the area or that may fly through the area when migrating. You haven't lived until you have listened to nature lovers who have found a bald eagle lying near a tower with a broken neck. That concern, while realistic, has been questioned in the past. For example, a two-year study of dead birds found around two tall towers in Iowa found that no birds were found that were listed as either endangered or concerned species. On the other hand, many of those birds where listed by the Department of Agriculture as disease carriers and common pests. Based on those results, it could be argued that the towers were providing a service to the community. It is an argument doomed to be greeted with scorn as happened when this author presented it at a zoning board meeting (with tongue planted firmly in cheek).

Still, the bird kill concern must be considered. In areas where birds such as the bald eagle are common or along well-known migratory flyways, special thought should be given to the use of dual lighting, even for very tall towers. These concerns have to be balanced with the high priority of aeronautical safety as well as the wishes of the public. As both the FAA and FCC are governmental concerns, they do respond to public input and to the comments of legislators (especially the latter). If at all possible, they will attempt to call for the use of the less obtrusive use of dual lighting when requested.

To summarize, don't hesitate to make your case for the type of lighting you would prefer on your proposed tower. Take into consideration the local requirements and the likely response of your management to complaints from the public. As a general rule, if you use straight strobe lights on your tower, you will receive complaints. ■

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

Send questions and comments to: don_markley@intertec.com

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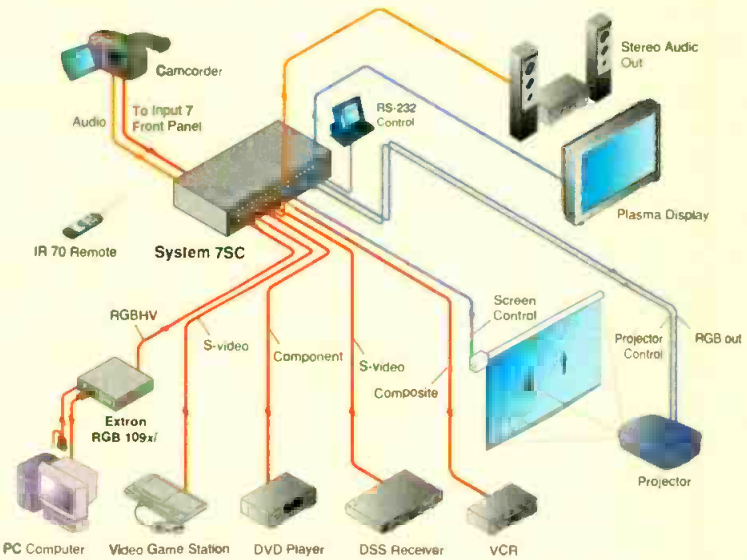

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Surround sound

BY JIM STARZYNSKI

Surround sound technology has been a part of the broadcast world since TV in the U.S. went stereo in the mid-1980s. The decoding format at the time was Dolby Surround, a matrixed encoded three-channel (L,R,S) audio soundtrack, a descendent from the film industry that is capable of being transported on a two-channel, stereo infrastructure. This proved to be a terrific advancement for TV stations, requiring only a minimal amount of upgrading to implement and brand their stereo stations with surround capabilities.

Much has happened since this innovation. Currently, there are two primary surround sound formats from Dolby Labs for the film, consumer electronics and television industry — one of which is Dolby Digital, the exclusive standard for ATSC Digital Television in the U.S. The other is the Dolby Surround format. Each of these has evolved to include added features as explained below. Digital Theater Systems (DTS) has multiple film and video formats and SDDS (Sony Digital Dynamic Sound) has a competing film format as well.

Formats for TV and film

Dolby Surround: Loosely termed 3 Stereo, this passive surround decoding technology was first introduced to the upstart home theater market in the early to mid-1980s. This technology lacks an active steered center channel but provides a mono surround channel for listeners. Dialog information is created by the left/right speakers and reproduced as a phantom center channel image. As long as the left/right audio signals are of equal level and the listener is in the correct viewing position, dialogue comes from the center of the home theater system, hopefully the same place the image is located. The rear channels incorporate a form of Dolby B noise reduction and have a limited frequency response of 100- to 7000Hz. Consumer Dolby Surround gear has been supplanted by Pro Logic equipment.

Dolby Pro Logic expands on passive surround by providing the listener with a steered center channel speaker output designed to draw dialog and effects to the screen of the program. This 1987 innovation allows the audience to sit anywhere in the room and always localize the dialog and center effects information as coming from the picture, as long as the center speaker is installed above or below the screen.

Pro-Logic II expands on standard Pro-Logic by offering additional movie and music modes to the decoder offering a more discreet-like experience to the rear channels for the listener.

Dolby Digital: In the early 1990s, Dolby Digital was introduced to the motion picture industry and subsequently started to hit the consumer video marketplace about five years later. This new technology brought digital reproduction with it and eliminates matrixing and the frequency response limitations of passive surround and Pro Logic. It's capable of up to six discreet digital channels, five of which can be full frequency. The system is based on audio bit-reduction technology. It uses perceptual coding and auditory masking to eliminate information in the original audio that is undetected by the human ear. (See Production Clips, *BE* February 1999.) This encoding and decoding process uses the Dolby AC-3 lossy bit-reduction algorithm. This process significantly lends itself to video technologies like DVD-V, LD and DTV where the image and ancillary data require massive amounts of bandwidth from the comprehensive transport stream.

Dolby Digital Surround EX adds an active steered *rear* center channel to a 5.1 soundtrack. It does this by matrix decoding of the left and right surround channels but does not require any additional channel infrastructure before decoding to do so.

DTS: Digital Theater Systems' first soundtrack was introduced in 1993. 5.1-channel DTS technology is used in motion picture, DVD-V, -LD and -CD formats. DTS' perceptual coder uses a lossy algorithm and operates at a higher bit rate than Dolby AC-3. Because of this process, DTS claims more accurate reproduction. However, the increased bandwidth required over AC-3 prohibits use of DTS in some applications.

In June, a new DTS-ES program introduced DTS-ES Discreet, Matrix 6.1 and DTS Neo:6, all of which add an additional channel to existing rear channel surround reproduction.

SDDS: Sony Dynamic Digital Sound is a motion picture-only format introduced in 1994. It boasts eight channels of discreet digital sound. The bit-reduction process is a lossy type utilizing the Sony ATRAC algorithm, the same technology used for Sony MiniDisc.

Viewers will continue to demand bigger and better quality audio programming to accompany their DTV pictures.

ATSC audio: How does it fit in?

Dolby Digital is the consumer name for products incorporating Dolby AC-3 encoding and decoding and, as stated above, is the standard for ATSC audio. Dolby Digital, however, does not necessitate 5.1-channel sound, as it may be misunderstood to do so, although it *may* be configured for 5.1 channels of audio. Dolby Digital programs may be recorded or transmitted in mono, stereo, matrixed surround (LT-RT) and a variety of multichannel configurations.

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A 3/2 (three front, two rear) channel setup and an additional low-frequency enhancement channel (LFE) is the maximum number of discreet channels possible, totaling 5.1.

This 5.1-channel audio payload is carried at a 384kb/s ATSC rate and has a frequency response for the main five channels of about 20- to 19kHz. The LFE is band limited to 120Hz.

The low-frequency enhancement channel may contain special discreet audio program content (additional effects like booms and crashes) and is not the same as the subwoofer's role. Therefore it's different than and in addition to the other low frequency signals that are contained as part of the main channels. Also, the LFE content is not downmix compatible. This means that if a DTV listener's monitoring equipment is not capable of 5.1-channel reproduction, an automatic downmix of the audio is usually available on the consumer decoder. This output supplies a Pro Logic-, stereo- or mono-compatible signal and is available at the digital audio output connection of the device and/or the analog RCA type connectors. Any low-frequency information contained in only the LFE will not be reproduced at this output. It is therefore necessary to make certain that all or some of any critical low-frequency LFE information is redirected to the main channels during a 5.1 mix or remix by the broadcaster, program supplier or re-mixer.

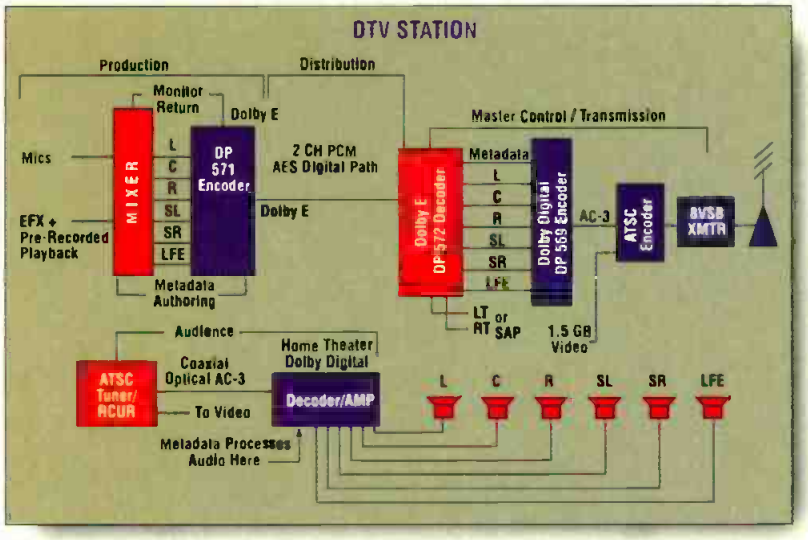

Figure 1. The DTV audio path through production, distribution, transmission and reception.

Mixing Surround Sound: NTSC vs. ATSC

Analog world: Mixing in Dolby Surround is an effective way to enhance an audio program with little additional equipment impact on the stereo TV infrastructure. A mixing console capable of at least four output buses and a suitable monitoring system is necessary, along with a surround encoder and decoder for creating multichannel programs. If properly mixed, a four-channel program mixed left-center-right-surround (LCRS) can be matrix encoded and the broadcast will be surround-, stereo- and mono-compatible. This composite-matrixed program will connect up within the plant on a standard stereo pair and can be decoded by the audience on Dolby Surround, Dolby Pro Logic and Dolby Digital consumer equipment.

The digital domain: Along with issues like 5.1 capability, the LFE and bit rates, it's also important to note that the DTV mixing engineer must establish the proper limiting of sound sources to prevent distortion. Unlike NTSC broadcasting, there may be no safeguard downstream to correct for errors. Increased dynamics are a goal, but proper levels must be maintained at the console (especially if it's digital) to avoid distortion from too hot a signal. Even metadata, as described below, can't repair a faulty signal once it's recorded. Levels can easily be monitored on any contemporary digital meter, especially the ones reading VU and peak simultaneously. Headroom should be used but cannot be completely used up. The digital path is not as forgiving as its analog counterpart and DTV's dynamics may be wide open right into the listener's living room.

The metadata element

Unlike NTSC analog audio, ATSC digital audio is accompanied by metadata information that is always present with the Dolby AC-3 bitstream. This data is used to adjust the audio at the listener's receiver/decoder. Metadata supplied by the producer or broadcaster allows the audio to remain in a fairly unprocessed form throughout the television plant and through transmission. Its intent is to both automatically adjust certain parameters like dialog levels and to allow the audience to select other pre-established settings like dynamic range choices. Other metadata establishes the amount and configuration of the channels; i.e. two-channel, 5.1 or Dolby Surround encoded, to name a few of the remaining settings.

Dolby E

Dolby E was developed to handle transporting multichannel audio within a digital television plant limited to a two- or four-channel AES audio infrastructure. It provides the necessary link at the distribution stage, the process in between contribution/production and emission of audio signals. Similar to AC-3/Dolby Digital, Dolby E has metadata capabilities compatible with the ATSC system. However, Dolby E's algorithm works at a higher bit rate than Dolby Digital and is capable of eight channels of audio encoded on a single AES pair including the metadata. Its signal is timed to the TV plant and is frame-compatible with video. Its milder codec is capable of about 10 cascades without noticeable degradation to the sound.

Dolby E provides a solution for transporting 5.1 channels of audio plus additional LT, RT or SAP channels along with metadata. It does this without the station having to expand its baseband infrastructure beyond an AES pair.

Four Channel Left-Center-Right-Surround (LCRS) program mixing at the professional level and LCRS (Surround and Pro-Logic) monitoring at the consumer level have blazed the trail for today's cutting edge 5.1 channel audio.

Viewers will continue to demand bigger and better quality audio programming to accompany their DTV pictures. Audiences are purchasing more and more multichannel home theater equipment, clearly stating their desire for outstanding audio soundtracks to support the amazing TV pictures DTV is capable of. ■

Jim Starzynski is principal engineer for Audio Technologies and Practices in NBC's Technical Planning and Engineering Group at NBC Headquarters in New York.

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Acterna's digital broadcast test and monitoring solutions enable broadcast engineers to monitor and troubleshoot their digital television transmissions in a TV station or network operations center. The WHD-TV Model Station depicted here provides an interoperability testing environment.

testing MPEG

by Pearse Ffrench

In the last few decades, computer technology has given automobile maintenance a complete makeover. Nowadays, the computer does the tinkering and, without it, the mechanic can do little to diagnose a problem or isolate a faulty part.

Similarly, broadcasting is facing its own technological shift as digital television replaces its traditional analog counterpart. Using computer technology, MPEG-2 digital compression shrinks TV programs, leaving more room in the broadcasting pipe for additional channels, HDTV, Internet, interactive services and more — all through the television receiver and all using the same amount of bandwidth that traditional analog services now occupy. These expanded possibilities offer increased revenue potential for everybody in the industry. But in order to take advantage of the opportunity, we're going to have to weather some changes. The

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digital transition will force nearly everyone in the industry to adopt completely new processes, learn new technologies and purchase new equipment—in short, we'll have to change the way we see broadcasting.

For many of us, the mental journey from analog to digital seems just as tenuous as the physical one. Chris Knechtel, manager of technical operations at the Model HDTV Station in Washington, D.C., meets a variety of broadcast professionals each week as they tour the Model Station. "The learning curve represents one of the greatest challenges for industry professionals across the board," he says. But with the FCC's mandate for all-digital broadcasts in the U.S. by 2006, we have little choice but to roll up our sleeves and dig in.

Knowing the basics of MPEG-2 transport is, of course, a must. Add that to a fundamental understanding of ATSC's PSIP tables and descriptors and you're building a decent foundation. Unfortunately, understanding the system is not enough. With the digital transition, programs and services will become "computerized and hidden" in transport streams, just like the innerworkings of the modern automobile. Without the right equipment in the shop, there is no way to diagnose or isolate problems in the new digital machine.

More often than not, breakdowns in digital transmission only become apparent when the picture suddenly disappears from the TV screen, giving broadcasters little clue as to the source or nature of the breakdown. Because of this, transport stream test equipment, which allows broadcasters to "see inside" the stream, will play a pivotal role in determining quality of service and customer satisfaction in the future. Like today's automobiles, digital television offers much more capability than its predecessor. But this new capability comes wrapped in a complex package that requires more sophisticated testing and measurement equipment than it ever did before.

MPEG-2 video compression

MPEG-2 video compression aims to reduce the amount of bandwidth needed to transmit a program without affecting its quality. This type of compression depends on *spatial encoding* and *temporal encoding*. Spatial encoding eliminates redundancy within a frame. For instance, a picture that contains a blue-sky background will likely contain several rows of identical blue pixels. Spatial encoding codes only one of these pixels, significantly reducing redundancy in the bitstream.

Temporal encoding eliminates redundancy between individual frames in the video stream. This can be accomplished through motion estimation and inter-frame prediction. Imagine, for instance, that you are encoding video that shows the bird's-eye view of a football game. Though the players move from frame to frame, the background scenery — the field itself — doesn't change. Temporal coding takes advantage of the similarities between sequential frames and encodes only the differences from one frame to the next. It also uses motion vectors to translate a moving object from one frame to the next, instead of re-encoding the entire object in each frame.

A compressed video stream is called an *elementary stream* (ES), as is a compressed audio stream. Though there are different methods for compressing audio streams, they all produce an audio ES, which is similar to the video ES. The audio and video ESs for a single program then follow a parallel path to the decoder, as described below.

MPEG-2 transport

Once an ES is compressed, the encoder creates a *packetized elementary stream* (PES) by splitting the ES into packets of one frame each (for video) or approximately 24ms (for audio). As with other forms of packetized data communications, each packet in the PES includes a header and a payload. (See Figure 1.) The header contains the *decoding time stamp* (DTS) and *presentation time stamp* (PTS), which tell the decoder when to decode and present the payload, which carries the picture or sound.

The PES is further divided into transport packets, the payload of which contains up to 184 bytes for each packet. A four-byte header is added for a total of 188 bytes per packet — the standard packet size for an MPEG-2 transport stream. A multiplexer combines the single-program transport stream with others like it to form a multiple-program transport stream. The multiplexer also adds data in the form of PSI/PSIP tables, which enable the decoder to locate and extract the components belonging to each program in the multi-program stream. It may also add to the stream additional data for interactive applications.

Each 188-byte packet in the transport

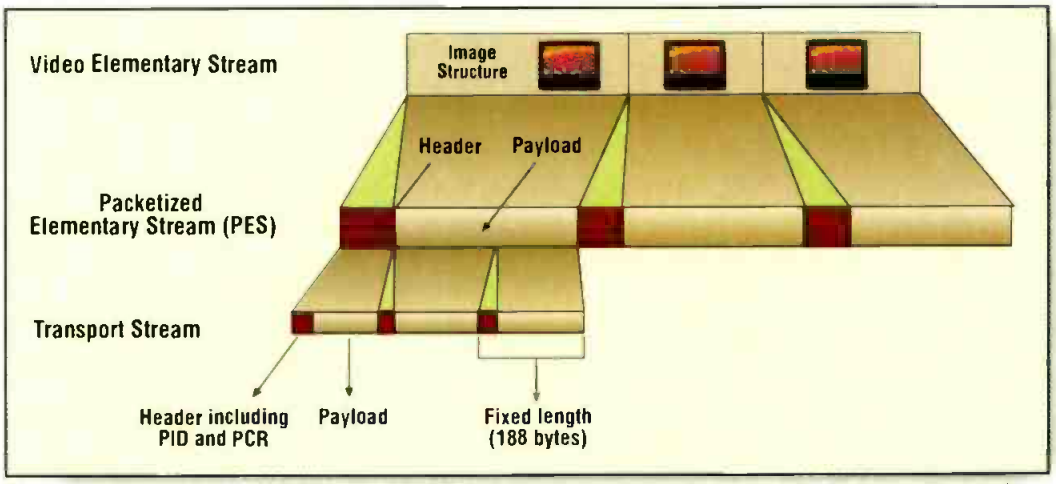


Figure 1. Each video frame from an MPEG-2 elementary stream is mapped into the payload of a packetized elementary stream (PES) packet. The PES packet is further divided into transport stream packets. A transport stream packet is 188 bytes in length with a fixed 4-byte header that contains the packet identifier (PID) and an optional variable-sized header that can contain the program clock reference (PCR).

stream, whether it contains audio, video, PSI/PSIP tables or data, is identified by a number called a PID, or *packet identifier*. PIDs allow the decoder to identify and sort the contents of the transport stream. This will become more apparent when we discuss decoding and the use of tables.

In order to maintain proper synchronization in the transport stream, the encoder periodically stamps transport stream packets with a *program clock reference* (PCR), a time value based on the system clock of the encoder.

PSI/PSIP tables

MPEG-2 *program-specific information* tables (PSI) provide the decoder with a map to the transport stream, which it uses to decode each program in the stream and present it to the viewer. The tables show the location of a program's audio and video components and tell the decoder whether the viewer has purchased access rights to the program. The tables are repeated frequently (for example, 10x/second) in the transport stream to support random access required by a decoder turning on or switching channels.

To expand the capabilities of the MPEG-2 transport stream, the Advanced Television Systems Committee (ATSC) developed its own set of tables called *program and system information protocol* (PSIP) tables. These act as extensions to the MPEG-2 PSI to provide such things as channel frequencies, event descriptions and ratings.

The following steps illustrate how a terrestrial digital television uses information provided by the PSI/PSIP tables to display a movie.

The first time the television is activated, it scans the range of available R/F frequencies. For each frequency that contains a digital television signal, it searches the stream for PID 0x1FFB, Table ID 0x00C8, which is the *terrestrial virtual channel table* (TVCT). In the TVCT, the television finds a list of all the channels available on the transport stream, along with their major and minor channel numbers. Because each R/F frequency can contain more than one digital television channel, the television uses the major and minor channel numbers to differentiate between channels located on the same R/F frequency. This allows it to provide quick access to any available channel upon request from the viewer.

Once all available channels have been located and identified, the television displays the list of channels to the viewer. The viewer selects, for example, KWWG-1 from this list, upon which the television uses the R/F frequency and the major and minor channel numbers to tune to the right frequency and find channel KWWG-1.

In order to take advantage of the opportunity, we're going to have to weather some changes.

Once it has decoded the transport stream on this signal, the television then locates the audio and video for the program airing on KWWG-1. This can be done in two ways:

The television once again finds the TVCT. This table contains a *service location descriptor* for each channel in the transport stream. The service location descriptor identifies the PIDs that contain the audio and video components of the program. The service location descriptor for KWWG-1 shows that the chosen video stream is located on PID 0x0070, while the audio track is on PID 0x0071. This descriptor also shows that the PCR for this program is on PID 0x0070.

The television locates PID 0x0000, which contains the *program association table* (PAT). This table points to the PID that contains the *program map table* (PMT) for the chosen program. Our hypothetical PMT PID is 0x0073.

The television then locates PID 0x0073, where it finds our program's PMT. The PMT identifies the PIDs that contain the audio and video components of the program. The television finds that the video is on PID 0x0070, and the English audio track is on PID 0x0071. The PCR for the program is also on PID 0x0070.

The television locates PID 0x0070 and PID 0x0071 and separates the audio and video packets out of the transport stream.

It then finds the timing information (PTS/DTS) located in the packet header of each audio/video packet and begins to process each packet for display to the viewer according to the decoding and presentation time specified in the packet header.

Meanwhile, the television locates the *system time table* (STT) on PID 0x1FFB, Table ID 0x00CD, to find the current date and time. This allows the television to start programs and advertisements on schedule and display the current time to the viewer.

The television next finds the *master guide table* (MGT) on PID 0x1FFB, Table ID 0x00C7. This table acts as an index, listing the PID values for each *event information table* (EIT) and *extended text table* (ETT) in the

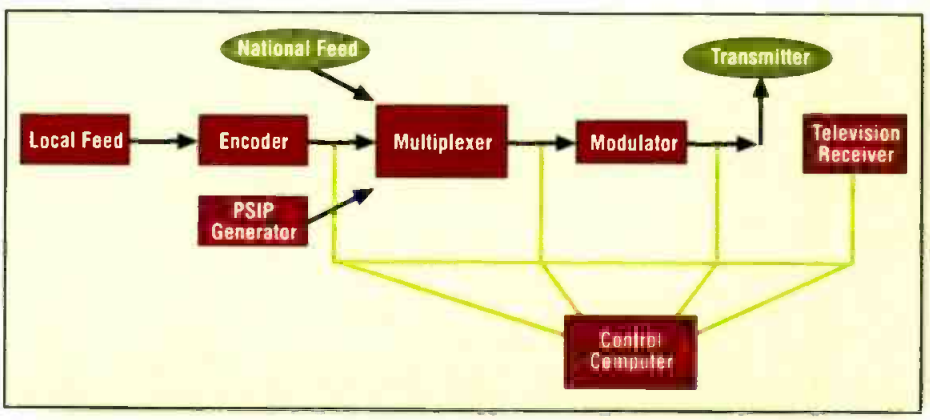


Figure 2. In this example, local programming is encoded and then multiplexed with the national feed downloaded via satellite. A PSIP generator supplies the multiplexer with table data for the transport stream. The stream is then modulated and finally transmitted to the viewer's receiver.

transport stream. These tables contain event (or TV show) details to be displayed in the EPG. The television finds that the EIT for our program is on PID 0x0050. This event also references an ETT, found on PID 0x0060.

The television identified the EIT on PID 0x0050. In the EIT, it locates the *content advisory descriptor*, which shows the rating value associated with this program.

The television next locates the *rating region table* (RRT) on PID 0x1FFB, Table ID 0x00CA. This table identifies rating schemes for different geographical regions. The television locates the rating scheme that corresponds to the country it is in. Using the value it found in the content advisory descriptor, it determines the rating for the program. If the rating is outside the user-specified parameters, the television will not display the program.

The television finds the rating is within the boundaries set by the user and begins displaying the audio and video for this program.

The television again locates the EIT, where it extracts the title, duration, and short description of the event and adds it to the *electronic program guide* (EPG) for display to the viewer.

Finally, the television locates the ETT for our program on PID 0x0060. This optional table contains a more detailed description of the event than can be given in the EIT. The television extracts the long description of the event for display in the EPG.

As the example illustrates, making sense of the MPEG-2 ATSC bitstream is a complicated process. Higher-level tables point the television to lower-level tables, which in turn point to specific packets of audio, video and data in the stream. This complex pointing structure exposes the MPEG-2 system to potential errors. A single flaw in the data can trickle down from a top-level table to affect the entire stream, causing errors in the EPG, delayed channel hopping or complete loss of a program.

In order to isolate and resolve these problems quickly, broadcasters and network operators rely on transport stream analyzers and monitoring systems to open the transport stream for inspection, verification and monitoring.

Transport stream testing and monitoring

The following examples illustrate common scenarios in which the right test and monitoring equipment will detect and isolate errors quickly, to ensure quality transmission throughout the broadcast chain.

• **Error isolation and finger pointing:** Because the broadcast data goes through several different forms or stages before reaching the viewer, the most effective monitoring solutions analyze the transport stream at various points along the transmission chain. This allows users to pinpoint and resolve errors as soon as they occur.

Figure 2 illustrates this concept by showing one example of a terrestrial transmission chain and indicating several possible monitoring points in the system. (Similar figures could be drawn to reference a cable or satellite system.)

As the figure shows, broadcasters can closely monitor the transport stream at each stage of this process — at the encoder, after the multiplexer, and before and after transmission. If an error first appears in the stream at the output of the multiplexer, operators can quickly isolate the multiplexer as the source of the error and repair or replace it without delay. By the same token, if excessive jitter appears on the stream at the output of the encoder, the cause of the problem clearly lies in the encoder.

One issue many industry players face is that of interoperability between different manufacturers' equipment. Because digital transmission systems almost always rely on equipment made by different manufacturers, a multiplexer made by one company must be able to read the output from another manufacturers' encoder. A system's failure to interoperate presents a huge problem. But whose problem is it? Which box is at fault? It's easy to point fingers, but the burden of proof falls on the broadcaster or network operator, whose transmission will continue to fail until he or she effectively isolates the problem and replaces the faulty equipment.

Effective monitoring systems allow the user to analyze several transport streams or several instances of the same transport stream simultaneously from a single control computer. This capability proves essential for major broadcasters responsible for a large number of transport streams. It simplifies the analysis of an entire network to a single window of LEDs. These LEDs represent the status of each transport stream in the network. When an error occurs, the user can drill down through the red LED to the location and description of the error using an approach like that in Figure 3. This smoothes the learning curve for inexperienced operators and takes the guesswork out of error correction.

• **Lip sync:** Studies show that viewers consider lip sync the first determinant of program quality, and many of us would agree. But while lip sync presented some challenges in analog transmission, it presents even tougher ones in the digital world.

Where traditional analog television typically offered only one audio (stereo) channel per program, digital television

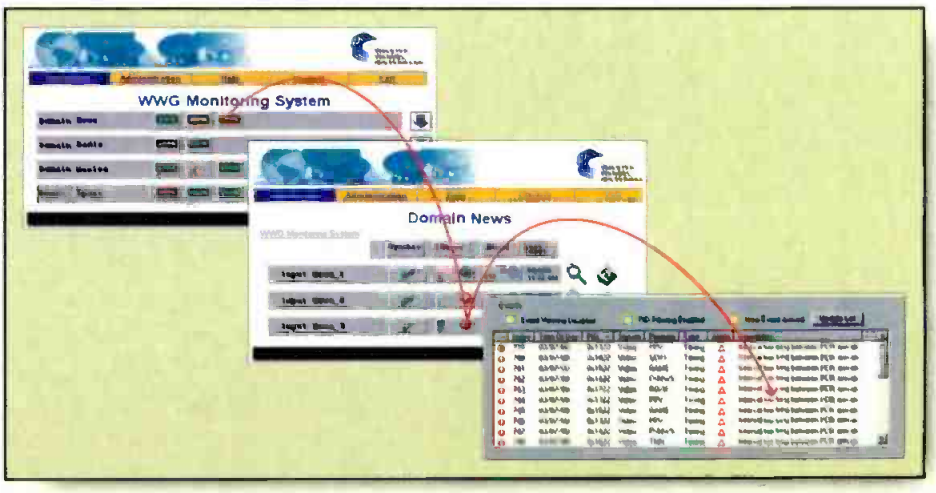
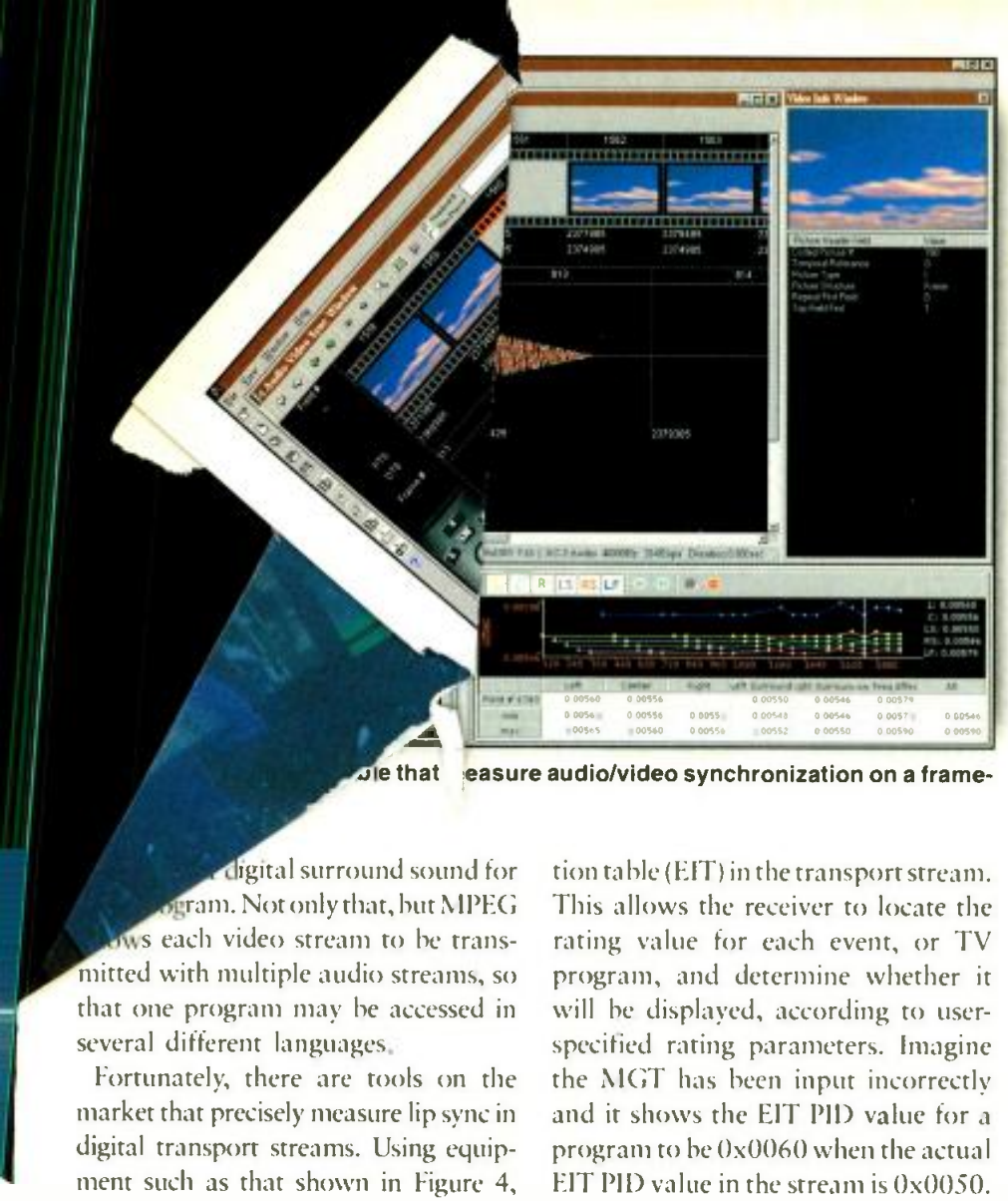


Figure 3. An example of the user interface for a Web-based monitoring system.



...ble that ...easure audio/video synchronization on a frame-

...digital surround sound for ...gram. Not only that, but MPEG ...ows each video stream to be transmitted with multiple audio streams, so that one program may be accessed in several different languages.

Fortunately, there are tools on the market that precisely measure lip sync in digital transport streams. Using equipment such as that shown in Figure 4, manufacturers and operators can ensure that their encoders are handling timing issues properly for all audio channels, regardless of the language.

• **Validating ratings and the EPG:** Because the Electronic Program Guide is the broadcaster's main interface with the customer, creation of the EPG is a major priority for broadcasters and manufacturers of PSIP generators. Information in the EPG, including ratings, show times and event descriptions, comes mainly from the PSIP tables discussed earlier in the article. Because the data in these tables is generated by hand, the possibility of human error necessitates extensive validation. As mentioned earlier, a single error in the PSIP data can perpetuate through the entire system and ultimately cause a breakdown. Again, transport stream analysis and monitoring equipment can help. Consider the following example.

The master guide table (MGT) lists the PID value for each event information table (EIT) in the transport stream. This allows the receiver to locate the rating value for each event, or TV program, and determine whether it will be displayed, according to user-specified rating parameters. Imagine the MGT has been input incorrectly and it shows the EIT PID value for a program to be 0x0060 when the actual EIT PID value in the stream is 0x0050.

When the television attempts to locate the rating value, it will identify 0x0060 as the EIT PID for the program, but when it looks for this PID, no EIT will be found. The television must either display the program without regard for rating or not display the program at all. Either choice is likely to upset viewers.

This error alone is costly enough, but similar errors in the TVCT, PAT or PMT can also cause a loss of programming. Again transport stream analysis is a must. A powerful real-time analysis tool will alert operators when these and other errors occur, enabling them to troubleshoot where necessary. As soon as it detects the erroneous PID value, the analyzer sends a flag to the operator. Once he or she identifies the problem PID, the MGT can be corrected at the PSIP generator and retransmitted to minimize disruption to the viewer.

• **Monitoring bandwidth usage:** Transport stream test equipment not only monitors for errors in the stream, it can also help broadcasters patrol their systems. For example, bandwidth is money — or at least the potential to make it. With a set amount of bandwidth allocated to them by the FCC, broadcasters must use every ounce of available space to maximize revenue potential. What bandwidth their own programming does not occupy can be leased to other companies for data transmission so that every bit in the stream does its share to bring in revenue.

But measuring who uses what percentage of the bandwidth from one moment to the next isn't easy. Without the means to measure bandwidth usage, broadcasters must rely on faith that their lessees will adhere to their contracts. Though a nice idea, this isn't always cost effective. Test tools can help broadcasters by reporting exactly what percentage of their total bandwidth each PID is using in the stream. With this information, they can verify that each of their lessees occupies only the bandwidth percentage allotted them.

Bandwidth is money — or at least the potential to make it.

Not only does bandwidth usage require monitoring, but the push to maximize bandwidth also increases the pressure on the transmission system, making it even more susceptible to errors. Again, monitoring and analysis tools can help identify these errors before they affect the viewer.

Despite DTV's complexity, sophisticated test equipment can eliminate much of the guesswork in providing quality digital programming to the consumer. With the right tools, even users with limited knowledge of digital transmission can diagnose, isolate and resolve problems in the transport stream with minimal disruption to the viewer. ■

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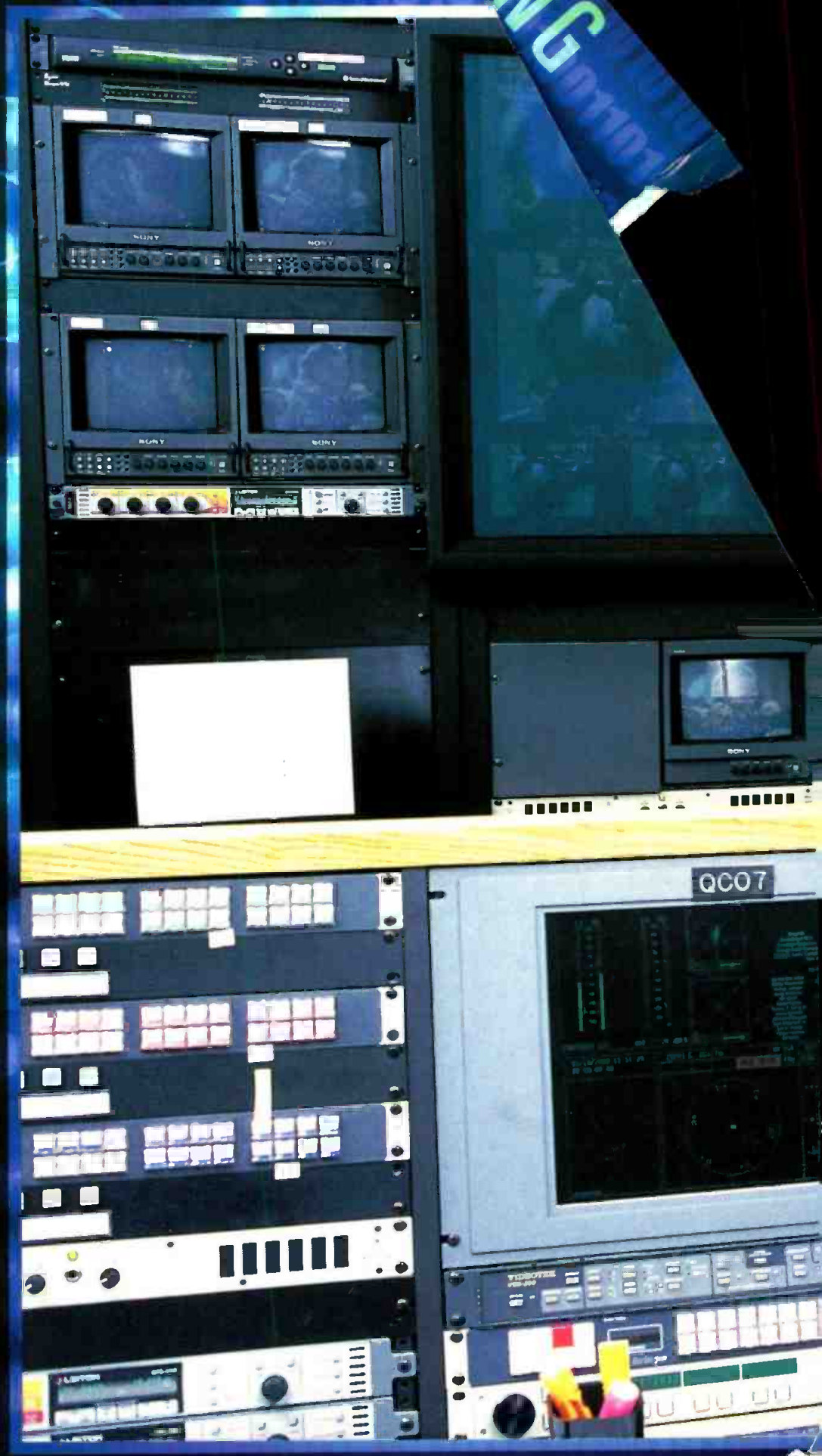
TESTING & MEASURING TELEVISION SIGNALS IN THE 21ST CENTURY

by Mark Everett



How are we to assure video quality in the compressed digital age? Many of the old methods remain valid, but some applications of those methods just don't fit. Some of our older methods have to be adapted and manipulated for use, even though they might appear as illogical or inappropriate. New procedures, methods and processes have to be developed and adapted to fit others of these situations. We have at least four different stages of signal use, each of which uses different test methods. The four separate areas are origination, production, distribution and transmission. Interwoven into each of these areas are other challenges such as video-to-audio time relationships, signal quality, skilled personnel and resource allocation.

Origination test and measurement requirements have changed considerably since the earlier days of color television. For instance, a typical field shoot required a few hours of camera set-up time for a shoot that could not last more than about two hours. After a couple of hours of shooting, the cameras in use and a lot of other equipment had to be realigned. So the shoot was stopped and the engineers started the whole process over

Today's increasing complex control rooms like that shown above, require operators to rely on automated test equipment to monitor a variety of analog and digital signals. Automated and centralized monitoring capability will soon be standard on sophisticated T&M solutions.

again. There were some attempts, even then, to include VITS (Vertical Interval Test Signals) into the original camera output to assist in camera chain alignment and subsequent video processing, but this concept never really caught on due to the added cost and bulk of the test generators. This is also the place where the film-style slate with the clapper was used to mark the alignment of the sound and picture. Electronic versions of the slate were developed to encourage the use of this process and versions are in use today. In these situations, a waveform monitor, vectorscope, high-resolution monochrome monitor and high-quality color monitor were required for use with each camera because the equipment needed nearly constant monitoring and adjusting.

Times have changed

Equipment stability and reliability has improved immensely. A modern camera or recorder needs almost no attention. The operators can now concentrate on the creative use rather than the technical control of the device. Automatic controls, especially in cameras, considerably reduce the needed intervention of an engineer. There are many cameras in use today where the camera was aligned in the factory and has not been adjusted since then — and the camera still makes perfectly acceptable pictures. This truth eliminates the need for a lot of test equipment and frees the engineers for other tasks. This does not eliminate the need, however, because there is always room for doubt. In any situation where there is a requirement to match video from two sources, the most cost-effective means of completing the task is to do it right the first time. If 'fix it in post' is not the means of solving all problems, then on-site, real-time signal measurement is still a requirement.

So, here is a location that will use essentially the traditional means of test and measurement. Field cameras, for the most part, output either analog, component analog or serial digital. Now there are compressed forms of serial digital in use, but, for the most part, the working output is serial digital. Analog or digital waveform, vector and picture monitors as well as traditional test charts are the tools for that portion of the trade.

The future will see all of these maintenance operations possible remotely. We will have a means to test, evaluate and correct all sorts of live video parameters analog or digital – full bandwidth or compressed, in real time. Here, automatic devices that can make comparisons between sources and then adjust a wayward source to match the standard will assist engineers. None of this particularly cutting edge, but these functions will become the rule rather than the exception.

If we look at any fieldwork as original production, the need remains for traditional test and measurement solutions. More than likely, productions are being originated in either film or digital video. The film is left for another discussion. Digital video will be in any of a number of formats – from standard-definition digital to compressed high definition. Here also, remote testing, measurements and adjustments are possible and probable. We expect that networked measurement and correction modules will be

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
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 chrominancedelay/gain, pulse to bar ratio, K-2T factor, differential chroma gain/phase, frequency response, red/green/blue phase and amplitudes

Several elements of a mixed format environment must be monitored to ensure quality signal.

placed at all critical points in the video chain. Networked monitoring, diagnosis and correction software will either assist the engineer or simply make measurements and adjustments based on a prescribed set of performance rules.

Once the video gets into the distribution system, more and more users are demanding automated signal monitoring and evaluation. Any situation where we have an engineer just watching television and looking for an error is begging for an automation-based alternative. A monitoring system will have to examine the active video and detect any number of undesirable conditions. Because automatic detection will catch every flaw, the system must be capable of user selectable parameters. Everyone agrees that luminance over 100 units is undesirable, but if the time duration is only one pixel, how much do you worry about that? In some instances you may direct the software to not alarm such a condition until five or 10 pixels in a row are over 100 units. Similar logic must be applied to black, freeze, silence and others. Testing and monitoring must be flexible enough to meet the myriad of signal types we will be using in production and distribution. Composite and component analog, serial digital and high definition formats must all be treated by the automated video testing systems. Audio is equally important and will be distributed in three distinct forms – analog, AES/EBU and embedded. The testing systems must be capable of measuring audio presence, levels, phase and timing relationship. Audio will be distributed in all sorts of combinations from mono to 7.1 channels and more. Testing and signal measurement will have the facilities to deal with these and more advanced audio requirements.

More than likely, as is even now apparent in the market, a facility will have a single dedicated engineering location with the necessary sophisticated test and measurement equipment to evaluate problems that either the operators or the automatic systems find to be erred or questionable. This test location will include laboratory grade picture monitors and the necessary traditional scopes and meters to assist the engineer in resolving the issue. All of the other test locations through the plant will, most likely, be using simpler monitoring and measurement devices that include more versatile and less costly types of displays. Multifunction, multiformat monitoring systems will be developed to solve traditional problems.

We have at least four different stages of signal use, each of which uses different test methods.

As transport methods have become more bandwidth conservative, video and audio compression systems continue to proliferate. These current and future compression systems provide the broadcasters with more efficient, reliable and artifact free means of moving, storing and processing images. We have a large number of proven methods for certifying data integrity, which has been in use for decades in the world of telephony. We also have many tools existing for use in the evaluation of the compression and decompression system elements. These test instruments work in both real time and non-real time situations. But, almost all of the analog type questions may still be asked of these digitally manipulated signals. Now we have more to measure – the analog base and the digital content.

A continuing issue is test signals in the digital and compressed domains. While we have developed many specific test signals for current "full bandwidth" digital signals, many user continue to demand the use of analog signals such as color bars. While analog test signals serve a useful purpose in evaluating the total system integrity, most of them do not stress or test digital paths as they do in analog paths. The issue of compression test signals is even more complicated. Years ago the industry learned that a design engineer of a compression system could easily recognize any fixed motionless pattern, as a typical analog test pattern nearly always appears, and present a perfect reproduction of the test signal at the output of the system. This almost never had a direct correlation with a normal television picture. Standard test video sequences have been collected and agreed as fair representations of sequences that may stress compression and decompression systems. These types of tests require a specific sequence of pictures, and are evaluated based on the expectation of the appearance of that specific sequence. We yet need a test method for compressed video that can be accomplished with client supplied active video, and in real time.

So where are the solutions in the next decade coming from? First, end users, advertisers and engineers will want to evaluate video and audio in a fashion similar to our current methods. Top level questions and observations will not have changed from fifty years ago. How does the picture look in relation to noise, color, color match, contrast, and brightness – all of those basic demands. The same levels of issues belong to sound, level, phase, noise, dynamic range and our new favorite – lip sync. All of these issues are analog issues, no matter how the picture and sound are transported. MPEG decoding will be adapted to waveform, vector and picture displays. Test modules will be located along the signal path to be used to locate the point of degradation or failure in the network. We will have networked collectors, evaluators and repair modules all controlled by centralized automation assisted by centrally located engineering support. We will still have to match cameras, paint pictures to suit directors and producers, limit video and audio levels, and mix separate video sources while producing pictures which are pleasing and acceptable to the consumer. To a large degree, analog solutions will be with us as long as our analog vision and analog hearing remains a human characteristic. ■

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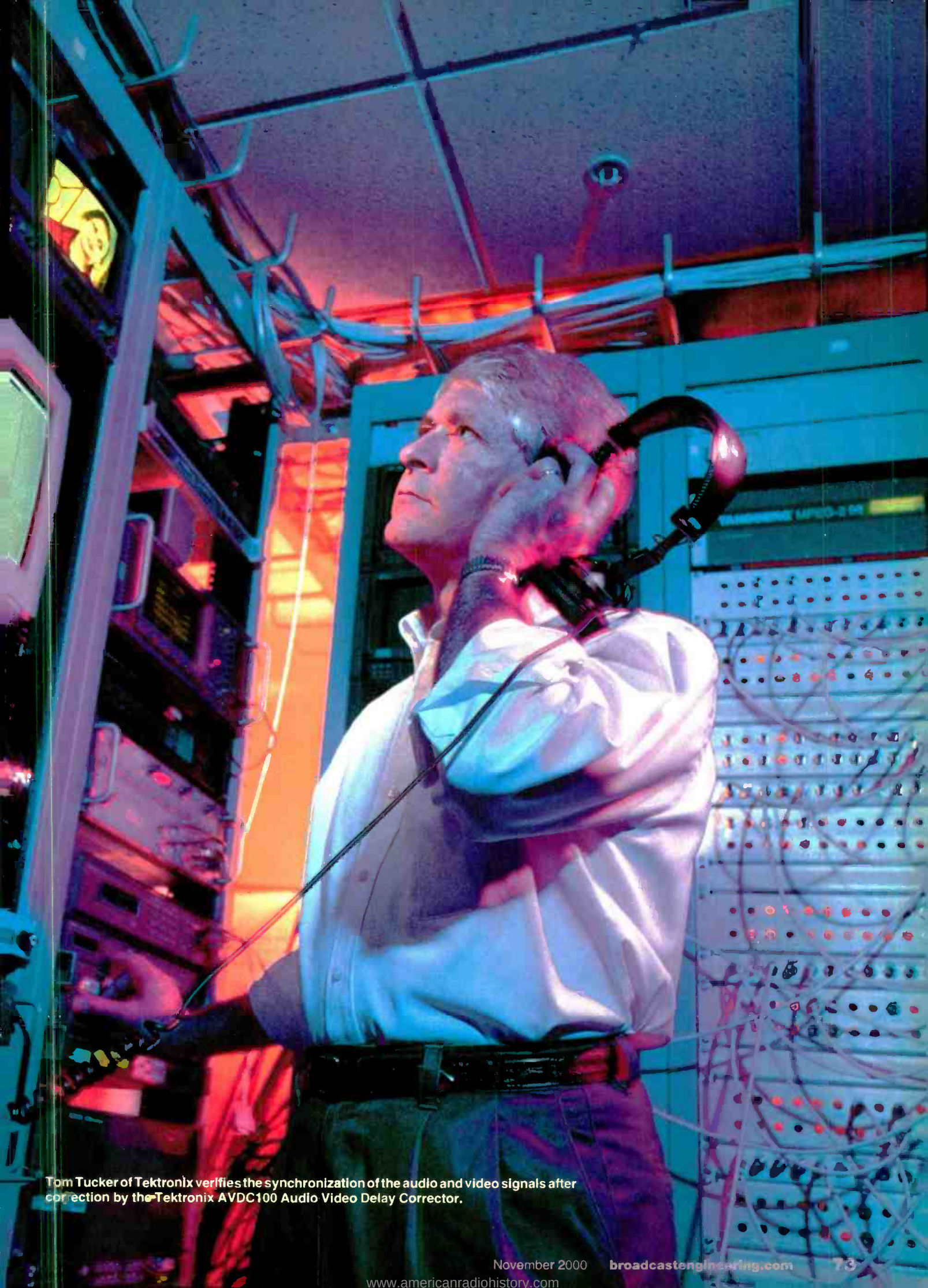
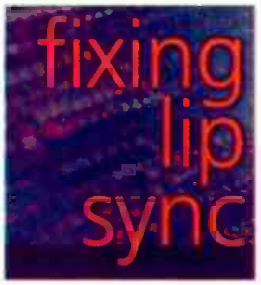
fixing lip sync

by Tom Tucker

As television grew, a technique known as "genlock" was developed to combine nonsynchronous program sources. Although this filled a need at the time, genlocking to a foreign signal was not always the safest or most satisfactory way of synchronizing signals. Luckily, it didn't take long for the industry to develop better ways of synchronizing various signals within and foreign to the plant. As



Tom Tucker of Tektronix verifies the synchronization of the audio and video signals after correction by the Tektronix AVDC100 Audio Video Delay Corrector.



digital technology evolved, the development of the video frame synchronizer enabled the synchronization of video signals from different sources. However, the original frame synchronizers dealt only with the video portion of the program material. As they were used, and oftentimes cascaded from one place to another, delays began to creep into the video path that delayed or retarded the video with respect to the audio.

In real life, video is subject to more processing steps than audio. Although the small individual delays caused by signal processing through various pieces of equipment inserted to perform particular jobs along the video path are usually imperceptible, these errors will compound, becoming additive as additional equipment is introduced into the video path. Even though the electrons representing the picture move at nearly the speed of light, it still takes time to go through each and every device. A few microseconds here and a few milliseconds there begin to add up. The heavy video processing common in today's DTV facility is a given guarantee for A/V timing errors, with video always delayed relative to audio. In addition to the labyrinth through which video usually passes, both audio and video are subjected to varying degrees and methods of compression.

If the video path could be the same each time through a facility, it would be a simple task to delay the audio accordingly, but that is nearly impossible in today's digital world. Even if frame synchronizers, which often create variable video delays of one to two frames, are removed from the equation, other video equipment such as distribution amplifiers, routing switchers, production switchers, patch bays, and patch cords hamper anything close to consistency of operation in most facilities.

The potential for unwanted audio tonal changes is proportional to the total amount of audio delay being corrected for.

One attempt to keep audio and video in sync was the development of the "slaved" audio synchronizer, controlled by a companion video synchronizer. This allows some level of control of video to audio latency and has been invaluable since the days of analog/NTSC plant operation. Fixed, predetermined amounts of audio delay have also been used, often set to ensure that the audio is always late with respect to the video. With delay added to the audio path at each point where there's a frame synchronizer, the audio is never perfect, but is kept within reasonable lip-sync tolerances.

The one major problem with this scenario is that it only takes into account events that transpire inside the plant. It does not take into account the diversity of paths the audio/video program material may have taken getting there. It also does not consider the variable delays that occur due to the routing of the video through varied equipment.

Say, for example, a station is covering a soccer game and there is no direct microwave shot to a relay station or to the studios. It is most likely the audio would be sent via conventional high-quality telephone circuits while the video would get sent via satellite. Comparatively speaking, even if the event or remote facility is only a short distance away, the audio will travel only a few kilometers compared to the nearly 44,600 miles the video will travel.

One other contributing factor to be considered is the possibility of improperly functioning timecode, which can create sudden shifts or gradual variations in the relative timing of the audio and video signals. When you add it all up, with only limited controls over the lip-sync issue, the problem continues to grow.

The solution is to address the problem at the beginning and ensure that some form of "indelible relationship" between the video and audio is estab-

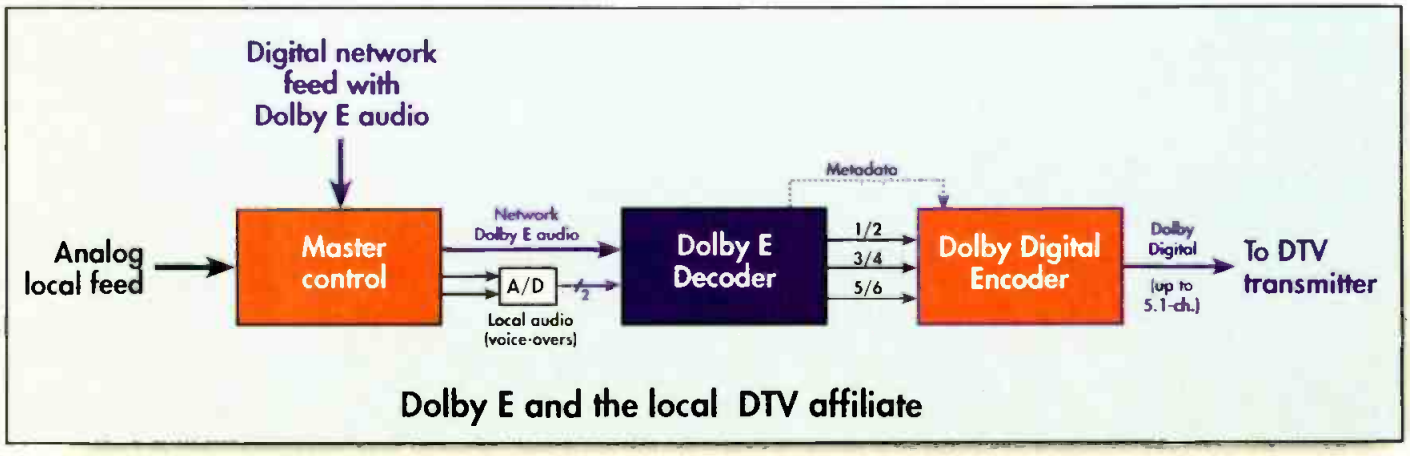


Figure 1. How networks and cable program suppliers deliver DTV programs with Dolby E encoded audio to the local DTV affiliate to decode into Dolby Digital for broadcasting.

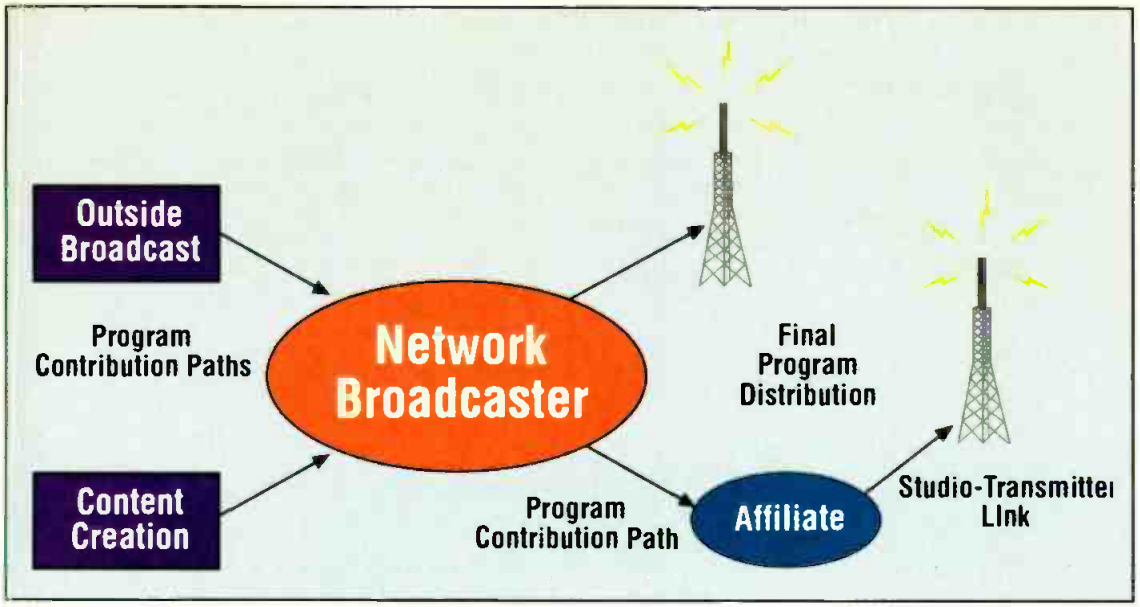


Figure 2. A typical network distribution path.

lished there, or at least very early on in the life of the material, and is imprinted on the video signal. This "indelible relationship," then, can be maintained throughout the production and distribution process. Doing so would then permit the pictures and sound to be retimed just prior to broadcast.

In addition to video delay, some audio equipment creates its own delay. According to R. Richard Bell, vice president of engineering at Dolby Laboratories, that company's AC-3 system imparts a certain amount of internal delay depending on the unit being used. The DP 569 multichannel (5.1) Dolby digital (AC-3) encoder has an internal minimum coding delay of 179 milliseconds. According to Bell, the DP 569 has internal and external user adjustable delay beyond this. An external TTL signal with a width equal to the desired delay can be used to return the audio to sync with the video.

The other well-known Dolby format is Dolby E. The DP 571 Dolby E encoder has a one video frame encode delay, and the DP 572 Dolby E decoder has a one frame video decode delay. When the Dolby E format is used, an analog composite video reference signal is required along with the audio or it will not encode the Dolby E bitstream. If this happens, the outputs will all be muted.

When mixing encoded and non-encoded channel pairs to a digital recorder, the non-encoded pair must be delayed to maintain synchronicity with the encoded signal. When switching back and forth between audio sources, this can become a significant issue. Other audio noise reduction and encoding systems have similar issues. Care must be observed, as it is not possible to know exactly what is coming off a tape or other source. It is therefore understandable why, even today, some digital television stations encounter lip-sync problems.

One promising new solution recently developed by Tektronix for the control of lip-sync errors is to incorporate watermarking technology into the digital video signal. In concept, watermarking video is similar to watermarking of still images in that subliminal information is added, frame by frame, to the video signal. Digital video is composed of a sequence of frames.

Tektronix digital video watermarking technology uses a series of extremely low-level *patterns*, to represent digital bits by controlling the phase in which the patterns are added to the video signal. With 16 patterns (bits) per video frame and 30 video frames per second, a *subliminal* data channel of 16x30 or 480 baud is possible within the video signal. Embedded within the live video program material, the watermark is imperceptible to the viewer but can easily be decoded, allowing recovery of a data *payload* within the subliminal watermark channel. The data payload can be of any type, as long as its bandwidth does not exceed the watermark channel baud rate capabilities.

The solution for lip-sync errors requires embedding some form of audio timing reference into the video signal at the point of program creation. The watermark channel is too low of bandwidth for embedding high quality digital audio. However, by sampling, digitizing and compressing contiguous two-second blocks of the audio program's natural analog waveform shape, a suitable timing reference can be created that easily fits into the watermark channel. This audio reference is embedded as the payload within the watermark, which is then added to the video. This embedded payload provides a reference point that can be decoded and used for comparison with the original audio program's waveform shape at any point downstream from its source. This includes any of the compression formats that either the audio or video goes through.

With only limited controls over the lip-sync issue, the problem continues to grow.

Any time-shift between the watermarked audio timing reference and the original audio signal is an indication that an audio-to-video delay error has occurred. This error information can then be used to automatically control corrective audio delay circuitry while remaining transparent to the end viewer. A classic use of this tech-

fixing lip sync

nology would be in eliminating lip-sync problems created during backhaul of remote broadcasts where video and audio signals take separate paths back to the studio.

In the remote production truck a watermark encoder samples the audio signal to create the timing reference that is added to the video signal in the watermark channel. The two signals then take their separate paths back to the studio.

In the studio the video is received and downconverted in the IRD and processed in the frame synchronizer, which may add variable video delays of anywhere from one to two frames. The video and audio (audio received from the ISDN line) are then both routed to the watermark decoder, which detects the watermark within the video signal and decodes the embedded audio time reference. Correlating the embedded audio time reference with the program audio received over the ISDN line allows timing shifts (an indication of lip-sync error) to be measured and used to dynamically retime the program audio and video signals.

Keep in mind that the potential for unwanted audio tonal changes is proportional to the total amount of audio delay being corrected for. For example, consider the audio timing change that must occur between two programs, one with a .5 second audio advanced lip-sync error and the other with no measurable lip-sync error. The audio timing correction can not slue instantaneously without causing a tonal change and must therefore slue over time. As a rule, an audio timing change of one (video) field per second (16ms NTSC or 25ms PAL) is the limit of audio timing slue rate before a pitch change in a fixed audio tone (line-up for example) is noticeable. Faster slue rates are possible with live, dynamically changing program audio, but typically a one field per second slue rate is considered "safe" without constant subjective monitoring.

The same would be true of watermarking video with a digitized version of the audio envelope's signature. As a production tool, the slue rate could be adjusted to compensate for any abrupt changes. It is truly a production call whether to accept lip-sync errors over a momentary audio advance or delay to compensate for timing errors. Few will disagree that it is better to have the capability to make such correction with their momentary glitches than to have an audience suffer through one of the most annoying issues in the entertainment business. ■

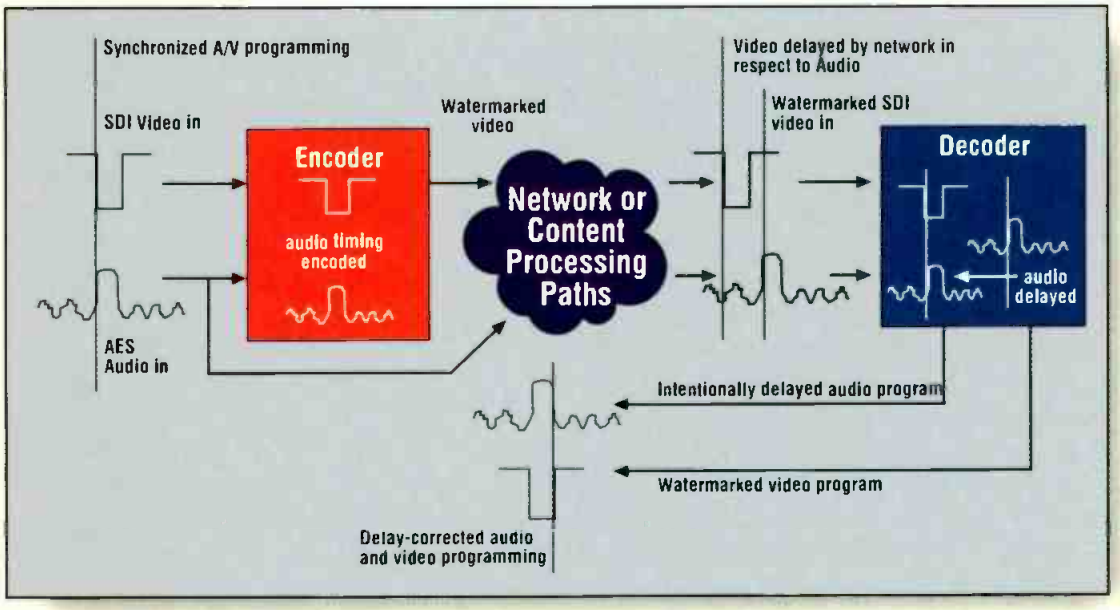


Figure 3. Audio and video processing paths during watermarking

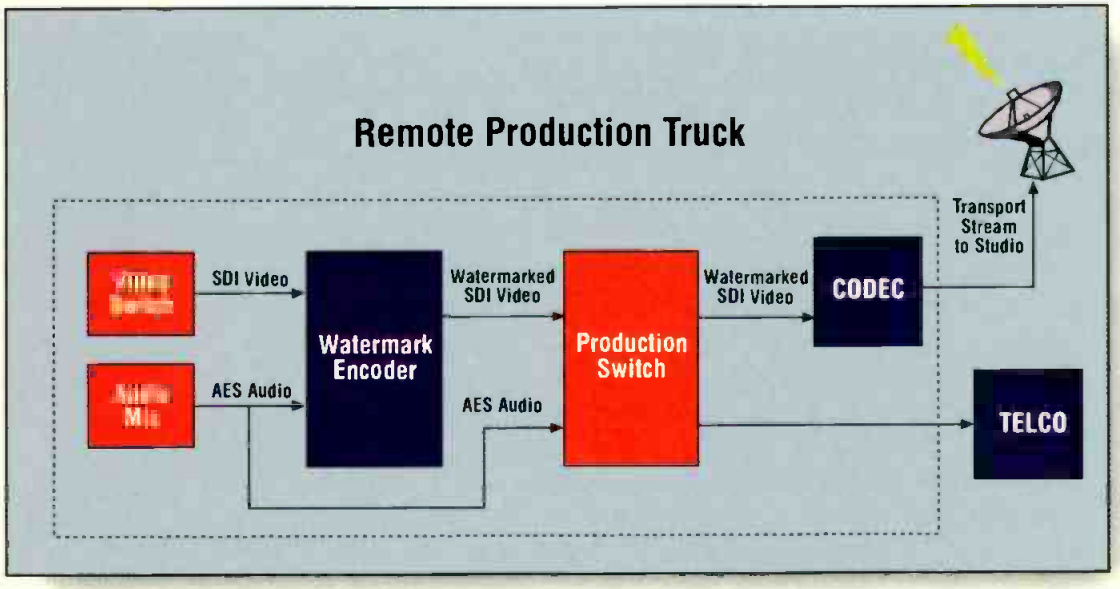


Figure 4. Typical watermark encoder installation in aremote production truck.

Tom Tucker is product marketing manager in the Video Business Unit for Tektronix Inc., Beaverton, OR.

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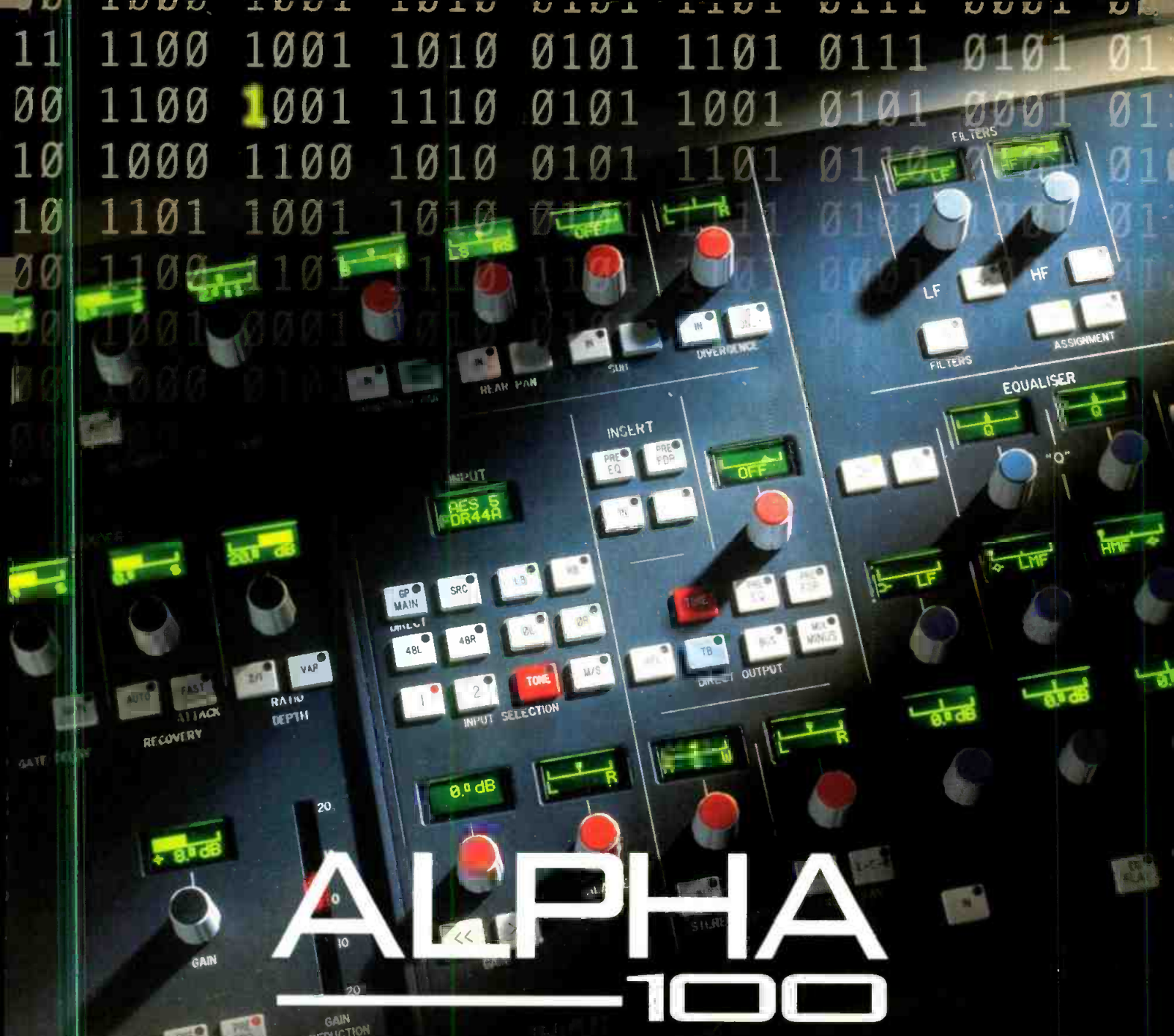
digital audio console update

by Gary Eskow

Broadcasters should choose a digital audio console based on the desired feature set, facility capabilities and future needs. A Euphonix System 5 console at Emerald Studios in Nashville is shown here. Photo courtesy of Euphonix.

Standards for the broadcast industry are in a state of flux that forces the manufacturing industry — who in some cases must apply years of research before introducing a product to the market — to make educated guesses as to the future needs of its customer base. Early estimates as to the penetration of HDTV by the year 2000 were much higher than the actual number of homes receiving these signals at this time. However, few doubt the attraction of detailed, large screen images and uncompressed 24-bit audio sampled at high rates will one day be the broadcast norm.

Audio for picture console technology is changing as well. The move to digital boards, well established in the recording business, has taken a bit longer to revolutionize the broadcast industry, in part because of a fear that single-point failure could cripple an on-air presentation. But this migration continues, and a number of manufacturers are releasing all new digital broadcast consoles this year. In this article, we review the current state of



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affairs regarding consoles built for broadcast.

What distinguishes an on-air console from a post or recording board? Perhaps the most significant point of departure lies in the fact that on-air consoles are ideally designed to optimize their integration into an open communications system, one that requires the mixer to receive information from outside sources and respond to it quickly. Routing to a variety of output targets, due to multiple format targets, is also crucial. Absent the live element and the need to participate with team members outside the studio, mixers working on records and in post applications require less extensive communications systems — perhaps no more than a simple talkback package. On the other hand, recording engineers in particular require processing capabilities, equalization especially, that are much finer than those used in live television.

The pressure of live broadcast applications has had a direct impact on the divergence in the way consoles built for this need and those used in other areas of the audio industry has proceeded. The relative quality of I/O conversion and equalization may be debated. (A/D and D/A converters across the spectrum have gotten better and better over the last several years, but the gap separating the "best" from the rest is arguable.) The fact is James Taylor recorded and mixed a very good sounding record with engineer Frank Filipetti on a Yamaha O2R console that costs less than $10,000. Major releases from other artists have been taken from concept to conclusion on inexpensive digital boards, or at the very least have incorporated them into the tracking process as well. However, the way of achieving these economies of scale is to layer as many functions as possible beneath each piece of on-board hardware and incorporate a small LED screen as the single visual reference. These tradeoffs are ones that cannot be made in on-air circumstances.

The assignable aspect of inexpensive digital consoles renders them unfit for live broadcast applications and reestablishes the comfort factor of the traditional analog model (one fader per input strip and dedicated hardware). However, the allure of automation, perhaps more than any other single benefit that digital boards bring to the table, has cast its spell over mixers in every area of the audio business. The major manufacturers and some smaller companies are vying for market share by assessing how much real estate networks are willing to invest in hardware and balancing the expense involved in fulfilling this requirement with a digital package that manages the console and perhaps shrinks the cost by reducing the amount of hardware required.

Given the rising level of sophistication among users of digital consoles, several manufacturers are now releasing product that allows the operator to tailor a board's assets to suit the individual's need. Engineers tracking a music session need at least 24 tape inputs but require less extensive routing to external sources than would be needed for an on-air broadcast, and would therefore call up an appropriate model prior to their session. Broadcast mixers might require no tape inputs whatsoever, but would need more extensive routing, and would therefore begin their workday with a different configuration.

Automation and the ability to be customized to meet individual engineers needs are the biggest advantages to digital audio consoles. An AMS Neve Libra Live audio console is shown here. Photo courtesy of AMS Neve.

> The relative quality of I/O conversion and equalization may be debated.

The fact that audio is often delivered in parallel streams, with mixers having to account for viewers listening to the audio portion of a broadcast in stereo and mono as well as 5.1, puts a monitoring burden onto a system that would not exist if audio was being downloaded into the home in a uniform fashion. Without question, the engineer working on broadcast audio has to be able to mix in surround while at the same time ensuring that viewers listening all the way down the line to a mono environment will be receiving the proper dynamic range. Are the advantages that features like these bring worth the expense? These are the kinds of questions broadcasters must answer. Remember, you can patch in a DAT player, a couple of CDs and a mic array to a console that costs no more than Johnny's first semester college bill, but can you live without the features you're giving up?

Flexibility is unquestionably the key factor. Along with the requirements imposed by the move to DTV, HDTV

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and 5.1, the adoption of the new Dolby E format, used to manage metadata on audio that passes through stages within a facility, has increased the routing demands placed on broadcast boards. As more and more processing takes place within a mixing environment, broadcasters' fears of single-point failure are rising. Computer redundancy, essential to allaying these concerns, is being built into most of today's high-end consoles. Different applications within the broadcast industry require different levels of redundancy. A facility that handles major sporting events and other prime-time live programming might be willing to pay more for extra back-up capabilities than one that takes network feeds until 1 a.m. If you're not sure how great your redundancy demands will be, it may be possible to get the manufacturer to agree to loan you the equipment until the console has passed through an initial trial period.

Are some consumers over-emphasizing redundancy? Manufacturers of consoles that use the Unix platform rather than the ubiquitous Windows or NT systems point out that the Unix platform, which is used to run air control systems, hospitals and banks, is more robust and less prone to failure than the others. Redundant power supplies may protect the console itself, but if the system relies on a less-than-stellar software platform the security may prove ephemeral.

Perhaps the chief advantage of analog consoles centers on the fact that individual console strips can be swapped in a manner of minutes. What variables exist in the digital realm, where strips are virtual? Different digital consoles plan for disaster differently, or not at all in the case of the smaller boards intended for the home recordist.

Since all digital consoles require some kind of sacrifice in the one button per function, one strip per input model that has been handed down from their analog predecessors, the way the requisite trade-off is handled is a hotly contested battle ground. Will a small set of mixers be working a broadcast console, or will a variety of freelancers be handling sessions? A team of mixers who will be given a week of training by representatives from a manufacturer upon purchase may be willing to sacrifice a bit of initial ease of access in order to take advantage of other features they value, but no facility can afford to have an independent engineer learning a challenging board on the job.

A firm understanding of a facility's current analog and digital routing, coupled with a confident projection of where this large configuration will project out over the next 10 years, is critical to the broadcaster shopping for a console in today's market. If a facility is holding on to a 2-inch 24-track tape recorder but plans on replacing it with digital equipment, the required number of analog tape inputs diminishes. A fundamental theme continues to re-establish itself: Spend time making projections on the way the rest of your facility will look a decade from the point of your purchase. Then gaze into your crystal ball and make an educated guess as to the state of digital broadcasting at the end of that period. The console you buy needs to be able to handle all of your current routing needs and those you anticipate. Many facilities faced with the need to purchase consoles for two or more rooms will try and save money by buying a reduced feature set for the board that will sit in what is today an offline space. Be careful. You could be penny wise, but pound foolish if in a few years your studio goes through an upgrade and you desperately need the functionality you sacrificed for short-term savings.

The console you buy needs to be able to handle all of your current routing needs and those you anticipate.

Another factor to consider when purchasing a broadcast board is the age of the technology you're buying into. If you value the track record of a well-established console manufacturer, then that factor will surely influence your buying decision. Competitors touting the advantages of newer digital techniques might try to caution you against buying into technology that's teetering on the edge of old age.

Consider one of the hot topics in the recording industry for a moment. The CD standard of 16 bit/44.1kHz has clearly been surpassed. Without a doubt audio recorded at the 24 bit rate captures the range of perceptible volume steps more realistically, and with greater detail, than its predecessor. Similarly, sampling rates of 88.2-, 96- or even 192kHz yield require less rounding off of material, especially the upper frequencies, than the norm of today. But how quickly will audio DVD or its competitors that take advantage of these advances catch on with the public? Many listeners find the experience of listening to highly compressed MP3 files straight from their computer fully satisfying. Anticipating consumer demand and building rooms that can handle audio as it will need to be delivered in the future may make or break a number of recording facilities.

Things aren't so different in the broadcast area. Literature touting the fact that its console ships ready to roll at 96kHz may be enticing, but will a broadcast path that contains this sampling rate ever become a reality? If a studio saves money by purchasing a console that tops out at the current industry specs will the decision turn out to be wise in the long run?

In the final analysis, it is certain that the days when poorly recorded audio with audible air conditioner noise, for example, will be masked by the poor quality of home playback systems are fading. The digital console is here to stay, based on the allure of automation and the strength of software. Nonetheless, savvy studios and broadcast facilities need to be educated consumers when it comes down to choosing from the current crop of audio for broadcast consoles. ■

Gary Eskow is a composer and journalist based in New Jersey.

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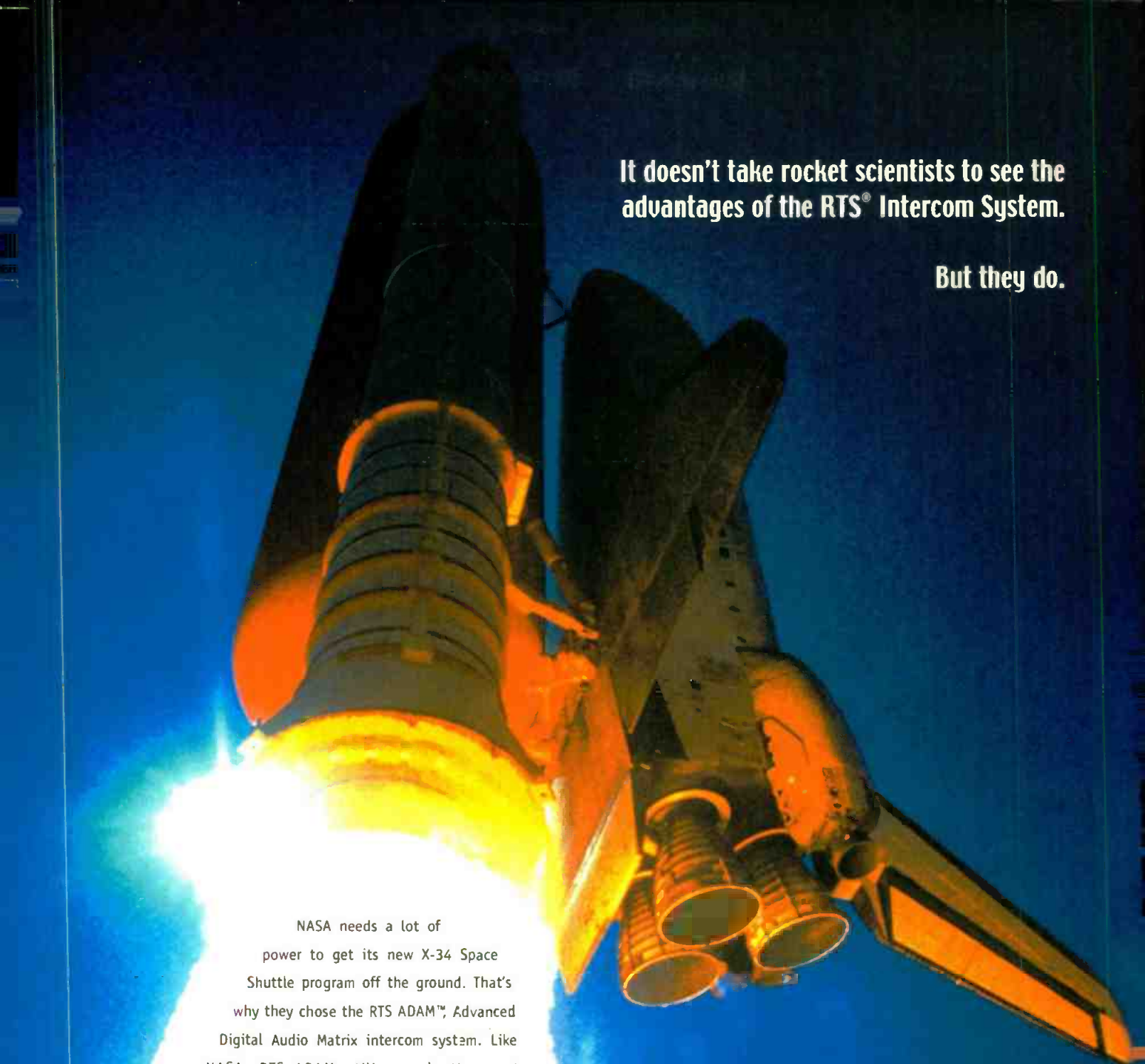

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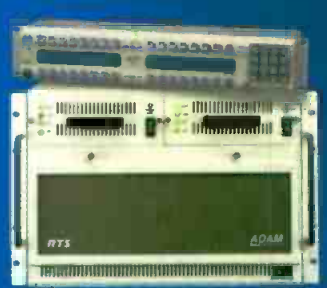

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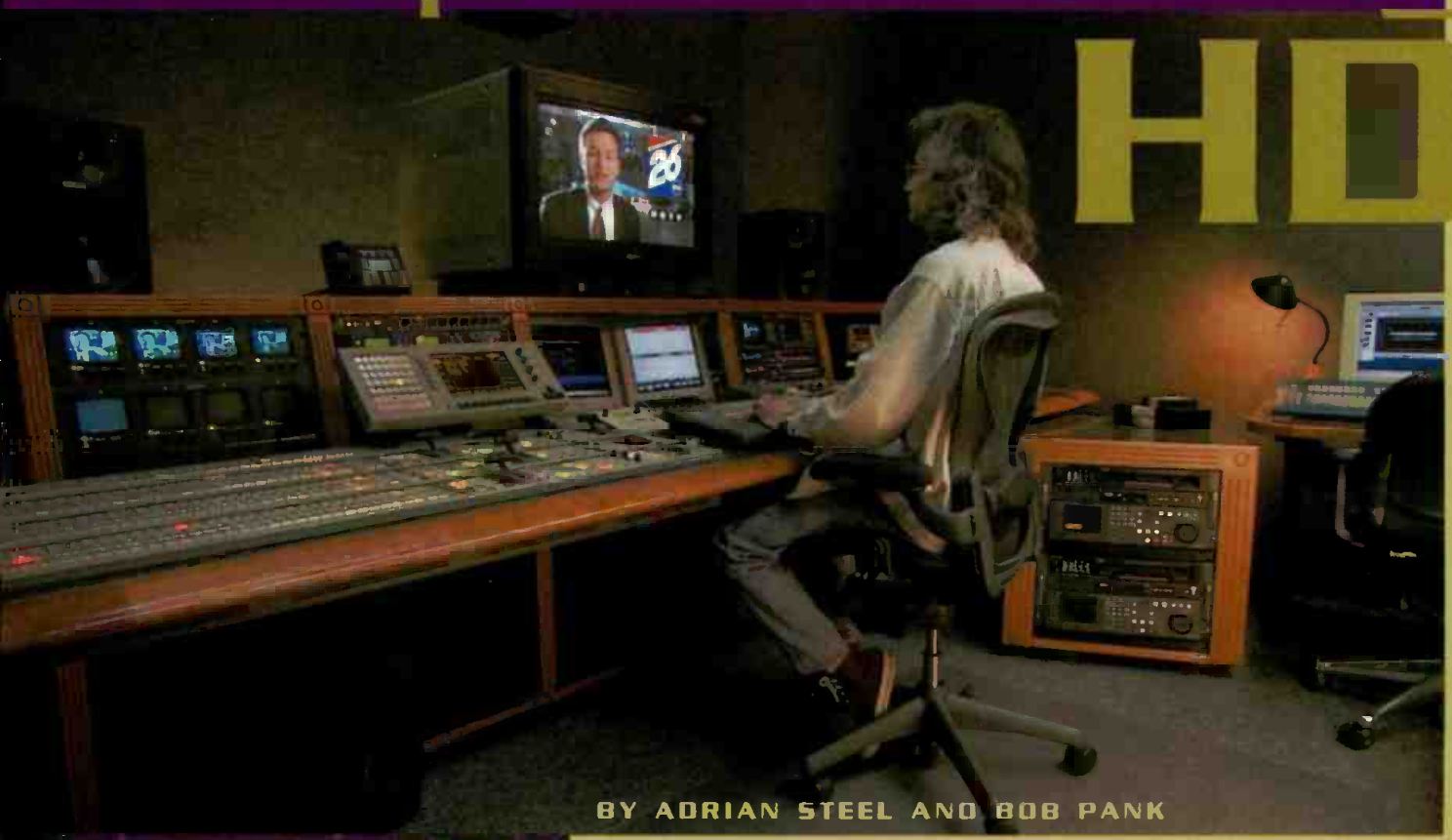

BY ADRIAN STEEL AND BOB PANK

HD is simply a six-fold bigger version of SD? True, but by growing so much it crosses a number of technical thresholds. That means handling the uncompressed signal presents some new challenges. For infrastructure, the HD signal transport is significantly different from that required for standard definition. Two major considerations are the higher power consumption due to the extreme clock speeds required for processing and a desire for ever-increasing levels of integration and functionality. There needs to be a clean-sheet approach to HD infrastructure development that is driven by customer priorities and requirements.

The problems start with the block diagram – the moment a line is drawn between two HD elements. Coaxial transmission of serial HD signals using HD-SDI becomes problematic above 100M. Using special cable this may be extended to 150M, but fiber optics are required to go any further. Clearly, both coaxial and fiber optic connections are a basic necessity for HD.

Enclosure

Due to the quantities required, infrastructure elements are ideally supplied in modular form. The key to the reliability and up-time is the modular enclosure itself. Cooling this is a big issue as modules will consume high power levels, so to prevent overheating the design must provide even airflow across each.

The steady uptake of HDTV around the world is generating a requirement for a new set of support systems. The infrastructure required to support HD signal transport and manipulation is significantly different to that required for standard definition (SD).

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Customer feedback indicates the need for front-to-back airflow. Providing this and satisfying cooling needs indicates horizontally mounted cards. The alternative of vertical mounting is not attractive or efficient. It is only most efficient with vertical airflow, requiring bulky plenum chambers and fans above and below the enclosure for even air distribution. Horizontal arrangement requires no plenums. There is the room in front and back-of-rack space behind. Furthermore, the cards themselves can be used to evenly divide the airflow between them.

Power supplies

For power supplies, the main difference from SD is that HD requires more due to the far higher clock frequency. Apart from that, the need for continuity of up-time is no different than SD, except that the material may well be more valuable than SD. There are still different power supply configurations required between post-production and transmission. For the latter, continuity of service is paramount – indicating the need for dual-redundant AC supplies – but not for the former.

One of the AC supplies is commonly uninterruptible. To use this, two AC inlets are required, each with sufficient power supply capacity to operate the entire unit. If there is both a main supply and a PSU failure, this is dealt with by dual AC inlets with double PSU capacity behind each.

Module structure

Hot-swap provides for continuous operation. For power supplies and fans, this presents no change from SD design, but for the signal-carrying modules themselves, things become more complex.

In all cases, hot-swap requires attention to mechanical design so that there is both easy access to the swappable parts and that the exchange will not upset electrical performance. With SD it is possible to pass the 270Mb/s serial bitstream through connector pins. In the 1.5Gb/s serial HD domain more care is needed as it is impossible to accurately maintain the 75Ω line impedance over many different connections. The resulting mismatches would cause various reflections making equalization and data recovery difficult at the receiving interface. On the transmission side it would also make the achievement of the 15dB SMPTE-specified return loss almost, if not completely, impossible.

Furthermore it is preferable not to have active electronics in the rear of the unit where access is more difficult. Equalization, reclocking and deserialization should not be placed there, even though this would greatly simplify the interconnection issues. All the active electronics should be on the main module, which is replaceable from the front of the unit.

Handling signals at 1.485GHz

There is clearly need for much care and attention in running HD-SDI down cables, through connectors and along tracks. Even very small differences in the amount of insulation cut back along cables within the connector make a measurable difference to the return loss. Meeting all the SMPTE specifications, including those for jitter and return loss needs careful attention.

Where coax falls off, fiber takes over. It is a great medium for transmitting signals at these sorts of frequencies. Distances that would be totally unimaginable using coax are deemed absolutely insignificant in the optical domain. Although it is not possible to use the very cheap LED-based fiber systems at this frequency, prices of the necessary lasers have tumbled in the last five years. This is due to the huge demands of the telecommunication industry for both speed and quantity.

However, telecommunications do not work the same way as HD-SDI.

Where coax falls off, fiber takes over.

Telecommunications typically send fiber optic signals over long distances. In a TV setup, especially where underfloor ducts are already overstuffed with fat coax, fiber optics may be used over short intrastudio hops as well as over long distances. Cable requirements may be from a one-foot jumper to 20km or more. Rapid reconfigurations may be a daily occurrence and being able to do this without having to think about attenuation is a bonus. This requires a receiver that can operate over a wide dynamic range — over 20dB would be useful.

Monitoring

Taking a fresh look at modular system design and considering the more demanding needs of HD, monitoring and control need to be given greater importance than before. Beyond the

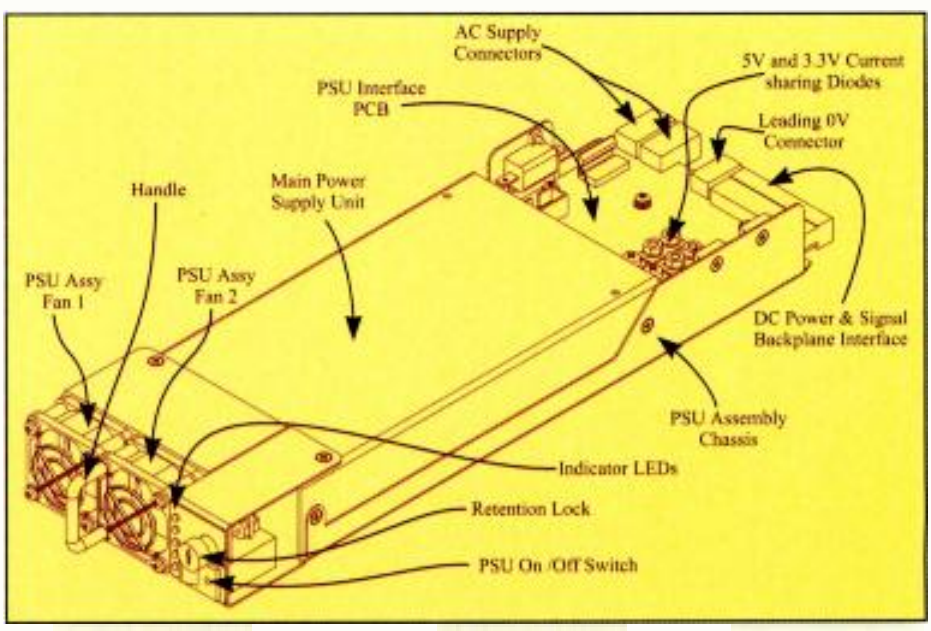

Figure 1. Typical power supply unit used in HD systems.

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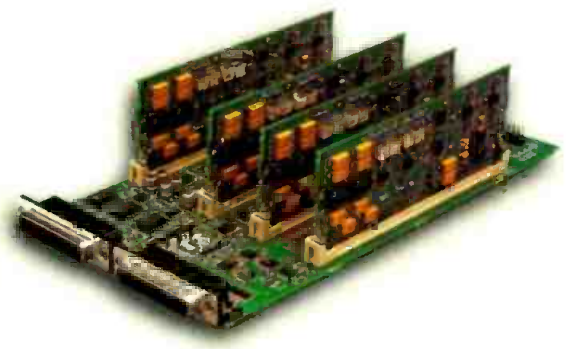

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board-edge LEDs there may be two further levels of monitoring: one provided by the infrastructure, and a further level by the applications running on the modules themselves. This requires both the boards and the enclosure to have monitoring designed-in from the start, not added as an afterthought.

Considering the numbers of modules and other infrastructure that goes into broadcast and post facilities, having a networked control and monitoring system has to be a real bonus. This should, at the very least, allow rapid location of any faults and, ideally, some way to correct or work around them. Even better would be a way to know about faults before they happen. Monitoring temperatures identifies potential malfunctions from a hot component to a below par fan. Offering the ability to drill down menu levels to reveal detail allows operation to be almost totally from the network – a much-favored practice for modern installations.

In a way, nothing is new. The definition of "high speed" is relative, not absolute, and changes with time. Some will remember that over 10 years ago, there were not totally dissimilar struggles to make SDI a practical reality over coax. Those issues have now been either solved or well identified and the solutions are known. In the same way more experience and technological advances will, no doubt, make HD-SDI equally easy to live with as SDI is today.

HD is still new but is causing new breeds of products to be brought to market that are not simply HD versions of existing SD designs. There is no legacy in this format so designs can start with a relatively clean sheet without having to compromise because of decisions made years ago. This is a fresh start and there is the opportunity to make better systems than current SD offers. ■

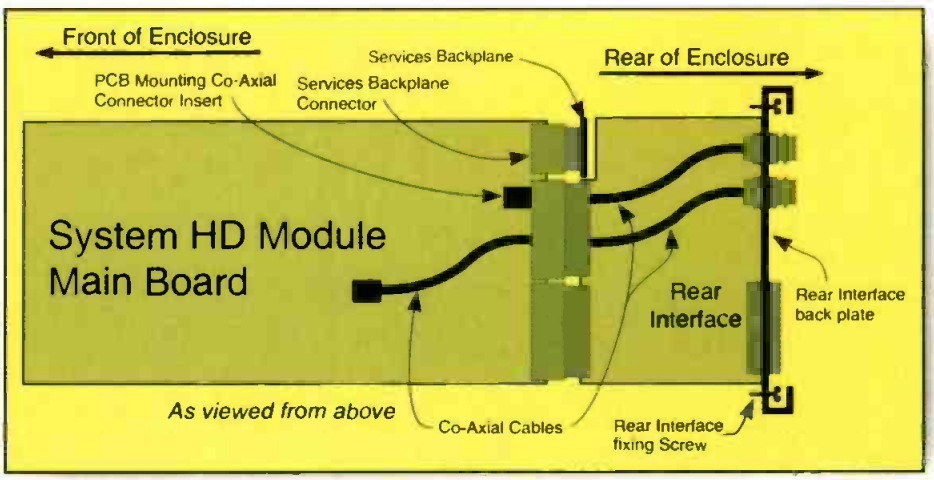

Figure 2. Note that the coaxial interfaces pass directly from the rear BNC to a coaxial insert pair within the connector that mates with the main board. There, coax is again used, leaving only short tracking to the equalizer.

Adrian Steel is senior design engineer and Bob Park is in technical communications for Snell & Wilcox Ltd.

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Applied Technology

Canon's image stabilization systems

BY GORDON TUBBS

Whether it's because video is shot in moving vehicles on the ground or in the air, in high winds, or on stadium platforms, image shaking can make a great shot hard to watch. This potentially frustrating factor is why Canon developed not one, but two cost-effective image stabilization systems. The first was popularized as an adapter (IS20B II) that fits onto our IF+ and IFxs lenses and is available as a build-in on 13X and 14X lenses. The second is built into the lens group of the new 86X HDxs.

Our first optical stabilization technology, also known as Vari-Angle Prism (VAP), was created for the heavy-vibration conditions created by moving vehicles like helicopters and cars. It uses a silicon fluid sealed in between two pieces of optical glass that move in relation to each other, causing the resultant prism to bend light in the equal and opposite direction of the vibration, effectively canceling it out and presenting a stable shot. Because this technology accommodates ENG lenses, using an adapter increased user flexibility without presenting a problem with weight.

Prior to our recent introduction of the new XJ86x9.3BIE (also known as the Digi Super 86xs), we realized that bringing it to market would entail much more than simply lengthening the PJ70x9.5BIE, our longest lens to date at the time. Vibrations that had previously been tolerable would now become unacceptable, especially in the HDTV format. However, a front-end lens adapter wasn't a viable solution for this studio/field unit, which would see duty in subtly shifting environments such as theaters and stadiums for entertainment and sports production. That's because VAP requires that the liquid prism be attached to the front of the lens or built in, an addition that would be physically impossible to build and control for large, box-style lenses. We had to go beyond the existing technology.

That meant going back to the drawing board to come up with a system that could handle the Digi Super 86xs which, like any long lens, was increasingly sensitive to vibration the farther out it went. The result was a new, Canon-exclusive technology: Optical Shift Image Stabilization (IS).

To develop IS, our engineers decided to use only the required glass elements that the Digi Super 86xs already had, without adding any more glass that could both increase weight and throw off the precision optics. With those parameters, we capitalized on our company's deep collective experience in optics to develop a unique solution: a lens group that shifts in parallel to the image plane.

When the camera lens moves, the light rays from the subject are bent relative to the optical axis, resulting in a blurred image because the light rays are deflected. By shifting the IS lens group in the Digi Super 86xs on a plane perpendicular to the optical axis to counter the degree of image shake, the light rays reaching the image plane can be steadied. For example, when there is a downward movement with the lens, the center of the image moves downward on the image plane. When the IS lens group shifts on the vertical plane, the light rays are refracted, returning the image center to the center of the image plane. Because image shake occurs both horizontally and vertically, the IS lens group has the ability to shift horizontally and vertically on a plane perpendicular to the

When the camera lens moves, the light rays from the subject are bent relative to the optical axis, resulting in a blurred image because the light rays are deflected.

The introduction of Canon's Digi Super 86XS zoom lens, shown above, required the development of a new technique known as Optical Shift Image Stabilization because a front-lens adapter could not be implemented in large, box-style lenses.

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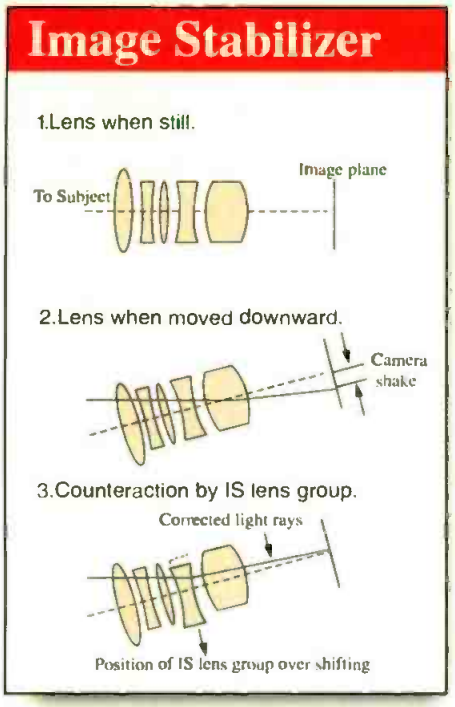

Figure 1. Canon's Optical Shift Image Stabilizer steadies image shake (as shown above) by moving the IS lens group vertically to refract light rays from the subject back to the center of the image plane.

optical axis, counteracting the image shake. (See Figure 1.)

The IS lens group is guided by two shake-detecting sensors, one for yaw and one for pitch, which actively detect the lens movement. The shake-detecting sensors constantly read the angle and speed of movement then send this information on to a high-speed 32-bit microcomputer. Next, the microcomputer converts the detection signals into drive signals for the IS lens group. In accordance with the drive signals, the IS lens group actuators move the IS lens group, counteracting the image shake and maintaining a stable picture. The system makes the Digi Super 86xs capable of counteracting vibration of ± 10Hz, more than sufficient for any tremors the typical platform would be subject to. Further bolstering the lens' performance is our HDxs technology, an optical system that achieves higher specs and virtually eliminates aberrations, while keeping size and weight down.

This is a zoom lens breakthrough that will have an immediate impact on the staging and shooting of entertainment and sports. Image stabilization becomes a necessity in large lens formats, where a small movement in the CCD translates into a much larger movement onscreen. Image shake becomes more evident with the introduction of ever larger display devices and the improvement in quality represented by HDTV. The benefit of Canon's IS technology cited by broadcasters at Fox Sports Networks and NEP Mobile Television is that it mitigates these problems by removing the inherent instability of camera mounting platforms. This, in turn, allows high zoom ratio lenses to be used more effectively to capture action in large venues such as the Olympics. IS and the Digi Super 86xs remove a major stumbling block for developing higher zoom ratio lenses, opening up a door which simply didn't exist before. The bottom line is a whole new creative angle for cameramen and directors, as well as the next wave of telephoto lenses. ■

For more information on Canon's image stabilization products, circle (450) on Free Info Card.

Gordon Tubbs is assistant director for the Broadcast Equipment Division of Canon USA Inc.

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Lightning Eliminators & Consultants' Dissipation Array System

BY JEROME KERR

Lightning: those dramatic bursts of white-hot voltage from the heavens that can instantly incinerate trees, spark fires, and knock out power and communications lines. Each year, lightning causes massive damage to business facilities across America. The destructive power of lightning is so great that even structures equipped with traditional lightning rods can suffer extensive damage.

Even if the facility is not directly struck by lightning, secondary effects such as bound charge and electromagnetic pulses can fry sensitive circuitry in the vicinity. Failures may be catastrophic or cause momentary or long-term lockup requiring replacement, repair, reprogramming or rebooting.

So-called "prevention" devices such as lightning rods and early streamer emitters, which are designed to collect and channel the force of a strike to ground, exacerbate the danger of a lightning strike. This 200-year-old technology was never intended for protection of modern high-tech automated facilities, but rather barns and other wood structures of that era.

These devices bring millions of volts and thousands of amps into close proximity to sensitive electronics systems and flammable products. Using them can actually increase the risk of lightning-related damage.

The answer lies not in channeling lightning, but in preventing the charge from accumulating in the first place.

What can be done to prevent lightning from damaging your business and data? The answer lies not in channeling lightning, but in preventing the charge from accumulating in the first place.

Lightning Eliminators and Consultants' Dissipation Array System, shown above, enables facilities to protect sensitive electronics from lightning strikes by utilizing the natural principle of charge transfer.

Let's start with the source. An electrical storm contains clouds called thunderheads — electrically-charged bodies suspended in the atmosphere. These charges continue to build during the storm, inducing a similar charge of opposite polarity onto the earth, thereby establishing a strong electrical field between the cloud and ground.

As the storm intensifies, charge separation continues within the cloud until the air can no longer act as an insulator and a strike occurs. Charge neutralization (the "strike") is caused by the flow of electrons from the cloud to the earth so that there is no charge difference between the two bodies.

When structures sit between the earth and the clouds, they are likewise charged. Because they short out a portion of the separating air space, they can trigger a strike. The lightning strike hazard for a given facility depends on the facility's location and characteristics including the structure's height, shape, size and orientation.

One solution for preventing lightning is the Dissipation Array System (DAS), which is based on a natural phenomenon known as the "point discharge" principle, or charge transfer. A sharp point in a strong electrostatic field will leak off electrons by ionizing the adjacent air molecules, providing the point's potential is raised 10,000 volts above that of its surroundings. This principle is demonstrated by what scientists call natural dissipation. The ionization produced by trees, towers, fences and other structures can naturally dissipate up to 90 percent of the total energy generated by a storm, thereby preventing the formation of lightning.

The DAS employs the point discharge principle by providing thousands of points with specific point separation. These points simultaneously produce ions over a large area, thus preventing the formation of a streamer, which is the precursor of a lightning strike.

This ionization process creates a flow of current from the point(s) into the surrounding air. Under storm conditions, this ionization current increases exponentially with the storm's electrostatic field, which can reach levels as high as 30,000 volts per meter of elevation above Earth. The charge induced on the site by the storm is removed from the protected area and transferred to the air molecules, which then move away from the site.

DAS prevents strikes by continually

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lowering the voltage differential between the ground and the charged cloud to well below the lightning potential, even in the midst of a worse-case storm.

Because it prevents rather than redirects lightning, DAS is possibly the best long-term solution to lightning strike problems. Lightning Eliminators and Consultants Inc. (LEC) has long been at the forefront of DAS development, installing systems in applications ranging from communications towers to tank farms, electrical power lines to public buildings. DAS has been used to protect facilities as large as three square kilometers and structures as high as 1700 feet.

Summarizing the benefits, DAS is:

- Simple: The design is straightforward, reliable and effective.
- Passive: The system consumes no power. It is activated by the energy of the storm itself.
- Universal: DAS can be used to protect any kind of building, tower, power line or large complex plant. Basic system concepts are custom-engineered for each individual facility.
- Preventative: It completely eliminates lightning strikes and all related secondary effects from the protected area, rather than attracting energy and attempting to conduct it to ground.
- Guaranteed effective: If a strike does penetrate the DAS-protected area, LEC will upgrade the system capability at no additional cost to the customer for one year from date of installation and/or recertification. ■

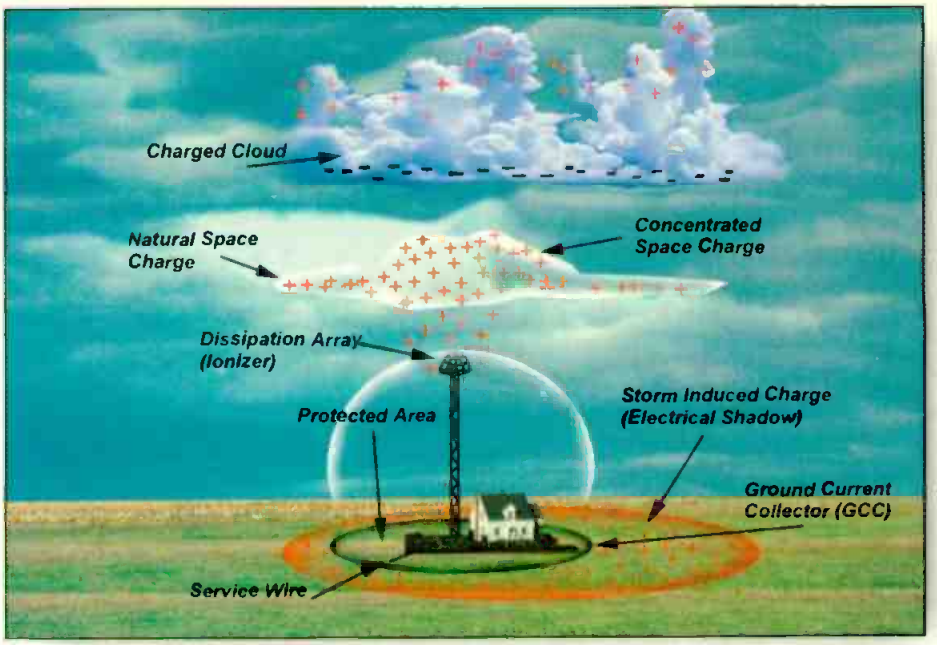

Figure 1. During a storm, structures on the ground become electrically charged by thunderheads, eventually resulting in a strike when the air between them can no longer act as an isulator. The dissipation array system protects facilities by continuously lowering the voltage differential between the facility and the charged cloud.

For more information on Lightning Eliminators' Dissipation Array System, circle (451) on Free Info Card.

Jerome Kerr is director of marketing for Lightning Eliminators and Consultants, Boulder, CO.

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Field Report

CNN transports commercials with Telestream's ClipMail Pro

BY JIM GRANT

This time next year almost all of the commercials seen on CNN outside the U.S. will have reached broadcast central in Atlanta via the Internet, and a fundamental change in the way this worldwide company does business will have occurred. Researching and validating the benefits of new technology and introducing it to a company presents some unique challenges, especially if the company reaches around the world.

Turner Broadcasting has taken the initiative to introduce timesaving and productivity enhancing technology throughout the many business units that comprise Turner. One opportunity for operational change that Turner had in mind at NAB2000 involved the fact that most commercials run on CNN international programming are produced locally in countries around the world. They are then shipped on tape to Atlanta for broadcast back to their countries of origin, which is both expensive and time consuming. Although satellite transmission was possible, the logistics and expense of that technology made it a non-starter.

Turner found a possible solution in Telestream's demo of the technology in its ClipMail Pro, which allows video and audio of any user-selected quality, from MPEG-1 to Master Quality 50Mb/s MPEG-2, to be transmitted over standard IP networks. That includes the Internet. The technology is referred to as "store-and-forward" to distinguish it from streaming technology.

By design, the system takes only bandwidth that is available and relinquishes it if needed elsewhere.

Turner tested two of the units, running them continuously for three months. Because it was important to assess the viability of ClipMail Pro over different speeds of Internet service, the Turner team simulated the conditions under which 30-second to two-minute commercials would move from various locations around the world to CNN International in Atlanta. They did this by assembling a stand-alone network complete with routers and hubs so they could control the speed at which data flowed for the tests. At Telestream's "Broadcast Quality" level, a 30-second commercial takes 30 minutes to transmit at 128K upload speed. Raising the bar to "Master Quality" level (50Mb/s), transmission time increases to two hours. Because the process uses FTP protocols, the commercial always arrives intact, regardless of the time to transmit.

After three months of testing, CNN chose Telestream's ClipMail Pro to transfer commercials produced in CNN's international operations to its headquarters in Atlanta for rebroadcast back to their countries of origin. Andrew Drooker and John Maniccia are shown here operating ClipMail Pro.

Also, the unit's use of FTP protocols means that from a technical standpoint it will work effectively with any connection speed. The user digitizes the material to be transmitted, choosing the quality level needed at the receiving end. In routine use, CNN plans to digitize clips at Master Quality, which is roughly equivalent to D1. The system then transmits the digitized file over the available bandwidth, with the time required for transmission based on the file size and that bandwidth.

After these tests, Turner began deploying units around the world. As such, a gradual rollout of the technology was designed. Four installations are planned for this fall. If all goes well, Turner will expand the use of the units to as many as 10 locations during 2001. The first unit will be

deployed in Brazil because there were issues regarding tape delivery delays from that location.

International deployment provides a host of challenges including varying customs regulations, language issues relating to training and technical issues ranging from power supplies to ISPs.

Customs regulations can make projects like this move at a snail's pace. For Brazil, CNN had to secure a test visa for the unit, allowing the technology to be brought into the country for testing purposes. Once it is in place, CNN plans to apply for a permanent visa to allow the equipment to stay in Brazil.

Turner Broadcasting's vice president of R&D, Andrew Drooker, and his team have decided to begin using this new technology in Brazil over a third party ISP rather than routing it through CNN's internal network. Drooker wants to quickly demonstrate that the unit can efficiently move commercials across continents and then convince the IT department that the implementation of this technology will not be a bandwidth hog on their internal network. By design, the system takes only bandwidth that is available and relinquishes it if needed elsewhere.

Training users is another issue but, again, because of the unit's intuitive interface and remote operations capability, this is less of a concern that it might be otherwise. All of the functions of the unit are accessible remotely through the use of a browser-like network application, which means that operational troubleshooting can be done from Atlanta. CNN runs lean staffs around the world, so deployed technology has to be robust and easy to use in order to succeed. Training on the system will include teaching the local tape librarian how to digitize commercials, how to load them into parcels for transmission to Atlanta and how to schedule their transmission for a later time of day. The operating interface works like familiar e-mail.

CNN runs lean staffs around the world, so deployed technology has to be robust and easy to use in order to succeed.

The trip to Brazil is planned for three days. The first day will involve establishing the unit's location in the office, connecting it to an uninterruptible power supply and a BetaSP tape machine, establishing connection with the local ISP, and beginning initial testing. The unit can accept RGB, S or composite video. The unit's touchscreen control panel can be located adjacent to the unit or remotely. For testing, typical commercials will be sent to a unit in Atlanta. Day two will be spent on additional tests and training the librarian on how to use the unit. Day three is available for additional operational tests.

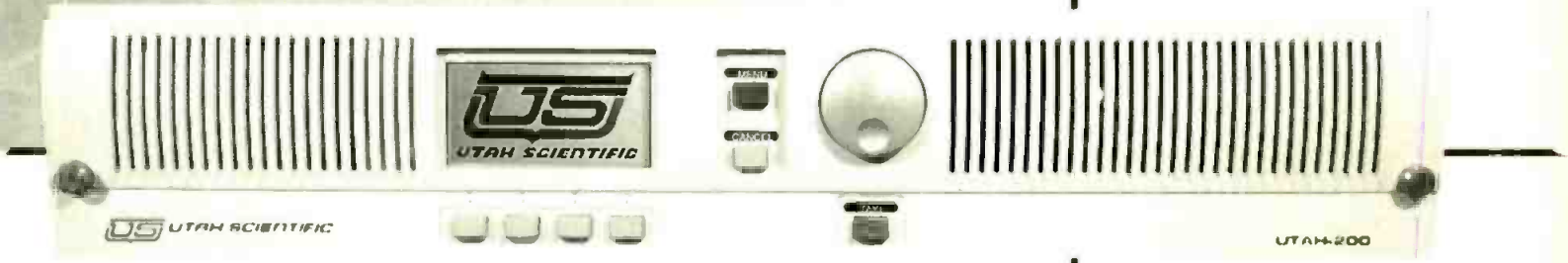
Unless some unanticipated obstacle appears as a result of the Brazil deployment, three weeks later the team will be off to Hong Kong. There, while customs is less of a challenge, the team will need to deal with a power grid that runs on 220V. This time the company's own bandwidth will be used instead of a local ISP, because Atlanta and Hong Kong are 12 hours apart and transmission of commercials can occur during a time when company bandwidth is not in heavy use.

As plans for this implementation have progressed, Turner's hoped-for trickle down of technology has also moved along. Word of the potential usefulness of this technology has reached TNT, Cartoon Network, and CNNfn. ■

For more information on Telestream's ClipMail Pro, circle (453) on Free Info Card.

Jim Grant is president of Communicating Services, Inc. in Atlanta.

There's a lot of experience in this little box



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Ikegami HDK-790D cameras at WNDU-TV/DT

BY GEORGE MOLNAR

In the broadcast industry today, there's no question that any equipment additions or upgrades have to be made with digital capabilities firmly in mind. In 1998, when it came time to replace our Ikegami HK-322 cameras, we looked to Ikegami again to see if they had the right solution to aid us with our digital transition.

When we checked out the Ikegami HDK-790D Field/Studio camera, it proved to be the ideal answer to our need for a unit that could deliver high performance in both 4:3 NTSC and 16:9 HDTV formats. Thanks to a powerful downconverter/upconverter incorporated into the CCU, we realized we could leave the guesswork to other people, while our engineering staff concentrated on getting great-looking images. The camera's CCD readout can be switched between interlace and progressive scan modes, and the signal can be converted in the CCU to the different formats. When the primary output is interlace (1080i or 480i), the CCD will be read out in interlace. When the primary output is progressive (720p or 480p), the CCD will be read out in progressive. That way the picture will originate at the CCD matching the interlace or progressive output.

Our natural approach to selecting new equipment is to try to get the best product on the market, while at the same time future-proofing as much as possible. So when we bought new cameras in 1998, we questioned whether we would need HD capability in ten years. With their superior performance in SDTV, the four Ikegami HDK-790D cameras we purchased met our needs for a future-safe upgrade, guaranteeing us HD capability, even if the rest of the station didn't go that way for a number of years.

Once the video signals are digitized at the preprocessing stage of the camera head, they stay digital throughout the camera chain.

Our facility consists of two studios. One is the WNDU News Center where we produce four hours of newscasts a day. The other is a busy video production company, Golden Dome Media, where we produce nationally syndicated programming like "AgDay" and live events such as press conferences. In all situations, cameras capable of producing great pictures with a high level of automatic operation were needed. As it turned out, the Ikegami HDK-790D met all those criteria and more, and had the key advantage of coming with the outstanding Ikegami technical and sales support that we had enjoyed in the past.

The specs on the HDK-790Ds are impressive, and we found they pay large dividends in real-world use. They're outfitted with three 2/3-inch 2.2 million-pixel 1080i FIT CCD image sensors, with effective pixel sampling of 1920x1080, which results in excellent picture quality even when the picture is downconverted to NTSC format. Also, once the video signals are digitized at the preprocessing stage of the camera head, they stay digital throughout the camera chain. Serial digital video is transmitted from camera to CCU using a fiber-optic core wired into the camera cable. The CCU performs additional digital processing, including downconversion for simultaneous SDTV output.

That these cameras were well thought out for real-world use becomes apparent elsewhere in their design. For instance, the Ikegami cameras allow us to supply power to the teleprompter through the convenient 2A utility outlet built right into the camera. The fiber optic cable that runs from the camera head to the base station provides all the power, which means one less heavy cable to move around the studios.

On top of all of these technical issues, the pictures that come out of the

WNDU-TV/DT selected Ikegami's HDK-790D cameras to capture images in both 4:3 NTSC and 16:9 HDTV formats. The decision allows WNDU to meet its current goals and prepare for the future needs of its two studios.

Remember, your digital signal is only as strong as its weakest link.

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HD VIDEO TEST SYSTEM

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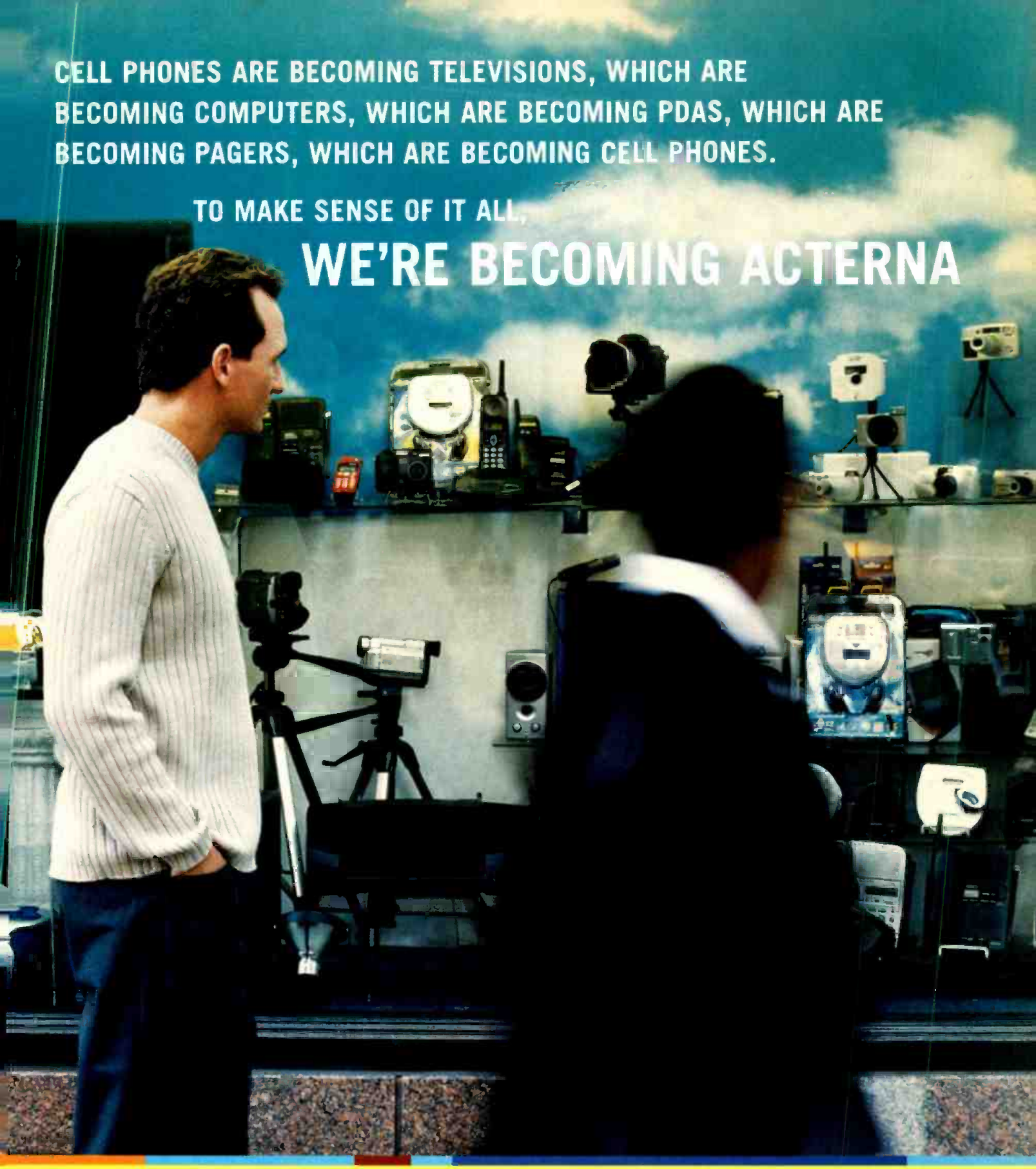

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NONLINEAR EDITOR OPTIONS

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Miranda Technology Kaleido-QC/DVStation interface: Miranda's multi-windowing visual monitoring solution incorporates Pixelmetrix's DVStation monitoring platform as an option; joint system obtains information about DVB/ASI and other MPEG-compressed streams and judge signal quality based on user-defined parameters; when a signal falls below the parameters, DVStation signals an alarm within Kaleido-QC; users can respond without leaving the Kaleido-QC environment; 514-333-1772; fax: 514-333-9828; www.miranda.com.

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Business Wire

Business highlights from broadcast and production

BY LAURA COLLINS, EDITORIAL ASSISTANT

Capitol Broadcasting Company station WRAL-TV in Raleigh, NC, recently purchased DVCPRO HD equipment from Panasonic to convert its field news operations to high definition. WRAL broadcast the world's first all-HDTV newscast at 5 p.m. on Oct. 13. The newscast originated live from the North Carolina State Fair, with news stories acquired and played back in DVCPRO HD format. In addition, the newscast previewed WRAL's new 24,000 square-foot all-digital news facility and to demonstrate the benefits of high-definition television.

WRAL will begin shooting, recording and editing its daily newscasts in high definition in January 2001.

Panasonic chose Accom's Dveous digital video effects systems to be used to create world feeds and daily summaries for the Sydney Olympic Broadcast Organization (SOBO). In addition, Accom's Affinity and StrataSphere nonlinear editing systems were used to produce 28 five-minute shows about Australia, a 15-minute opening show called "Welcome to Australia, Sydney and the 2000 Olympic Games," and the closing montage piece for the Games.

Other countries using the Dveous for their coverage were Canada (CBC), Spain (TVE) and Mexico (Televisa). Korea used a two-channel Dveous for coverage of the Games and, Sweden and Norway used three Abekas 8150 switchers.

NBC also utilized DVE systems and DDRs from Accom, as well as a WSI 2Xtreme, to create a unique look for its Olympic broadcasts. The Dveous systems were installed in five control rooms at the NBC compound and in two remote trucks.

KUHT/Houston and WXVT-TV have purchased automation systems from Crispin. KUHT/Houston installed Crispin's new System 2000 to automate its new digital facility, the LeRoy and Lucile Melcher Center for Public Broadcasting.

WXVT-TV is using the RapidPlayX to control a Profile video server for commercial playback.

Screen Shot

Dark Angel created with Clarity HD

Rainmaker Digital Imaging is using Pixel Power's Clarity HD to create titling for Fox's new series, *Dark Angel*. The program, created by director James Cameron, debuted Oct. 3 at 9:00EDT/8:00CDT and is being simulcast in standard definition and high definition.

Affinity edits Summer X-Games

ESPN used the Affinity nonlinear editor from Accom in its coverage of this year's Summer X-Games in San Francisco. The system has been used for the past several X-Games, and this year was used to create bumps, teases and digitized super bumps.

Five Dveous DVE systems and two Abekas 8150 switchers were also used in ESPN's coverage.

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IMMAD ECVS announced its intent to purchase **Synergistic Technologies**, a Pittsburg-based systems integration company. STI will be merged into IMMAD ECVS' U.S. operations under the management of IMMAD ECVS president and C.O.O. Rich Bisignano.

Leitch was selected by Panasonic to provide close to $6 million worth for the 2000 Olympic Games, including more than a dozen of its new Integrator routing systems. Other equipment used at the Games included audio distribution amplifiers, multiformat frame synchronizers, and video and audio converters.

Canadian broadcast distributor Bell ExpressVu recently purchased a Leitch server and news package for its Vu! pay-per-view service.

A number of broadcasters have purchased the Kalypso Video Production Center from **Grass Valley Group**, including WGBH in Boston, Euromedia in France, Eurohits in the Netherlands and the BBC. The systems will be used to create content for U.S. public broadcasting stations, upgrade regional news studios, produce music videos, and in a mobile unit for production of the French Open.

Grass Valley Group's ContentShare Platform has also been incorporated as a fundamental component of **Editware**'s new DPE-500 Series editing system.

iNEWS and **Media Exchange International** have announced a strategic partnership to offer broadcasters the opportunity to distribute media assets to vertical markets online via Virtual Private Networks (VPN).

Media assets and accompanying metadata will be managed and assembled by the iNEWS NRCS, while MEI administers and facilitates the broadband VPNs. The technology resulting from the partnership will enable broadcasters to target branded media assets to various niche markets.

iNEWS has also formed a partnership with **Vertigo Multimedia** to integrate Vertigo's Producer ON AIR and Producer Interactive systems into the iNEWS NRCS platform to allow broadcasters to immediately integrate new media input, such as viewer feedback, into live productions.

iNEWS also announced a phased project to combine their Media Browse 2000 with the Media360 media asset management system from **Informix**.

Omneon Video Networks and UK-based **Pharos Communications** have formed an application partnership utilizing Omneon's Video Area Network in conjunction with Pharos' process control systems.

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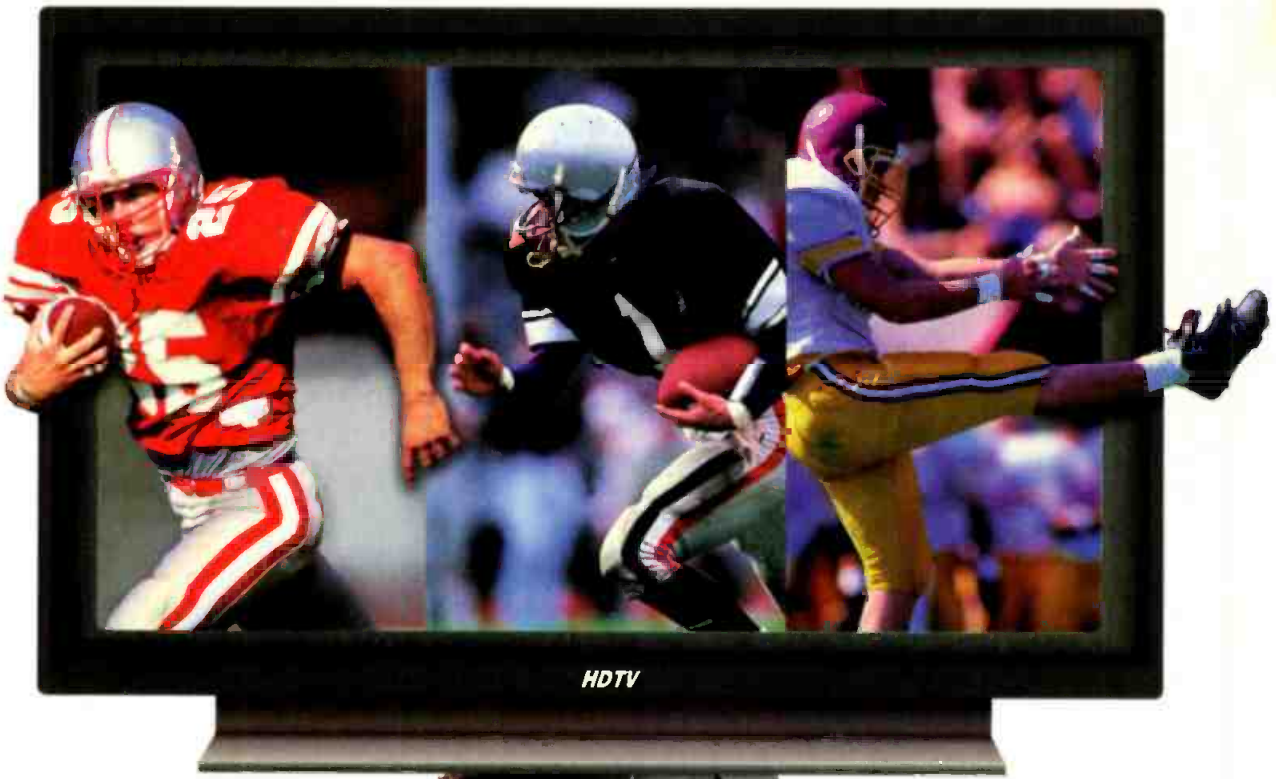

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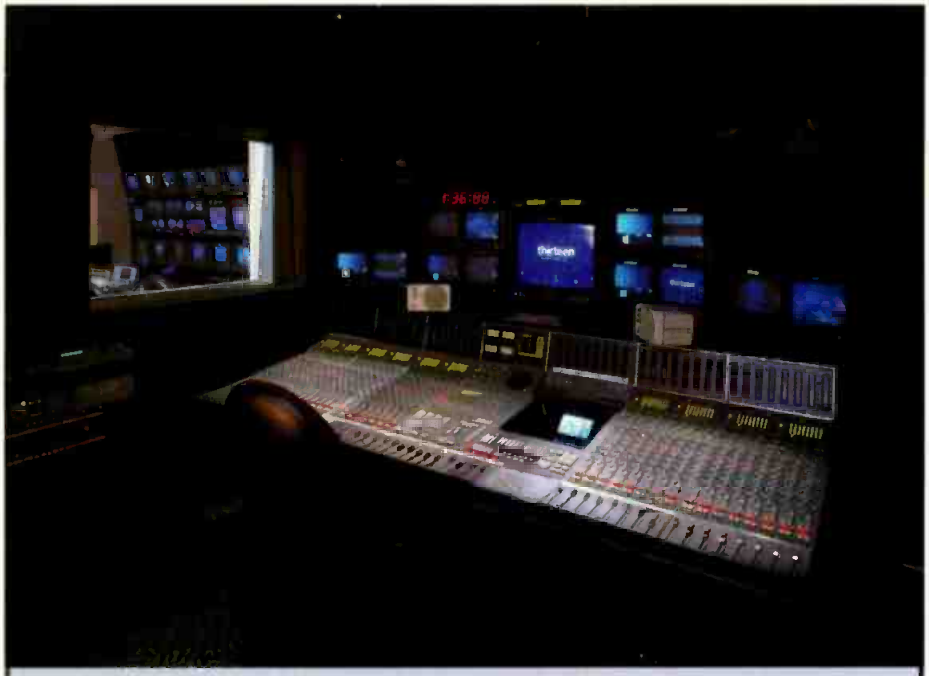

Clarification:

The September cover was incorrectly identified on the Table of Contents page. The photo actually shows WNET Public Television's recently installed 48-channel Solid State Logic Aysis Air console in its new all-digital production facility located in midtown Manhattan. The console is the centerpiece of the main production audio room servicing live and live-to-tape studio production. The Aysis Air is part of WNET's general move into being an all-digital facility as the industry moves to digital broadcasting. The photo was taken by Dave King.

Avid and **OmniBus Systems** announced a joint development project to provide tighter integration between their systems. Avid's shared storage system, Avid Unity, will be utilized to allow the companies' asset management and playout systems and content creation tools to share information more easily.

OmniBus will also work with **Pixel Power** to develop a character generator network interface enabling Pixel Power's Collage, Graphite and Clarity ranges to be available within the OmniBus automation environment.

EMC Corp. has acquired **Avalon Consulting Group**, a Denver-based supplier of rich media management software for the television broadcast industry, to operate as a unit of EMC's Media Solutions Group.

Mindport MCT and **SGI** have formed an alliance to integrate Mindport's content streaming software with SGI's video servers for broadcast and broadband applications to provide broadband network customers with a comprehensive broadband streaming solution.

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Sky News recently ordered five Pinnacle Systems FXDeko CGs with Rocket for Deko and ClipDeko. Four of the units will be utilized in the main Sky newsroom in London, and one will be installed at their Westminster Studios.

Thomson Tubes Electroniques has acquired Siemens' Berlin-based power grid tube operations, enabling them to offer a wider choice of broadcast transmission tubes. Siemens' operations will be transferred to TTE's Thonon plant in 2001.

FAST Multimedia and Hewlett Packard have announced an agreement to ship FAST's native DV editing system, purple., with Hewlett Packard's Kayak XM 600 as a turnkey system.

Cisco Systems has appointed Tandberg Television as an official reseller and systems integrator for Cisco's networking products to broadcasters. The agreement will deploy Cisco's universal broadband routers, interactive network adapters, DVB cable access routers and remultiplexing systems with Tandberg's evolution 5000 MPEG compression, broadcast management solutions, and modulation and multiplexing systems.

Tandberg Television has integrated its evolution 5000 multiplexers with Logic Innovations' 1U IP Encapsulator to provide opportunistic data solutions using SMPTE 325 in 20-, 30-, 70- and 100Mb/s versions. The integration will allow broadcasters to reclaim unused bandwidth in their digital broadcast streams.

Fox affiliate KPDX-TV is utilizing Panasonic DVCPRO digital component video equipment in the expansion of its news coverage and creation of its own newsroom. Equipment purchased for the station includes nine camcorders, five laptop editing systems and seven studio editing VTRs.

PBS station Thirteen/WNET New York and Peter Fish jointly purchased four Libra Series digital audio consoles from AMS Neve. Two of the consoles will be installed in Thirteen/WNET's two new audio post rooms, to be used for live mixing and post production applications. They will also provide for some of the audio needs of

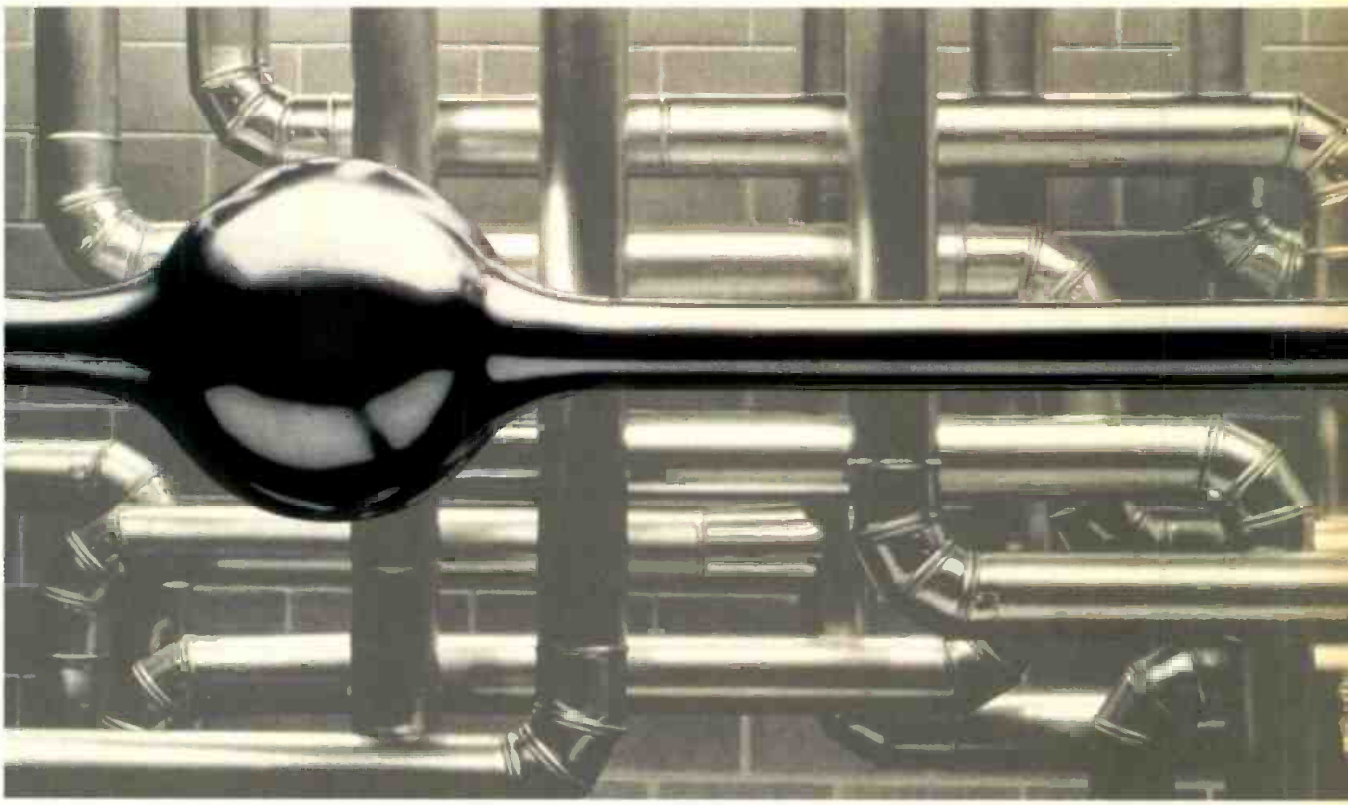
Screen Shot

NBC4 wins Emmy with Quantel

NBC4 in Washington, D.C., won an Emmy for a compilation of promotions including a 30-second spot for the Washington Redskins' pre-season and the *Redskins Report*, a weekly highlights show airing during the football season. The award-winning promotions were created using Quantel's Editbox and Paintbox FAT.

Animations were produced and sampled on the Paintbox FAT and completed comps were edited on the Editbox nearly at the same time.

DTV Transmission
So Much Content–So Little Bandwidth



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MOTOROLA
Broadband Communications Sector

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Fish's new audio post production facility. Fish will employ the other two consoles in his new facility.

Paris-based Plus XXX Studios has also selected AMS Neve equipment. The facility was the first to purchase AMS Neve's 88R analog console.

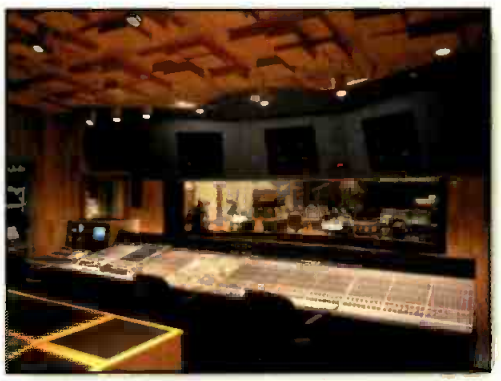
San Francisco station KTVU-TV selected Grass Valley Group's digital newsroom solution including Vibrint FeedClip, Vibrint NewsEdit and the Profile XP Media Platform. KTVU will use the system to replace the tape-based news systems currently in use.

Two stations, KTTC-TV in Rochester, MN, and WGEM-TV in Quincy, IL, recently purchased DTV transmitting and encoding equipment from Harris Corp. KTTC-TV will use a Harris Sigma CD high-power UHF DTV transmitter and a FlexiCoder MPEG-2 encoding system to offer digital service. WGEM-TV also purchased a FlexiCoder encoding system.

Signet Sound Studios installed 1034B active monitors from Genelec in Studio A. The monitors fill the L-C-R positions in the studio.

Kentucky Educational Television selected Hitachi's multilevel digital FM transmission system for the digital upgrade of its microwave network.

Todd-AO Scoring, a division of Todd-AO Studios, recently purchased a Solid State Logic SL 9000 J Series SuperAnalogue console to upgrade its scoring stage. The facility used the 96-input console to record the music soundtrack for the upcoming feature, *The Grinch*.



With the growing commitment to 5.1 audio among broadcasters, Dolby Laboratories' Dolby E audio coding technology is increasingly being used to facilitate multichannel programming distribution. Since September of 1999, facilities including Broadway Video, Pacific Ocean Post Sound, Warner Bros. Video Operations, IVC and the sound department for Walt Disney Pictures have installed Dolby's DP571 and DP572 Dolby E codecs.

Miranda has formed a new Operations Group encompassing Miranda's marketing communications, sales support, inventory and technical/customer support activities. The new group will develop an e-commerce strategy as part of an effort to streamline the process of bringing products to market. Robert Young will serve as vice president of operations for the new organization.

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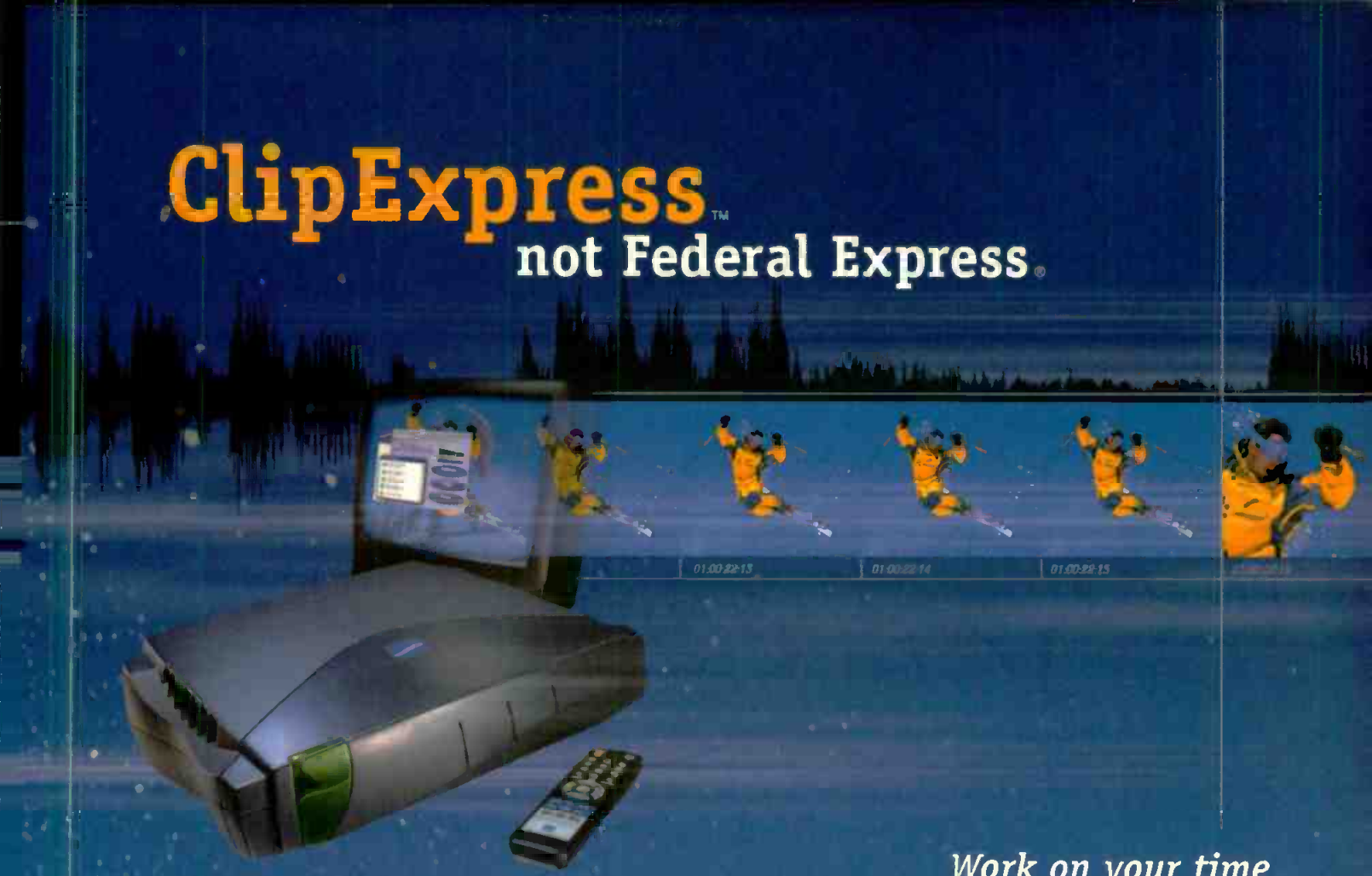

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The Weather Channel recently purchased a Radamec robotic control camera system consisting of two RP2A robotic pedestals with HK 435 pan/tilt heads, a PCU computer and two touch-screen operational panels.

Philips Broadcast, an associate company of Philips Digital Networks, supplied six LDK 23HS cameras to Fox Sports Network for electronic field production on major sports events throughout the United States.

PEOPLE

Omneon has added Timothy Slate as vice president of marketing and Jim Leighton as director of product marketing.

The following people were appointed to the speaker and microphone division of Telex's Pro Audio Group: Mike O'Neill, as vice president and general manager for speakers worldwide and for amplifiers in the U.S.; Joel Johnson, as general manager for wired and wireless mics worldwide; and Ralph Strader, as vice president and general manager for intercoms worldwide. Tom Hansen has been promoted to vice president of sales for installed sound, and Kent Rahn has been hired as director of marketing communications.

Andy Ioannou has been named CEO of North American operations for OmniBus.

Vega recently announced four sales and marketing staff appointments. Douglas Weinstein is joining the company as sales and marketing manager. Kimberly Ham has been promoted to sales administration manager. Darshon Ware was appointed as order administrator. Marco Garcia has joined Vega as technical sales specialist.

Pixel Power appointed Bruce Levine to the position of vice president of sales.

Marty Matsuhashi has returned to the post of president of Hitachi after a two-year stint as General Manager of Overseas Sales.


Marty Matsuhashi

Leitch recently appointed John Edwards director of product development. Kent Ewing was appointed director of operations.


Roi Agneta

Roi Agneta has been appointed chief operating officer of Vertigo Multimedia.

Colin Pringle has been appointed group marketing director for Solid State Logic.


Jim Wilmer

Calrec Audio has appointed Jim Wilmer as regional sales manager for North America.


Roderick Snell

Roderick Snell, president and founder of Snell & Wilcox, was recently honored by the British Kinematograph Sound and Television Society (BKSTS) with the President's Award. Snell received the award for his achievements in improving worldwide video standards for more than 25 years. ■

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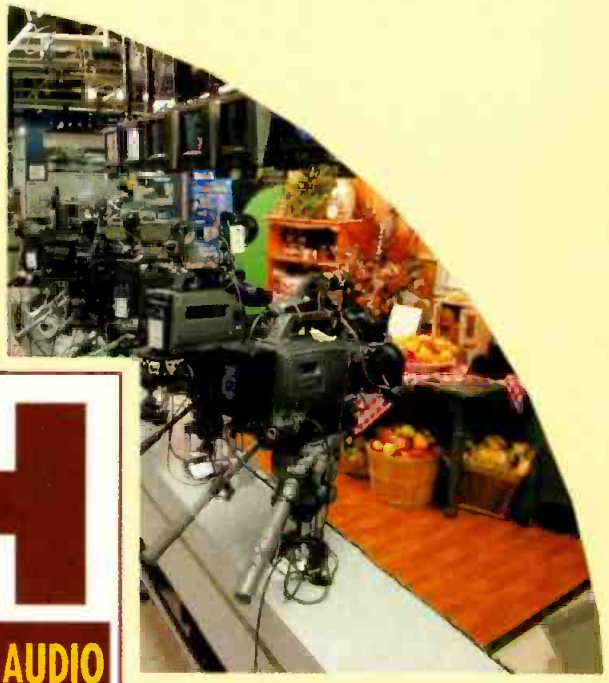
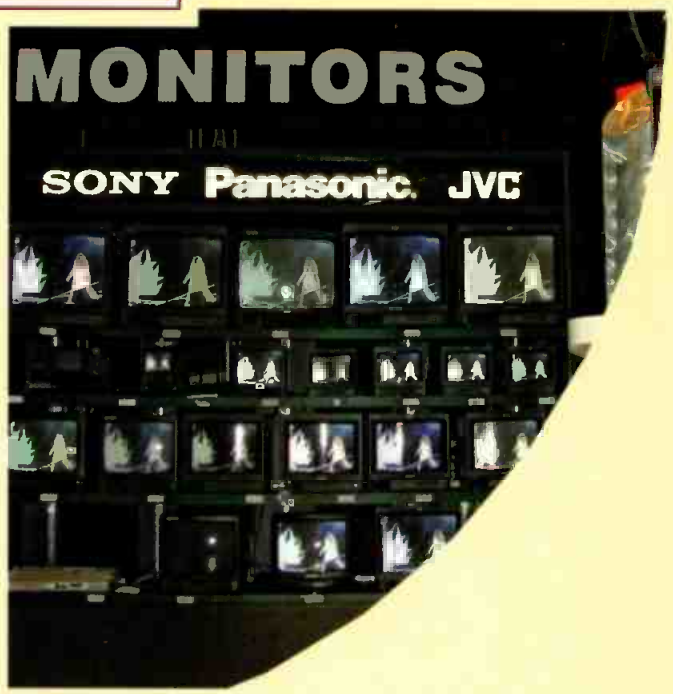


B&H

PHOTO - VIDEO - PRO AUDIO



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QUICK DIAL 74

SONY

DSR-250 3-CCD DV & DVCAM

Introducing everything you need in an event camera and more. The new completely digital DSR-250 from Sony is a high image quality reduced size camcorder which has been optimized for shooting events and parties. Every feature you could want is included in this revolutionary acquisition tool.

- **1/3 inch x three 380K pixel** (effective 340,000 pixels) **CCD's** that allow two scanning modes: 480 progressive (for still) or interlaced (for video). They also provide high quality acquisition with increased resolution and sensitivity at reduced noise and vertical smear.
- **530 lines of horizontal resolution**, allowing you to capture your subject with tremendous detail
- **Switchable aspect ratio** 4:3 (TV mode) or 16:9 (Movie mode)
- **OXF-E01 high resolution 1.5" black & white viewfinder** (same as on DSR500/1 & DXC-D35) enables easier focusing. Automatically switches from 4:3 aspect to 16:9.
- **Records in DVCAM or DV**, standard tapes or mini. Up to 270 minute recordeding in DV mode onto a 184 min. DVCAM tape.
- One touch auto focusing in manual focus mode.
- Manual or automatic functioning. Focus, Iris, Shutter-speed, Zoom Gain (3 positions and memory).
- **Flip out 2.5" 200,000 dot LCD monitor**, finally available on a professional camera • Time date stamp.
- **58mm lens with 12x optical zoom**
- **Advanced optical stabilization** allowing for a high quality digital zoom out to 24x, with a maximum digital zoom out to 48x
- **Assignable time code** (Rec Run, Free-run, User-bit)
- 16 bit 2 channel audio recording, or 12 bit 4 channel
- **Digital in/out** (IEEE1394) and **analog in/out**.
- **Still image capture onto memory stick** • Upload graphics from memory stick or USB adapter, software included
- Phantom 48V power • Built in speaker • Directional microphone in pro mic holder. 2 XLR audio inputs
- **Built in edit controller.** Equipped with an I.LINK interface, allowing camcorder to serve as edit player or recorder.
- Soft shoulder pad. • **Wireless remote controller.**
- Uses sony's lithium Ion batteries (BPL series).
- External 12V supply/Connection for light. The DSR-250 is equipped with light output (DC 12 V, maximum 30 watts).

DSR-300A 3-CCD Digital (DVCAM) Camcorder

Inheriting many of the same features and functions as the DSR-130, the affordable DSR-300A actually extends operational convenience with a range of new features and peripheral products. Remarkably compact and lightweight, the improved DSR-300A provides high mobility without compromising picture quality and can be held comfortably on your shoulder through the longest shoots and gives videographers the ability to acquire their footage quickly and easily.

- The DSR-300A has three 1/2" IT Power HAD CCDs to deliver 800 lines of horizontal resolution, 62dB S/N ratio and high sensitivity of F11 at 2000 lux.
- Power HAD CCDs also gives you a low smear level of -110 dB (DSR-300) allowing more freedom to shoot highlighted subjects
- With built-in 26-pin VCR interface, they can feed composite or S-Video output signals to an external recorder for parallel or back-up recordings. VCR recording modes including Parallel, Interval (only) and External (only) are selected via the trigger switch positioned on the operational panel
- With the DSR-300A, a picture previously recorded on tape can be superimposed on the viewfinder screen (Freeze Mix Function), allowing you to easily frame or reposition the subject just as in the previous shot. Combined with the SetupLog function, the retake shot becomes a breeze
- LSI Digital Signal Processor (the very same one used by the DxC-D30 cameras) for a high signal-to-noise ratio of 62 dB.
- Both mini cassettes (PDVM series) and standard cassettes (PDV series) can be used with the DSR-300A. With PDV-184ME (Standard), a maximum recording time of 184 minutes can be achieved. They can also play back tapes recorded in the consumer DV format
- For operational convenience while shooting, the Time Code is superimposed on the viewfinder screen or MONITOR OUT screen, even during playback
- DXF-B01 viewfinder featuring variable peaking, 3 level tally light and a white LED light with 2 levels of intensity to illuminate the lens setting • IEEE1394 I.Link (out only)
- Color Temperature Shift allowing the operator to manually shift the white balance either towards blue or red to compensate for conflictive (color temp mix) and because of the wide range it also provides creative artistic painting

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/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 the end of the tape, 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-20.

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, it 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

- 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.

SONY

DCR-VX1000 3-CCD Digital Camcorder

B&H SPECIAL $2495

The DCR-VX1000 records 500 lines of horizontal resolution, and has a higher S/N ratio than cameras costing ten times more. Also records audio digitally, using PCM technology, the same as used in CDs for a breathtaking dynamic range of 96 dB. Most important though, since video and audio signals are recorded digitally, you can copy or edit multiple generations with no loss in quality. Analog tape artifacts like color bleeding, dropouts and generation loss are all a thing of the past.

- Eight-speed 10X optical zoom lens goes from 5.9 to 59mm in 4.1- 20 secs. Also provides a digital 20X zoom.
- Records 12-bit/32kHz audio with two pairs of stereo tracks
- Automatic and manual audio level record controls.
- Built-in time base corrector (TBC) delivers jitter-free playback and dead-perfect stills.
- Digital effects include audio and video fade (to black), overlap and slow shutter • Time-lapse recording
- Sony's Super SteadyShot reduces high frequency camera shake without compromising image quality.
- Records "extended data codes". Automatically stores date/time, shutter speed, iris and other data for easy recall.
- Records drop-frame time code for accurate editing.
- Record still image pictures with audio for up to seven secs
- Focusing, exposure and white balance are all automatic or can be manually controlled.
- Zebra pattern indicator just like professional cameras.
- Preset, store and recall your own custom settings for color intensity, white balance, sharpness, brightness and gain shift (0dB/-3dB).
- Precision 180,000 pixel color viewfinder incorporates a separate information sub panel which displays time code, battery time, tape remaining and other camcorder functions without cluttering up the viewfinder
- Control L terminal for communication between camera and edit controller
- Built-in ND (neutral density) filter
- Square lens hood reduces external light flare effects

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. Incorporate three 1/2-inch 380,000 pixel IT 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). Rugged construction with a rigid diecast magnesium housing. Extremely portable, compact and light weight (lesss than 11 lbs. fully loaded). 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
- 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.

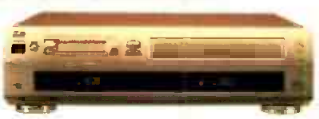
Professional Performance

- 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.

SR-VS10U MiniDV and S-VHS VCR Combo



The HR-DVS1U is a unique all-in-one video solution combining miniDV and Super Hi-Fi Stereo in one VCR. The MiniDV deck allows direct playback of cassettes you've recorded on a MiniDV camcorder without any cables to connect. One easy solution!

- Mini DV Format &High Resolution Super VHS and VHS
- Super VHS ET Recording
- Pro-Cision 19 micron width EP Heads
- DigiPure Technology w/ TBC and 4MB Frame Memory
- PCM Digital Audio (DV) and Hi-Fi VHS Stereo with MTS Decoder • Jog/Shuttle on Remote
- VCR Plus+ with "Cable Eye" Cable Box Controller
- Insert Editing with Flying Erase Head • Plug & Play
- Audio Dubbing • Auto Index and Index Search
- DA4(Double Azimuth) Head Helical Scan System
- Digital AV Tracking • Express Programming • Auto SP-EP Timer Recording • Active Video Calibration • Multi-Brand TV/DBS Compatible Remote with Jog / Shuttle
- S-video Input on Front / Back Panel • Two S-Video Output on Back Panel • Rear AV INPUTs, Gold Plated Front Inputs
- DV Playback Component Video Output. Two A/V Outputs

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 mains 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.

IDX

NPH-50

50 Watt Nickel Metal Hydride Batteries

Packed with 50-watts of power, these batteries provide long run times, using them as you would a traditional NP-type battery. Equipped with IDX's proprietary SF technology, they can even be charged in existing Negative Delta V style chargers, like the Sony BC1-WD, or any IDX nicad battery charger.

Both batteries are identical except that the NP-H50DX adds a power indicator.

- High capacity NiMH cells • Standard thermal and short circuit protection, extra thermal fuse for safety, special plastic design for added strenght.
- Environmentally safe • High efficiency/low temperature module • Capacity: 50Wh (13.2V/ 3.8Ah) • Camera run time: 115min @26 Watts)

NP-H50 ..... 129.95 NP-H50DX 149.95

JL-2 PLUS

2-Position Multi-Format Charger/Power Supply

Universal charger/Power Supply.
2-channel sequential quick charger and power supply for Lithium-Ion, NP/BP-type NiCad and NiMH battery packs.

SONY 800 SERIES

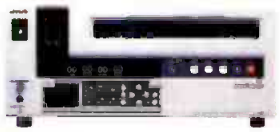
UHF WIRELESS MICROPHONE SYSTEMS

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.

SONY

UVW-1200/UVW-1400A

Betacam SP Player • Player/Recorder



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

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

UVW-1600/UVW-1800

Betacam SP Editing Player • Betacam SP Editing Recorder

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

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

PVW-2600/PVW-2650/PVW-2800

BETACAM SP 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.

PVM-20S1WU

20-inch 16:9 Color Production Monitor

The PVM-20S1W incorporates all of the superb features of Sony production monitors for 16:9 viewing in post-production and broadcast stations. It features multi-system compatibility, blue gun, underscan and H/V delay. It also offers flexible signal connections, a full range of optional functions and ease of operation.

- 16:9 aspect ratio CRT with dark panel for high contrast image reproduction • Accepts component (Y/R-Y/B-Y), RGB, Y/C and composite signals • Beam current feedback circuit for stability in the color balance
- Optional component serial digital interface kits BKM-101C (video)/102 (audio) available • Switchable aspect ratio (4:3 and 16:9) • Color temperature D65, D93 or user preset (3200K to 1000K) selectable
- On screen display for adjustment/ operation • User preset function
- Underscan, Blue Only and H/V delay mode available
- Auto chroma/ phase setup
- Accepts external sync
- Digital 3-line comb filter • Auto/Manual degaussing
- Mountable into an EIA standard rack with the optional SLR-103 slide rail kit.

B&H SPECIAL $999

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

13-inch and 19-inch Production Monitors

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

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

PROFESSIONAL VIDEO TAPES

FUJI

Professional Grade VHS

PG-30	2.29	PG-60	2.39	PG-120	2.59

Broadcast Grade VHS Box

BGR-30	3.49	BGR-60	3.99	BGR-120	4.69

H471S S-VHS Double Coated

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

M221 Hi 8 Double Coated

Metal Particles		Metal Evaporated	
P630HMP	4.49	E630HME	7.69
P660HMP	6.29	E660HME	10.49
P6120HMP	8.49	E6120HME	13.99

M321SP Metal Betacam (Box)

05S	10.99	10S	11.99	20S	12.99
30S	13.99	60L	20.99	90L	32.99

DP121 DVC PRO

12M (Med.)	7.49	23M	8.79	33M	10.99
63M	19.99	66L	22.50		
94L	30.99	126L	39.99		

maxell

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	27.95

Panasonic

Mini DV Tape

AY DVM-30	6.49	AY DVM-30 (10 Pack)	ea. 5.99
AY DVM-60	7.49	AY DVM-60 (10 Pack)	ea. 6.99
AY-DVM80	12.99	AY-DV123EB	20.95

DVCPRO

AJ-P12M (Medium)	7.99	AJ-P24M	9.99
AJ-P33M	11.49	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	4.79	P6-30 HMEX	8.19
P6-60 HMPX	6.79	P6-60 HMEX	11.99
P6-120HMPX	8.99	P6-120HMEX	15.99

PR Series Professional Grade VHS

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

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

T-30BA	3.69	T-60BA	4.19	T-120BA	4.99

MQ Master Quality S-VHS (In Box)

MQST-30	7.49	MQST-60	7.69	MQST-120	7.99

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

KCS-10 BRS (mini)	8.99	KCS-20 BRS (mini)	9.99
KCA-10 BRS	8.99	KCA-20 BRS	9.49
KCA-30 BRS	10.69	KCA-60 BRS	14.99

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

KCS-10 XBR (mini)	9.79	KCS-20 XBR (mini)	11.29
KCA-10 XBR	10.29	KCA-20 XBR	11.79
KCA-30 XBR	13.29	KCA-60 XBR	17.39

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

KSP-S10 (mini)	10.49	KSP-S20 (mini)	12.29
KSP-10	10.99	KSP-20	12.69
KSP-30	14.29	KSP-60	18.59

BCT Metal Betacam SP Broadcast Master (Box)

BCT-5M (small)	11.99	BCT-10M (small)	12.49
BCT-20M (small)	12.99	BCT-30M (small)	13.49
BCT-30M (small) (10 Pack)			ea. 12.99
BCT-30ML	14.99	BCT-60ML	21.99
BCT-90ML			30.99

Mini DV Tape

DVM-30EXM w/Chip	12.79	DVM-60EXM w/Chip	16.99
DVM-30EX "No Chip"	11.99	DVM-60EX "No Chip"	12.99
DVM-30PR "No Chip"	7.99	DVM-60PR "No Chip"	9.75

Full Size DV Tape with Memory Chip

DV-120MEM	24.99	DV-180MEM	26.99

PDV Series Professional DVCAM Tape

PDVM-12ME (Mini)	14.49	PDVM-22ME (Mini)	15.19
PDVM-32ME (Mini)	15.49	PDVM-40ME (Mini)	15.99
PDV-94ME (Standard)	32.99	PDV-124ME (Standard)	37.99
PDV-184ME (Standard)	44.95	PDVN-64N	24.95
PDVN-124N	31.95	PDVN-184N	39.95

Professional Services

Classifieds

Services

Classifieds

For Sale

Circle (198) on Free Info Card

Classifieds For Sale

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Advertising rates in Broadcast Engineering are $146.00 per column inch, per insertion, with frequency discounts available. There is a one inch minimum.

Ads may also be purchased By-The-Word for $2.25 per word, per insertion. Initials and abbreviations count as full words. Minimum charge is $45.00 per insertion. Frequency discounts and reader service numbers not available for by-the-word classified space.

To reserve your classified ad space, call Brian Huber at 1-800-896-9939 or 913-967-1732 Fax: 913-967-1735 e-mail: brian_huber@intertec.com

Classifieds Help Wanted

ASSISTANT CHIEF ENGINEER - Get in on the ground floor for HDTV. FOX/WB Affiliate looking for sharp Assistant Chief. Responsibilities include maintenance of electronic broadcast equipment, computers and telephone system for station. Requires 2 years minimum experience in broadcast maintenance including troubleshooting and repair of studio, audio, graphics and computer systems. Knowledge of microwave and satellite transmission systems a plus. Send resume to Human Resources, WZDX-TV FOX 54, 1309 N. Memorial PKWY, Huntsville, AL 35801. EOE

MAINTENANCE ENGINEER wanted for small market TV station. Experience with studio equipment, transmitters, and microwave required. Knowledge of SNG operations and computer networks helpful. Live in a beautiful area with four seasons of great outdoor recreation. Send resume and salary requirements to Director of Engineering; P.O. Box 5268; Missoula, MT 59806 or email charlie@keci.com .

UPLINK ENGINEER: Sure Shot Transmissions, a N.E. Ohio based mobile satellite uplink co., is seeking a full time engineer / operator. Candidate must have a clean driving record and previous experience on C or Ku band uplinking. Must be willing to relocate to Ohio and work nights, weekends, holidays and long stretches on the road. Salary depends on experience. Benefits include vacation, IRA, health insurance. Contact Tim Dailey at 330-542-0900 or E-mail to timdailey@sureshotsat.com.

BROADCAST TECHNICIAN Requires a minimum of 5-yr. experience working at major market TV broadcast facility. Must possess skills necessary to perform all assignments related to air operations and studio production, as well as be willing to work a variety of shifts and days off. An Associates Degree in electronics related field, technical school certification or FCC commercial license is preferred. Mail resume or fax 215-581-4515 **(no calls)** to James D. Gilbert, Director of Engineering, WPVI-TV, 4100 City Ave., Suite 800, Philadelphia, PA 19131 EOE

Classifieds

Help Wanted

MAINTENANCE ENGINEER

Audio Video Resources has a unique career opportunity for the right individual with the right attitude. The successful candidate will be responsible for repairing broadcast level vtr's, cameras, and associated equipment. He will also perform maintenance and systems integration in the field. Experience should include 5 years in a station or dealership environment preferably with factory training on Sony, JVC, and Panasonic equipment. Administrative/ Management experience is also desirable. Generous salary, benefits, & 401K. Drug test required. Fax resume to (602) 274-7416 Attn: J.L. Mohr.

Southeastern broadcast leader seeks to identify television and radio engineers interested in being key contributors to the dominant air product in the respective market.

Ideal candidates for television Chief Engineer require strong knowledge of broadcast television engineering and in-depth technical knowledge of how a TV station operates and functions and how its technical infrastructure relates to the overall transmission of the air product. Eight years technical "hands-on" experience desired, plus ability to administer and manage capital budgets and projects. Commercial FCC general class license is highly desired.

Radio Technician candidates will be responsible for project execution, maintenance, and all technical operations at state of the art multi-station radio facility. Background in high power AM directional, FM combined RF transmission systems. Direct experience with Media-Touch and Novell networking a plus.

For more specific information and confidential employment consideration you may contact HIRED@JPC.COM. Applicants should send resume to: Personal/ Confidential, Classified Ad Coordinator, Broadcast Engineering, Dept. 803, 9800 Metcalf Avenue, Overland Park, KS 66212.

Classifieds

Help Wanted

Maintenance Engineer – LMG, Inc. seeks an experienced Maintenance Engineer for their Orlando, Florida location. Must be proficient in component level repairs on broadcast, professional and consumer video and audio equipment.

Candidate must show a strong aptitude in projector installation and maintenance. The position requires a minimum of five years experience in A/V or related industry. A strong working knowledge of analog and digital video formats and computers is preferred.

LMG offers a competitive wage and benefits package. Fax resumes to (407) 438-8422, Attn: HR, or visit our web site www.LMG.net to post your resume or mail to P.O. Box 770429, Orlando, FL 32877-0429. EEO/Drug Free/Smoke Free. No phone calls please.

CHIEF ENGINEER: WGBO/Univision 66 Chicago is looking for a Chief Engineer with a minimum of 5 Years experience as a Chief or Assistant Chief Engineer. Candidate will assist in preparation and administration of capital and operating budgets and be responsible for equipment purchases and installations. Candidate will act as liaison between engineering and all other departments for daily operations, major events and special projects. Candidate must have a good track record as a proven project manager, staff developer and administrator with excellent managerial, organizational, communications and interpersonal skills. Experience in all areas of television broadcast maintenance, including UHF transmitters, ENG systems, studio equipment and knowledge of FCC Rules & Regulations is required. College degree or equivalent industry training as well as computer literacy required. Send resume and cover letter to Human Resources, Univision/WGBO, 541 N. Fairbanks Court, 11th Floor, Chicago, IL 60611. Fax: (312) 494-2745. E-mail: fbaker@univision.net. EOE.

MAINTENANCE TECHNICIAN: WATE-TV6 has an immediate opening for a Broadcast Maintenance Technician. Applicant must be a graduate of an accredited electronics school or-college. Must be capable of troubleshooting broadcast electronic equipment to the component level in cameras, videotape machines, switchers, transmitters, and associated terminal equipment. Must have an understanding of computers and microprocessors as they apply to broadcasting equipment. Transmitter experience is necessary. Must have a General Class FCC license and SBE certification a plus. Interested parties send resume to: **WATE-TV6, ATTN: PERSONNEL, P.O. BOX 2349, KNOXVILLE, TN 37901.** No beginners and no phone calls, please. EEO Employer.

CEI, a leading Broadcast Systems Integrator, is seeking professionals for the following position: **Installation Supervisors and Technicians** (Staff and Freelance) Qualified Candidates will have experience with audio, video and control cabling and broadcast equipment installation. Must be able to follow system detail drawings and cable run sheets. **Broadcast Service Engineer:** The Service Engineer will provide technical repair and maintenance services to broadcasters, post production facilities and other A/V clients. This position requires working with clients to provide on-site and/or shop repair services for broadcast equipment. Applicants must be experienced in the component level repair of cameras, video tape recorders and other production equipment. Fax or send resume and salary requirements to: Human Resources, Communications Engineering, Inc. 8500 Cinderbed Road Suite 100, Newington, VA 22122. Fax # 703-550-5180. Email: shay.martello@commeng.com

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STUDIO MAINTENANCE ENGINEER
Must be able to perform the following duties: install and maintain studio transmission equipment including video switchers, audio consoles, DVE, CG, SS, cameras, and robotics. Familiarity with automation systems and master control environment. Should possess a general computer/networking background. Must be able to work on a rotating shift schedule. Candidate should have an engineering degree or equivalent technical training. SBE/FCC certification a plus. If you want to be a part of the exciting transition to HDTV in the most exciting city in the world, please send your resume and cover letter to: Kurt Hanson, Chief Engineer, WABC-TV, 7 Lincoln Square, New York, NY 10023. No telephone calls or faxes please. We are equal opportunity employer.

KPTM 42/KXVO 15 is currently accepting applications for a Maintenance Supervisor. The successful candidate should have an educational background in electronics and electronic maintenance, and 3 to 5 years television engineering experience. Duties include maintaining and trouble shooting UHF transmitters and studio equipment, overseeing day-to-day maintenance operations, and assisting with staff development and training. Experience with 1", SVHS, or DVC Pro tape formats preferred. The ability to work across departmental lines as well as working with minimal supervision is a must. Please send your application or apply in person to: KPTM 42/KXVO, Attention: Personnel, 4625 Farnam Street, Omaha, Nebraska 68132 EOE

Media General Broadcast Group
www.mgbg.com WJHL-TV WJHL Newschannel 11 is seeking a Studio Maintenance Technician. Applicant will perform the repair, modification, installation, and integration of all technical equipment, related to the operation of the station. A college degree in electronics, military training, or trade school certification preferred. Good communication, and computer skills a must. Must be a team player and be available to work nights and weekends. Excellent benefits package. Attn: Chief Engineer, WJHL-TV, P.O. Box 1130, Johnson City, TN 37605. EOE M/F Drug Screen. Send resume to: HR Dept.

Classifieds

Help Wanted

TOP ENGINEER SOUGHT

Top-level engineer sought by industry's most cutting edge and respected systems integrator. Large firm with entirely A-list clientele looking for an engineer with the ultimate technical chops to join our dedicated team. We offer top pay, significant benefits, interesting work, and an opportunity to work with people who love what they do. Expertise in AUTOCAD and Excel a must. Send your resume to Personal/ Confidential, Classified Ad Coordinator, Broadcast Engineering Dep't. 801, 9800 Metcalf Ave., Overland Park, KS 66212-2216

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Broadcast ENGINEERING
THE JOURNAL OF DIGITAL TELEVISION

ASSISTANT CHIEF ENGINEER: WTVY-TV (CBS), a Benedek Broadcasting station, has an immediate opening for an Assistant Chief Engineer with a minimum of four years experience in the installation and maintenance of all types of broadcast related equipment. Must be able to repair equipment to the component level and possess a General FCC license and/or SBE certification. Computer networking experience is considered a plus. Must be self-motivated, computer literate and be able to work flexible hours. Salary commensurate with experience. Mail resume to Human Resource, WTVY-TV, 285 N. Foster St., Dothan, AL 36303. Fax #334-793-3947. E-mail sybil@wtvynews4.com. EOE.

Major National Broadcast and A/V Systems Integrator seeking **DIRECTOR OF ENGINEERING.** Candidate should have BSEE or equivalent. Ten years management experience in broadcasting (systems integration, systems architecture, installation/maintenance, testing & repair). Project Management experience is a plus. Applicants should also have basic knowledge of architectural, mechanical and electrical systems; strong oral and written communications skills, strong people management skills, strong budget management skills and be computer literate. EOE. Pre-Employment Drug Screen. Send your resume to Personal/Confidential, Classified Ad Coordinator, Broadcast Engineering Dept. 802, 9800 Metcalf Ave., Overland Park. KS 66212-2216

Paxson Communications is looking for qualified candidates for the following:

Regional Director of Engineering

Should have a minimum of 10 years as a Television Chief Engineer or equivalent with a strong background in RF and management. Will oversee approximately 10 television stations. Location of home office is flexible, but Chicago is preferred, with regular travel required to all stations in your group.

Chief Engineer of Television Station

We have several openings for Television Station Chief Engineers across the country. Applicant should have a minimum of 5 years as a Television Chief Engineer or equivalent, with a strong background in RF.

Chief Engineer of Broadcast Integration Facility

Strong knowledge of both analog and digital broadcast equipment and its interconnectivity, capable of designing control rooms, knowledge of CAD programs and strong management skills mandatory. Minimum 5 years in broadcast, wiring techniques and attention to detail needed. Applicants wanting to live in a tropical Florida setting should apply.

Technician for Broadcast Integration Facility

Several applicants are needed at Paxson's integration facility to interconnect broadcast equipment into a "turn-key" master control. Capability to read schematics, solder, work with your hands and attention to detail a must.

For more details and job qualifications, please send your resume, references, and salary requirements, indicating position desired, to: **Paxson Corporate Engineering, 11300 4th Street North, Suite 180, St. Petersburg, FL 33716. Fax: 727-576-2876 or email: engjobs@paxemail.com.** EOE

CLEAR CHANNEL of Jacksonville seeks person to operate and maintain SNG truck. Must have good driving record and be willing to travel on short notice. Must be able to maintain and operate DVCPro, microwave/satellite, editing, switching, and various computer equipment. Ideal candidate will be a self-starter, well organized, and have a proven record in technical repair. Send resume to Jerry Randall, Chief Engineer, WAWS/WTEV, 11700 Central Parkway, Jacksonville, FL 32224. EOE

Classifieds Help Wanted

ENGINEERS

Turner Broadcasting System has career opportunities for experienced television engineers. These career positions demand an extensive background in equipment maintenance, digital video and audio, and knowledge of computer systems and networks. Please mail or fax your resume and cover letter to:

Jim Brown
Assistant Vice President of
Engineering Services
Turner Broadcasting System, Inc.
One CNN Center
P.O. Box 105366
Atlanta, GA 30348-5366

Fax: 404-827-1835 • Phone: 404-827-1638
e-mail at: cnn.engr.jobs@turner.com
TBS is an equal opportunity employer.

CNN

THE WORLD'S NEWS LEADER

Maintenance Engineer

Houston's WB39 KHWB

A Tribune Broadcasting Company

KHWB is looking for a highly qualified, motivated maintenance engineer. Computer skills and software knowledge are required. The applicant should have a technical education or SBE certification. Demonstrated experience with component digital equipment, embedded audio, CODFM microwave, compressed digital Up-Link, Newsbase, ENPS or Louth GMT systems is a plus.

KHWB is an EOE and Drug Free Workplace. Please, no phone calls. Fax resumes to 713-781-3609, e-mail to sliu@tribune.com or mail resumes to: Human Resources, KHWB WB39, 7700 Westpark Dr., Houston, TX 77063

TELEVISION MAINTENANCE ENGINEER Position is now available at IN TOUCH MINISTRIES. A degree in electrical engineering or equivalent experience is required. Applicant must possess excellent logic skills. Post production maintenance experience helpful. Send resume and salary requirements to Darvin Sparks, In Touch Ministries, 3836 DeKalb Technology Pkwy, Atlanta, GA, 30340 or fax to: 770.936.2749

BROADCAST MAINTENANCE ENGINEER: Broadcast Engineer needed for National News Network in Washington DC. Extensive background in broadcast equipment maintenance. Team leader, minimal supervision, good communication skills, min 5 yrs experience. Digital knowledge a plus. Competitive salary and excellent Benefits. Fax resume, letter c/o Eng. Manager 202-515-2217. Email John.Cunha@turner.com

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www.broadcastengineering.com

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EOM

Rethinking the DTV deal

BY PAUL MCGOLDRICK

Don't you just hate it when someone reneges on a deal? It doesn't matter whether it is a small thing like meeting for lunch or a big thing like a job offer – when someone changes their mind or realizes the deal isn't as good for them as they thought we all get peeved. It becomes so much worse when someone hints we are not going to meet our part of a bargain before we even get a chance to.

Recently at the Museum of Television and Radio, FCC Chairman William E. Kennard made what was, in large part, a political speech about the social and international effects of television and the responsibilities of broadcasters during this year's political season. From the title of his speech, "What Does $70 Billion Buy You Anyway?" you might have guessed that he also took the opportunity to poke at some DTV implementation doors, a subject he approached by declaring how much DTV could do for children. One of DTV's purposes is "to serve children in dynamic, innovative ways" with more educational programming, Kennard said. "So the parents of 10-year-olds do not have to choose between allowing their children to watch *Buffy the Vampire Slayer* or *Dawson's Creek* or resigning them to cartoons."

Mr. Kennard obviously believes it is the children's duty to be permanently ensconced in front of the TV. Although many broadcasters would be happy to provide more educational broadcasting, market realities are such that most cannot afford to do so.

Then Kennard went on the attack. He pointed out that bandwidth is "the most valuable resource of the information age" and broadcasters should speed up the return of "the valuable analog spectrum to the American people." By "people" of course he means big business.

What seems to have got up the Chairman's nose is the small print of DTV spectrum allocation. Congress has put Kennard between the proverbial rock and a hard place – they want the old analog spectrum sold to balance the budget, but they also made the rules on the allocations. The one rule that has become the problem is that broadcasters have been granted the additional digital spectrum in addition to that used for analog transmissions, which they can keep until 2006 *or* until DTV penetration reaches 85 percent of the American market, whichever is *later*. Kennard believes that "later" actually might not be until 2025.

Kennard wants Congress to close the 85 percent loophole.

So Kennard is accusing broadcasters of "spectrum squatting," calling the business model of the next decade one where the slogan might be a Twix commercial, "Two for me, none for you." Even if this is true – and there is certainly reason to believe that it is not entirely untrue – it was rather insulting to the industry in general. Congress could certainly be described as creating the monster Kennard believes he is having to live through. Congress has also created his alter-ego dilemma in getting back that spectrum. He needs, perhaps, to direct his frustration to that branch of government instead of accusing the broadcasters first in a political approach.

To persuade broadcasters to get back on the implementation track Kennard wants Congress to close the 85 percent loophole, require DTV capability on all new receivers after January 2003, and require broadcasters to pay a fee for their analog channels after Jan. 1, 2006. That "spectrum-squatters' fee" would escalate yearly until "broadcasters complete their transition to digital and return the analog spectrum to the American people."

This is not how you deal with contract agreements. You read the small print with all the other text and you look at the implications of what you are signing. You look at the ramifications, the what-ifs and the probabilities and then decide whether to commit yourself. Once you have committed you go along with it – or you go back to the negotiating table and give something more to the other parties to make it happen the way you would like.

With a tiny chunk of 700MHz spectrum netting the government $519 million recently and auctions in Britain raising $33 billion, and Germany $45 billion, the phraseology sometimes used by officials is quite astonishing. The head of the FCC's wireless bureau recently told a Senate committee, "Today we simply do not have enough spectrum to give everyone all that they want." Give? At these prices the beachfront properties that spectrum represents are hardly suitable for the first-time buyers in wireless businesses.

But when you come to a spectrum argument with the mindset that the broadcasters – a huge chunk of your oldest customers – are sitting on a $70 billion giveaway that you now think is not fair maybe you need to start thinking about your replacement. You only become part of the problem, Mr. Kennard, when you think in terms of punishment rather than help. Many stations need that help to make this transition, sit down with them and work around it. ■

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

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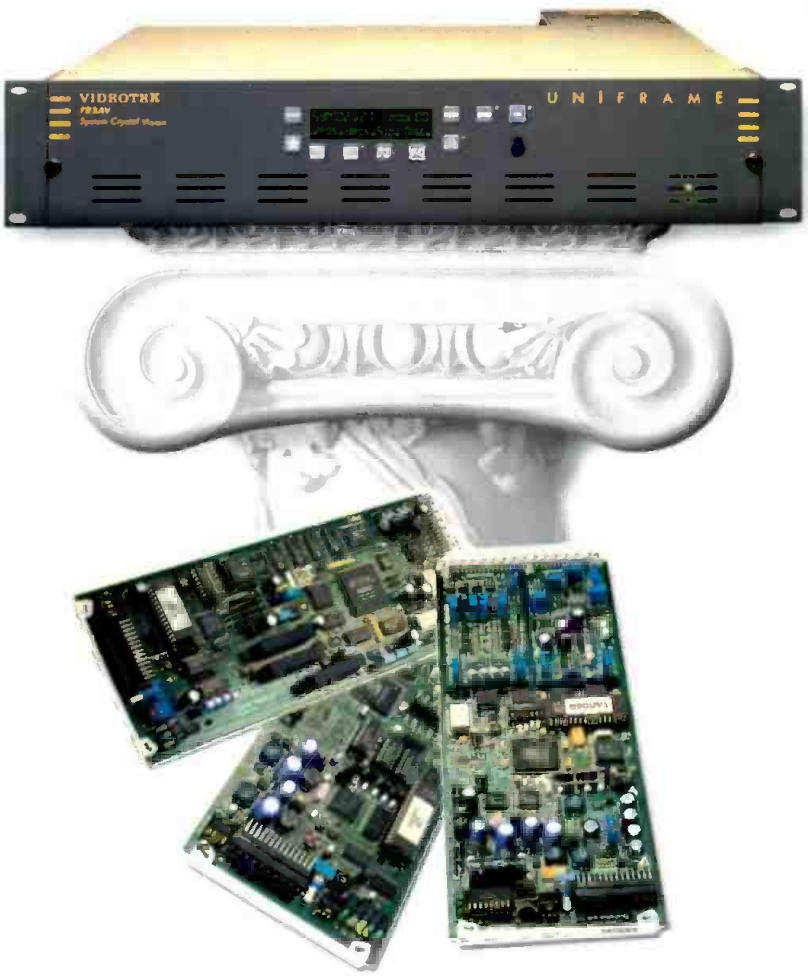

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