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JULY 1999

Broadcast ENGINEERING®

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- Understanding DTV transmitters
- Selecting transmission line

Also:

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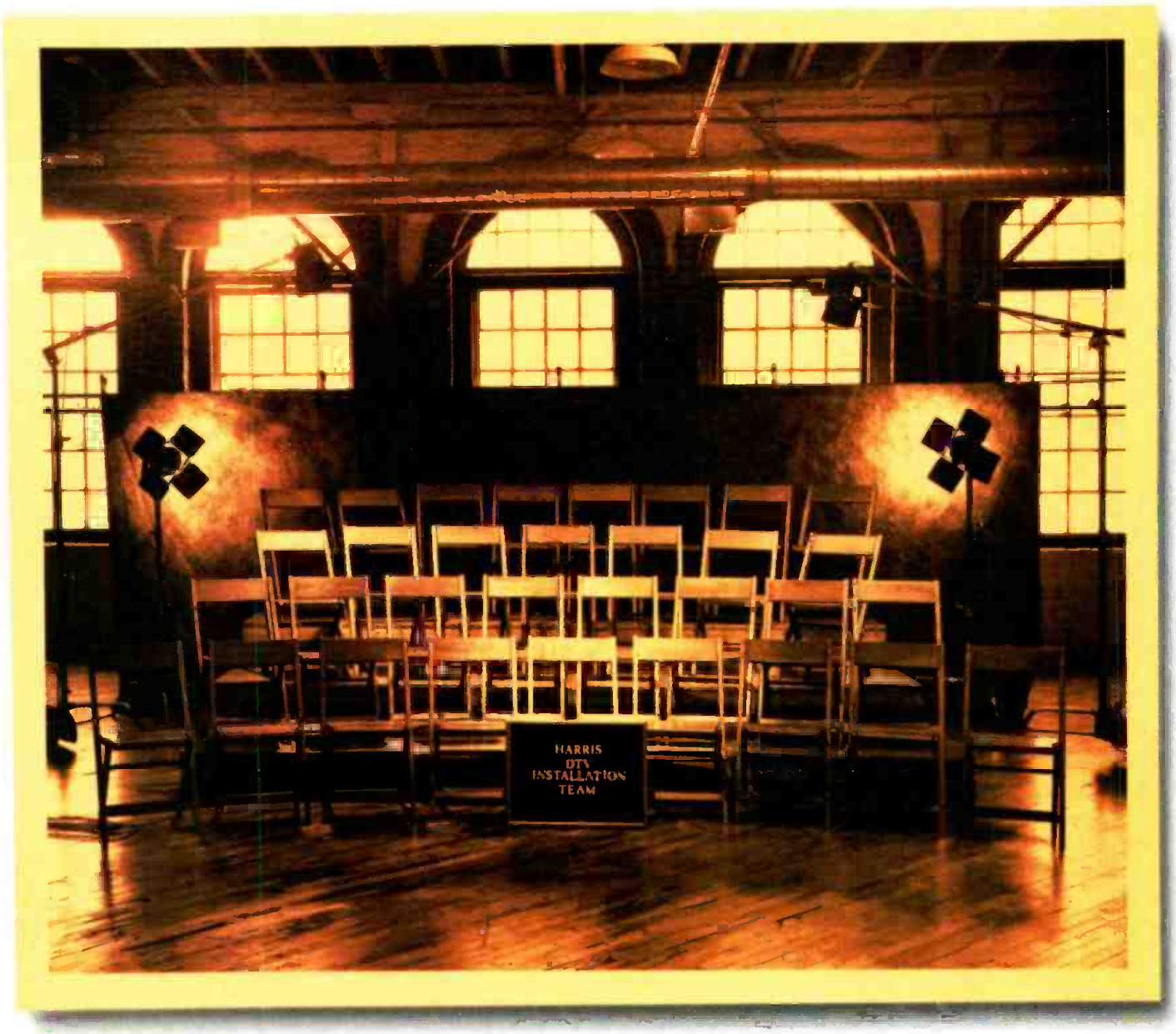

*As of November 16, 1998.

Installing nearly 2/3* of the DTV transmitters doesn't leave much time for other things.

The last thing on the minds of our DTV installation experts is getting together for a group photo. Our dedicated (and very busy) DTV staff has already put more stations on the air than all of our competitors combined. So if you're one of the stations that need to be digital by November, you can rest assured our DTV field experts know what it takes for a smooth conversion. By the November 1, 1998, U.S. DTV launch date, Harris had already partnered with 27 stations to lead the way into the digital era. But there are still more to go. And we're ready. With or without a team photo.

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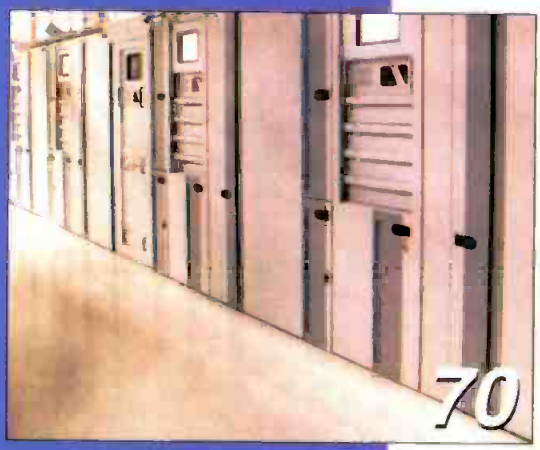

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Digital Handbook

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COMPUTERS AND NETWORKS

ASK DR. DIGITAL

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THE NEW GOLD STANDARD

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ON THE COVER: *Cover shows new antennas for Detroit stations WWJ-DT and WTVS-TV as installed last month on a 1087-ft tower designed, fabricated and erected by LeBLANC Broadcast. An antenna for WWJ-TV was subsequently installed and the station began operations on June 22nd. The tower is capable of supporting a total of six TV antennas from the 50-ft candelabra. In addition, the tower is capable of supporting two FM panel systems and associated services. Photo courtesy LeBLANC Broadcast.*

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913/967-1905 fax

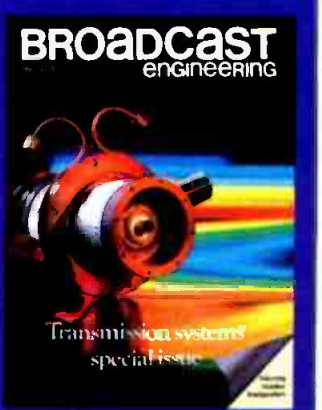
FREEZE FRAME

A look at the technology that shaped this industry.

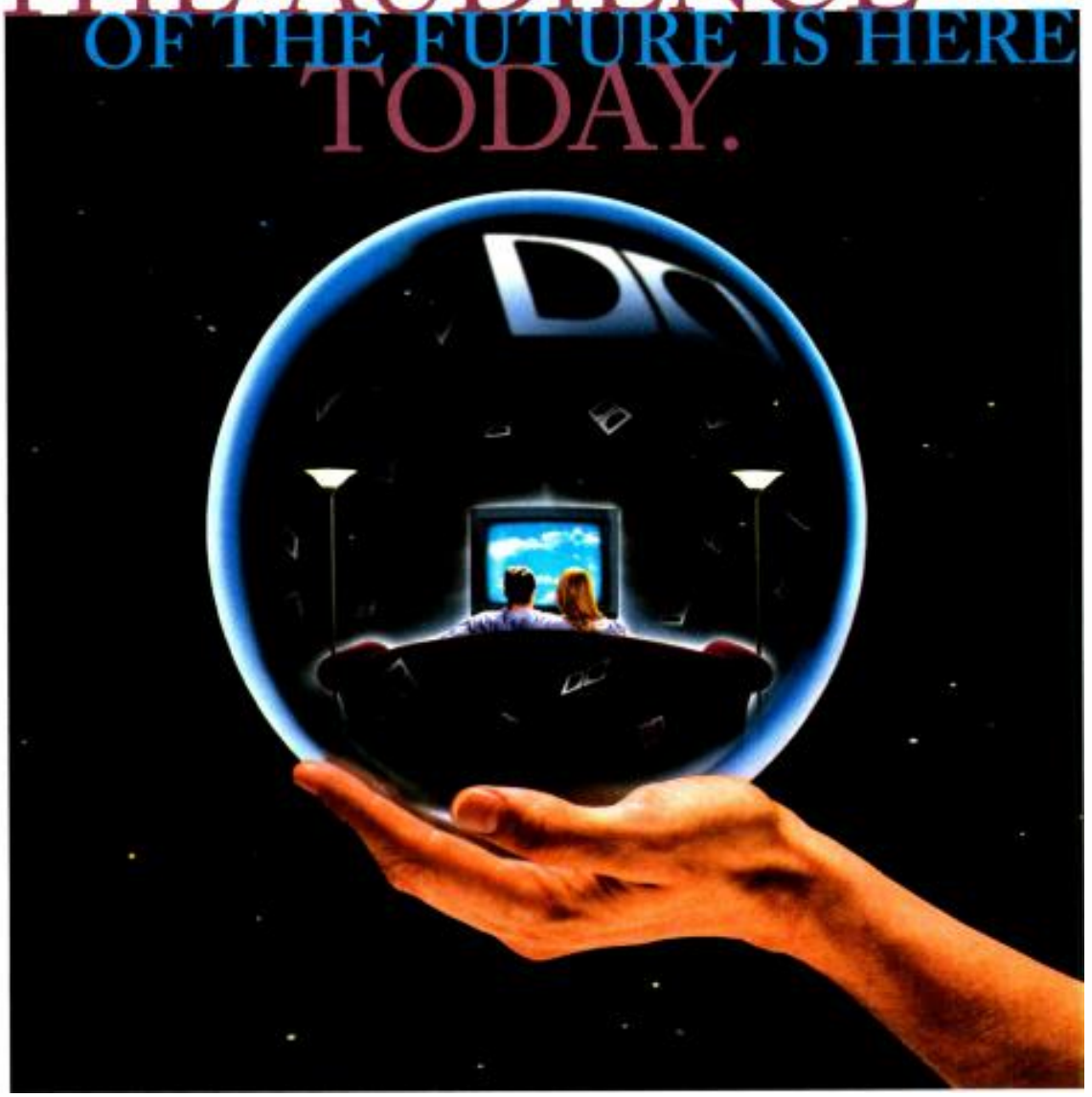
Do you remember?

You can win a Broadcast Engineering T-Shirt!

What is the device shown in the photo on the cover of the May, 1986 issue of Broadcast Engineering? The first five correct answers win a T-Shirt. Send your entry to: brad_dick@intertec.com.



THE AUDIENCE OF THE FUTURE IS HERE TODAY.



You don't need a crystal ball to tell that the future of audio is surround sound. After all, it's here right now. Millions of consumers already expect multichannel sound with their favorite TV shows and movies. Sound brought to life by Dolby Surround. And by Dolby Digital for 5.1 channel audio with digital TV. So, if you aren't delivering programs with multichannel audio today, where will your audience be tomorrow? For more information on surround technologies and products from Dolby, visit our web site.

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Editorial

Let the buyer beware

I just returned from a family reunion. It was great to meet and visit with cousins, aunts and uncles. We reminisced and laughed about old times. Sharing stories and recollections all are part of what make reunions such memorable occasions.

Documenting such events is always important. And, for me, the small disposable film cameras have been a convenient solution. This time, unfortunately, I was tricked through a camera manufacturer's deceitful labeling practices.

Just before leaving town I purchased three of the small green disposable cameras. While at the reunion, I took about 75 photos of family and friends. You know the goofy shots that mean something to only me. In addition, there were the obligatory family pictures. Those one-of-a-kind, never-to-be-repeated photos of entire families — those that help you remember loved ones and those that remind you of who's missing, for instance, my dad isn't in the photos this time.

After returning home, I took the film to be developed. Upon picking it up, I was shocked to learn that the developing wasn't the typical $6 per roll but $12 per roll. Curious, I asked why, and was told, "That's just what we charge for that kind of film." I realized something was wrong here, but I just hadn't yet figured it out.

After looking at the pictures, I was so disappointed I almost cried. The photos are grainy, fuzzy, out of focus and, frankly, just plain crap in terms of image quality. I'm used to getting decent picture from those inexpensive 35mm disposable cameras but these pictures were totally inferior to what I'd expected. And, it wasn't just that I had a bad camera because all three cameras produced equally bad pictures.

Finally, I noticed a small phrase on the package containing the developed pictures. There was the phrase "24mm film." 24mm film? Who the hell ever heard of 24mm film?

Where I thought I'd purchased 35mm film cameras, instead, I was getting 24mm film cameras. Adding to my growing anger was that no where on the green and black camera packaging does it say that the film is 24mm, not 35mm. If I had *chosen* the smaller film format, there would be no one but me to blame. But in this case, the manufacturer hides that significant detail.

All this leads me to believe that a similar case of misleading sales tactics are about to be unleashed upon American consumers.

Viewers are going to find themselves purchasing TV sets with no information on the actual display characteristics. Vendors are going to use every trick in the book, including such weasel words as "digital," "16x9," "improved resolution" and who knows what else to entice the purchase. The result is that consumers will have no idea of what image quality they're actually going to get. It's already started. At one press event, when asked about lines of native resolution of a particular set, the manufacturer *refused* to answer the question.

So, thanks to the inept FCC, we're facing the launch of DTV sets of varying image quality and no assurance set makers won't use every trick in the book to confuse and confound consumers. Perhaps, instead of using bogus phrases or numbers to confuse us, the set vendors may just try to hide the truth by say nothing — just like I discovered on those little lousy cameras.

Let the buyer beware was never more true.

Brad Dick

Brad Dick, editor

Send comments to:
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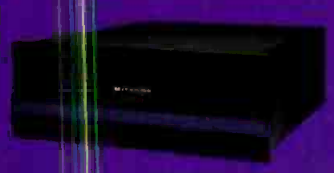

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Reader Feedback

Kennard's army of lawyers

The May editorial titled, "Kennard's army of lawyers" hit the hot button for several Broadcast Engineering *readers. Here are a few of their comments:*

Just a short note to let you know that your editorial hit the nail on the head and I hope that at minimum the vice president and key FCC officials along with Kennard gets a copy of that editorial.

Commercial broadcast is in complete disarray with the deregulation and lack of technical expertise in the FCC.

Best regards,

DEAN SEVER
SBE MEMBER
BROADCAST CONSULTING ENGINEER

Bravo for going to bat, Brad Dick. We faxed your editorial to Senator Burns as a follow-up for a request. We operate cable systems in mobile home parks and Comcast, Insight and ATC have retracted their offer to buy [our system] "due to the Cable Act of '92." Yet, AT&T and MediaOne may be allowed to merge, because they *don't rival each other*. Is this a level playing field?

Recently, Ex-Commissioner Chong told us (since '92), "You are operating in a gray area, you are caught in the middle...even though FCC abrogated grandfathered exclusivity, you have to continue paying royalties to the park."

The [Telecommunications] Act was about fostering competition. Odd, in view of the consolidation that has occurred. Are we being used as pawns? No answer from FCC/Congress for years.

HANS HETTLER
CABLE SYSTEM OPERATOR

I find it very interesting that Clinton chose not to nominate a single person with an engineering background as one of the current commissioners of the FCC; all five are lawyers. After reading their bios, it is difficult for me to avoid the conclusion that the majority (at least three of the five) of his choices were based on how politically correct they looked on paper, and not how well they would perform their jobs. Kennard's bombastic comments have done nothing to dissuade my opinion.

If Kennard really wants to protect the consumer, as he so often claims, he needs to sit down, shut up and let the experts weed out solutions. He also needs to realize that progress may be slim on his boss's watch. Exacerbating the situation will only draw attention away from the real issues.

BILL FIELD
EXTRON ELECTRONICS

New digital tape format

In the May article, "New digital consumer format," the author says that DVHS will utilize the huge supply of VHS tape that has already accumulated.

How is that so? D-VHS will not likely record on standard VHS tape, will it? You can't record an S-VHS signal onto a tape made for VHS/VHS-HQ recorders.

KENNETH OTTO
WBCC TV
COCOA, FL

News editor Larry Bloomfield responds:

With regard to the article I wrote, "'New digital consumer format," you were on track when you questioned if this consumer device is capable of recording digitally received material (bit streams) on VHS tape. Please keep in mind that this is a consumer device. JVC incorporated legacy format capabilities into it, which would include functionality to record and playback the older "supply of VHS tape that has already accumulated," as stated in the article. This is, however, for analog material only. When in the "VHS mode," the device it is not a digital recorder.

Dave Walton, marketing communications manager at JVC, says, "The D-VHS recorder is designed around VHS recording technology to ensure compatibility with over 700 million VHS recorders worldwide. In the VHS mode, the machine will behave just like any other VHS recorder and use the same tape. When recording digital bitstreams, a higher grade of tape is required, and therefore tapes bearing the 'D-VHS' mark must be used. The huge worldwide inventory of VHS recordings will not be obsolete with D-VHS."

Recent Freezeframe winners:

August Villasenor, ECE
Quezon City, Philippines

Garen Braun
KGAN,Cedar Rapids

Norm Birnbaum
WTHR-TV, Indianapolis, In

This month's question is on page 6. See if you can identify the item on the cover. The first five correct answers win a *Broadcast Engineering* T-shirt. ■

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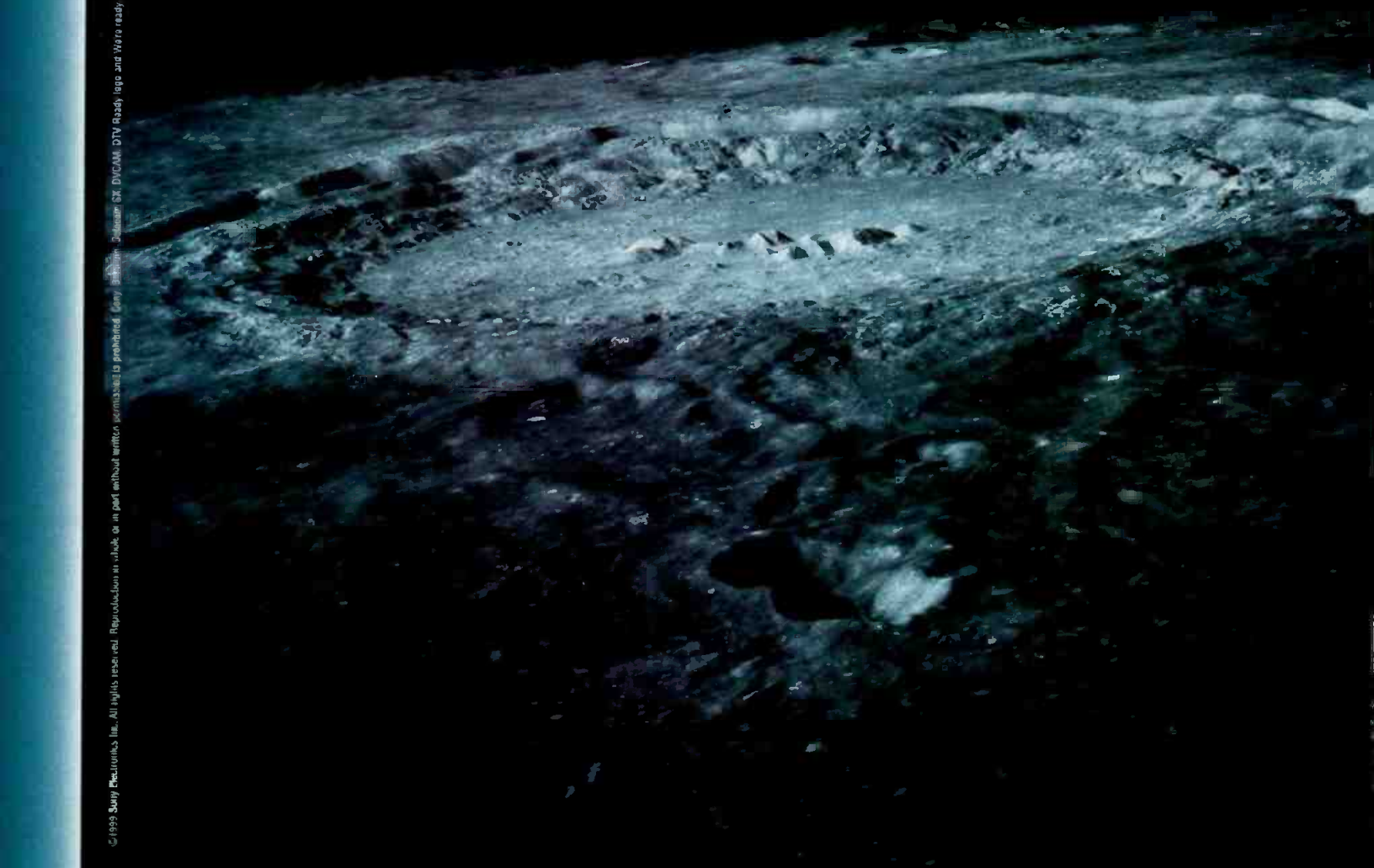
July 20, 1969 - Sea of Tranquility

One man took a small step and made a giant leap.



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SONY

News

Production company shoots first HD sitcom pilot

BY LARRY BLOOMFIELD

A southern California production company recently filmed and produced the first multicamera sitcom pilot in a high-definition format.

RC Productions used three Sony HDC-750 HD portable studio cameras, peripheral equipment, CCU monitors and three dedicated Sony HDW-500 HD VTRs to film the pilot for "Sam 'N Ella's" in the 1035i 30fps format. The program focuses on a Chicago restaurant located across the street from the Second City Actors Workshop, with some of the actors serving as the restaurant's staff.

"A great deal of interest has been expressed by all the networks," said Tony Pretzello, the show's line producer. "Both because the story concept is good and the show is in the new digital high-definition television format."

The shoot was done at Empire Studios in Burbank, CA, in one of its three NTSC studios. However, the only Empire Studio technical equipment used was its audio mixer and intercom gear. The engineering manager, Andrew Sabol, had a small temporary control room built to house the additional high-definition equipment in a small corner of the studio.

When Sabol was hired to head up the electronic aspects of the show, the director had not been decided upon. There are two ways the multicamera show could be done. One way is to use isolated tape machines, in the same manner that filmed shows are done with the director on the floor. The other way, in addition to the isolated tape machines, is to run everything through a switcher and give the production company a line cut show with the director calling the shots in a television control room (booth). In each case the show is put together in post-production.

RC productions used Sony HDC-750 cameras to film the pilot for Sam 'N Ella, the first sitcom to be filmed and produced exclusively in an HD format. Photo by Isabella Vosmikova.

When the shoot was over, the tapes were taken to Laser Pacific in Hollywood, CA, where the show was put together by Tucker Wiard. The tape playback units provide an NTSC-letterbox format output. Using this low-resolution output with an AVID Media Composer, Wiard edited the show, generating an edit decision list (EDL). The EDL was then taken to Laser's HD online edit suite where the final HD version was put together using the high-quality equipment.

"The show went together like we've been doing it for several seasons, " said Pretzello. "The only differences were the 16:9 monitors and some exceptionally sharp and outstanding pictures."

Wiard, who was on set during some of the taping, said that production was delayed a couple of times as they had to wait for the touch-up paint to dry. Normally this is not an issue in NTSC as it can't be seen. Wiard also pointed out

FRAME GRAB

A look at the issues driving today's technology

Internet experience segregates different consumers

Income and education are key differences between experienced and less experienced and off-line consumers.

	Online more than 42 months	Online less than six months	Offline
Median age of head of household	38	41	49
Median household income	$59,860	$52,050	$29,230
Percent college educated	88%	65%	36%
Percent white collar	66%	38%	22%
Percent technology/ optimists	87%	67%	40%

SOURCE: www.forrester.com

Cover all the bases with Portable One Dual Domain

Interface

Digital Analog

Today's audio testing requires a comprehensive audio analyzer. A hand-held jitter meter or audio monitor just won't do. Whether you're facing a new high performance a/d converter, multimedia audio, a transition to digital broadcasting, or just another routine week of maintaining a mixture of digital and analog equipment, you'll need to make three types of measurements: digital audio, digital interface, and analog audio. The Portable One Dual Domain does all three.

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(09-04-98)cs

that the prop squiggly-line menus normally used in NTSC productions were replaced with real menus as you could actually read what was on them.

Sabol added that determining the aspect ratio the show would ultimately be delivered in was one crucial item that could not have been overlooked. While the show was filmed and produced in 16:9, Sabol said had the film been delivered in 4:3, some shots would have been cropped so that actors would not have appeared on screen.

During the filming of the pilot, Sabol said a downconverted NTSC version was also recorded for offline editing. Recording the low-resolution version saved the production company rental costs for using a downconverter for editing purposes.

Pretzello believes this is the first multicamera sitcom pilot done in high-definition. "We put together a really great, well-experienced crew and encountered no problems whatsoever," Pretzello said. ■

KOMO broadcasts first local digital newscasts.

"OK, here we go. Roll the open. Up sound-full. Standby to the studio. Dissolve to two and cue the talent." With these words on May 18, 1999, Greg Berg, director of KOMO 4's 5p.m. News in Seattle made television history. Berg opened the first local news program to be broadcast from start to finish in digital high-definition.

According to Joe Barnes, KOMO's news director, the May 18 news program was the first to be broadcast in HD. Future local newscasts, a total of about 32 hours a week, will be done simultaneously in both analog standard-definition on channel 4 and high-definition on KOMO-DT channel 38.

With more than 3500 HDTV sets in the Seattle area, "We are now the first in the world to broadcast local daily news in digital high-definition television," says Pat Holland, vice president of technology for Fisher Broadcasting Inc.

Holland said he had to come up with a plan just six days before KOMO became the first station in the country to broadcast not just one but all of its local news programming in digital 1080i HD.

"Mixing SD, HD, 720p, 1080i, etc. signals will be a learning experience for everyone," Holland said. The landmark broadcast was the result of KOMO's ongoing close, strategic relationship with Sony.

Sony high-definition multipurpose HDC-700 studio and HDC-750 portable cameras and HDW-500 HDCAM VTRs are used for KOMO's simulcasts. KOMO was able to produce the newscast in HDTV and simultaneously output standard definition using the cameras' on-board downconverters, thereby eliminating the need to conduct two separate broadcasts.

The analog outputs were switched through KOMO's Grass Valley 300 production switcher. With a little in-house engineering, the technical staff at KOMO was able to tie the Grass 300 switching commands into their Leitch digital routing switcher, which is where the digital outputs were switched. Since news normally consists of hard cuts, the video transitions were simple for this first ever event and will be the order of the day for a while. Holland says that KOMO will be installing a digital switcher in the very near future that will handle effects and wipes.

Although committed to 720p, in order to launch its HD news efforts KOMO went with Sony's 1080i equipment with the promise that Sony would retrofit the equipment to 720p when the boards are available. Laurence J. (Larry) Thorpe, Sony's vice president of acquisition systems, said that equipment would be available some time this fall.

Holland said some of the news stories KOMO has been airing in HD have been in stereo when appropriate. The station would consider broadcasting AC-3 audio when more permanent HD production facilities could be built and each story would be addressed on its own merits.

Fisher Broadcasting is owner and operator of two ABC affiliates, KOMO-TV in Seattle and KATU in Portland. Fisher Broadcasting also owns Fisher Communications Inc. and a number of radio stations. Holland stressed that the lessons learned in Seattle will go a long way in developing other television properties as the occasions come up.

KOMO has a long history of adopting new technology before other West Coast commercial stations. The station began broadcasting in color in 1954, in stereo in 1984, and was the first to begin HD broadcasts in 1997. ■

KOMO-TV, Seattle, began broadcasting its local newscasts in an HD format in mid-May. While the ABC affiliate is currently broadcasting in 1080i, it plans to broadcast in 720p this fall.

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Grebow joins Sony, Henderson promoted at Chyron

Edward Grebow was recently named president of Sony Electronics Broadcast and Professional Company by Sony's president and CEO Dr. Teruaki Aoki. Grebow, former president and CEO at Chyron Corporation left the broadcast graphics, routing and automation systems company after a two-year stint. In addition to his Chyron experience, Grebow brings to Sony "a wealth of experience in network television, television production equipment manufacturing and related fields," says Dr. Aoki.

Grebow's experiences also include a two-year tour with the Bell Atlantic, Pacific Telesis Group, and Nynex joint venture TELE-TV, and seven years as executive vice president of CBS Inc., where he was involved in broadcast operations and engineering, technology, management-information systems, facilities, personnel, and general administration.

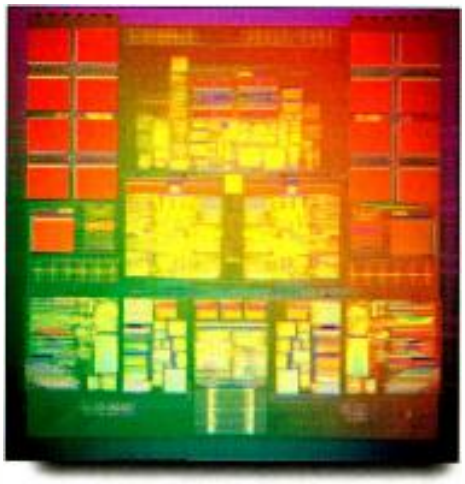
Grebow fills the seat at Sony formerly held by Charles A. Steinberg, who recently took the position of Special Adviser to Dr. Aoki.

Chyron didn't let the seat vacated by Grebow grow cold. In a public announcement made the same day Grebow's move to Sony was announced, Chyron named Michael I. Wellesley-Wesley its executive chairman and promoted Roger Henderson to the position of president and chief executive officer. Neither Wellesley-Wesley nor Henderson are strangers to Chyron. Wellesley-Wesley has been a director and non-executive chairman at Chyron since June 1997 and served as chairman and CEO from June 1995 to June 1997. Henderson, also a director, was an executive vice president and managing director of Chyron's U.K.-based subsidiary Pro-Bel. ■

IBM debuts copper chip technology

IBM recently introduced the S/390 G6 Parallel Enterprise Server — the first server to be powered by copper chips.

What makes the G6 special is that it is capable of delivering nearly 50 percent more performance over its predecessor, the G5. By employing the copper technology to the G5, IBM was able to exceed the old 1000-MIPS barrier, bringing performance up to 1600 MIPS. The copper approach also permitted IBM to nearly double the number of transistors and add two additional processors to the G6's multichip module (MCM) without increasing its size. The G6 also takes advantage of IBM's advanced electroplated flip-chip technology, which supports increased performance and more efficient communications between the chips on the MCM and other parts of the system. This ability is important because the dense copper circuitry on the MCM demands packaging capable of supporting up to 50,000 I/Os.



IBM's copper chip technology allows its newest servers to process 1600 MIPS.

The 127mm-square multichip module features 31 chips, including 14 microprocessors with nearly 1.4 billion transistors, each running in excess of 630 MHz, wired together on the MCM. The MCM itself is composed of 88 layers of glass ceramic substrate and six layers of thin film wiring. In addition to this there are eight L2 cache chips, each with a 2MB capacity (a total of 16MB of L2) which is shared by each of the CPU chips, four memory bus adapters, two cryptographic elements, two storage control chips and one clock chip. There is nearly a kilometer of wiring keeping all of this connected.

The MCM connects to the system board with 4224 pins, of which up to 2400 are signal I/Os and the remainder are power and ground pins, enabling uniform power distribution along with increased noise immunity. ■

Pending legislation allows DBS to carry local signals

New Congressional legislation would impose a "must carry" requirement mandating that any DBS service that offers any local programming must offer all local programming in those same markets.

The legislation in both the House and Senate would impose new regulations by 2002. The bill aims to level the playing field between cable and satellite and foster better service at lower prices as the result of competition.

The legislation passed the U.S. House on April 26 with a near-unanimous approval in a vote of 422-1, with Rep. Robert Brady casting the sole dissenting vote. The Senate passed a similar bill in late May, and a conference committee has been named to reconcile the two bills.

With final action on the satellite bill imminent, DirecTV has announced plans to join its competitor, EchoStar, and deliver local broadcast network channels by satellite to more than 50 million homes. The bill would open 211 designated market areas with more than 1575 NTSC stations to both EchoStar and DirecTV.

DirecTV's offering of local-into-local is contingent upon two actions. First, the FCC must approve the acquisition of the remaining Tempo high-power satellite assets, which will provide DirecTV with additional full CONUS capacity. Second, the passage by Congress of legislation that will allow satellite companies to provide local-into-local service. With the timely FCC approval of the acquisition of Tempo's frequencies at 119° during the first part of June, DirecTV can now roll out local-into-local service beginning later this year. They will be able to deliver some of these signals from the existing in-orbit Tempo II satellite at the 119° slot. DirecTV service is currently offered via their three birds at 101°. No mention was made about legacy issues with current subscribers.

DirecTV also expects to introduce a combination DirecTV/ATSC set-top box, which will allow consumers to seamlessly integrate satellite programming with digital off-air signals as local

The PESA Tiger is quickly becoming the router of choice for studio and mobile broadcasting around the world. It's no wonder the competition is nervous!

The PESA Tiger size advantage is undeniable - a 144x144 video switcher requires only 12RU, while the audio switcher packs two channels of analog or AES audio into a scant 8RU. And there's plenty of muscle behind those good looks. Both Tiger switchers support mixed analog and digital matrices in the same frame.

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broadcasters convert to digital. EchoStar's Charlie Ergen welcomed DirecTV "to the right side of competition.

"We always knew as a company that once we got legislation, they (DirecTV) would compete with local-into-local. They have to or else we will have 90 percent market share in the DBS business," he said.

The legislation also settles the issue of satellite television companies carrying distant network affiliate broadcasts. CBS and Fox filed suit against DirecTV in U.S. District Court in Miami, claiming that such carriage violated the Satellite Home Viewer Act. The Court ruled satellite companies were illegally providing network broadcast to more than 700,000 customers and ordered satellite companies to cease carrying network broadcasts. ■

FOX Leaves NAB

The Fox Broadcasting Company and its 22 owned and operated television stations withdrew its membership in the National Association of Broadcasters (NAB) in June.

The action is in an apparent protest to a decision made by NAB's board of directors to continue to lobby to retain the 35 percent ownership cap on network-owned stations, which is the percentage of homes that network-owned stations are permitted to cover.

The Telecommunications Act of 1996 raised the percentage of homes each network's O&Os are permitted to cover from 25 to 35 percent coverage. Since that legislation was passed, the networks have expressed that they'd like an even a larger percentage.

Although the NAB board decision disappointed network representatives, Fox Broadcasting and its stations are the only ones to withdraw membership in NAB over this issue to date.

"The decision to withdraw from NAB was made after thoughtful deliberation," said Peggy Binzel, Fox lobbyist and News Corp. senior vice president. "We do not take any glee in this decision.

"Broadcasters face growing competition from cable, satellite services and the Internet. The broadcasting industry can not continue to be aggressive competitors in the future if we are bound by rules designed for yesterdays three network universe," she said. "Deregulation of broadcasting is Fox's number one legislative priority. The board of NAB has taken a position in direct conflict with this priority. Our decision is not just about one issue; it is about a different point of view regarding the future of broadcasting."

Dennis Wharton

"The Fox withdrawal did not come as a surprise," said Dennis Wharton, senior vice president of corporate communications at NAB.

Wharton says the industry "is much more effective if we can present a united front before public policymakers, but the real strength of the NAB comes from the fact that we have member stations at the grass roots in every city, every county, and every district in the country."

Network withdrawal is not unprecedented in NAB's history. ABC withdrew for a year and a half in the early '90s. Wharton says, "FOX will be welcomed back into the fold should the network choose to return." ■

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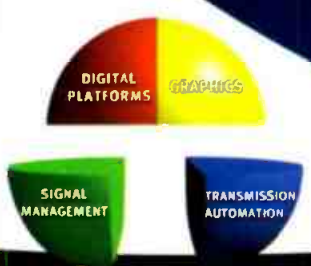

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Judge rules AT&T must share cable lines with Internet competitors

In a ruling that may affect access to the Internet, a federal judge in Portland, OR, ruled local governments can force the AT&T to open the cable modem market to competing Internet service providers.

This ruling involves a case which represents one front in a battle that has pitted AT&T against a coalition of ISPs and consumer groups that argue that an emerging source of high-speed Internet access, cable modems, faces monopoly control. The argument being that just as local phone companies must connect to a variety of long-distance providers, cable companies should offer a variety of ISPs if they offer any Internet services. On another front, American Online and other ISPs have been lobbying regulators and Congress to make cable companies offer their high-speed Internet subscribers a choice of service providers, without giving a leg-up to any one in particular.

In his ruling, Judge Panner said that AT&T had "no contractual right under the franchise agreements to exclude competitors from the cable modem platform."

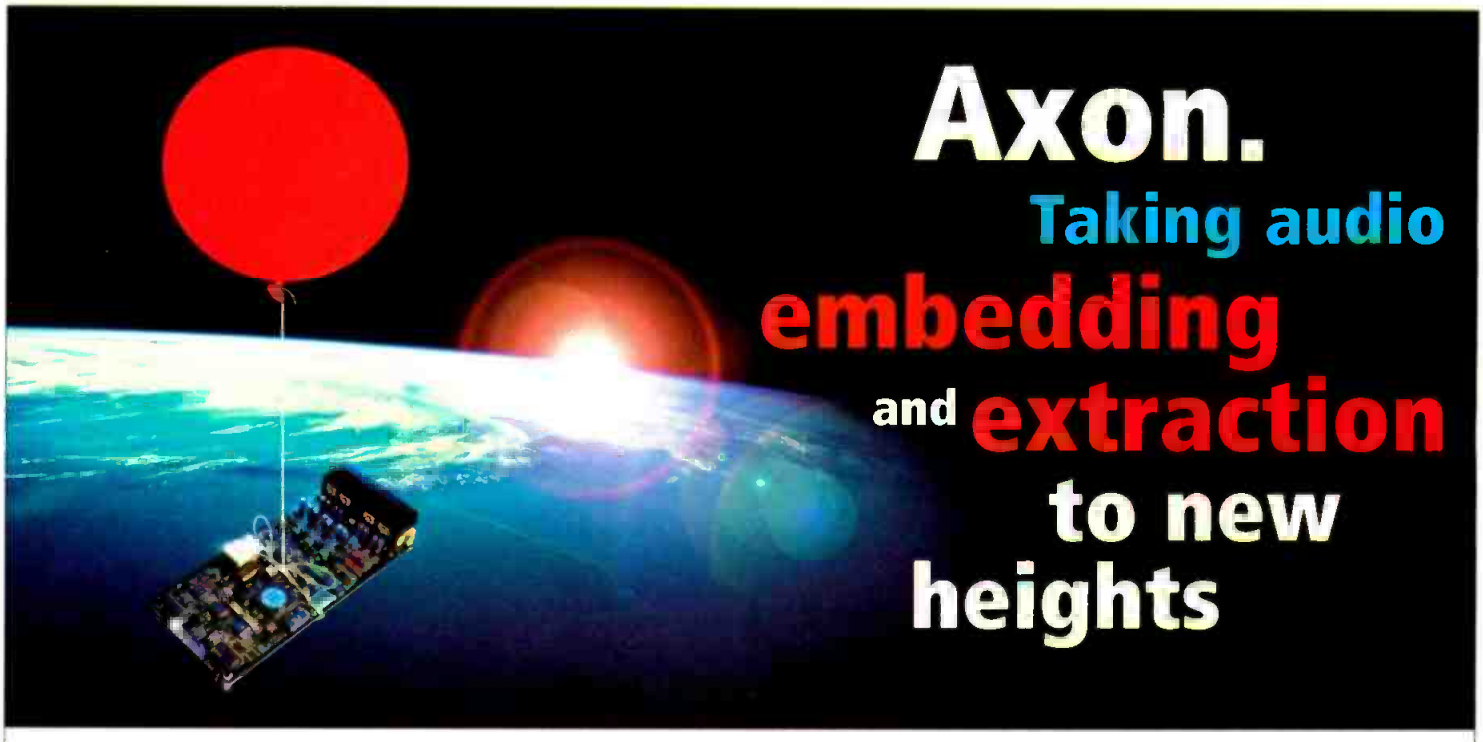
AT&T announced it is seeking a speedy appeal of Panner's ruling. The company claims the Cable Act prohibits local governments from stipulating that companies must provide telecommunications facilities and services as a condition of a franchise transfer.

The battle began when AT&T announced it would purchase Tele-Communications Inc. (TCI), one of the nation's largest cable companies with 14 million subscribers. The cable infrastructure would also give AT&T significantly greater bandwidth and carriage abilities.

Changes in the ownership of cable companies must meet the approval of local governmental entities before those deals become final. ISPs and other consumer groups in the Portland and Multnomah County area urged local politicians to challenge the deal. ISPs and consumer advocates contend that AT&T should not be allowed to use TCI's cable lines to offer Internet access exclusively through the At Home Network, a cable modem service provider partly owned by AT&T.

The Portland City Council and the Multnomah County Commission did not approve the franchise transfer when the issue came before them, saying AT&T must first allow competing providers to offer high-speed Internet access over its cable lines.

Cable companies argue there is little incentive to expend the large amounts of money to upgrading infrastructure for high-speed Internet connections if merely to become a pipe for competitors and other services. This very significant decision will no doubt have a ripple effect through other local government entities ■



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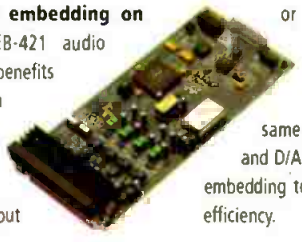

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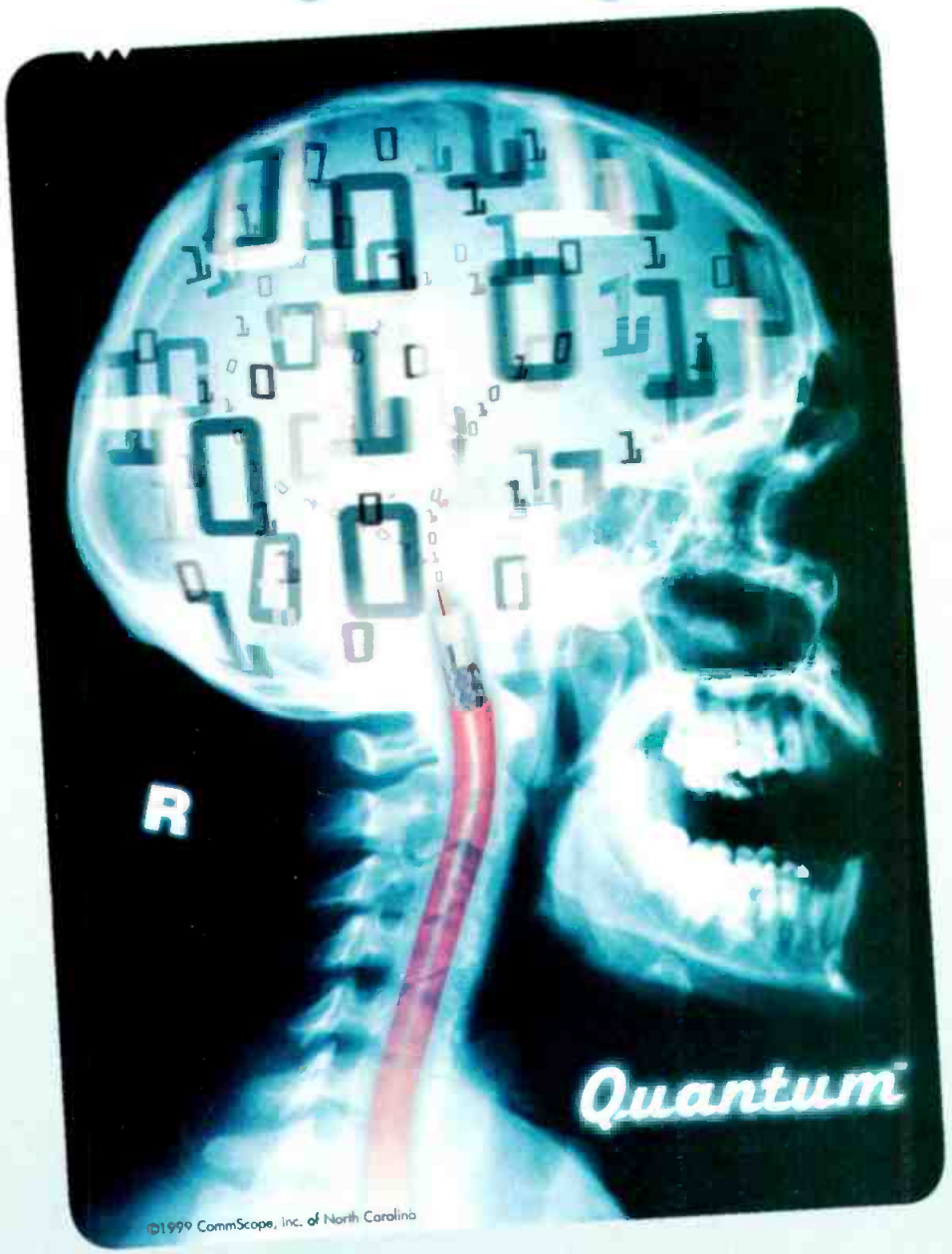

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FCC Update

FCC considers new broadcast services on channels 60-69

BY HARRY MARTIN

The FCC is considering licensing new broadcast services, as well as mobile and fixed wireless services, in the channel 60-62 and channel 65-67 portions of the channel 60-69 band. The 60-69 band, previously used for UHF television, was reclaimed last year in accordance with a mandate from Congress and potentially reallocated to a combination of public safety, mobile, fixed wireless, and broadcasting services. The FCC already adopted operating rules for public safety services on channels 63-64 and channels 68-69. The Commission started a proceeding to adopt technical operating and licensing rules for new services in the channel 60-62 and channel 65-67 portions of the band. If the FCC can satisfactorily resolve interference and regulatory classification concerns associated with the operation of different services in the same band, it is considering allowing broadcast, mobile (advanced cellular) and fixed wireless (microwave) services each to operate throughout the channel 60-62 and channel 65-67 portions of the band. The Commission emphasizes it is not yet clear whether broadcasting will work in a band where mobile and microwave services operate. Prospective licensees would acquire spectrum through an FCC auction and advise in their applications which type of service they chose to offer. Licensees could offer one, two, or all three of the service types permitted (broadcast, mobile, fixed wireless). If they chose broadcasting, they could offer any kind of video, audio, or data broadcasting service. The licensees also could change from one type of service to another.

This new flexible spectrum management approach by the FCC corresponds to changes in the communications industry. Many currently anticipate that within a few years, broadcast, mobile, and microwave operators, along with satellite, cable, and electric utility operators, will be offering a large variety of services, including multichannel video and audio, local telephone, long distance telephone, Internet access, interactive video, data transmission and Internet shopping and financial services. The operators will differ only in the technical facilities they use as a conduit.

The FCC proposes to license the new services in the channel 60-62 and channel 65-67 bands under Part 27 of its rules, which was adopted recently to govern similar flexible-use frequencies in the 2.3GHz band (the Wireless Communications Service or WCS). In addition, the FCC starts from the presumption that services resembling traditional broadcast services also would be subject to Part 73 of the rules, which governs broadcasting. The FCC asks, however, whether there are reasons that broadcasts in the channel 60-62 and channel 65-67 bands should not be subject to particular elements of Part 73. In addition, the FCC proposes specific auction rules for the band.

The FCC proposes that there be no limitations on eligibility to operate in the new band, except for current foreign ownership restrictions. It asks if there are reasons not to apply its character qualifications policies, multiple ownership rules and CMRS (commercial mobile) spectrum caps. It proposes varying time limits for placing facilities in operation and tentatively proposes to permit licensees to sell portions of their frequencies and licensing areas to other operators. It seeks comments on the length of license terms and renewal expectancies. The FCC also asks how it should apply common carrier and EEO obligations to services in the band.

The Commission tentatively concludes it should provide each licensee a pair of frequencies to permit two-way services, and asks how much bandwidth licensees will need. It asks how mobile and microwave services can be licensed to geographic areas and broadcast services to communities of license. The FCC requests comments on a range of technical issues, including interference to other services in the band, interference outside the band, and RF safety. It also proposes protection standards for existing full power television stations and planned DTV allotments in the band.

The comment/reply comment period ends Aug. 13. New rules may be issued by mid-2000.

Cable signal carriage: ADIs to DMAs

The Commission recently released an order addressing various issues in connection with the upcoming transition to use of Nielsen's designated market areas (DMAs) for the purpose of defining cable television signal carriage markets. In 1996, the Commission decided to switch to Nielsen's DMAs from the Arbitron areas of dominant influence (ADIs), primarily because Arbitron no longer publishes current information on television markets.

The new market definitions based on Nielsen's DMAs will become applicable for the upcoming Oct. 1, 1999, must-carry/retransmission consent election and will go into effect on Jan. 1, 2000.

Since Nielsen's DMAs are similar to Arbitron's ADIs, most television market designations will not change. However, in some cases use of DMAs will result in different market definitions. By Commission estimates, 135 counties will change markets because of the switch to DMAs. ■

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

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

Dateline

Television stations in the following states must file their biannual ownership reports on the new Form 323 on or before Aug. 2, 1999: California, Illinois, North Carolina, South Carolina and Wisconsin.

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Tower licensing: the real challenge of DTV

JERRY WHITAKER, BE CONFERENCE CONSULTANT

Building a DTV facility is no small feat. Anyone who has done it — or is in the processing of doing so — can attest to this fact. The challenge comes down to three primary issues: technology, business and licensing.

Of the three issues, licensing can be the greatest problem for broadcasters.

Every television station requires a transmitting antenna. Every antenna requires a tower to support it. In the mixed NTSC/DTV environment, many stations, therefore, need to modify an existing tower or, heaven forbid, build a new one. Enter the FAA.

In our column this month, Douglas Garlinger, no stranger to the DTV conversion process, outlines the problems of dealing with FAA rules and procedures. We had planned to present a companion piece from an expert at the FAA, or at least some general comments on their tower licensing policies as they relate to DTV. Unfortunately, we were unable to get any official response from the agency by press time. This observer did speak with several FAA staff members who acknowledged that DTV-related tower licensing has been an issue, but department policy prevented them from saying anything on the record.

The FAA-DTV tower clearance problems seem to stem not so much from any official decisions on the subject, but instead from a lack of knowledge of the requirements and constraints of DTV in at least some of the FAA's field offices. The experience of stations across the U.S., therefore, has been uneven; some have encountered problems, some have not.

The good news is that there are people in the FAA willing to work with stations to solve problems that they may experience. The bad news, from our standpoint anyway, is that nobody is willing to discuss these issues publicly.

Everyone involved in DTV planning knew that the problems surrounding tower licensing, not just from the FAA standpoint but also — and more importantly — at the local government level, would be considerable. Last year, you may recall the FCC announced the creation of a DTV task force to target potential tower site problems related to DTV implementation, and to work with local authorities and broadcasters to solve those problems. Surely, this program has met with some success, although its impact is hard to measure and — in any event — there is only so much that even the FCC can do.

The Commission defers to the FAA in determining whether the construction of an antenna tower may pose an aviation hazard, and requires that the safety of any tower over 200 feet above ground level or any tower within certain proximity to public use airports must be reviewed by the FAA. Information required on the FCC construction permit form advises the FCC staff as to whether such a tower location or height is involved. Applicants for construction permits for any such towers are required by FCC rules to notify the FAA of the proposed construction before the construction or alteration is to begin or before an application for a construction permit is filed. The FAA then issues a written determination stating that the proposal either would or would not be a hazard to air navigation. FAA approval must be secured and forwarded to the FCC before construction of an antenna or tower will be approved by the Commission. If the FAA determines that the tower would be a physical hazard, the FCC will not approve the construction permit application.

When the FAA determines that there is an aviation hazard because of possible radio frequency interference with aviation communication signals, the FCC makes an analysis of who will be responsible for resolving possible conflicts, and may not automatically defer to the FAA determination as to which party should bear the cost of equipment changes. ■

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

EXPERT

Douglas W. Garlinger, LeSEA Broadcasting

The FAA approval process has not yet impacted DTV implementation. Most DTV stations presently on the air use existing towers that have not required an increase in structure height. The full implementation of DTV will require the construction of many new towers. NTSC and FM stations displaced from their present towers will also require new towers. The apparent lack of internal cooperation between the FAA and the FCC could impede the timely implementation of DTV.

A Notice of Proposed Construction Form 7460-1 filed with the FAA to build a new DTV tower receives no special consideration. It is treated exactly like any other Notice of Proposed Construction. It appears the individual FAA Regional Offices have not received any specific guidance from the FAA on DTV-related applications.

FAA interference studies are performed at the regional level. The Regional Airspace Specialist is a highly skilled professional who has not been informed of the differences between the NTSC and DTV signal. The Regional Airspace Specialist plugs the television ERP into an Airspace Analysis Model (AAM) to analyze potential interference levels. Early versions of this FAA software failed to "square" the relative field factor of the antenna pattern when determining ERP. This resulted in interference calculations that overstated the levels of potential interference.

Early versions of the AAM used worst-case aircraft receiver criteria rather than

Integrating HDTV and Component Video Signals

Increasingly, production facilities are integrating HDTV and component video signals into systems. Production staff members in screening rooms need to preview HDTV or component video images. For rooms using RGB video, these signals first need to be converted into analog RGB signals. For this application and many others, Extron introduces the CVC 200, a universal, hi-res HDTV and Component Video to RGBS or RGBHV converter.

Extron's CVC 200 offers two distinct advantages—HDTV 720p and 1080i input capabilities. The universal CVC 200 is ideal for converting HDTV (720p, 1080i, and SMPTE 240) signals to high-quality RGB formats. Now HDTV as well as component video images can be easily previewed on CRT or other RGB displays.

For component video images, Extron's CVC 200 converts Betacam, W-VHS, and other component standards to RGBS or RGBHV. Other applications include converting DVD component video to analog RGB formats for displaying DVD images on RGB projection screens.

Extron's simple-to-use CVC 200 provides a rotary switch for selecting input formats. The rack-mountable CVC 200 features BNCs as its input and output connectors. A 100-240VAC, 50/60 Hz, internal power supply is included.

Extron's CVC 200 provides the following advantages:

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- Converts Betacam (Y, R-Y, B-Y) to RGBS or RGBHV
- Converts SMPTE component video (Y, R-Y, B-Y) to RGBS or RGBHV
- Converts W-VHS (Y, Pr, Pb) RGBS or RGBHV
- Converts DVD component video (Y, R-Y, B-Y) to RGBS or RGBHV
- Tri-level to bi-level sync conversion for HDTV
- Rotary switch for selecting input formats
- Inputs and outputs on BNC connectors
- Rack-mountable
- Internal power supply (100-240VAC, 50/60 Hz)

The CVC 200 lists for $895 (US Dollars)

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The FAA recognizes the NTSC requirement limiting spurious emissions to -60dB below peak visual. The AAM typically suggest additional attenuation to at least -80dB below peak visual as measured at the transmitter output for spurious emissions in the 118 – 137MHz and the 225 – 400MHz aviation bands. The AAM does not take into account that the transmitter plant waveguide or antenna would further attenuate or eliminate such spurious emissions.

The FCC DTV RF mask requires spurious emissions to be -110dB below DTV average power. The AAM should be modified for analysis of DTV stations. Otherwise, your FAA approval may well limit DTV spurious emissions to -80dB below peak visual power.

It appears the FAA expects DTV applicants to file a Form 7460-1 when a DTV station is added to an existing tower even when no increase in height would occur. This would allow the FAA to study potential interference. The FCC does not require such a filing and is concerned only that the structure is registered and poses no physical hazard to aviation.

Any man-made structure or natural formation that extends significantly above average terrain poses a physical hazard to aeronautical navigation. Tall structures, mountains, icing conditions, thunderstorms, low visibility, wind shears and air traffic congestion can all pose aviation safety hazards. These hazards are minimized or eliminated by up-to-date information and proper procedures.

En route commercial and private IFR aircraft follow well-established vector airways. Each airport control area has established approach and departure vectoring altitudes to safely move airplanes in and out of an airport. All navigable airspace in the area of the airport is considered when establishing these approach and departure procedures.

Navigable airspace is reduced any time a new tower is constructed. Minimum vectoring altitudes approaching and departing a nearby airport may be affected. Aircraft may be required to ascend or descend more steeply or vector around the new tower. The personnel at the local FAA control facility tend to jealously guard all navigable airspace. Who can blame them? These facility level personnel want the maximum versatility to establish their local airspace procedures. They do not like towers.

When a local facility person is overprotective of airspace, it starts a "domino effect" of negative recommendations up the chain to the FAA Regional Office. It is difficult for higher level managers to reverse that effect. Facility personnel often oppose new towers even when there has been minimal opposition from local VFR pilots. New tower requests are denied and proposed heights are reduced. There is no avenue available for broadcasters to communicate directly with local facility personnel to help overcome objections.

All tall structures pose hazards. Proper airspace procedures eliminate those hazards. The U.S. Congress, through the FCC, has mandated the implementation of a DTV system for the U.S. The FAA should raise the level of awareness among Regional Airspace Specialists and foster a climate of willingness to accommodate DTV tower requests whenever possible. ■

Douglas W. Garlinger is the director of engineering of LeSEA Broadcasting Corp., the author of the SBE Introduction to DTV RF.

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Transition to Digital

MPEG coding

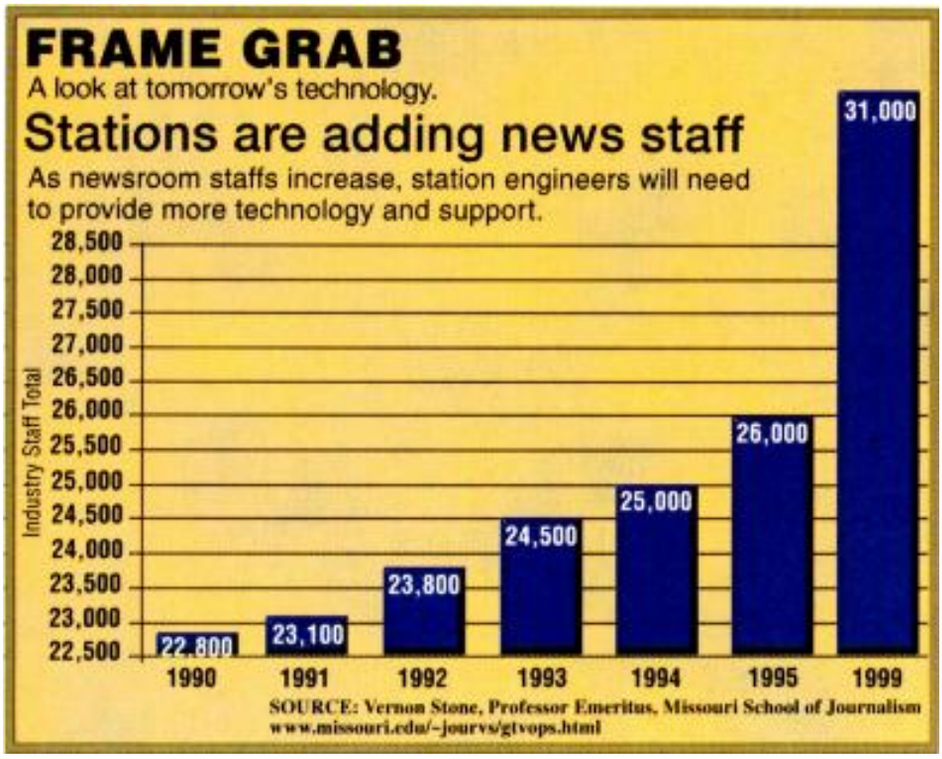
BY MICHAEL ROBIN

In 1986 a study group called the Joint Photographic Experts Group (JPEG) was formed under the auspices of the International Standards Organization (ISO) and several related UN agencies. Their task was to work on the development of an international standard for the compression of still-frame images. The result was the JPEG standard, a compression technique applicable to single (stationary) pictures. Several mathematical techniques are used to reduce the information content by removing spatial redundancies, consequently reducing the bit rate requirements. JPEG uses a very popular spatial redundancy removal technique called Discrete Cosine Transform (DCT). A derivative of JPEG, called Motion-JPEG, allows the storage of video on computer disks for editing applications.

Profile / Level	Simple I,P 4:2:0	Main I,P,B 4:2:0	4:2:2 Profile I,P,B	SNR I,P,B 4:2:0	Spatial I,P,B 4:2:0	High I,B,P 4:2:0 or 4:2:2
High		1920x1152 80Mb/s				1920x1152 100Mb/s
High 1440		1440x1152 60Mb/s			1440x1152 60Mb/s	1440x1152 80Mb/s
Main	720x576 15Mb/s	720x576 15Mb/s	720x608 50Mb/s	720x576 15Mb/s		720x608 20Mb/s
Low		352x288 4Mb/s		352x288 4Mb/s		

Table 1. The MPEG-2 standard provides a variety of data rates. Parameters are specified based on specific levels and profiles. Pixel counts, sampling structures and maximum data rates are shown.

MPEG, which stands for Moving Picture Experts Group, goes beyond JPEG and applies temporal compression in addition to spatial compression. The initial version, now called MPEG-1, is used to encode low-resolution pictures to data rates of about 1.5Mb/s. MPEG-2 was developed for the delivery of compressed television for home entertainment. This set of compression and systemization algorithms and techniques has well-defined rules and guidelines. Because of this, it allows for variations in the values assigned to many of the parameters and provides for a broad range of products and interoperability. These definitions are integrated into an MPEG toolkit or syntax that addresses a variety of cost vs. performance standards described as levels and profiles (see Table 1). A further extension of MPEG-2, called the 4:2:2 profile, has been developed to record and transmit studio-quality video more efficiently than M-JPEG. This article is the first in a two-part series that looks at MPEG video compression (now commonly referred to as coding) concepts.



Coding video

The goal of video compression is to represent an image with as few bits as possible, while preserving an appropriate level of quality for a given application. Compression is achieved by removing the redundancies in the vid-

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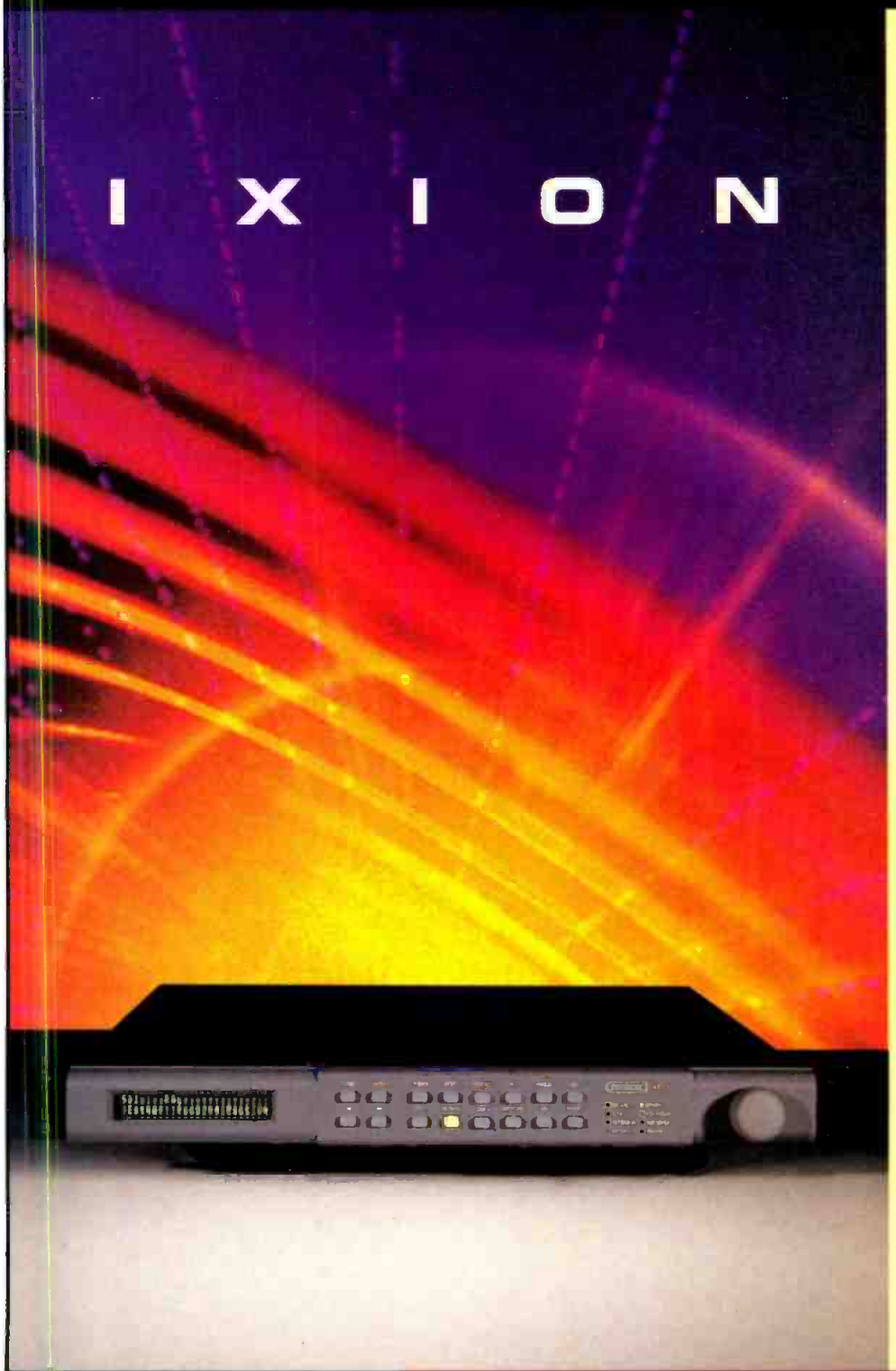

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eo signal. Lossless compression techniques lose no data. The compressed signal can be decompressed to obtain an exact duplicate of the original signal. However, lossless techniques allow only modest amounts of bit rate reduction, rarely exceeding 3:1. Lossy compression techniques are irreversible. They allow for higher bit rate reductions but result in distortions and artifacts. These can be made invisible to the eye but these changes to the original signal are permanent.

Compression systems work by eliminating redundancies in the data stream. Because redundant data need not be retransmitted, the result is a reduction of the necessary bit rate. Some of the redundant data is non-essential. One example of non-essential data is the area outside of the active picture area. CCIR 601 does not sample data in the vertical and horizontal blanking intervals. It relies instead on the transmission of EAV and SAV information to supplement sync data. Removing the horizontal and vertical interval allows for a bit rate reduction on the order of 55Mb/s without affecting the picture quality.

Spatial redundancies occur when, in large areas of the picture, adjacent pixels have nearly identical values. Temporal redundancies occur when consecutive pictures are similar. Compression systems work by separating the redundant (predictable) information, which does not need to be transmitted, from the unpredictable information (entropy), which needs to be transmitted. An ideal system would transmit only the entropy and reconstitute the redundant information from a reference picture.

In addition, the human vision system (HVS) creates what is known as perceptual redundancy. The result is reduced sensitivity to small picture details and to chroma details. All picture details invisible to (or unnoticed by) the eye can thus be removed.

MPEG tools

The MPEG specification is best described as a collection of bit rate reduction and compression tools. Among these tools are DCT, quantizing, run length coding (RLC), variable length coding (VLC) and a buffer for smoothing the changes in data rate.

DCT is a lossless, reversible, mathematical process that converts spatial amplitude data into spatial frequency data. The image is divided in blocks of eight horizontal pixels by eight vertical pixels (8x8 block) of luminance (Y) and corresponding color difference (C_B and C_R) samples. Figure 1 shows how a television picture is divided into 8x8 blocks. A block of 8x8 pixels is transformed into a block of 8x8 coefficients describing the amplitude of a particular frequency. The upper left corner pixel represents the DC component. Moving across the top row the horizontal spatial frequency increases and moving down the left column the vertical spatial frequency increases. Essentially, the signal is converted into one value for the DC component and 63 values for 63 other frequencies, a process equivalent to a spectrum analysis.

The video signal has most of its energy concentrated at DC and the lower frequencies of the spectrum. The DCT process results in zero or low-level values for some or many of the higher spatial frequency coefficients. This process does not result in a bit rate reduction, but rather the opposite. Because the transform is the equivalent of a mathematical multiplication, it results in coefficients with a longer wordlength than the original pixel values. Many times, the result of transforming an eight-bit pixel block is an 11-bit pixel block. Despite this, the DCT process does convert the source pixels into a form that allows for easier compression.

Because a large number of coefficients resulting from the DCT process have zero or near zero values, they need not be transmitted. This results in considerable compression. The ignored coefficients represent non-discernible picture details, making this part of the compression essentially lossless. Higher compression factors require a reduction of the word length (number of bits per sample) of non-zero coefficients, which results in an inaccurate representation of the picture. The HVS is characterized by a reduced perception of fine picture details as well as of fine-grained noise. Fine picture detail, if present, tends to mask fine-grained noise whereas noise in uniform picture areas is highly visible.

When analog signals are represented digitally, they are characterized by quantizing errors. These errors are essentially visible as noise. Long word lengths (a large number of bits per sample) result in low noise (high SNR). Short word lengths (a low number of

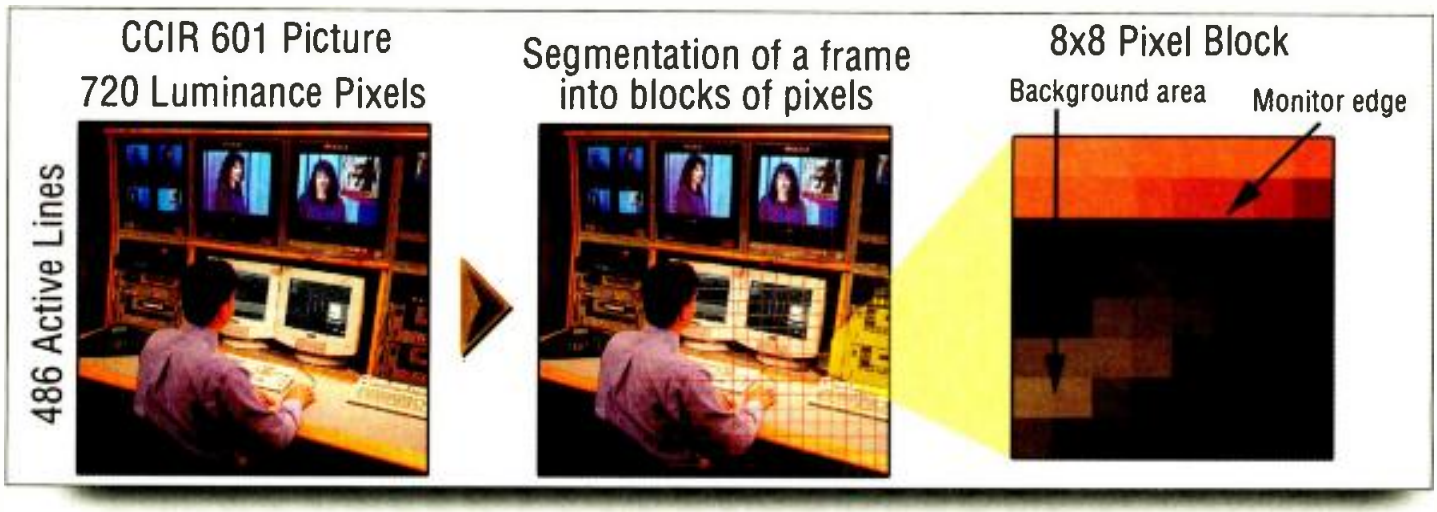

Figure 1. As part of the compression process, images are broken down into 8x8 pixel blocks. A standard-definition picture consists of 720 luminance pixels by 486 active lines. A 720x480 block can be broken down into 5400 (90x60) 8x8 pixel blocks.

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bits per sample) result in an increased noise level (low SNR). The DCT process splits the signal into different frequencies and it thus becomes possible to control the noise spectrum for minimum visibility and maximum compression. The method used is to assign more bits to low-frequency coefficients and less bits to high-frequency coefficients by a process of weighting.

cific weighting tables and the decoder is supplied with information as to the weighting model used.

Run length coding (RLC) is a method of reading the coefficients in a particular order. The DCT transform of a non-interlaced picture, such as MPEG-1, results in significant coefficients located in the top left area of the block. Reading the values out of the memory in a 45° diagonal zig-zag as shown in Figure 2a, results in sending non-zero coefficients first followed by a long string of zero values. Figure 2b shows the manner in which the coefficient values are read out in the case of an interlaced picture. The RLC process efficiently encodes the sequence of DCT coefficients by sending a unique codeword in place of a long string of zeros resulting in even more data compression.

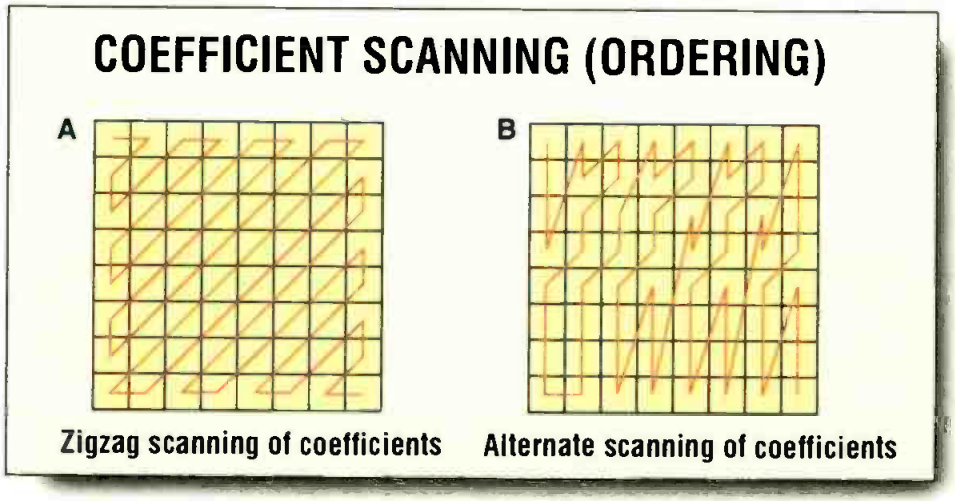

Figure 2. Two scanning sequences are used to place frequency coefficients into a serial datastream. The sequence on the left is used for progressively scanned images, while the sequence on the right is used for interlaced images. Both result in long strings of zeros which can be easily compressed.

In the process of weighting, DCT high-frequency coefficients are divided by a value n>1 and the result is rounded to the nearest integer. The value of n varies with the position of the coefficient in the block. The higher frequencies are assigned higher values. As a result, coefficients representing low spatial frequencies are quantized with relatively low steps and have a high SNR. The coefficients representing the higher spatial frequencies are quantized with large steps and suffer from distortion and low SNR. The weighting process is controlled by specific weighting tables and the decoder is supplied with information as to the weighting model used.

The DCT, requantizing and RLC processes result in certain coded values occurring more often than others, giving rise to a predominance of near-zero coefficient values. The variable length coding (VLC) process allocates short codewords to frequently occurring values (e.g. stationary picture or non-varying background) and long codewords to infrequently occurring values (e.g. varying or moving objects).

Compressed video information is inherently variable due to the varying content of successive video frames and results in a variable bit rate. The recording or transmission of data requires a constant bit rate, which is achieved by using a buffer. The input to the buffer is variable over time and the output is read out at a constant rate. To avoid overflow or underflow of the buffer, a rate control generated by the buffer adjusts the quantizer step size depending on the video content and activity. This results in a constant bit rate (CBR) but also a variable picture quality (VPQ).

With many of the basics covered, next month we will look at how the MPEG datastreams are assembled. ■

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

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

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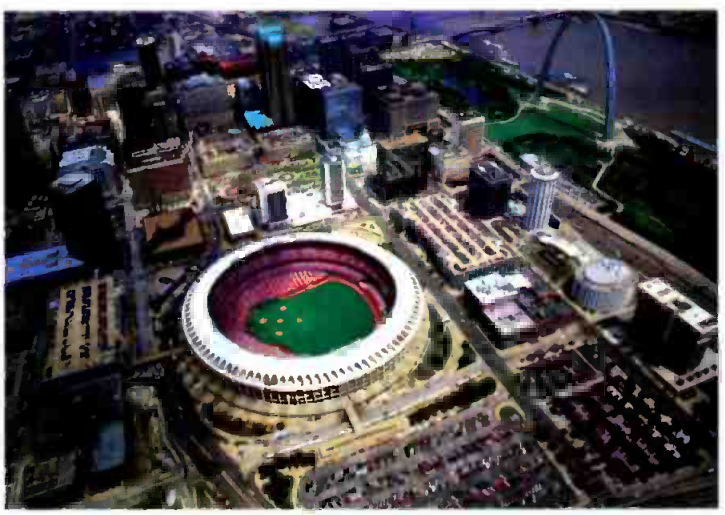

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Fibre Channel basics

BY BRAD GILMER

At this year's NAB there were numerous products employing Fibre Channel technology. Fibre Channel has gone mainstream. This month, we will look at some Fibre Channel basics including what it is, how to build a Fibre Channel network and where things can go wrong.

What is Fibre Channel?

The Fibre Channel Association defines Fibre Channel as follows:

"*Fibre Channel is a one gigabit per second data transfer interface technology that maps several common transport protocols including IP and SCSI, allowing it to merge high-speed I/O and networking functionality in a single connectivity technology. Fibre Channel is an open standard as defined by ANSI and OSI standards and operates over copper and fiber optic cabling at distances of up to 10km. It is unique in its support of multiple interoperable topologies including point-to-point, arbitrated loop and switching, and it offers several qualities of service for network optimization. With its large packet sizes, Fibre Channel is ideal for storage, video, graphics, and mass data transfer applications.*"

Within this definition there are several key concepts. First, Fibre Channel leverages off of existing low-speed networks. If you are familiar with Ethernet, some of this knowledge is transferable to Fibre Channel. Second, Fibre Channel allows three common topologies; point-to-point, arbitrated loop and switched. Third, it allows designers to employ two very common protocols, IP and SCSI. This allows manufacturers to easily migrate to Fibre Channel. Finally, unlike ATM, Fibre Channel block sizes are large, making it a good match with the very large file sizes typically found in video.

One important difference to note between Ethernet and Fibre Channel is that Fibre Channel arbitrated loop or FC-AL is a loop topology. Even though Fibre Channel and Ethernet hubs look very similar on the outside, they are different internally (see Figure 1).

Fibre Channel topologies

Point-to-point is the simplest and least-expensive topology to implement. In an equipment pair, the Fibre Channel Gigabit Linking Modules (GLMs) are connected back to back. No hubs or other control devices are needed. Costs are low, installation is simple, network bandwidth is well defined, and control and interoperability issues are limited.

The next step up in Fibre Channel topology is the *Fibre Channel arbitrated loop* (FC-AL). FC-AL has several advantages. As with point-to-point above, it is low cost and external hardware is not required. In small configurations it is simple, and for that reason, easy to troubleshoot. It is also very expandable, with a limit of up to 126 devices per loop. Single loop FC-AL does have some problems. First, it is prone to failure. Since it is a single loop, a break anywhere in this loop crashes the entire network. Second, in a single-loop configuration, Fibre Channel does not support simultaneous communications. This can seriously limit bandwidth on the network.

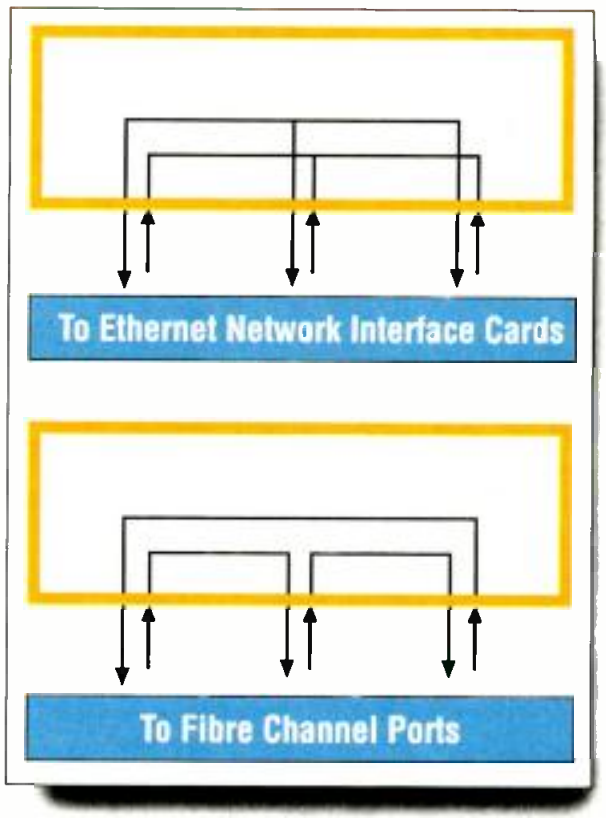

Figure 1. Fibre Channel arbitrated loop (FC-AL) and Ethernet hubs may appear similar but are quite different. Ethernet hubs essentially parallel the transmit lines and the receive lines. Within an FC-AL hub, the transmit and receive lines are configured in a loop arrangement.

Because of the difficulties noted above, single loop FC-AL configurations without a central hub are rare. A central hub in all but the smallest installations may make troubleshooting easier because it is easy to disconnect equipment until the faulty device is located. Most hubs are "self-healing," meaning that if nothing is plugged into a port on the hub, or if the hub detects a problem at the other end, it will jumper around the open portion of the loop to restore the network.

Broadcasters will find that most vendors employ a dual-loop configuration. The dual-loop FC-AL eliminates the single-loop failure mechanism. If one of the loops fails, the other assumes the load. A dual-loop FC-AL also allows simultaneous communications between devices, greatly increasing bandwidth available. While the cost of dual-loop topology may be greater, for most applications the security and performance increases are worth the increased costs.

The third common Fibre Channel topology is *switched fabric*. If you are familiar with switched Ethernet

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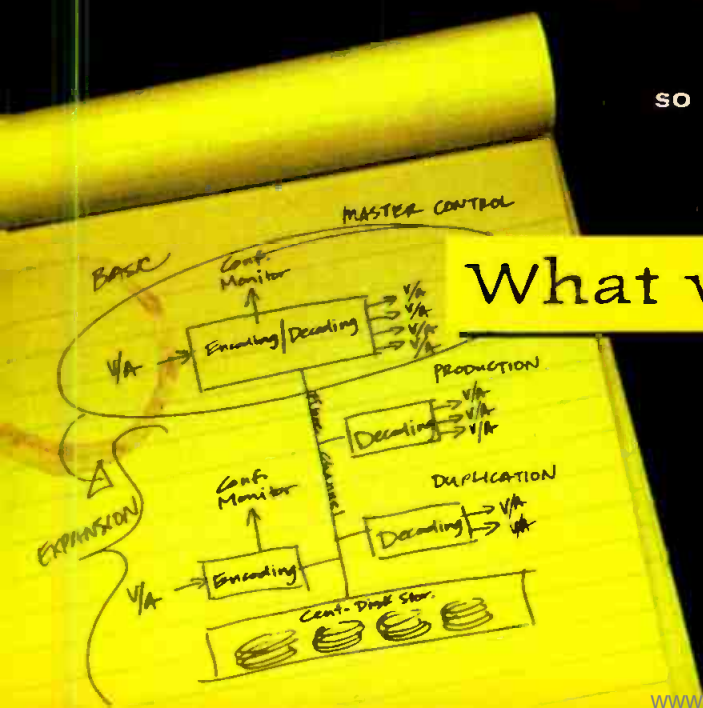

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networks, you understand the basic premise behind switched Fibre Channel. Figure 2 illustrates a typical switched topology.

Switched Fibre Channel works by connecting full-bandwidth pipes between any two devices that wish to communicate. This allows many devices to communicate at the same time. It also increases the effective bandwidth available for each device dramatically, and it provides fault tolerance in large networks. Of course, all of this comes with a large price tag — anywhere from $20,000 to $100,000 and beyond depending on the complexity of the switch. It used to be difficult to find switches for Fibre Channel. Now, it is easy to find a variety of switches to meet most broadcasters' needs. However, if you are going to build a large Fibre Channel network and are looking for switches with full redundancy and SNMP monitoring, your choices at this point are limited. McData makes a product called the ED-5000 Fibre Channel Director. This switch supports 32 ports with a throughput performance of 32 million frames per second and an average latency of less than 2µ. It has online diagnostics, call-home and email notifications systems, and allows hot swapping of most components. These features are common in the Ethernet world, but are not available in most Fibre Channel switches.

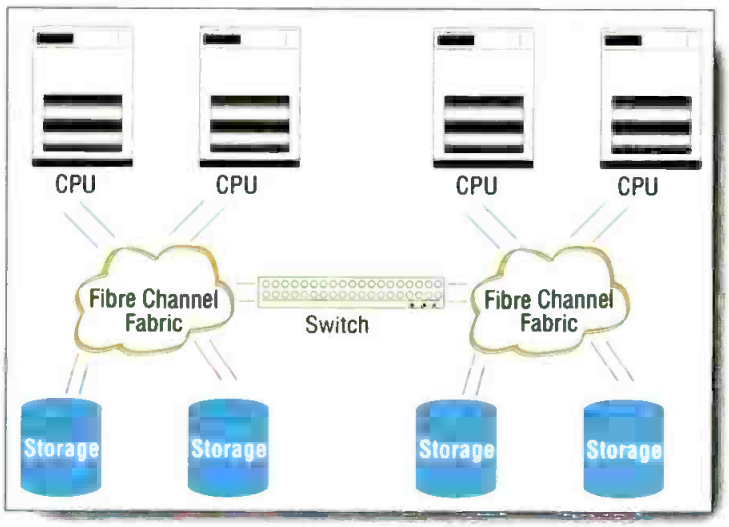

Figure 2. Fibre Channel networks can be arranged in a switched structure to provide increased bandwidth and isolation.

Fibre Channel and storage area networking

One of the hottest topics recently is *storage area networking* (SAN). A simple way to think of SAN is that it is a high-performance network on the other side of a server (see Figure 3). Servers have always supported some sort of network connection for communications between the server and clients. The leap with SAN is to separate I/O and computing (host) functions from the storage itself. Once you have done that, then why not use a network to connect the storage to multiple hosts? This is exactly what SAN does. It allows data to be shared among a number of host servers.

Beyond the simple model shown in the diagram, some companies are working on a Video SAN Recorder or (VSR). The VSR will have functions similar to a simple VTR, but will record and playback data from a SAN. Editors in a newsroom would be able to all get at the same incoming story. One could edit a quick

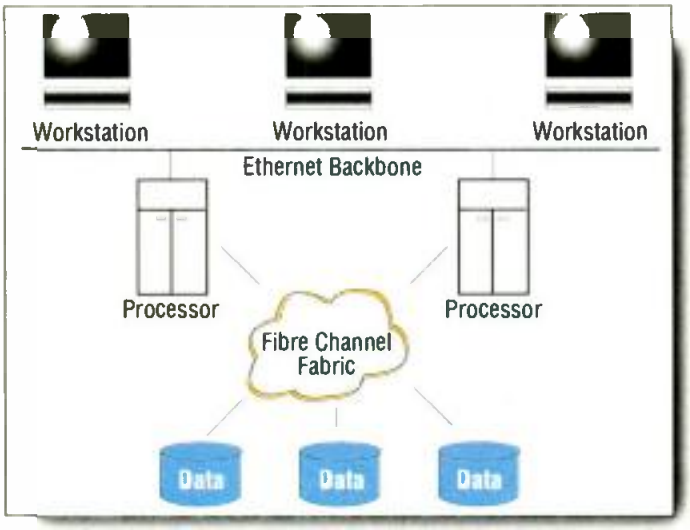

Figure 3. Storage Area Networks (SANs) provide a means to connect a network of storage devices to multiple servers.

version to get a this-just-in version on the air. Another editing team could be working to get a more complete package together for the evening news. However, SANs are easier to draw than to implement. While much of the hardware exists now to build a SAN, there are two vital components missing – an overall system to present a consistent view of the data to the user and a way to control access to this data. Vendors are working hard to resolve this problem. As with most new technology, one or two of these proposals are likely to win out. In the mean time, it may be possible to use SAN where multiple vendors are not involved.

By the way, one important thing to know about Fibre Channel is that Fibre Channel networks do not have to be built using fiber optics. Non-optical Fibre Channel (non-OFC) implementations are fully supported using coax.

Fibre Channel and serial storage architecture

For some time now, there have been two approaches to large storage system architectures — Fibre Channel and *serial storage architecture* (SSA). As is the case with many competing technologies, the two approaches have been essentially incompatible, forcing engineers to choose between the two approaches. (For more information about SSA, see the Computers and Networks column, October 1998, Fibre Channel vs. SSA).

SSA and Fibre Channel have traits that are desirable. Fortunately, it appears that the two technologies will be merged into one product called *Fibre Channel – Enhanced Loop*, or FC-EL. FC-EL products take the best from both technologies and are backward compatible with Fibre Channel – Arbitrated Loop (FC-AL) and SSA.

Fibre Channel seems well suited to meet the needs of the broadcaster. Its high speed, extensibility, large block size, low-latency components and the promise of SAN all are well suited to the task of transporting program content. No doubt traditional serial digital routing systems will carry data using the Serial Data Transport Interface (SDTI). However, it also seems clear that Fibre Channel will find its place in our facilities. ■

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

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Ask Dr. Digital

Tape incompatibilities revisited

BY STEVE EPSTEIN, TECHNICAL EDITOR

I am writing to inform you of a little publicized DV format war being waged by Sony and Panasonic at the expense of their customers. The company I work for, International Television in Rochester, NY, purchased a Panasonic AJ-D650 some years back for feeding DV-based formats to our AVID editor. This machine was chosen based on Panasonic's advertised claim of playback compatibility with DVCPRO(25), consumer DV and DVCAM. At the time, we had a Sony DCR VX 1000 digital camcorder with plans to purchase a more professional camcorder in either the DVCPRO or DVCAM format. Early on, we experienced digital dropout problems when playing the Sony recorded DV tapes in the Panasonic machine. Later, after the purchase of a Sony DSR300 DVCAM camcorder we also experienced digital dropout from the DVCAM tapes played in the Panasonic machine. We sent the AJ-D650 back to Panasonic with an explanation of our difficulties. They returned it, saying everything checked out.

Later, a Panasonic field engineer came to our facility. What he said shocked us, based on Panasonic's own advertising to the contrary. He said that the Panasonic machine is not really supposed to play the other DV formats well, and he went on to elaborate that the use of Sony's DV and DVCAM tapes in the Panasonic machine can damage the heads. He said Sony tape is so abrasive that you could only expect about five hundred hours before the heads are shot. The plot thickened when our Sony DCR VX 1000 began acting up. It would not read its own timecode and would lock up within five minutes of the end of the tape. Dropouts became severe. We sent the camcorder back to Sony for their standardized repair. The repair estimate was for over $800!

Sony's explanation was that deposits found in the machine indicated our use of Panasonic tape. The use of non-Sony tape caused deposits such that they would not guarantee any repair that didn't include the replacement of the head drum and the entire tape path. We have a situation where two major manufacturers who are adherents to a supposed DV standard are claiming the other's product causes massive damage to their respective machines. Buyers be warned. You will not hear about this silent war until your machine goes tilt and you end up eating a huge repair bill or experience an incompatibility problem that the manufacturer failed to warn you about.

Leland Brun
Rochester International Television

Dr. Digital responds: Them there's fighting words! Upon receiving this letter I called Leland and verified the situation. I also sent a fax to the appropriate parties at Sony and Panasonic requesting a response to these claims. In hopes of avoiding the standard corporate line as well as a flowery discussion of future compatiblility, I specifically asked that they include answers to the following questions:

1. Are DVCAM and DVCPRO machines compatible with consumer DV tape?
2. Can DVCPRO decks play back DV and DVCAM recordings without being damaged (including excessive wear) and without causing damage to the tapes?
3. Can DVCAM decks playback DV recordings without being damaged (including excessive wear) and without causing damage to the tapes?
4. Is this issue a result of ME vs. MP tape or an issue that is a result of Sony tape vs. Panasonic tape? Can you recommend a third party tape stock that can be used in all three types of machines (DV, DVCAM and DVCPRO)?

Panasonic's response:

DVCPRO VTRs can basically play back tapes recorded on consumer DV or DVCAM equipment. Regarding playback of consumer DV tape on DVCPRO VTRs, we have not experienced problems with DV tapes from Panasonic or most other DV tape suppliers. However, the quality of DV tape from one supplier is not stable. This causes some DV tapes to have a high error rate. This problem is not a matter of ME vs. MP tape. Panasonic ME tapes or those from other suppliers, and MP tapes for DVCPRO do not cause problems. We have not found any problem with playback of Panasonic DV tapes in any consumer DV VTRs and DVCPRO VTRs. However, we recognize that high error-rate problems occur with some SONY DV or DVCAM tapes. We recommend DVCPRO MP tapes for DVCPRO recording or playback, and Panasonic DV tapes for consumer DV machines. We do not have any comment on DVCAM, a format that was not developed by Panasonic.

Roy Kinoshita
Product Marketing Manager, DVCPRO
Panasonic Broadcast & Television Systems Company.

Sony's response:

From its very beginning the DVCAM format (which has sold over 80,000 units) was designed to be 100 percent compatible with the consumer DV format for playback. In fact, the new DSR 2000 is compatible with DVCAM, DV

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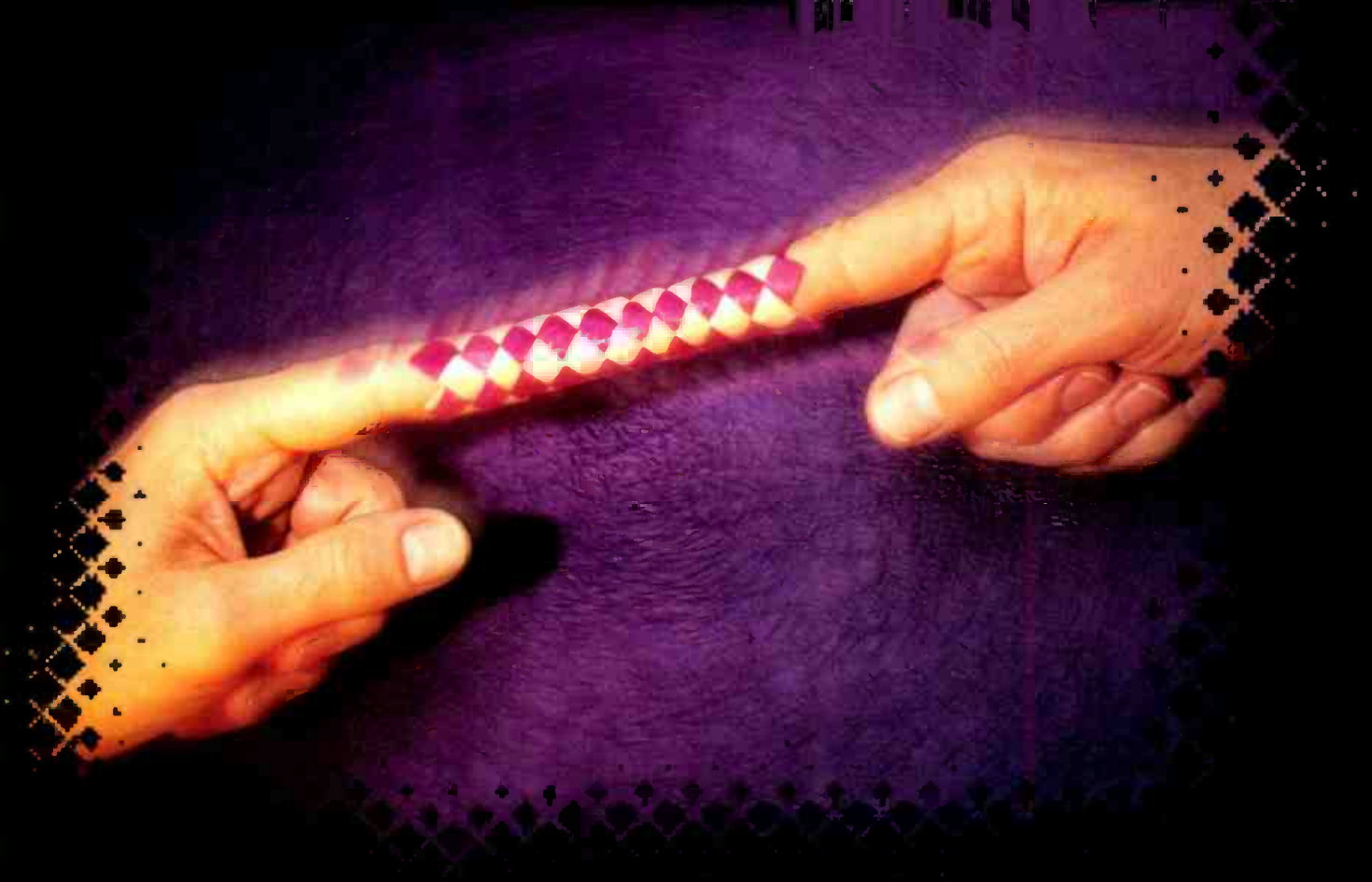

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SYSTEMS DESIGN SHOWCASE

KCET

Digital Educational Telecommunications Center

One of two master control rooms. Each is designed to monitor and control multiple digital channel streams and HDTV. Note the line of sight into the broadcast operations area. Photos by Sandra Williams.

By Darrell Wenhardt

In 1989, KCET Channel 28, Los Angeles, realized that its existing master control and related on-air support facilities had succumbed to old age. The systems were housed in the old film vault section of Fleming Street Studios, one of the first film studios built in the Hollywood area in 1912. KCET needed a new facility.

The challenge was to design and build a facility that would be flexible and adaptable to technology shifts and growing operational demands, while consistently supporting programming and business operations without interruptions.

Building infrastructure

Building design began with a series of meetings with management, programming, engineering, operations and facility leaders. The meetings included the design team, the architect (AHT of Los Angeles) and broadcast consultant (CBT Systems of San Diego).

Initial data suggested that the current administrative, financial, programming and studio operation areas could remain in the existing facilities. The on-air broadcast operations and the directly related on-air support studio, editing, voice-over, maintenance engineering offices and multimedia development departments required new facilities.

CBT Systems began laying out specific technical-related operational areas, including the central equipment room, master control, on-air operations area, videotape dub and format area, online and offline editing, video production control room, audio production control room and a small production stage, Studio C.

As the architectural shell and interior layout details took shape, CBT Systems evaluated building infrastructure requirements for power, grounding, HVAC, mechanical systems, acoustics and signal distribution.

Acoustics

Sound transmission control and control room interior acoustical treatment was critical. All production control, editing and master control rooms were designed to implement full 5.1 surround sound.

KCET

Not only did room interior noise criteria levels become critical, but sound transmission levels between walls and ceilings became even more important to isolate the additional subwoofer energy. Thus, the design goal for building partition sound transmission ratings ran STC-50 to STC-62. In-room noise criteria requirements ranged from NC-15 to NC-30.

A combination of isolated slab subfloors, floating floors, double-wall construction, floating ceiling lids and cavity absorption were employed to achieve both good in-room acoustical performance and excellent audio containment between adjacent rooms.

Cable and signal distribution

An 18-inch raised-access flooring system was designed as the main component of the facilities signal cable distribution system. The architect and consulting teams closely studied and coordinated the building permit, associated building and NEC code sections relating to raised access flooring and related cabling requirements.

The signal cable distribution and installation plan involved countless hours of thought and planning. The prior practice of piling new cable over old without a plan to reutilize the existing cable was something the station wanted to change and guard against in the new facility.

CBT Systems engineering team's was based upon Icon source panel and Icon destination panel demarcation points throughout the facilities.

All circuits entering and/or leaving the central equipment room terminated and cross-connected at coaxial and twisted-pair Icon blocks mounted in 56RU racks next to the central equipment room.

All connections to remote control rooms, technical areas and interbuilding connection points were made via trunking lines between the central equipment room and Icon blocks at the remote locations. The trunking was overbuilt, in some cases by 100 percent, to provide for first-day and future build-out cable conductivity requirements.

This system will not completely future-proof the facility, but it will provide a solid backbone of infrastructure signal cable support for many years to come.

Racks and consoles

Through the early stages of design development, KCET repeatedly stated that the goal of the new facility must be to allocate space and infrastructure resources to future growth and technology advancement. This meant more rack space and adaptable console design.

Additional square footage was allocated for equipment racks. A separate area was designed to employ 36-inch deep racks to support extra-deep file server equipment. This separate area was set aside because of the server's higher per-rack heat load, higher operating sound level and sensitivity to dust and airborne particles.

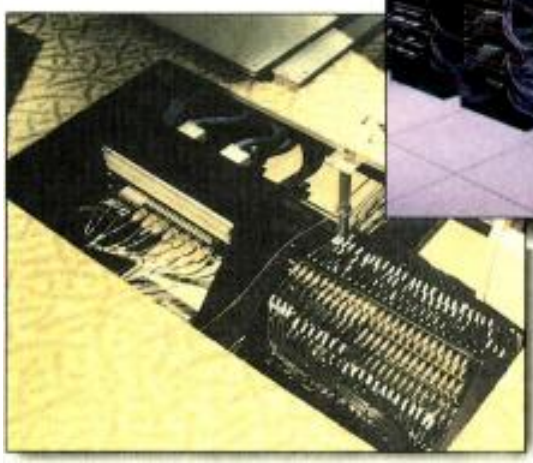
Another key set-up element included seismically rated rack-based support for all equipment racks. These massive steel frames, bolted to the concrete subfloor, are designed to support the equipment rack load during earthquake activity, not an uncommon occurrence in the Los Angeles area.

Operational consoles in each control area received a similar "future growth" and adaptability design criteria. Here the CBT Systems team developed a stamped metal-based modular console design. This approach provided a complete "erector set" console set up which will permit KCET to reconfigure individual console bays by adding height, display mounts, equipment shelves, and support arms at will as operational changes dictate.

Broadcast operations and technology

With a solid building infrastructure in place, the engineering and operations design team and CBT Systems' engineers turned their attention to technical operational requirements. A process flow review ensured that all elements of broadcast programming, from traffic program log development to interstitial material editing to multichannel on-air signal flow, were covered.

The technology approach centered on KCET's desire to develop a "video tapeless" operational philosophy. Using a 601 serial digital video and AES digital audio foundation, a system architecture that included extensive Fibre Channel video file transfer capability was developed. The system design requirement defined five technical sections: incoming program ingest, program production, program editing, program cacheing and program transmission.



The unique application of coaxial and twisted pair Icon modules in the central equipment room (above) and at remote demarcation locations (photo left), provides KCET with an extensive pre-wired cable trunking system to support rapid system changes and upgrades. Top photo by Sandra Williams.

Photo provided by the NBA

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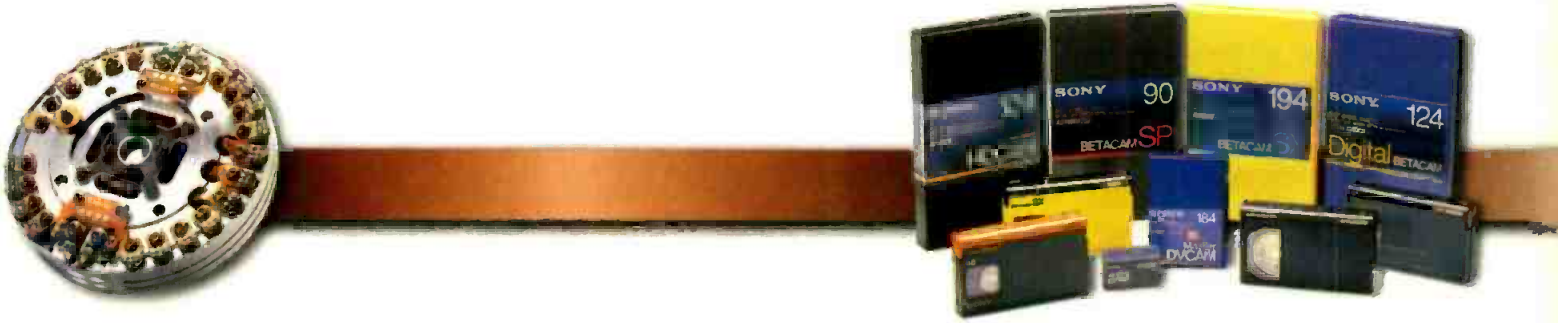

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Program ingest, media control and editing

With these requirements in place, a network of video file servers was established to support all levels of technical and production operations without traditional videotape support. Program media flow and multichannel broadcast control was designed as a fully automated process. Louth was chosen to manage all aspects of the automation system. Program ingest and formatting, program near-line and archive storage, media transfer and routing, and multichannel broadcasting were all placed under the automation control and media tracking system.

Three program media ingest and formatting stations were created for high-quality videotape transfer. Each station is supported with a full compliment Leitch Digibus A/D conversion, digital noise reduction, audio processing and associated analog and digital signal monitoring.

Program and interstitial material editing in the new facility is handled by both full-function and limited-function nonlinear editing rooms. The full function rooms are based around Editware 351 control platforms. Because of Editware's operational familiarity to the editing staff and nonlinear control of the Tektronix Profiles, each edit room's video switching, effects and graphics is supported by Grass Valley 1200 production switchers, Pinnacle DVExtreme and Chyron MAX! graphics systems.

Audio control and processing in the edit rooms is digital. The mixing platform is Graham-Patten DESAM 400. Audio monitoring is set up for both 5.1 surround sound and four-channel discrete with a full complement of Genelec self-powered, full-range speakers and subwoofers, as well as Sony and Yamaha digital audio effects processors.

Field acquisition is currently in Sony Beta SP. To maintain tape compatibility and to begin a technological direction to implementing full MPEG signal throughput, the station selected Sony Beta SX as its new field acquisition format. Thus, each edit room is outfitted with two Beta SX Editing VCRs for material ingest.

Signal routing

KCET implemented a multiple matrix versus single matrix routing system architecture. This kept the overall crosspoint count down and left KCET with better options in the future to add specific router segments (i.e. HD). Philips' Venus was chosen as the digital and analog router and is controlled by the Jupiter switcher. A Philips' Saturn serves as the master control switcher.

Each all-digital edit room is equipped with an Editware nonlinear driver to control multiple channels of Tektronix Profile and Sony SX tape. Photo by Sandra Williams.

A hybrid analog/digital 64x64 ingest router handles all incoming satellite, microwave and fiber feeds. This unit also services the analog/digital tape format and dub area, and the analog/digital signal processing routing.

The main router is a 128x128 serial digital platform with three levels of AES audio, one level of timecode and one level machine control routing. A separate 128x96 analog video router was employed to support video monitoring and signal source ID tracking.

A 32x32 expandable to 64x64 digital transmission router with three levels of AES audio provides desired multipath and multichannel transmission capability.

Video servers

Developing a tapeless video process flow meant the heavy application of video file servers, RAID and data tape. The engineering team chose Tektronix Profile PDR 200s and Ampex DST data tape libraries.

The initial systems build-out contains nine four-channel Profiles with related 24Mb/s storage capacities ranging from five to 21 hours. The overall file server system design was implemented to support a total of 20 Profiles supporting some 68 I/O video channels, each capable of eight channels of audio.

The server architecture includes ingest server channels for incoming program material, edit servers to handle segment and program review and editing, a RAID-supported production server cache connected to one Ampex 712 data tape library, a main program cache with interface to the second data tape library, and four identical main transmission servers to support KCET's initial requirement of four fully backed up, full-time broadcast channels.

Broadcast master control

As part of its long-term programming distribution plan, KCET developed engineering and operational plans to implement two full-function master control rooms. Master Control I is designed to provide separate feeds to both the current analog Channel 28 transmitter and the new digital Channel 59 transmitter. (KCET is scheduled to begin digital broadcasting in December.)

Master Control I will also support three additional channels of regional programming and/or multichannel broadcasts over the new digital transmitter. Additionally, the system is prewired for a HD switching path to Channel 59.

Master Control II is designed to support up to 12 channels of planned regionalized feeds and local educational

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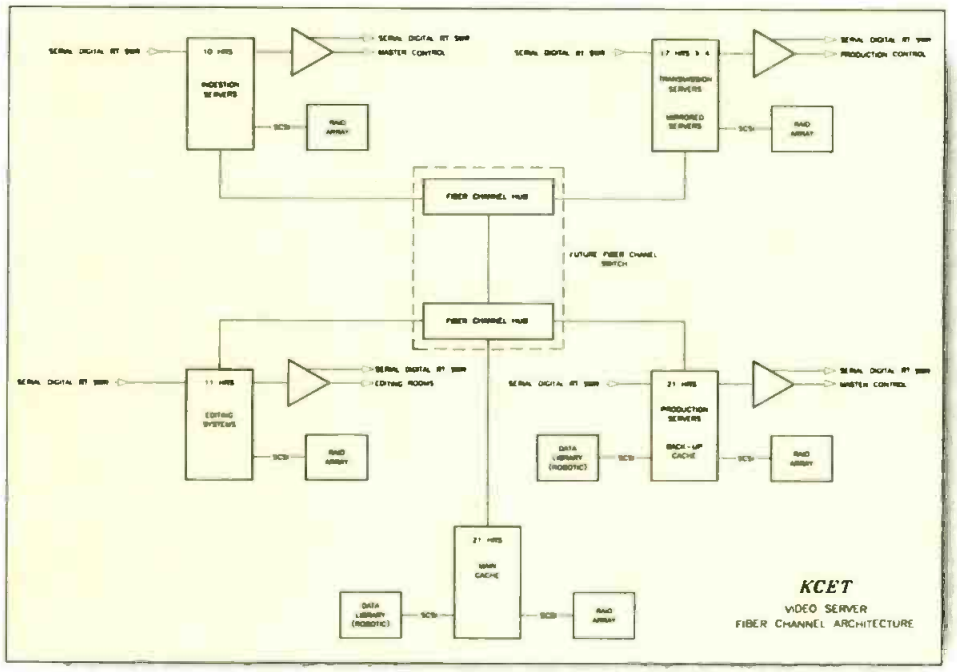

Figure 1. KCET employs a basic file server, RAID cache and data tape library architecture. Signal routing and data transfer is handled by both serial digital and a Fibre Channel network.

programming channels.

All source program and interstitial material to be broadcast on all master control channels is set up to originate from the transmission video file servers. Each channel will be programmed and controlled by the automation system. Each transmission server can store a total of 17 hours of program material. These servers are fully backed up with mirrored units. Daily storage needs outside of the 17-hour range are stored in a main program cache server capable of 21 hours of storage and in the Ampex 712 DST data tape library system.

Operational areas, Phase I, Phase II

The design team developed a two-phase systems implementation approach.

Phase I puts into place all elements necessary to bring current analog channel broadcast operations online with digital technology. These requirements led to the initial build-out of the central equipment room, the video file server room, the videotape format and dub area, the broadcast operation area, Master Control I and Edit Room I.

As broadcast programming increases at KCET, the new facility is prepared to handle the demands, having been prebuilt-out and prewired to immediately support the addition of the following operational spaces and channel capacities:

- Master Control I — Expansion to include HD.
- Master Control II – Built-out to support 12 channels of programming.
- Studio C and Production Control Room C.
- Audio control and sweetening.
- Edit Room II.
- Edit Rooms A, B and C.

Studio C, with its attendant production control room, implements new cameras capable of 16:9 digital operation. Studio C utilizes high-output compact fluorescent lighting technology.

The audio control room will be implemented to support both Studio C digital productions and to provide the overall facility with a digital audio sweetening and voice over control room. Several digital audio mixing and server-based editing platforms are currently being considered for application in this area.

Edit Rooms A, B and C will employ full nonlinear "shared" media editing platforms interfaced into the facility's file server network.

The Profile Server architectural features Fibre Channel hubs configured to facilitate upgrading to a fiber switch as system capacity demands increase.

With these additions, KCET will fulfill its initial design goal of providing an advanced digital television production and broadcast center to serve as the public television station for Southern and Central California. ■

Darrell Wenhardt is president of CBT Systems, San Diego.

Design Team, KCET

Al Jerome, president
Don Youpa, vice president
Horace Scott "Scotty", vice president engineering
Bill Burroughs, chief engineer
Bill Christian, facilities manager
Joe Saavedra, senior engineer
Architect: AHT Los Angeles
Construction Management: Ray Wilson Company
Broadcast Consultant and Systems Integrator: CBT Systems
Darrell Wenhardt, principal consultant
Edward Webster, senior engineer
C. Stanley Ellington, senior designer
Paul Schankin, project manager

Equipment list

Louth automation system
Ampex DST-712 automated cartridge library
Aphex 320A stereo audio processor
Avalon archive manager
Chyron MAX!, MAXINE!
Cisco 200 Series catalyst, 2916XL 100BaseT Ethernet switch
RTS intercom
Denon DN-C680 CD player
Dolby SDU-4 surround decoder
Editware N-VPE351-K2 editing controller
Fostex D25 edit controller
Genelec 1030A speakers
Graham-Patten 409
Grass Valley Group 1200 Edit Switcher
Hitachi SuperScanPro 620 monitors
Ikegami color monitors
Leitch Digibus processing equipment
Leitch CSD-5300 master clock driver
Miranda ASD-251u video A/D converter
NVision audio D/A processing
Panasonic color monitor
Philips Mars digital video switcher, Saturn digital master control switcher, Jupiter control processor Venus A/D routing switcher
Pinnacle DVExtreme
RTS intercom
Tektronix test equipment and monitors, Profile video servers
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Videssence lighting
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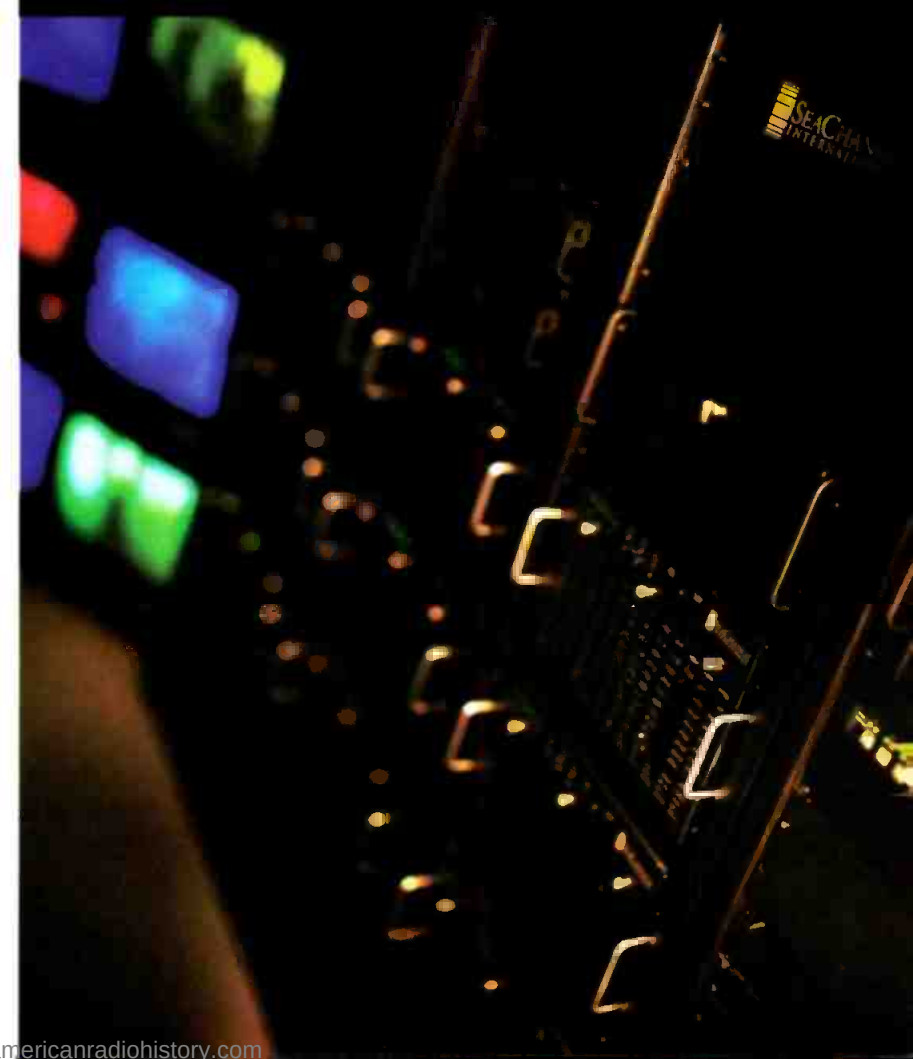

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Transmission & Distribution

Improvements in transmitter technology

BY DON MARKLEY

Perhaps the years have caused a loss of perspective, but it doesn't seem too long ago that tuning a television transmitter was akin to one of Hercules' feats. Cleaning out a mammoth stable or killing a many-headed snake was small change when compared to simultaneously getting both color and power out of a transmitter. The gain-bandwidth product always seemed to be slightly too small as one either tuned to make the colors resemble something seen before or to make those stupid thermometers move enough to indicate that the desired power level was even near. Achieving both the same night was a feat worthy of celebration until one remembered that the same conditions probably wouldn't exist the next night.

That problem corrected itself significantly over the years as designs improved; better devices were developed for amplifiers, and exciters became better at compensating for the problems involved when the amplifiers were not quite up to the desired linearity. Then, external correction circuitry became available, sometimes using signals in the vertical interval, to automatically correct for minor transmitter problems. Surely Farnsworth would have smiled.

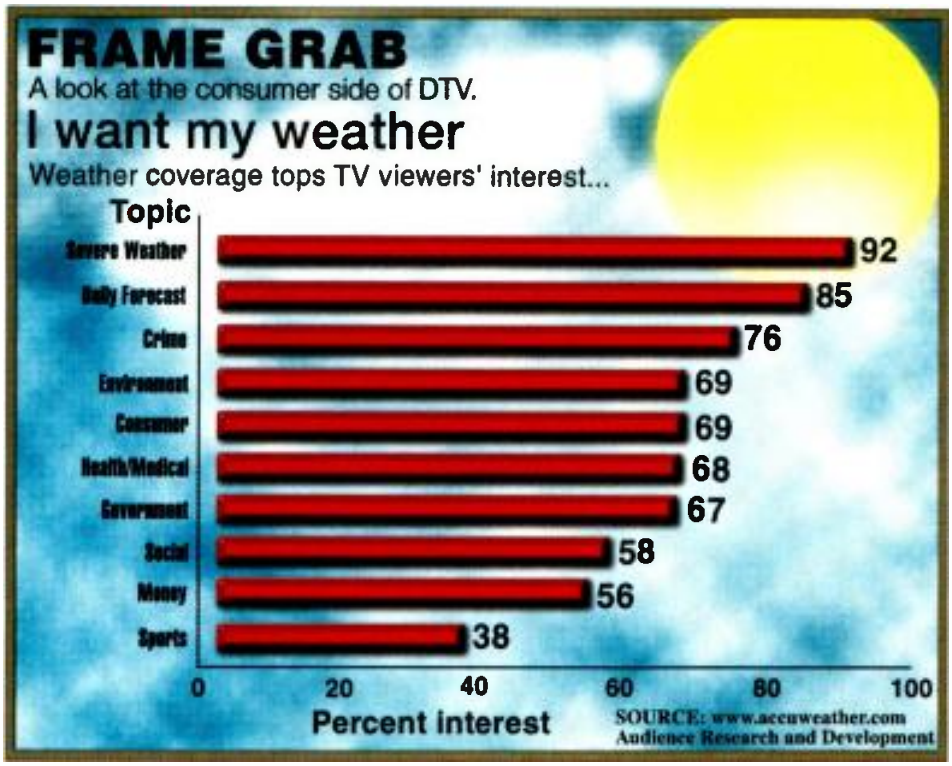
A new era of transmitter behavior has been entered thanks to our friend, the microprocessor.

Microprocessors, our new friends

Now, a new era of transmitter behavior has been entered thanks to our friend, the microprocessor. Transmitters are available with extensive built-in monitoring of the overall system performance. This starts with simple items such as VSWR foldback to avoid blowing up the whole system when either ice build-up happens on the antenna or a fault occurs in the transmission line or antenna. Extensive amounts of controlled feedback regulate system linearity, gain and group delay. In DTV transmitters, external systems monitor the overall transmitted signal, including the ability of the system to maintain the output within the required mask. The system determines what changes are necessary and makes those changes automatically.

Going further, one manufacturer has a totally software-controlled exciter that will operate as either a DTV or an analog system depending upon simple front panel instructions. In two device systems, one manufacturer uses separate exciters for each output amplifier. This permits a high degree of correction for each individual IOT. The outputs are then filtered and combined in the normal fashion. This would seem to be near the ideal. The exciters, locked together, provide very good performance under normal conditions. If either exciter fails, the remaining unit drives both amplifiers in a more traditional configuration with only a slight performance decrease.

This multiple exciter approach primarily applies to IOT systems. In solid-state transmitters, the optimum method would be to apply the appropriate correction signal to each solid-state device. However, due to the number of devices involved, this is



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Rarely, has *one* video tape format inspired *so many* words.

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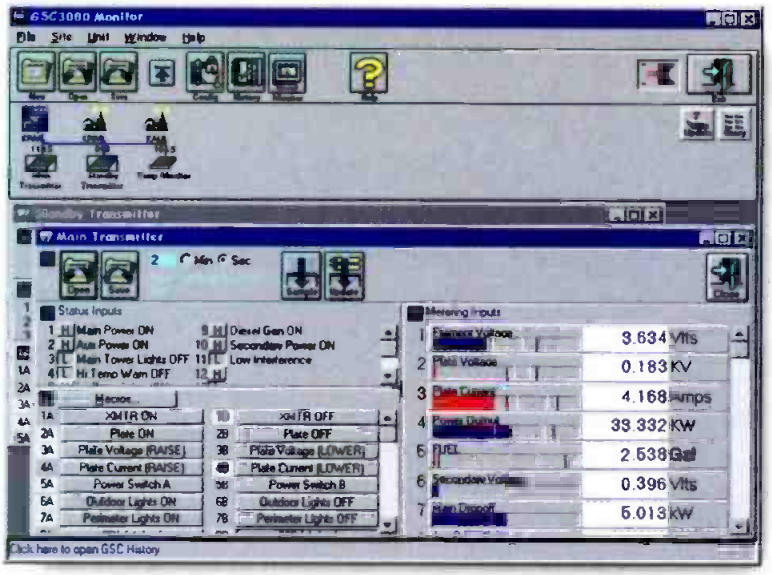
not a practical approach to the problem. Because the performance of these devices cannot be individually corrected, it is difficult to make full use of their power capabilities. The solution is to run those devices at well under their maximum power levels in a range where they are more linear. While that solves the compensation problem, it results in a greater number of devices being needed for a given power level. This contributes to higher price and size. The general thinking is that there will be some change in that situation within the next couple of years.



Today sophisticated monitoring systems allow operators easy access to a variety of parameters and controls. Many times these systems can be accessed from almost anywhere using a properly setup laptop.

Care and feeding

At first glance, it would appear that the role of transmitter technician has been degraded to that of providing coolant and power to an all-knowing, all-seeing automatic box. Not so klystron breath. As with all other increases in technical complexity, modern transmitter systems bring with them a significant increase in complexity of repair. Yes, they do break down sometimes although the reliability is far superior to the transmitters of old. It is imperative that transmitter personnel attend manufacturer's schools to learn these systems. It no longer is enough to simply read the instruction book. All the major manufacturers have organized classroom instruction to train their customers in the care and feeding of their product. Attending the school and maintaining the system carefully is absolutely necessary if the expected performance and reliability is to be realized.

Today's transmitters provide a very high level of performance reporting that can be accessed either by modem or by remote control. Some equipment includes a significant amount of built in diagnostics to aid in troubleshooting. In some cases, the manufacturer's service department can access the equipment,

ATSC Power Play.

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allowing them to assist in the troubleshooting process. In any case, highly adequate operational data is available for a remote monitoring system.

In that area, stations are cautioned to read the fine print carefully. Some of the newer remote control/monitoring systems have their own little booby traps waiting. The new computerized systems allow multiple transmitters at multiple sites to all be controlled and monitored from one central location. That central site can normally be accessed by modem from any site with a telephone and will display all of the meter readings for all the sites along with allowing full remote control. One little problem can be the refresh rate. That is, how long after a control input is made, can the operator expect to the see the results reflected on the meters. In some very large systems, that delay can be as long as 30 seconds. Such a delay is certainly inconvenient and may well be unacceptable. It certainly slows the task of making small adjustments such as raising or lowering the power slightly.

Some of the newer remote control/ monitoring systems have their own little booby traps waiting.

Not all systems carry that penalty for size. Some manufacturers are able to keep the refresh rate down to under a second regardless of system size. In selecting a new remote control or monitoring system, be sure to check both the overall system capabilities along with how fast those capabilities respond to your wishes. It's sort of like your youthful backseat activities. A quick response to your control inputs is needed to determine if you need to change methods or simply start the car. ■

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

SEND Send questions/comments to:don_markley@intertec.com

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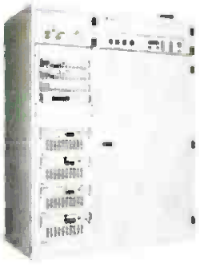

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Using microphones

BY BENNETT LILES

While most aspects of broadcast production have undergone a whirlwind of change during the past two decades, modern technology has had surprisingly little effect on how microphones are used. The only significant change in such instruments has been miniaturization.

Lavs and lapels

One of the first mics small enough to be worn was the RCA BK-6B. It looked like an oversized shotgun shell hanging around the talent's neck on a string called a "lavalier" and trailed a quarter-inch wide cable. That term is still around though the mics that hung from them are long gone. These lavs or lapel microphones now come in sizes barely larger than the tiny cables that serve them. Lapel mics come in omni and directional types. Omni lapel mics hear in all directions equally and due to the physics of contruction can be made smaller than directional lapels.

Used primarily in panel talk shows and news formats, each of these types has its good traits and its bad ones. Unfortunately, most TV set walls are concave and hard. This focuses studio sounds onto the set like a big parabolic dish. Omnis are the worst about picking up this noise bouncing off the set and if guests are placed very close together, it will be very difficult for the mixing operator to leave all the mics at operating level without the show sounding like it's in a barrel. In a free-form format, directional lapel mics are best. They interact less and can be left at or near operating level. This avoids "upcuts" where each guest's initial few impromptu syllables are barely heard until the sound operator responds. The downside of directional lapel mics is that they are larger and more susceptible to breath popping. Windscreens are usually necessary and of course, they increase the weight and visiblility of the mics on the guests. Light, thin clothing will often sag under the weight of a directional lav and require a piece of note card to be clipped on the underside of the mic, behind the fabric, to strengthen and stiffen it.

Ridden hidden

Hiding microphones on mobile talent requires an extra bag of tricks. Lapel mics have been taped on bras, stuck under fleshtone bandages and hidden in hair. One popular way to conceal a lav under clothing where "rustle" is a problem, is to make two triangles of gaffer's tape folded like a flag, with the sticky side out. Place the mic against the tape where its top is slightly inside of the longest edge of the triangle. Press the two triangles together to form a "sandwich" with the mic just peeking out between the top edges. Place the mic on the chest of the performer, preferably between an outer shirt and an under T-shirt. The sticky tape should minimize the rustle of clothing layers rubbing past each other. Directional lavs can be used as long as they are not covered. Never wrap anything around a directional microphone. Blocking its side ports will cause it to become omnidirectional and color its frequency response.

Typical lavalier mics have small capsules (elements) that are connected to the remainder of the electronics using a thin wire. Small clips allow the elements to be attached. Some units are sealed against moisture and can even be spray painted.

Shotguns are generally used on booms, above actors. Each boom operator needs headphones with communication and mic monitor. Multiple shotguns can cause phase problems so multitrack recording is advised. The scene can be remixed once the dialog is recorded.

Testing! This thing on?

On podiums it is better to have a podium mount than to use stands with booms. These mounts are the size of a silver dollar and have three holes for mounting screws. In the center is a threaded protrusion just like the top of a mic stand. Metallic goosenecks are best kept short. The heat of lights can often make them sag under the weight the mic. Small, black gooseneck mics have become very popular and work well, but beware their tiny windscreens. These are more decorative than functional and can be very sensitive to breath popping at less than a foot from the speaker's mouth. When two mics are used, place the mics themselves within two inches of each other. The distance between them must be smaller than the wavelength of the highest audible frequencies or phase cancellations will occur with very unpredictable coloring of the sound as the speaker sways back and forth on one foot and then the other.

When mixing TV with PA from a control room, set the levels for the TV mix first. Then bring up the PA level on each mic until it starts sounding reverberant, then back off a little on the PA level for that mic. Use only the minimum PA level and get the speakers close to the audience and as far in front of the mics as possible. In talk shows with PA it is best to use directional lapel mics for more gain before feedback. ■

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

TOWERS: Not all are created equal

may have been subjected to loads approaching or exceeding the design limits, and failure may be imminent. Most towers that do not meet design code have no outward manifestation of their condition.

For certain conditions, leg overstresses of 20 to 30 percent can be accommodated by midpanel horizontals, i.e. installation of a horizontal member midway between the existing horizontals. This extra member resists the tendency of the legs to bow out. For example, consider a tower with an "x" bracing system with the tower legs supported every 10 feet. The leg is 6" solid round bar. Adding a horizontal member (see Figure 1) at the middle of the panel increases the leg capacity 36 percent.

Horizontal and diagonal members are more easily replaced with larger members, or by adding an additional member back-to-back with the original. Guy wires can be increased in size and tensions adjusted. Foundations can be buttressed. But in many cases, the overstresses are such that reinforcing is prohibitively expensive from both a material and labor standpoint, or the physics can't be made to work. In these cases, a new tower is the only sensible solution.

Evaluating tower proposals

Many factors should be considered when evaluating tower proposals in a competitive bidding process. On the surface it can be argued that the tower meets spec, and, therefore, the lowest price should necessarily be accepted. But there are factors, some subtle, that should not be overlooked when making the decision.

The tower is probably the least understood component of a transmitter site. In the simplest terms, the tower is a bending beam supported by an elastic suspension. In other words, the technology is analogous to that employed in a suspension bridge, except in this case the bridge is vertical, on end.

While design codes specify combinations of ice and wind loads that the tower must withstand, they leave considerable discretion to the designer as to design philosophy. Many times the design comes down to a question of lowest cost or best investment. Some design solutions can provide the best of both worlds, but many times that is not and cannot be the case. Clearly, if the engineer is aware of site-specific wind and ice conditions that exceed the published map values, these conditions are best taken into account and conveyed to the tower suppliers.

Photo of the installation of a 17-ton Dielectric traveling wave antenna on the nearly 2000-foot KNOE-TV tower near Monroe, LA. Photo courtesy LeBlanc Broadcast.

Face width and number of guy levels

Generally speaking, a tower with a wider face width is stiffer and, therefore, requires fewer guy levels than one with a narrower cross section. At the same time, there is a tradeoff in the initial tensions and guy sizes required in a larger tower vs. the number of guy levels and the face width. A good design optimizes these trade-offs, achieving an appropriate degree of stiffness without requiring excessively large guys. It is easy to get caught up in a design spiral that can arise from an injudicious selection of material sizes: Unnecessarily large legs present a larger wind load. The larger loads require larger guys. Larger guys in turn place a heavier downward load on the legs, which in turn must be upsized. Then the whole cycle starts over.

In some cases, face width is constrained by the desire to optimize radiation patterns from panel antennas or side-mounted antennas. These factors may force a change in the size of the tower face, or may in fact, by happy coincidence, facilitate the installation of the antenna by minimizing the standoff distance of a panel from the tower. Figure 2 shows what happens when the tower face width is changed from 56" to 84". The result is a near perfect omni pattern becomes somewhat directional.

Guy anchors

Some designers attempt to minimize the tower's cost by using one anchor point per azimuth. While theoretically such a design meets specifications, this approach is intuitively less desirable than one that distributes the loads over more points. Single anchor points can be used in towers

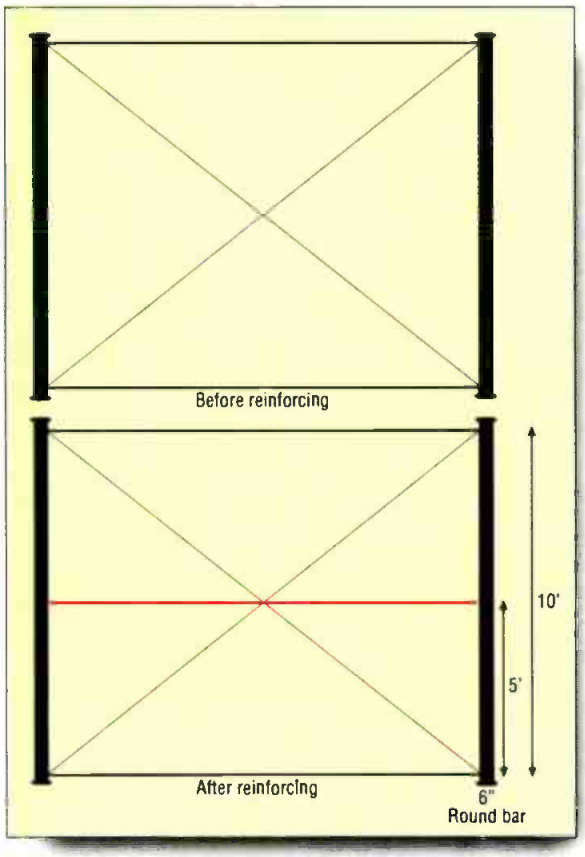


Figure 1. Most tower designs utilize an "X" style bracing system. Additional leg capacity can be obtained by adding reinforcing members. In this example, adding a reinforcing member halfway up the leg section increases the capacity 36%.

up to 500 or 600 feet, but multiple anchors along each azimuth provide some added protection against anchor failure. Such an approach also leaves more flexibility for future changes to the tower, where the addition of another guy level is a relatively simple task.

The typical anchor radius for small towers is 80 percent of the height and for tall towers around 70 percent. The smaller the radius, the greater the guy sizes, and the greater the loads imposed on the tower shaft by the guys. Foundation loads also increase dramatically as the guy radius decreases.

Examine proposed guy radii carefully to ensure that the tower supplier has not proposed an unrealistically large radius that cannot be accommodated within your property boundaries. The problem becomes worse on hilltop sites that can have severe drop-offs. In these cases, the guy radius will extend approximately one foot out for every foot of drop-off.

Member sizes

Often when a tower is designed to just meet spec, the sizes of the legs, horizontals and diagonals are such that additional loads beyond those originally listed cannot be added easily. Valuable information can be gained by asking the supplier for the leg load and face shear diagrams. These curves plot the forces in the members (legs or bracing) against their capacities over the full height of the tower. Some designers go to great lengths to match the loads to the capacities by varying the member sizes frequently. While such a tower has been value engineered and does meet spec, it does not represent a good investment. In many cases, a small percentage of additional cost invested in larger leg sizes will provide judicious reserve capacity that can generate considerable revenue later on. The bottom line is that the leg sizes shouldn't follow the load diagram so closely that an extreme number of size changes are made. A typical tall tower will have four to six different leg sizes (see Figure 3). A greater number (such as 10) suggests an overly tight design.

Investing in additional leg capacity is a wise choice, because legs are the most difficult part of the tower to reinforce. While in the past, the legs of smaller towers were often reinforced by welding additional vertical material, such practices have, in large part, been discontinued. It is extremely difficult to control the quality of welding performed several hundred feet in the air. A good weld requires preheating of the surfaces to be joined, and the application of a uniform weld with proper penetration. During factory shop welding, not only are the joints preheated before welding, but they are also wrapped afterwards to control the cooling rate. Horizontal and diagonal members, guy sizes and the number of guy levels can all be changed. However, a tower leg, once in place, cannot be removed.

For a good understanding of how the member sizes were chosen, ask the tower supplier to provide and explain the stress vs. yield curves. Often a relatively small percentage increase in raw material cost will pay off handsomely by providing a judicious element of reserve capacity. This may be achieved by asking that all structural components of the tower to be designed not to exceed 80 to 90 percent of the member capacities depending on future expansion plans.

A tower leg, once in place, cannot be removed.

Material specification

Tower steel is available in a variety of strengths. A typical yield value for lighter tower designs is 36ksi, (ksi = thousands of pounds per square inch) where-

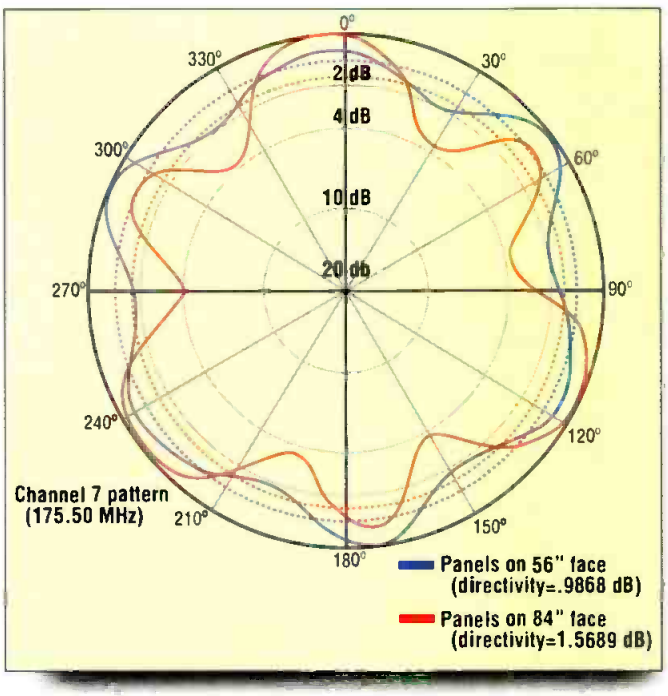
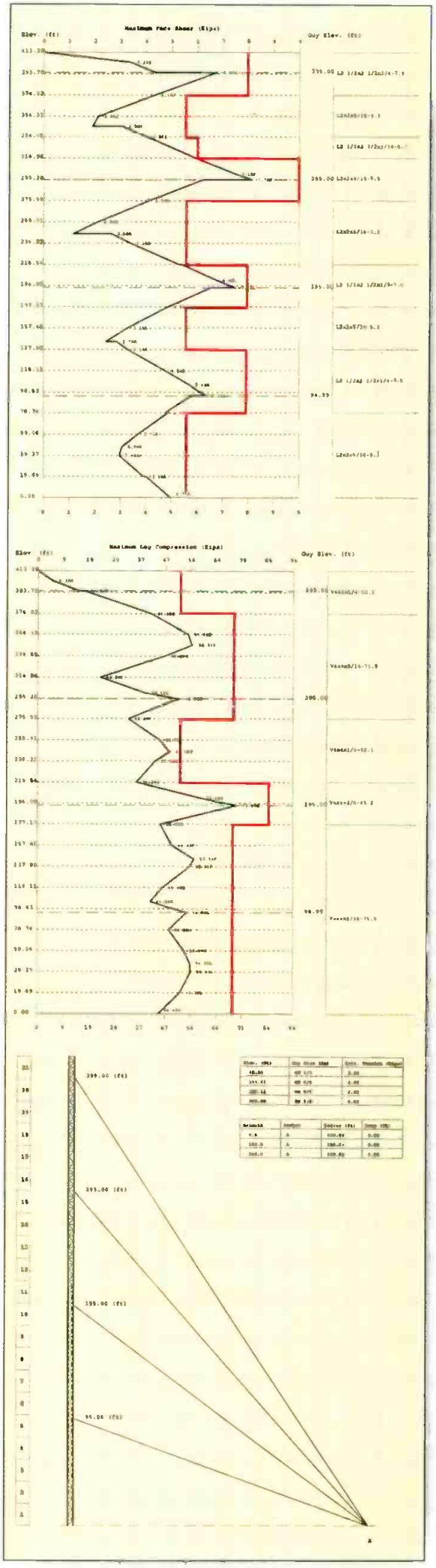


Figure 2. Considerations must be given to face size and antenna mounting. Shown are the resultant patterns obtained by mounting the same panel antenna on two different face sizes. In the first case (blue) the panels are mounted on a 56" face and the pattern is nearly omnidirectional, directivity (max/mean) is .9868dB. Placing the antenna on an 84" face (red) results in a more directional antenna (directivity= 1.5698dB).



TOWERS: Not all are created equal

as tall towers will utilize large leg sizes (up to 12") with strengths of 50 or 80ksi. When comparing leg sizes of competitive designs, note the strength of the steel. Smaller diameter legs of higher-strength steel are not only equivalent in strength to larger diameter legs of lower strength, but they also have the advantage of presenting a smaller wind area.

With many tower manufacturers, the grade of steel (yield tensile and strength) is the only specified parameter, but there are other important characteristics of steel that need to be addressed and specified correctly. While suitable structural grade steels have performed satisfactorily over the years, some structural steels may not be suitable for use in communication structures. Some steels are intended for use in buildings or in applications where the temperature is always above 40° F (5° C).

Recent changes in the methods of manufacture and marketing are causing concern for the designer and how well these steels will perform in the structure. The principle concerns are (a) one steel covers many grades, (b) undersize but within tolerance of some shapes, and (c) increased use of scrap, introducing tramp elements into the product.

Legs for some towers are often made of large solid round bars with diameters up to 12". However, the column design values published by the American Institute of Steel Construction are based on tests of a large number of wide flange sections. Using these curves without further examining the residual stresses in these sections is somewhat questionable. Also, the designer must specify special straightness values for these bars.

Figure 3. An example of leg load and face shear diagrams. The black lines indicate actual loads, while the red lines indicate the calculated capacities. Extra tower capacity is the difference between the two.

Structural steels can exhibit a great difference in their ability to absorb energy. This is described as toughness and is of importance in the design of structures. At room temperatures, most structural steels are very tough and will fail in a ductile manner (essentially, they bend). As the temperature decreases, the steel loses toughness and can fail in a brittle manner (fracturing, as opposed to bending). For good ductility and toughness, the use of a properly heat-treated steel or a *fully killed* (fine grain) steel with suitable chemical composition is recommended. Killed steel is a term (coined word) used in the steel industry that defines fine grain and its chemical composition.

In addition to the manufacturing process of the steel, other factors can contribute to brittle fractures. Structures that are subjected to dynamic loads (such as vibrations or oscillations in a structure's resonant frequency) are more susceptible to brittle fractures. Cold working, punching and other fabrication operations may also contribute to the problem. The interaction of the many effects that can cause brittle fracture cannot be readily calculated. The best way to prevent this condition is avoiding or reducing the conditions that can cause brittle fracture as well as selecting suitable structural steels.

Charpy V-Notch impact tests are used as a measure of the toughness of structural steels. Because the toughness of the steel decreases as the temperature decreases, once it is cold enough, it will become brittle. To determine the temperature at which this transition occurs, a series of tests are performed to find the energy absorbed with each specimen at different temperatures. These results are plotted on an Energy Absorption-Temperature chart (see Figure 4). By heat treating the steel, the transition temperature can be lowered, which ensures the steel will remain ductile to that temperature.

This is important because the characteristics of steel at low temperatures may never be a problem in Texas, but certain-

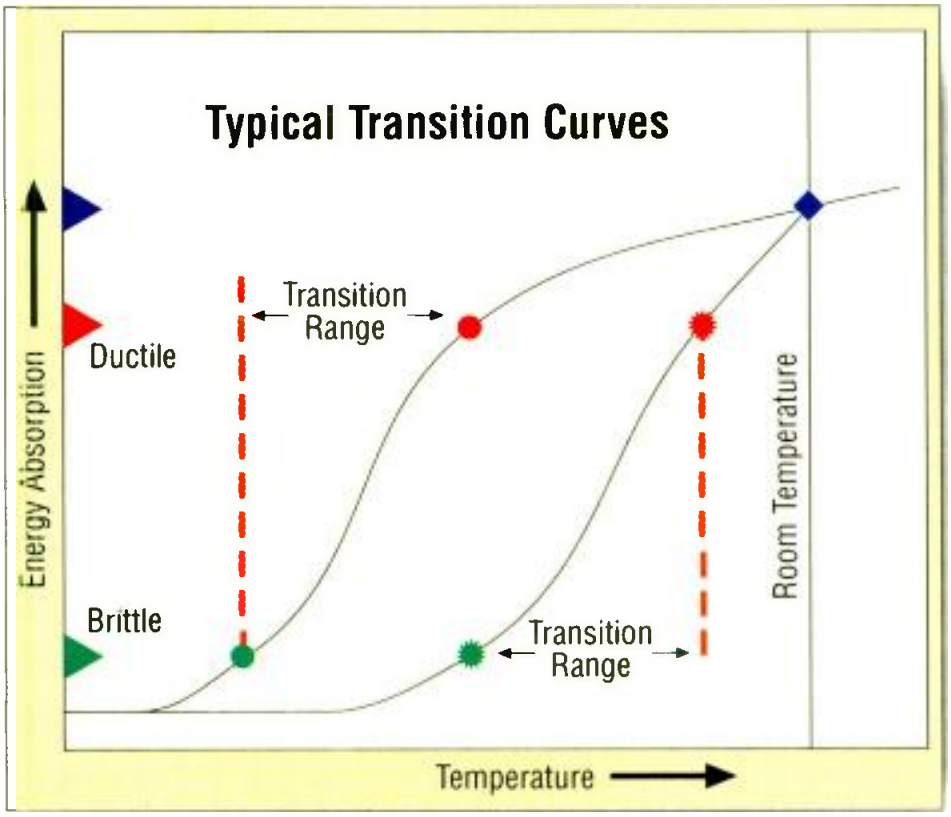


Figure 4. Energy absorption varies with temperature. Even though two steels may have the same energy absorption at room temperature, the amount of energy each can absorb may be considerably different at lower temperatures. When used in cold climates, exposed steel can become brittle. Therefore, the transition temperature range should be lower than the expected outdoor minimum temperature.

ly are of concern in a mountaintop location with subzero temperatures. Over time, steel subjected to low temperatures can become brittle and fail at less than design loads.

Other design factors

Twist and tilt are often specified as being 0.5 degrees for both parameters and at full load conditions. It is debatable whether twist and tilt should be designed for full worst case load conditions, which may occur only once every thirty years, when usually the system design of microwave systems allows for serious fade conditions. Typically, when wind is very high, the kind of fading mechanisms normally associated with deep fades (i.e. ducting or multipath fading) are not likely to occur. Therefore the normal system fade margin is usually more than adequate to take up the signal loss arising from microwave antennas being misaimed. The purpose of this discussion is not to argue against stringent twist and tilt requirements, but rather to ensure that all bidders are designing to the same constraint. Alternatively, purchasers can choose to specify twist and tilt at operational wind speeds, such as the wind speeds that are expected to occur on a more frequent basis, perhaps annually.

Another technique used in minimizing tower costs is to assume the most beneficial placement of loads. Transmission lines can be partially shielded by tower legs. Microwave dishes placed back-to-back at the same elevation have a shielding effect which can reduce the load of the added dish by 50 percent. Again, there is nothing wrong with utilizing these techniques, provided that the constraints on load placement are realized and accepted by the tower owner. The chief engineer should make sure that such underlying assumptions are fully stated.

Over time, steel subjected to low temperatures can become brittle and fail at less than design loads.

Another indication of tower stiffness is the deflection profile under rated load conditions. Some towers deflect in a sinusoidal manner about the guy points, showing minimum deflection near the guy attachments, but exhibit large excursions in between. Such a deflection profile could be problematic in the case of systems utilizing rigid line or large waveguide sections for UHF TV (see Figure 5).

A good, balanced design will exhibit a monotonic deflection, i.e. under maximum load conditions it will lean uniformly in one direction above its base, with deflections increasing somewhat linearly with height.

Tower proposals should be evaluated very carefully. Question your prospective tower suppliers with respect to the considerations mentioned in this article, and if in doubt, refer the designs to a competent third-party consultant for adjudication. You are making an investment that should last 40 years. Make it wisely. ■

Raymond J. Carnovale, P.E., is president of LeBlanc Broadcast Inc., and has been in the broadcast industry for over thirty years.

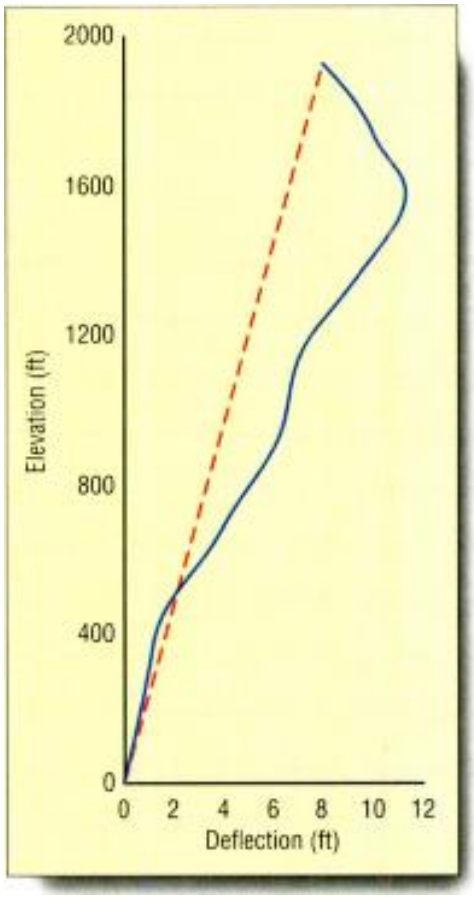
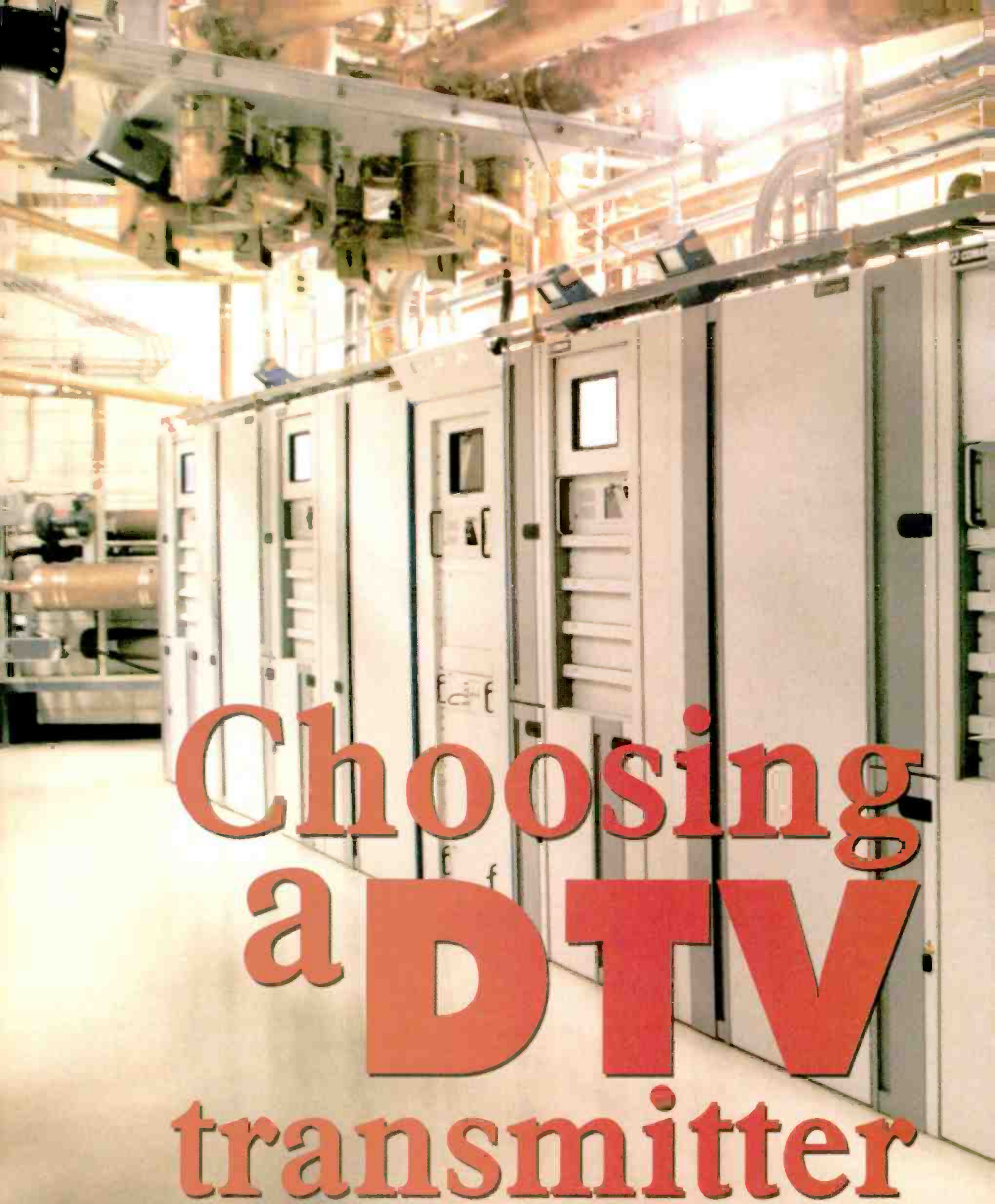


Figure 5. A desirable deflection profile would exhibit even deflection that increases with height (dotted line). This deflection profile is undesirable because of the reduced deflection that occurs starting around 1600 ft.



Choosing a DTV transmitter

WBTV in Charlotte, NC, went on air at 1MW ERP with Comark Advantage Digital transmitters in September 1998. Photo courtesy of Thomcast Communications, Inc., Comark Division.

By Howard McClure

They say that experience is the best teacher, but what we have experienced with NTSC is not necessarily the best preparation for the challenges that lie before us in the new world of DTV. Most of us are novices when it comes to the technical ins and outs of this new technology, yet decisions on how we are going to implement DTV in our facilities must be confronted and answered now. It's tempting to fall back on our NTSC education and to make these decisions based on age-old experience, but this would be a mistake. There are a number of new parameters that must be considered before we make any final decision on how to implement DTV.

Choosing a DTV transmitter

Rethinking performance measurements

What we do not know can hurt us, and it will hurt us if we do not consider the differences between DTV and NTSC. For instance, group delay has long been one of those performance measurements that was "required" without being especially meaningful, since it primarily affected only the color components of the signal. If the red lipstick was still on the face then the group delay was OK. NTSC group delay was specified to be radiated within ±0.05mS to ±0.1mS of the FCC prescribed curve (FAR73.687(a)(3)). But DTV group delay should be ±0.015mS across the entire 6MHz channel, a far more restrictive requirement on a specification which has heretofore received little attention.

Amplitude response is another situation that requires close attention. In NTSC, the FCC requirements were no more stringent than 2dB with an allowed variation up to −8dB at the color subcarrier (FAR73.687(a)(1)). But DTV amplitude response should be ±0.1dB and flat across the channel. A specification like this may not by itself seem too scary, but how you achieve it may cause more degradation than you would suspect.

Our early learning taught us that if we had a VSWR problem in our transmission line or antenna, we should place a fine tuner in and match out the VSWR problem. But now that we have such a tight specification on group delay, introducing a fine matcher may not be an option due to the group delay it will introduce. Likewise, anything introduced into the transmission path that can cause phase or amplitude errors will degrade the overall signal. Currently available DTV modulator/exciters have pre-equalizers that will compensate for known characteristics like mask filters but will not correct for flange reflections or other effects caused by tuners or resonant circuits in the transmission path — all of which are subject to change with the environment. For this reason, your system design should minimize disturbances in the transmission path that are subject to environmental change.

What we do not know can hurt us, and it will hurt us if we do not consider the differences between DTV and NTSC.

Toward common transmission sites

Common transmission sites are becoming quite popular for many markets and this brings about other decisions that our NTSC experience has not prepared us for. In most of the world, common transmission sites are the norm because a transmission authority generally controls them. But in the U.S. we have very little experience to draw from. Common transmission sites most often utilize redun-

Acrodyne's ACT 60/3D is designed for adjacent channel applications for NTSC/DTV combinations.

dant systems, multiple feed lines and common aperture antennas.

Since DTV requires less transmission power than has generally been used in NTSC, common aperture antennas are more acceptable than in the past. Common aperture antennas can also be made redundant by sizing the feed lines to handle the full power requirements on one half of the antenna. If a failure should occur in part of the antenna, the other half can be fed the full power through the redundant transmission line to maintain your ERP. Most common aperture antennas are broadband and therefore are not limited to what channel can be accommodated. Another advantage of common aperture antennas for DTV is they can be mounted on existing towers if the tower is not already loaded to capacity.

Two more antenna considerations for DTV are reflection and reradiation. From our NTSC experience we know that near-in reflections do not significantly impair the NTSC signal unless they are greater than the rise time of the signal, or approximately 120nS. In DTV, one symbol is 92.9nS so that a reflection or reradiation of (92.9nS/2) would cause a worst-case scenario because it would tend to cause a cancellation of a symbol. Multiples of 46.25nS would cause the same errors to be generated. For example, 92.9nS is equal to a reflecting source 91.45 feet from the antenna or even closer in if it is a reradiation source. This highlights the need to very closely evaluate any reflecting source within approximately 200 feet of the antenna, since a reflection or reradiation could cause bit errors to be radiated in some azimuth of your antenna pattern.

An Itelco 604K 80kW IOT undergoing final acceptance tests at the factory.

experience of common sites show that virtually every technical issue can be handled in a common site for 40 percent to 70 percent less than in the go-it-alone NTSC past. Common transmission sites can also provide benefits that may not have been affordable before. Redundant antennas, transmission lines, and transmitters all become a part of the well-designed common transmission facility. Some markets are considering establishing a transmission consortium to provide transmission services to the individual stations on a contract basis, where the redundant capability of the system station can guarantee on air availability at a fixed cost. This is a total departure from the industry's past history, but with the competition of cable, satellite, DVD and home movies, the cost vs. benefits calculation sends a very clear message.

The benefits of every station having its own transmitter facility, tower, transmission line and antenna should be looked at from the standpoint of DTV.

Cost considerations

The traditional American transmission site is up for review. The benefits of every station having its own transmitter facility, tower, transmission line and antenna should be looked at from the standpoint of DTV. With what is known today about DTV propagation, it makes a lot of sense to collocate all the stations in a given market so the viewers will have a better opportunity of reception for all the stations in an area.

If the technical advantages are not enough to consider collocation, then the financial situation should tip the scale. Today's technology and the

Planning DTV transmission step-by-step

Remember, this is a new technology that we are about to employ, so we should set aside the tried-and-true prac-

Choosing a DTV transmitter

tices of the past and consider the new requirements of the DTV system before making any decisions on what components should go into a new DTV system. Here is a step-by-step guide of things to consider before you commit to purchasing any equipment or components for your DTV system.

1. There are many technical advantages for both the viewers and the broadcasters in common transmission sites, so investigate the possibility of sharing the best transmission site in your market.

2. Take a look at where your market is and where the people really are. Many markets have changed significantly since your NTSC coverage was planned, so take a new look at where your market is now and where it will be in the next 10 to 15 years.

3. Determine the shape of the antenna pattern that will best fit your market and its predicted growth. Many NTSC antenna patterns were omnidirectional because directional antennas were not in common use or not available when the NTSC coverage was planned. Directional antennas provide the benefit of directing energy toward where it is likely to be used and away from where it can not be used or could cause a problem like multipath. Directional antennas can sometimes be less expensive and generally require less transmitter power.

4. Select an antenna that allows flexibility in frequency so you can accommodate additional channels or change channels after the NTSC channels have vacated the band. After the initial wave of DTV stations goes on the air, it is possible that some channel swapping will take place to eliminate interference or to allow for additional channels. In either case, having the bandwidth available is money in the bank.

5. The choice of a transmission line to feed the antenna will depend upon the antenna you select. (See "Transmis-

Constant efficiency amplifiers

By Robert Symons

IOTs have been used in broadcast applications for many years. Modifying an IOT by adding a multistage depressed collector allows the resultant device to provide linear amplification with nearly constant efficiency. Because these devices are linear, they can be used for both NTSC and DTV applications. Adding a multistage depressed collector to an IOT not only increases its efficiency, but when operated at the appropriate voltages, the combination operates as a constant efficiency amplifier over a wide range of power outputs. These new devices have been called CEAs (constant efficiency amplifiers).

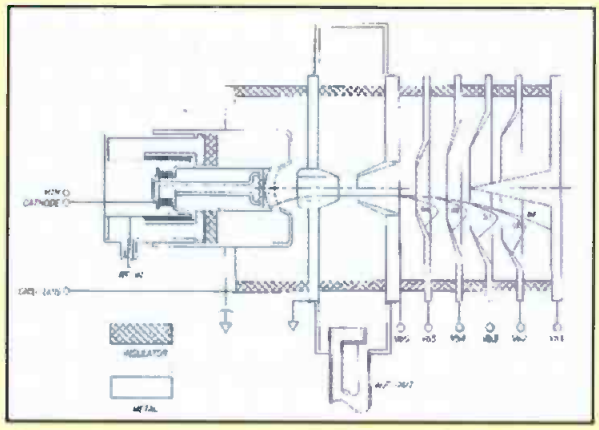


Figure 1. Schematic representation of an inductive output amplifier with a multistage depressed collector. Lines a-e represent typical electron trajectories.

For 8-VSB modulation, a CEA should require one-half the input power of a conventional IOT. Figure 1 shows a basic schematic of the CEA, in which the output cavity is followed by a multistage depressed collector. Shown are several typical electron trajectories (a-e). The collector electrodes are connected to progressively lower potentials between the anode potential and the cathode potential. This is done so more and more energetic electrons penetrate more and more deeply into the collector structure and are collected on lower and lower potential electrodes.

An idealized collector model assumes that each electron is collected by the most depressed collector electrode it can reach. This is not unrealistic if the collector is properly designed. Using a software simulation, electrode shapes close to the ideal were determined. With the intentional randomization of the DTV signal power dissipation on each electrode was not a problem. However, because the NTSC signal can dwell on a specific RF voltage level (e.g. black level), worst case power dissipation also had to be considered. As a result, the first depressed electrode was placed at a potential high enough to permit it to divert electrons from the electrode at body potential. The remaining electrodes were adjusted accordingly. It was determined that with a cathode voltage of –32kV and collector voltages of 0, -8kV, -14kV, –18kV and –21kV satisfied the design criteria.

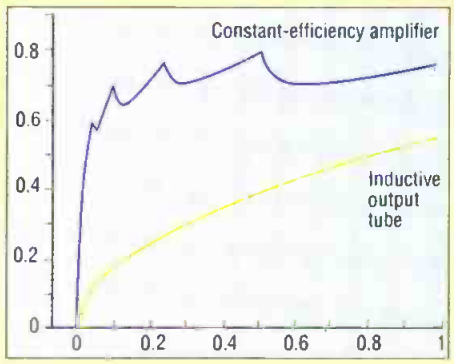
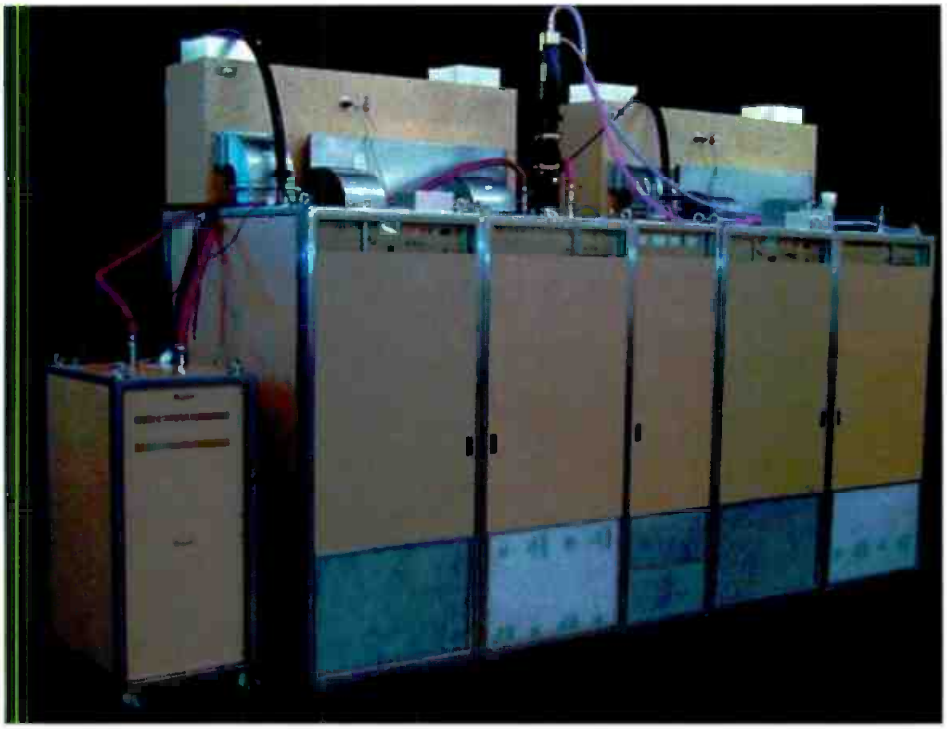


Figure 2. Calculated efficiencies of a conventional IOT and a CEA using an idealized collector model.

Tests have shown that for a DTV signal, the average efficiency will be reduced from 62% to 58% when adjustments are made for NTSC operation. If the device will be used for only one type of signal (DTV or NTSC) then the electrode voltages should be optimized for that signal. Although at present, these devices are in the early stages of development, we currently have a unit that has been built and partially tested. With a 15kW average output power the efficiency was 60% when biased for Class-AB operation. This is about twice the efficiency of a an IOT at that power level. ■

Robert Symons is technical director at Litton Electron Devices Division, San Carlos, CA, and Williamsport, PA.



Itelco's 50kW IOT transmitter for DTV applications offers two tubes and two 90kW switch-mode power supplies.

sion line for DTV" p. 76) A broadband antenna will generally have a dual feed line capability, whereas a resonant slot antenna will have a single line feed. A dual feed line allows for not only back-up for the line itself but also for the antenna if it is designed to feed the upper and lower halves separately. In normal operation, each feed line will feed half the transmitter power to half the antenna. In the event of a failure in either the antenna or line, the total transmitter power can be delivered to the good side and on-air operations can continue at full ERP. Repairs can be effected to the failed component while operating on one half of the antenna.

6. In another departure from tradition, a rigid transmission line has long been the preferred method of getting the transmitter power to the antenna, but now there are new rules. The requirement for broadband systems and the DTV requirement for minimum group delay have, in many cases, tilted the table in favor a continuous transmission line, without periodic disruptions or flange reflections. The side benefit is that the cost to install a flexible line is less, as is the line itself.

7. If you are to be part of a common transmission site, one of the decisions you will have to make will be how to combine the multiple channels into the feed line system. With the high number of adjacent channels (N+1 or N-1) you will most likely have several adjacent channels. Consider stacking two broadband antennas on top of each other and feeding the even numbered channels into one antenna and the odd number channels into the second antenna. The difference in center of radiation between the two antennas will normally be less than 50' so there is no significant height advantage. In this method, standard channel combiners can be used and located in the transmitter building where maintenance can be easily accomplished if required.

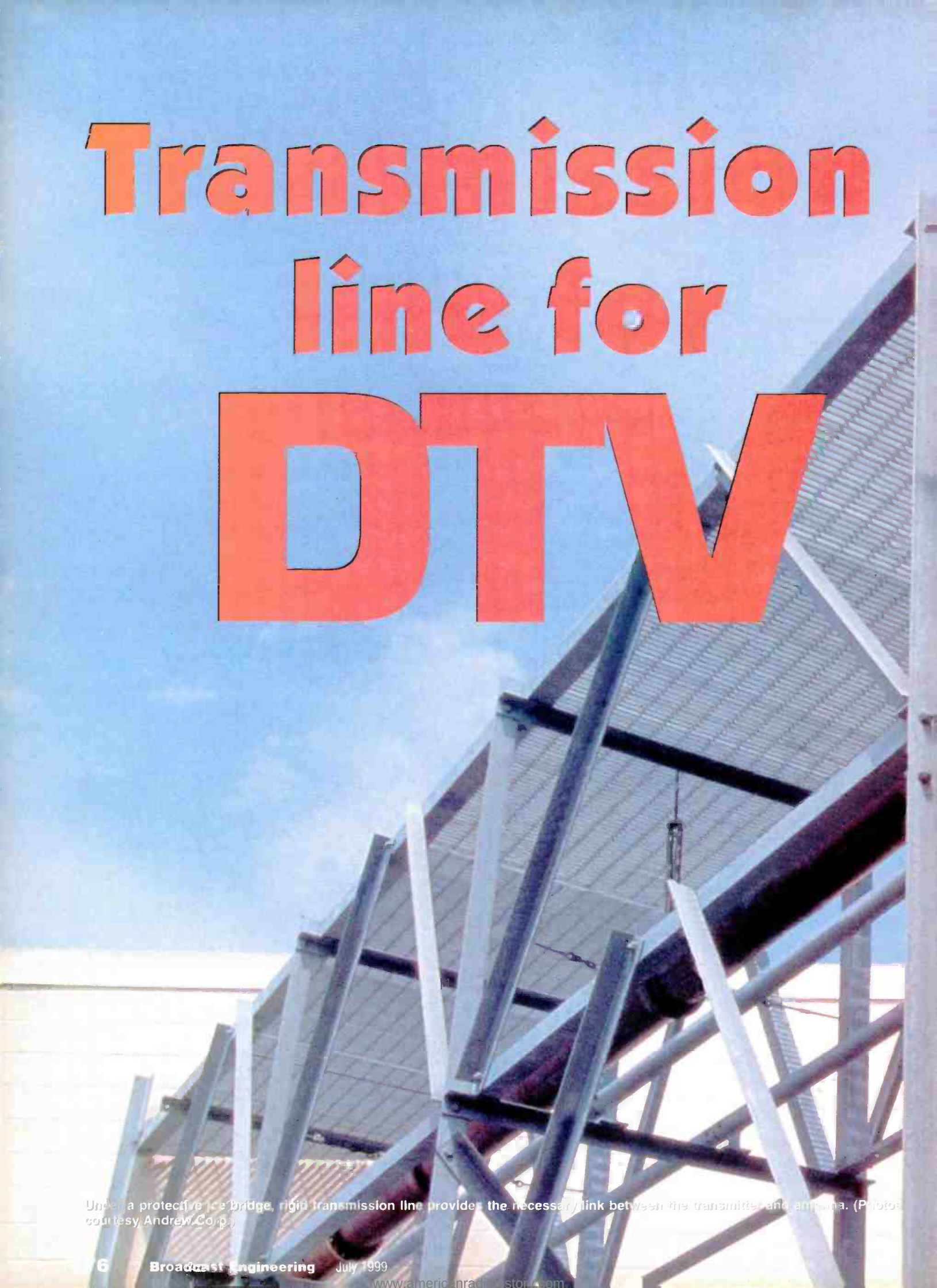
8. Finally, the choice of transmitter will depend on power output requirements and on whether you're a UHF or VHF station. Many stations with output powers of 10kW or less are likely to utilize solid state transmitters, whereas higher-powered UHF stations will likely use tube-based transmitters. Here, too, the technologies have changed. NTSC transmitters have traditionally been air-cooled, but with the advance of solid-state transmitters and higher-power UHF transmitters, liquid cooling could offer improvements in reliability and cost.

Although history and experience are helpful, they should not be allowed to confuse today's issues. DTV and NTSC are different, and times have changed. New transmission facilities must be evaluated using a different set of rules. Common transmission sites along with wideband transmission systems may need to be part of your facility's DTV mix. Weigh the options carefully as you move down the road towards DTV. ■

Howard McClure is vice president of North American operations for Itelco USA, Westminster, CO.

The Harris PT40CD DTV transmitter at WPLG-TV, Miami, gives 40kW peak and 10kW average power.

Transmission line for DTV



Under a protective ice bridge, rigid transmission line provides the necessary link between the transmitter and antenna. (Photos courtesy Andrew Corp.)

By Thomas Mikolajewski

High-power transmission line provides the link between broadcast transmitters and antennas and plays a critical role in signal quality and reliability. Picture quality can be degraded by reflections caused by flanges, elbows, and connections to combiners and filters. Carefully selecting transmission line to handle high-power RF signals without overheating from current flow or arcing due to high voltage ensures long-term reliability. When selecting transmission line, the first consideration is to match transmitter output characteristics to antenna input characteristics. This information leads to transmission line design parameters, such as average and peak power rating, VSWR performance, characteristic impedance, cutoff frequency, line efficiency and group delay. By evaluating these factors, the type and size of transmission line can be determined.

With the arrival of DTV, a new set of requirements is being placed on transmission line. In place of single-channel broadcast, many transmission lines will now need to carry multiple channels with a mix of analog and digital signals. A new approach is needed to meet the numerous channel combinations and broadcast formats required. This article discusses some relevant transmission line selection criteria and presents an example of combining nonadjacent channels on a rigid transmission line.

Transmission line options

Transmission line is available in two general constructions: flexible and rigid. Flexible transmission line is divided into corrugated coaxial foam dielectric cable and corrugated coaxial air dielectric cable. Rigid transmission line is divided into a coaxial air dielectric and waveguide.

Corrugated coaxial transmission line has several advantages over rigid transmission line. Continuous lengths greater than 1000 feet are available. These sections are supplied

on a reel, making them easy to pull up a tower. Also, flexible transmission line is a good choice for applications needing broad frequency response because flange reflections are eliminated. In addition, coaxial cable hangers are simpler to install than rigid line hangers.

Two types of flexible transmission line can be considered for broadcast signals. Corrugated coaxial foam dielectric cable is usually not used for high power broadcast because the maximum cable diameter of 2 1/4" limits average power handling below what is needed for typical television transmitters. Corrugated coaxial air dielectric cable in diameters up to 5" can be used for AM, FM, and low-power VHF broadcast applications. Long lengths are available, pressurizing the broadcast antenna is possible and VSWR performance is acceptable but attenuation is high, affecting average power rating.

Several types of rigid transmission line are available. For very high-power UHF broadcast, the choice is rectangular, elliptical or circular waveguide. Waveguide provides the lowest attenuation and the highest average power handling. Rectangular waveguide is available in various sizes, typically ranging from around 5"x10" to 10"x20". Circular waveguide typically ranges from 12" to 18" in diameter. Due to the large size, a major consideration in tower design is windload from rectangular and circular waveguide. Elliptical waveguide can be used to address this, but wind direction can be a problem. Like circular and rectangular waveguide, elliptical waveguide is available in various sizes.

High power VHF and medium power UHF can be handled by rigid coaxial transmission line. Rigid coax is available in sizes such as 3 1/8", 4 1/16", 6 1/8", 7 3/16" and 8 3/16" diameter. The advantage of this line is low attenuation with reasonable average power, low single-channel VSWR, and low windload. A disadvantage is the need to counteract the effects of expansion and contraction of both inner and outer conductors; this requires expensive spring hangers and some form of thermal compensation or sliding contact of the inner conductor.

Transmission line considerations

The main function of transmission line is to connect the broadcast transmitter to an antenna. Many factors influence the selection of the right line for a particular application. Classical transmission line calculations take into consideration parameters such as operating frequency, attenuation, average and peak power, and characteristic impedance. But just as important to long-term reliability is VSWR performance, efficiency, group delay, windload on tower and lightning survival. Coaxial rigid transmission line average power and peak power ratings will be considered here.

Proper installation of rigid transmission line includes the use of appropriate hangers along both horizontal and vertical runs.

The average power a transmission line can handle is primarily limited by the ability of dielectric material to withstand high temperature without deterioration. Secondary factors, such as oxidation of copper resulting in high contact resistance at connections, usually applies only to sliding-type contact joints. Heat is generated by current flow in rigid line conductors because of attenuation (copper losses and dielectric losses). The rigid line inner conductor runs hotter than the outer conductor because less surface area is available to remove heat. Maximum average power is determined by the long-term (20 year) survival of dielectric insulators subjected to heating by the inner conductor. Because attenuation is frequency dependent, average power is also frequency dependent (higher frequency equates to lower average power).

Table 1 indicates standard conditions applied to average power ratings by most manufacturers. Actual average power rating for transmission line depends on site conditions such as maximum ambient temperature, altitude, solar load, windload, salt spray and industrial pollution, and operating conditions such as line pressurization and VSWR.

Peak power is calculated from the maximum allowable voltage gradient between inner and outer conductor that does not cause arc-over. Safety factors are included to take into consideration air density, absolute pressure, ambient temperature, tuning screws, transitions to transmitter and antenna, moisture, and contamination. An equivalent DC test voltage is calculated and applied between the inner and outer conductor to verify the peak power rating for transmission line. Peak power is not frequency dependent but is dependent on the size of inner and outer conductors and line pressurization.

For single channel applications, peak power is not a limiting factor, but it must be considered for multiple channel transmission systems. Table 2 indicates standard conditions applicable to peak power rating.

Rigid transmission line does not have a flat frequency response like flexible transmission line. Flange joints located at fixed locations cause VSWR spikes at approximately 24MHz intervals. To cover the broadcast frequency band, several discrete rigid line lengths, such as 20-, 19.75- and 19.5 feet, move flange spikes outside the single-channel 6MHz bandwidth range. Through proper selection of sec-

PARAMETER	VALUE
Ambient temperature	Maximum 40°C
Inner conductor temperature rise over ambient	60°C or 80°C
Line pressurization	Zero gauge pressure
VSWR	1.0
Altitude	Sea level
Solar radiation	None
Windload	None

Table 1. Standard conditions applicable to average power ratings for rigid line.

tion length, low VSWR is ensured at the desired channel.

Multiplexing television signals in a single rigid transmission line is practical for adjacent and nonadjacent channels that fall within the standard section lengths noted for single channel applications. For adjacent and nonadjacent channels that do not fall within the standard section length, special computer programs can calculate a custom section length for low VSWR performance. These combinations can include VHF+VHF, VHF+UHF, and UHF+UHF channel groupings and signal formats such as NTSC+NTSC, DTV+DTV, and NTSC+DTV.

PARAMETER	VALUE
Ambient temperature	Maximum 40°C
Line pressurization	Zero gauge pressure
VSWR	1.0
Altitude	Sea level

Table 2. Standard conditions applicable to peak power ratings for rigid line.

The limiting factor for single channel UHF broadcast is average power. But for multiple channels, peak power can be a limiting factor. Therefore, both average and peak power need to be calculated when combining broadcast signals on a single transmission line. A complication arises due to the frequency dependency of average power. For adjacent channels, this is probably not significant, but if channels are not adjacent, the frequency dependency must be considered.

Dual channel calculations

As an example, the combined average power and peak power for NTSC (channel 30) and DTV (channel 50) will be calculated for rigid transmission line. For NTSC channel 30 (566–572MHz), an ERP (effective radiated power) of 1000kW and an antenna gain of 25 will be used. By dividing these numbers, the input power to the antenna becomes 40kW. Next, 6 1/8" 50Ω rigid line is selected. With this line and an average line length of approximately 1500 feet, transmission line efficiency is 80%. This requires the transmitter to deliver 50kW (peak-of-sync) to the transmission line.

Using the following equation, peak NTSC power is equal to 87kW.

$$\text{NTSC Peak Power} = \sqrt{(\text{Peak-of-sync-power} + \sqrt{10\% \times \text{Peak-of-sync-power}})^2}$$

Average NTSC power is based on a picture power level with black screen of 60% peak power and an aural power level of 10% peak power. NTSC average power equals 61kW.

$$\text{NTSC Average Power} = (60\% \times \text{Peak Power}) + (10\% \times \text{Peak power})$$

For the DTV channel 50 (686–692MHz), an ERP of 80kW and an antenna gain of 10 is used. Dividing, the input power to the antenna is 8kW. With an assumed transmission line efficiency of 80%, the transmitter is required to deliver 10kW average power to the transmission line. It should be noted that NTSC transmission is based on peak power, and DTV is based on average power. Peak DTV power is calculated by using a 7dB ratio between peak power and average power. DTV peak power is 50kW.

$$\text{DTV Peak Power} = 5 \times \text{DTV Average Power}$$

Average power for the combined channels is determined by comparing the calculated average power to the maximum average power of the rigid line at the operating frequency. For 6 1/8" 50Ω rigid line, the maximum average power for channel 30 is 71kW and for channel 50 is 64kW. The average power ratio is calculated as a percentage and combined. This shows the average power for NTSC-DTV is 101% of maximum average power for 6 1/8" rigid line. With consideration of line pressurization and ambient temperature, this percentage can be lowered to an acceptable level.

$$\text{Channel 30 Ratio} = \frac{\text{NTSC Average Power}}{71\text{kW}}$$

$$\text{Channel 30 Ratio} = 85\%$$

$$\text{Channel 50 Ratio} = \frac{\text{DTV Average Power}}{64\text{kW}}$$

$$\text{Channel 50 Ratio} = 16\%$$

Peak power for the combined channels is determined by calculating the equivalent voltage units; therefore, impedance need not be considered. Combined peak power is determined by adding each channel's voltage units and squaring the sum. Peak power for the NTSC-DTV transmission is 268kW,

$$\text{Combined Peak Power} = (\sqrt{\text{NTSC Peak Power}} + \sqrt{\text{DTV Peak Power}})^2$$

which is well below the 6 1/8" maximum peak power rating of 1500kW.

Multichannel rigid line

In some situations, final channel allocation may not be known, or an existing antenna may need to be replaced with one for another channel, or the lower power requirements for DTV may mean several channels can be combined in one transmission line. Does this mean rigid transmission cannot be considered because of flange spikes? No. Rigid coaxial transmission line can be specially designed with these applications in mind. A wide-bandwidth rigid coaxial line can be used. With some sites needing multiple elbows to clear existing obstructions, broadband elbows are required to maintain the low system VSWR performance.

Broadband, low VSWR performance can be provided where multiple channel transmission line is required by progressively changing rigid line section length. Flange reflections cannot be completely eliminated, but by using one of several schemes for varying section lengths in predetermined steps, reflections do not add to unacceptably high VSWR (typically less than 1.10 over the UHF band). For simultaneously broadcasting several channels or where final channel assignment is uncertain, air coaxial cable for low power or broadband rigid transmission line for high power provides good VSWR performance across the entire UHF band.

Although the transmission line is just one part of the overall broadcast link, unique applications require looking at the entire rigid coaxial transmission line as a system. This means every component in the transmission line, such as combiners, filters, line sections, elbows, impedance matching sections, and transitions, must be included in the calculation of system performance. Each item separately must handle high-power RF signals and limit reflections to the transmitter and subsequently radiated from the antenna. This is especially important for multichannel applications. ■

Thomas Mikolajewski is supervisor, Broadcast Transmission Line Design Engineering, Andrew Corporation, Orland Park, IL.

Digital videotape formats

With the small size of many of today's VTRs, formats such as DVCPRO can be easily used in mobile applications.

By Kenneth Hunold

The handwriting is on the walls, and everywhere else in the broadcast facility. Digital recording technology will become the dominant recording process in the broadcast industry (and eventually in the home as well). Even consumer champ VHS and broadcast Betacam will eventually fall out of favor. It has been many years since a new analog tape format was introduced. But it seems that every year at NAB, three or four new digital recording formats are introduced.

Round 1: 19mm

The first digital VTR format was standardized by SMPTE as D-1. D-1 recorders process *digital component video*. This is a signal where the individual components, luma (Y), and the two color difference components, blue minus luma (B-Y) and red minus luma (R-Y), are individually digitized.

The video signal is sampled according to the ITU-R (formerly CCIR) Recommendation 601. This document specifies that the luma signal should be sampled at 13.5MHz, and that the color difference signals should be sampled at 6.75MHz. The chroma signals are sampled at half the luma sample rate because it was determined that the human visual system cannot discriminate color changes as well as it can discriminate changes in brightness. ITU-R Rec. 601 has also been called 4:2:2 sampling. This shorthand notation dates to when multiples of the color subcarrier (such as 4fsc) were suggested as sampling rates. 525-line systems would use 14.3MHz as the luma sample rate (four times 3.58MHz) and 625-line systems would use 17.7MHz (four times 4.43MHz). The ITU recommended an international sampling rate of 13.5MHz for both 525- and 625-line systems, but the 4:2:2 nomenclature lives on.

In D-1 VTRs, video is sampled according to ITU-R Rec. 601, and those samples are quantized to eight-bit values. The data is recorded onto 19mm (3/4-inch) oxide tape. Four digital audio channels are included, each of which is sampled at 48kHz and quantized to 16 bits. Separate cue audio, timecode and control tracks are included.

The second digital recording format standardized by SMPTE was a *composite* digital format and designated, appropriately, D-2. The unique part of the composite digital signal is that the entire composite signal is sampled including sync, color subcarrier and color burst. The NTSC signal is sampled at four times the color subcarrier frequency, or 14.3MHz, and these samples are quantized to eight-bit values. As in D-1 VTRs, four digital audio channels are included, with analog audio sampled at 48kHz and quantized to 20 bits.

Round 2: ½-inch

The next two digital formats were D-3 and D-5. (D-4 was omitted, most likely because the number four is considered unlucky in Japan.) D-3 and D-5 are both 1/2-inch tape formats and mark the change from the 19mm tape (used in D-1 and D-2) to the 1/2-inch format. The D-3 format is a composite digital format sampled at 4fsc and quantized to eight-bit values. Four digital audio channels are included. The D-5 format is a component digital format. Video sampling is per ITU-R Rec. 601. A unique feature of the D-5 format is that it allows video samples to be quantized to 10-bit values instead of the eight-bit quantizing used in earlier formats.

The D-3 and D-5 VTRs also allow for some limited compatibility between formats. With the proper options, D-5 VTRs can play back D-3 format tapes, and provide either a composite or component digital signal. However, D-3 VTRs cannot play back D-5 format tapes. This backward compatibility concept has been applied by many other

Digital videotape formats

manufacturers to various product lines.

Many of the new tape formats introduced in recent years use data compression or bit-rate reduction. Digital Betacam is one such recorder. By using a DCT-based compression algorithm resulting in a data reduction of approximately 2:1, 10-bit component digital signals can be recorded on 1/2-inch metal particle tape. Four audio channels are included. The small size of the tape and transport has allowed for the development of camcorders and standalone portable recorders. The concept of backward compatibility has also been applied here. Properly optioned Digital Betacam decks can play back analog Betacam-format tapes. Digital VTRs cannot, however, make analog recordings.

Round 3: ¼-inch and ½-inch

The consumer DV format accomplishes some initial data reduction by subsampling the two color difference components (R-Y and B-Y). Instead of sampling the chroma signals at half the luma sample rate, they are sampled at one quarter the luma rate, reducing the amount of data the system has to deal with. The familiar 4:2:2 shorthand notation for ITU-R Rec. 601 sampling has been modified to reflect the new ratios. This type of sampling has been dubbed 4:1:1 sampling and still uses 13.5MHz for luma sampling. This 4:1:1 subsampled video is quantized to eight bits per sample and applied to an intraframe compression system. Intraframe means that all the compression is based on the current frame, as if it were a still image. This is an advantage in editing systems that need frame-accurate edits. Further compression can be accomplished if comparisons are made to adjacent frames, which is the basis of the MPEG compression algorithm. The subsampled video data is compressed approximately 5:1 to a data rate of about 25Mb/s. The consumer DV format allows for either two channels of audio sampled at 48kHz and quantized to 16 bits, or four channels sampled at 32kHz and quantized to 12 bits.

Different manufacturers have developed products with enhancements and modifications to the consumer DV format. The DV format was originally designed for 25Mb/s, but by stacking several DV compression engines, the data rate can be increased. Of course, there has to be a place to put all this data. That requires either a wider tape or a faster linear tape speed, or both.

The DVCPRO format changes the track pitch to 18 microns (consumer DV is 10 microns) and adds an analog control track to increase the durability and reduce editing lock-up time of the system. To do this, and also to add an analog cue track, metal particle tape is used instead of the metal evaporated tape used in the consumer format. (Conventional analog recordings cannot be made on metal evaporated tape.) Because of the change in track pitch, tape speed must be nearly doubled. A larger tape cassette has been used to increase time of play. The DVCPRO format has been standardized by SMPTE as D-7.

While not technically an enhancement of the consumer DV format, the Digital-S format does use the DV compression algorithm. The video is sampled according to ITU-R Rec. 601 (full 4:2:2 sampling) and is less compressed than the other DV extensions (approximately 3:1). This results in a higher data rate, about 50Mb/s. Digital-S uses a wider, 1/2-inch metal particle tape in a shell very similar to S-VHS. Even though the Digital-S format includes space for four audio tracks, early machines only utilized two of those channels. New machines have been developed that have access to all four audio channels. The Digital-S format has been standardized by SMPTE as D-9.

The SMPTE designation D-8 was skipped, allegedly for the same superstition that removed D-4 from the sequence. (I suspect that there will be no D-13 format approved when we get to that point in the sequence.)

The DVCPRO extension to the DV family has been further extended to 50Mb/s (called DVCPRO50) to provide 4:2:2 sampled 525i video, and also 525p (480 active line) scanned camera signals. It is important to remember that VTRs do not have image scanning formats or aspect ratios. The cameras that create the signal and the monitors that display the image determine those parameters.

Currently one of the few formats available for HD acquisition and production, these HDCAM VTRs were used by KTVU for the Chinese New Year parade.

Another professional extension to the DV format is DVCAM. The track pitch for DVCAM is 15 microns, but metal evaporated tape is retained from the consumer format. This means there is no separate control track or cue track. Timecode information is extracted from the ITI (Insert and Track Information) portions of the track, which is common to all DV formats. Camcorders and dockable VTRs have been developed for this format, in addition to desktop and rack-mount editing VCRs. 4:1:1 sampled eight-bit video with two or four-channel audio are available as in the consumer format.

In addition to Digital Betacam, there

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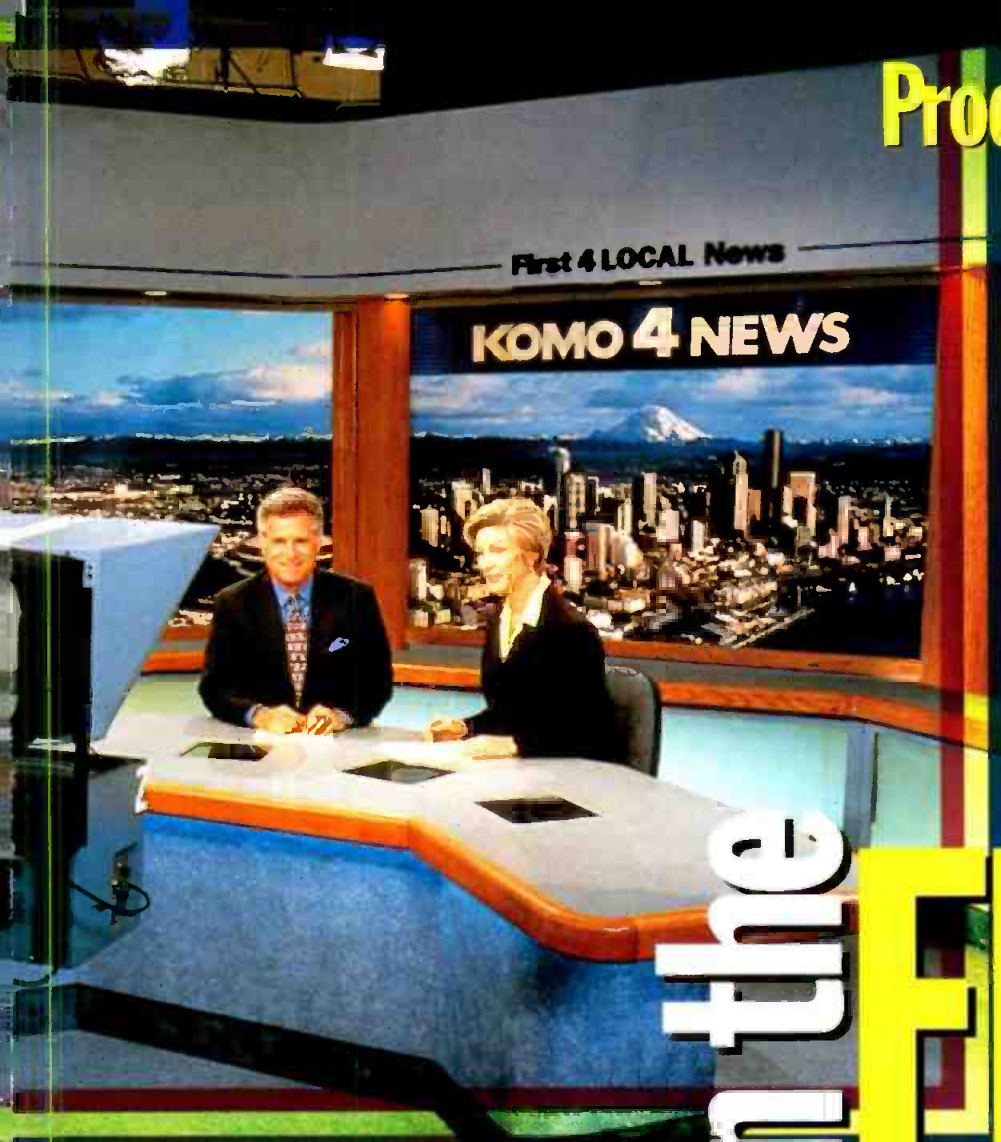

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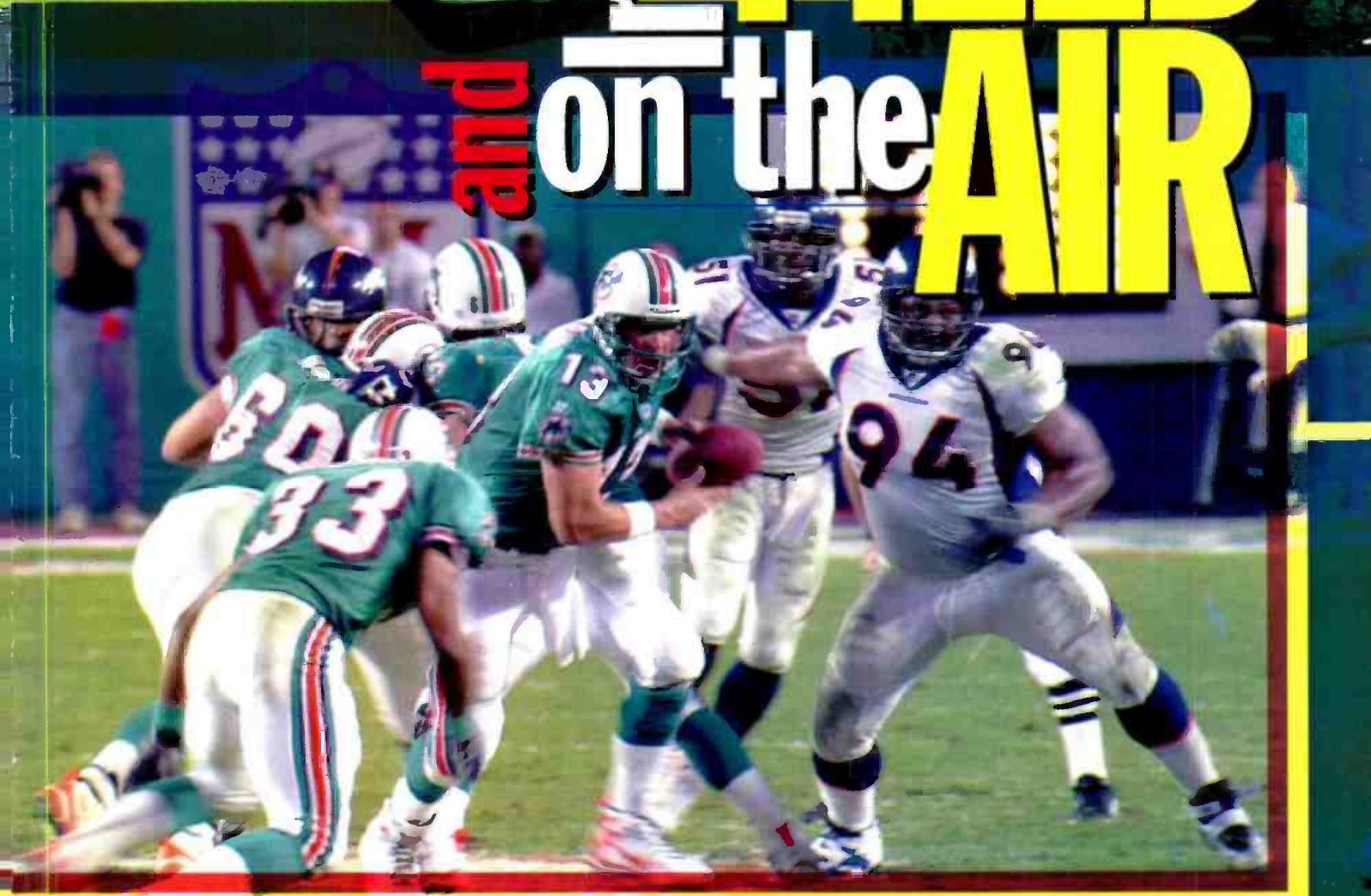

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For better or worse, the annual NAB Convention is the benchmark by which the video industry measures progress. At the most recent show (April 19-22, 1999, Las Vegas), DTV-related hardware and accompanying software could be found in abundance. It was clear to even the most casual observer that digital broadcasting has consumed the minds of the professional video industry. NTSC, although still the moneymaker, was relegated to the background.

What was missing at the show, however, was any clear indication as to how TV stations could make money with DTV. This is a critical issue for the entire video food chain. There are many theories but no firm answers. This issue has been a bone of contention for years with broadcasters, some of whom wish DTV would simply go away. The "nonbelievers," however, continue to decline each year.

All of the major networks have DTV and, most important, HDTV pilot projects running. In this issue of *Producing for HDTV* you will find several high-profile efforts in this regard. The technology is beginning to catch on with program producers and distributors, if not consumers. Rest assured that consumers will indeed jump onboard the DTV bandwagon, as soon as they see what the technology has to offer. The price of sets must come down, too, but that's the nature of the electronics business. Remember paying $2,500 for an 8MHz AT computer (circa 1989)? A lot can change in 10 years.

The only disturbing note to come out of the NAB Convention was a proposal by one broadcaster, Sinclair, that the modulation method specified in the ATSC DTV standard be re-evaluated. The modulation method used now is 8VSB, and Sinclair is suggesting that another method, COFDM, be considered. Beyond the technical details of this suggestion is the real threat of slowing the implementation of DTV technology — for stations and consumers.

The bottom line is that the ATSC system is the most thoroughly studied and tested TV transmission method in the industry's history. At some point, we all need to agree that the system is final and that implementation can proceed. The Sinclair arguments, which may have technical validity, nonetheless come too late in the process.

Included in this issue of *Producing for HDTV* are the following articles:

HDTV: From Concept to Reality — The list of HDTV pioneers is growing as the video industry gears up for "the next big thing."

Audio: The Key to High-Definition Video — High-definition video is making its presence felt in the production suite, but what about the audio component?

New HDTV Products

We hope you find this special supplement informative and useful. As always, your comments are welcomed. Additional background information on HDTV can be found at *www.technicalpress.com*.

Jerry C. Whitaker
Editorial consultant

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HDTV: From Concept to Reality

Jerry Whitaker, *editorial consultant*

The list of HDTV pioneers is growing as the video industry gears up for "the next big thing."

In addition to being a national leader in HD programming, WETA chose to be an early adopter of digital broadcasting, along with six other public TV stations across the country. Digital transmissions originate at the WETA tower in Arlington, VA. Digital broadcasts include WETA's HD productions and other high-definition programming as it becomes available. *(Photo courtesy of WETA)*

KOMO in Seattle is the first newscast in the world to go high-definition.

Despite the skeptics and naysayers, high-definition television continues to find a home in business and industry, post-production, broadcasting, and, well, in the home. The number of facilities experimenting with this powerful technology increases each month, and business managers are finding creative ways of actually making money with HD. The NAB Convention in Las Vegas in April was a watershed event of sorts. For DTV, in general, and HDTV, in particular, it marked the end of the experimentation stage and the beginning of the implementation stage. Esoteric arguments about modulation methods aside, the ATSC system has left the starting gate and is beginning to reach its stride. Evidence of this momentum can be found in the considerable financial and technical investments made by companies large and small across the United States and around the world.

This just in: KOMO-HD

On May 18, KOMO, Seattle, Channel 4 News became the first newscast in the world to broadcast daily local programming in high-definition. KOMO simultaneously launched the dual broadcast of all its newscasts in analog standard definition on Channel 4 and high-definition on KOMO-DT Channel 38, making history with its 5 o'clock broadcast. KOMO-DT is broadcasting more than 30 hours of local HD news each week. Vice president and news director Joe Barnes said that the milestone was significant beyond just being first. "We will use the new tools and technologies to better cover the local people and issues in our community, as well as continue to offer the highest quality local news in the Northwest."

To facilitate the project, KOMO purchased Sony high-definition cameras and HDW-500 HDCAM VTRs. Using the HDC-700 studio and HDC-750 portable high-definition cameras, KOMO is able to produce the newscast in HD and simultaneously output standard definition using the cameras' onboard downconverters. This process eliminates the need to generate two program streams.

KOMO also made a commitment to the Betacam SX format for its newsgathering operations. Using widescreen Betacam SX camcorders, KOMO news teams can shoot in the widescreen 16:9 aspect ratio, then upconvert the material for the high-definition broadcasts. News crews also are using Sony HDCAM camcorders to shoot some story segments in high-definition. The broadcasts, thus, consist of a combination of original HDCAM footage and upconverted Betacam SX material.

The KOMO HDTV first is part of a heritage of leadership in the Pacific Northwest. KOMO was the first station in the region to broadcast "live" and in color in 1954, and the first to broadcast in stereo in 1984. KOMO ABC 4 was also the first

commercial station on the West Coast to transmit HDTV in 1997.

Beyond just bragging rights, the KOMO HD newscast is significant in that news was always assumed to be one of the last areas of the broadcast schedule likely to enjoy the benefits of the advanced technologies represented by high-definition television. However, the ultimate goal of a newscast is to tell stories, whether the people are famous or unknown. What better way to tell a story than with images and sounds that capture not just the scene but the subtleties and mood of the event — and the individuals involved in it?

WETA and the fine art of HDTV

WETA is the flagship public broadcaster in the nation's capitol and the third-largest producing station for public television. It is also a national leader in producing HDTV programming. To date, WETA has completed six HD programs and has two in production. They are:

Impressionists on the Seine, a documentary on the collection of paintings by Renoir, Monet, Manet, Sisley, Pissarro, Morisot and Caillebotte.

The Legacy of Generations, a program exploring the culture and creations of Pueblo Indian women potters.

Woven by the Grandmothers, a documentary revealing the traditions and artistry of Navajo weavers.

The Kennedy Center Presents: A Tribute to Muddy Waters, King of the Blues, a performance special honoring the blues legend.

WETA HD Showcase, which inaugurated the public broadcaster's digital service and consists of clips of WETA's HD productions and an HD music video shot in the Washington area.

The first HD program shot at the executive mansion, an *In Performance at the White House* special titled *The Singer and the Song*.

The two other programs in production are based on exhibits at the National Gallery of Art in Washington, DC: *Van Gogh's Van Goghs* and *John Singer Sargent*.

WETA has been active in the development of digital television. On March 23, 1992, the station conducted one of the world's first digital HD broadcasts with General Instruments, which originated at WETA and was received on Capitol Hill. In 1994 the station began its transition to digital with the purchase of Digital Betacam videotape recorders to replace its 1-inch VTRs. On July 24, 1996, the company was granted an experimental license from the FCC for digital TV broadcasting. The station constructed a DTV transmitter, which was first tested on April 3, 1997. WETA began broadcasting a digital signal on an experimental basis in April 1997. On Nov. 9, 1998, WETA inaugurated its digital broadcast service on its permanent assignment on Channel 27 with *WETA HD Showcase*.

Later this year, WETA will complete construction of its new broadcast center, an all-digital TV and radio origination facility. The station will use Tektronix Grass Valley routing and switching products and Profile digital video servers in the new center, which was designed and is being built by Communications Engineering, Inc. The products to be installed by CEI include several Profile PDR digital video servers, a Grass Valley SMS7000 series routing system, Grass Valley M-2100 master control system, and a new series of modular products.

WETA-TV 26 and 90.9 FM are public broadcasting stations serving Virginia, Maryland and the District of Columbia. Its educational, informational, cultural and public affairs programming and related services (analog) include *The NewsHour with Jim Lehrer*, *Washington Week in Review*, and *In Performance at the White House*.

WETA broadcasts DTV programming 24 hours a day, seven days a week in the greater Washington area.

Hudson River Studios moves forward

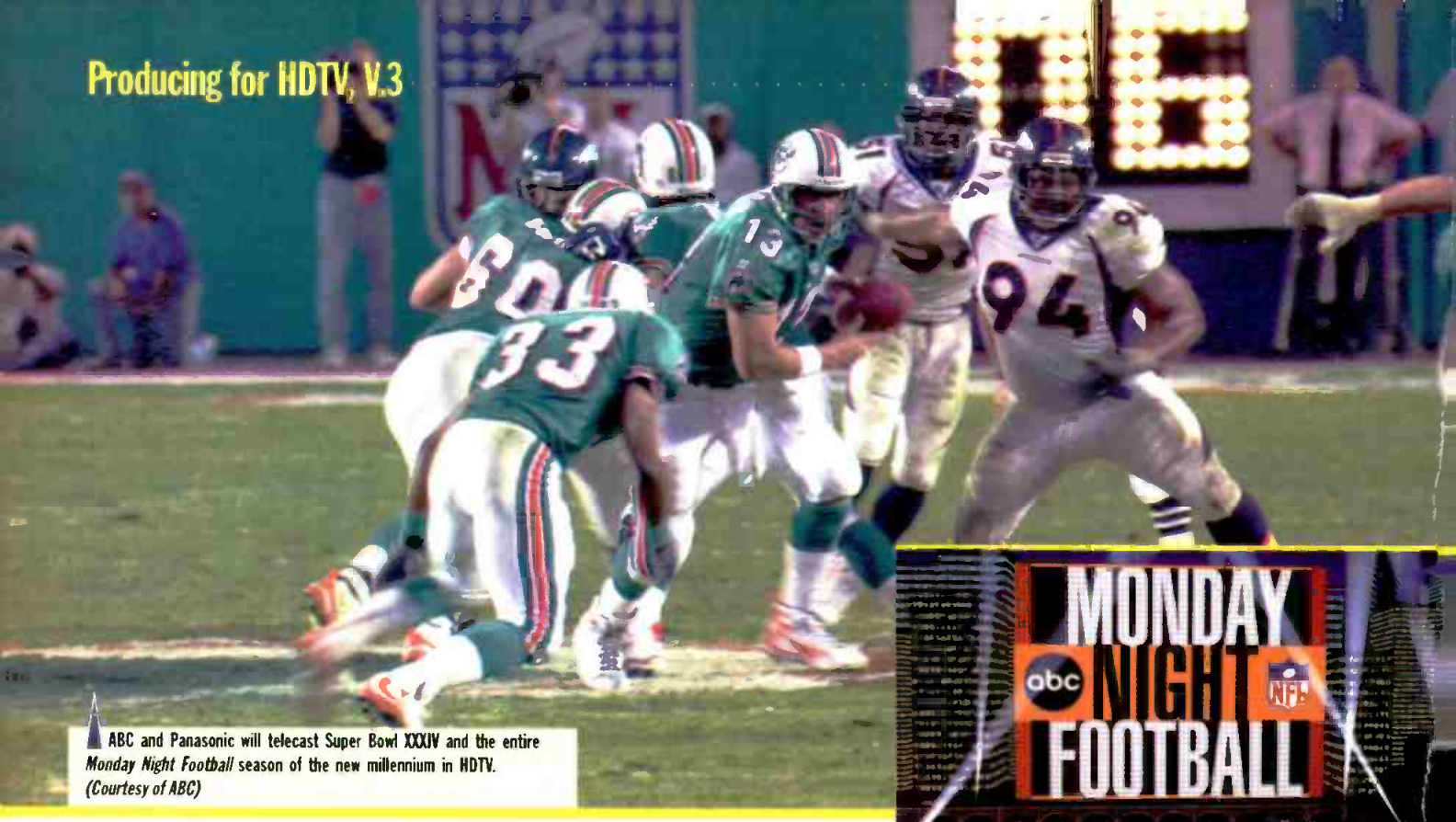
Work continues on the impressive Hudson River Studios (HRS) complex in New York. The HRS facility, announced last summer by Mayor Rudolph Giuliani at a City Hall news conference, will feature five stages ranging from 12,500 to 18,300 square feet. The largest of the stages is being designed for potential film production. HRS is also working on the construction of a high-definition mobile unit, which will provide a fifth control unit for the facility.

HRS will offer production offices, dressing rooms, edit suites, full scenery shop and an extensive storage area. TeleVest, which oversees Procter & Gamble Productions' long-running daytime dramas *As the World Turns* and *Guiding Light*, has signed an agreement on behalf of P&G to use two of the five studios at Hudson River to produce the shows, which will serve as anchor tenants of the new facility. Discussions continue with clients in New York and California regarding use of the remaining studios.

The new TV and film production complex will feature new HDK-790D high-definition cameras and high-definition monitors from Ikegami. Among the lenses selected from Canon USA were the UJ65X field zoom, UJ20X studio, and HJ18X long zoom ENG models. The facility will use the latest generation of production switching, routing and modular products from Grass Valley, graphics equipment and Pro-Bel routing equipment from Chyron, and

The new HRS film and TV production complex will feature Ikegami HDK-790D high-definition cameras and Canon lenses. *(Courtesy of Canon USA)*

An artist's rendition of the impressive Hudson River Studios (HRS) complex in New York, scheduled for completion next year. *(Courtesy of Hudson River Studios)*



ABC and Panasonic will telecast Super Bowl XXXIV and the entire *Monday Night Football* season of the new millennium in HDTV. *(Courtesy of ABC)*

ABC will be presenting *Monday Night Football* in HDTV, a highly visible and innovative way of celebrating the 30th anniversary of the program. *(Courtesy of ABC)*

Libra production audio consoles from AMS Neve. DeSisti Lighting will supply its tracking studio hoists in the complex.

Richard Benowitz is president and CEO of Hudson River Studios, Washington, DC. The issues facing Benowitz and his team — moving from the planning stage to the implementation stage — are no different that those faced by many facility managers today. This process, however structured, is critical to both the technical and financial viability of any new facility.

The Hudson River Studio complex is scheduled to open next year.

Monday Night Football: Up the middle for HD

Super Bowl XXXIV and the 1999-2000 season of *Monday Night Football* will be broadcast live in high-definition television. The upcoming *Monday Night Football* season will be the first live, regularly scheduled HDTV sporting events in prime time and will be broadcast in 720p, ABC's selected HDTV format. The HDTV telecasts will be produced and transmitted independent of ABC's *Monday Night Football* on the traditional analog network.

To make the HDTV broadcasts possible, Panasonic will build and outfit a 720p HDTV mobile production truck, which will travel to all 17 *Monday Night Football* games, one wild-card playoff game and Super Bowl XXXIV in Atlanta on Jan. 30, 2000. The mobile unit will contain Panasonic HDTV equipment, including 720p studio cameras, recorders, monitors and support gear. In exchange for 720p HDTV equipment and production subsidies, Panasonic will receive a "billboard" announcement in the pre-game show on ABC's analog and HDTV telecasts. Panasonic also will receive commercial time during the HDTV broadcast.

According to Patricia Fili-Krushel, ABC Television Network president, "Live sporting events provide the best platform to demonstrate the viewing benefits of high-definition television. *Monday Night Football*, as the only live, prime-time sporting event, offers the greatest opportunity to showcase HDTV to the American public."

In a press release, Warren Allgyer, president, Panasonic Broadcast & Television Systems Company, stated that Panasonic's "involvement with these broadcasts is representative of our corporate commitment to delivering an end-to-end solution for our customers."

It is worth pondering this statement for a moment. The reality is that partnerships, such as the ABC/Panasonic pairing, are vital to the rapid implementation of HDTV and/or DTV. In this case, and others cited in this publication during the past months involving different manufacturers and broadcasters, the realization is succinct: No vendor, network or producer can go it alone.

Parallels are often drawn between the implementation of color television four decades ago and the implementation of DTV today. Clearly, one of the principal driving forces that made color television a practical reality was the synergy within RCA. David Sarnoff, the flamboyant ruler of RCA, was determined to make color television a success. He pumped millions of dollars into color programming that ran on NBC, which at the time — of course — was owned by RCA. Without such synergy, color television would surely have languished for many years.

Today, the name of the game is *partner-*

Schedule for the 1999-2000 season of *Monday Night Football*

The dual HDTV/SDTV broadcasts air at 9 p.m. Mondays (Eastern time), except as noted (*):

Sept. 13, Miami at Denver
Sept. 20, Atlanta at Dallas
Sept. 27, San Francisco at Arizona
Oct. 4, Buffalo at Miami
Oct. 11, Jacksonville at New York Jets
Oct. 18, Dallas at New York Giants
Oct. 25, Atlanta at Pittsburgh
Nov. 1, Seattle at Green Bay
Nov. 8, Dallas at Minnesota
Nov. 15, New York Jets at New England
Nov. 22, Oakland at Denver
Nov. 29, Green Bay at San Francisco
Dec. 6, Minnesota at Tampa Bay
Dec. 13, Denver at Jacksonville
Dec. 20, Green Bay at Minnesota
Dec. 27, New York Jets at Miami
Jan. 3, San Francisco at Atlanta
Saturday, Jan. 8, Wild-card Playoff Game*
Sunday, Jan. 30, Super Bowl XXXIV*

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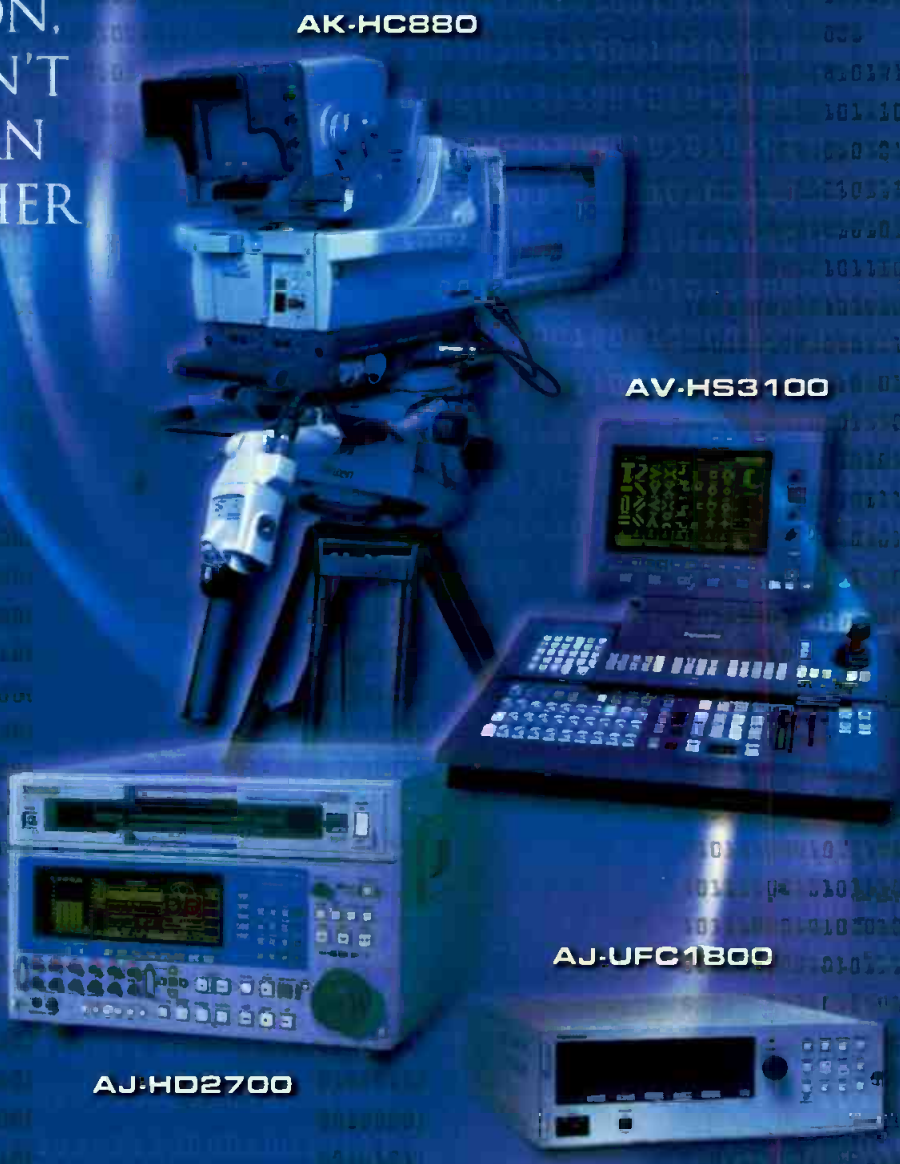

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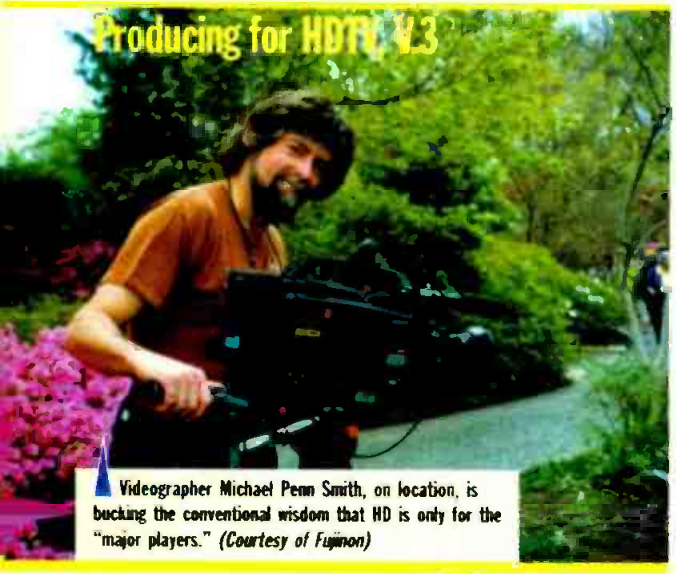

Videographer Michael Penn Smith, on location, is bucking the conventional wisdom that HD is only for the "major players." *(Courtesy of Fujinon)*

ships, as evidenced by the ABC/Panasonic effort. It is a way of accomplishing what Sarnoff did in the 1950s and '60s using the business models of the 1990s.

To continue from Allgyer's statement, "By becoming involved in providing attractive HDTV programming, Panasonic is facilitating the entire DTV program process, from the program itself to the camera's capturing it, all the way through to the DTV set in the consumer's home."

Quite correct. It's the *Sarnoff factor*, and it works.

ABC began broadcasting high-definition television, including 5.1 channel surround sound, on Nov. 1, 1998, with the theatrical presentation of *The Wonderful World of Disney: 101 Dalmatians*. Since then, the network has broadcast 31 theatricals in HDTV, including *Mission Impossible*, *Forrest Gump*, *Courage Under Fire* and *A Time to Kill*. Currently, 18 ABC stations broadcast DTV signals.

PennSmith HD

Michael Penn Smith is an independent camera operator shooting high-definition video in the southwestern United States. He recently opened PennSmith HD, a director of photography services company specializing in HD video cinematography. Smith sees a need for HD images within the broadcast market and has started shooting exterior stock photography footage of sights around Dallas.

Smith's commitment to HDTV is significant because he is essentially a one-person shop, from the creative standpoint at least. When most people think about integrating HDTV, they think big networks, big production houses and big studios. They rarely think about independent operators.

Smith was previously president of the Texas Production Facility, a production services company, and will retain ownership participation of that company while operating PennSmith HD. His equipment list will match anybody's HD inventory: a Sony HDW-700 camcorder, HDW-500 VTR, PHM-14M8U high-definition video monitor, and Fujinon lenses.

According to Smith, "With the emergence of high-definition video as the new standard for broadcasting, serious attention to image quality is returning." Amen to that.

HD Vision continues pioneering work

HD Vision of Irving, TX, has an impressive résumé of work in high-definition. One of the company's latest projects was its involvement with Bill Young Productions of Houston for the George Strait Country Music Festival in Tampa, FL.

HD Vision provided Bill Young Productions a mobile unit (HDV-3) for its taping of the music festival. This was HDV-3's maiden voyage after the installation of a Snell & Wilcox HD1024 digital high-definition production switcher. Also onboard were six Sony HDC-500 cameras, two HDC-750 cameras, four HDW-700 camcorders, two Sony HDW-500 recorders, five Panasonic HDD5 recorders, and Canon HD lenses.

The George Strait portion of the Country Music Festival was recorded as a live concert. A music video for his new single *Write This Down* was edited from the concert video and delivered as a final approved music video just four days later.

The HD Vision and Bill Young Productions crews worked long into the night to provide selected Digital Betacam down-conversions for the music video online. Gary Foster, Bill Young Productions' chief editor, delivered the video on time to MCA/Nashville. The full 105-minute concert was offlined at Bill Young Productions and then onlined at HD Vision for eventual broadcast in high-definition and standard definition over a variety of outlets and media.

The concert also was webcast to more than 9000 viewers of the George Strait web page, the first HD concert distributed live over the Internet. The webcast, officials at Real Networks reported, contained some of the best video ever streamed over the Internet.

TNN Nashville recorded the audio for TV, Web and potential CD release. TNN staff mixed the audio, under the engineering direction of Steven Tillisch, using the Neve Capricorn console and Studer 48-track digital recorder. Digital audio word-clock sync between the high-definition mobile and the audio mobile was managed with the N-Vision SG-4410 master digital audio generator.

PACE (the concert promoters), SHOWCO (concert sound) and Dallas Backup (concert lighting) supported the event and helped to make the first HD-imaged Country Music Festival a considerable success.

Pitcairn on location

In a previous edition of *Producing in HDTV*, we profiled the work of Feodor Pitcairn. As this work continues to progress, it is worth revisiting Pitcairn's efforts to capture, in high-definition, marine habitats and related nature-focused stories for PBS. Pitcairn Productions is using Sony HDW-700 camcorders on two projects. In *Realm of the Killer Whale*, about two-thirds of which will be originated in HD, Pitcairn is depicting the little-known stories of life in waters ruled by pods of orcas along the coast of British Columbia. Although much of the emphasis in this show will be on the whales, Pitcairn also will emphasize their environment. He has already made at least six trips to British Columbia for this project and plans to visit again this fall. Final photography should be complete by the end of the year.

Another project, which will be shot en-

Feodor Pitcairn Productions is filming *Ocean Wilds*, a five-part documentary for PBS. Sea lions sun themselves on the rocks in British Columbia. *(Photo by Bob Cranston)*

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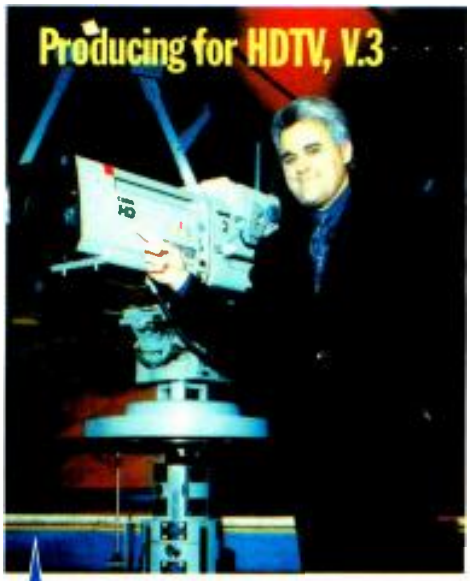


The Tonight Show with Jay Leno has raised the bar for TV production with its move to HDTV. The show, which has a history of "firsts," began taping in HD on April 26. *(Courtesy of Canon USA)*

tirely in HD, is *The Whale Oasis*. This episode of his 5-part documentary for PBS will focus on the species of whales and dolphins that gather around the Azores, a series of nine volcanic islands in the North Atlantic. His principal subject is the most spectacular of all marine mammals, the sperm whale, but he plans to tell compelling human stories. The production company planned to revisit the area for additional shooting.

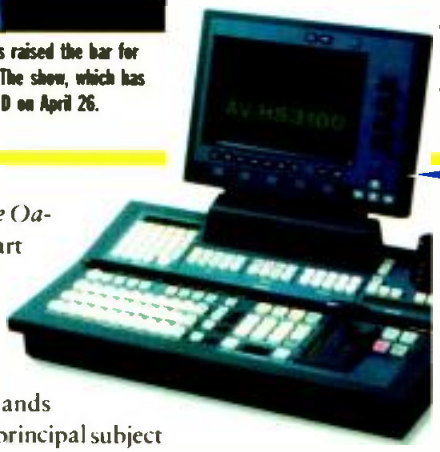
The PBS series is scheduled to air in 2001, but even then the general viewing audience likely won't own the high-definition televisions necessary for optimal viewing *Ocean Wilds*. Still, observed Pitcairn, "We're making evergreen programs. I hope they'll continue to be shown 15 years from now. We're in very good shape for the future of television. We're shooting today for tomorrow's viewers."

Complete Post one year later

Remember those decisions you made at this time last year. Do they still seem like a good idea? Well, in the case of Complete Post of Hollywood, CA, the answer is "yes." About a year ago, Complete Post, one of the country's largest post-production facilities, made a serious investment in HDTV production equipment. The company installed a full Panasonic HDTV system, including six AJ-HD2700 1080i/720p switchable, D-5 high-definition VTRs with AJ-DFC2000 480p downconverters; an AV-HS3100 1080i post-production switcher with digital video effects; three DT-M3050W 30-inch, 16:9 multiformat monitors; and related interconnecting equipment.

Bob Blanks, Complete Post vice president for engineering, said that the AV-HS3100 had become a focal point of an emerging HD editorial suite and that its D-5 HD VTRs had been integral to the success of the facility's growing HD telecine work for major studios. "The studios we service have a firm commitment to the 1080i production format, but we're happy that the D-5 HD VTRs can operate in a multi-image environment," he says. "This facility will increasingly require the ability to easily switch between 1080i and 720p, and we're ready."

This case points out one of the great benefits of the equipment spawned by the ATSC DTV system. The variety of scanning formats allowed for in the ATSC documents have been far less burdensome or dauntingly technical than originally believed. Scanning formats were hotly debated in many circles last year, but the video industry realized it will be dealing with many formats for years to come, and the equipment is designed to accommodate this need. There is, of course, a financial burden resulting from such features. However, the economic benefits far outweigh them.



Complete Post of Hollywood, CA, reports increased HD-related business and is looking forward to even more. A key component of the Complete Post HD suite is the AV-HS3100 1080i post-production switcher with digital video effects. *(Courtesy of Panasonic)*

Heeere's HDTV

OK, I couldn't resist the Ed McMahon takeoff. *The Tonight Show with Jay Leno* launched its foray into HDTV on April 26. With the assistance of Sony, Canon and other vendors, NBC's late-night offering once again raised the bar for production quality. You may recall that *The Tonight Show Starring Johnny Carson* began taping in stereo long before any other network programs gave it serious consideration. The effort to increase the audio quality of the program in the mid-1980s included new production facilities, new micing, and new techniques for dealing with the uncertainties of live television. That effort, led by Ron Estes, set *The Tonight Show* apart from any other network-produced program, live or taped.

The Tonight Show with Jay Leno is being broadcast in the 1920x1080 format using Sony digital high-definition (HDVS) equipment. Although the set remains virtually the same — except for a "pop-up" 34-inch HD monitor behind Leno's desk — Sony's Systems Integration group totally revamped the NBC Burbank facility behind the scenes to accommodate the new equipment. Work began in March 1998 with removal of old equipment and installation of new HD equipment into the infrastructure. Existing camera controls and graphics were stationed in a remote truck, allowing NBC to continue broadcasting while reconstruction was under way.

The goal of the project, naturally, was to make a seamless transition to the HD equipment for viewers, and — equally important — to make the transition as painless as possible for the crew. The control and edit rooms were built with the same switcher and DVE equipment to give NBC redundancy and to facilitate operator training. The control and edit rooms include the HDS-7000 HD switcher with an HDME-7000 2-channel DVE, and a DVS-2000 SDI switcher with two channels of a DME-3000 SDI DVE that can be upconverted to HD and fed into the switcher. In the studio, HDC-700 1080i studio cameras, HDC-750 cameras and HDW-700 camcorders enable NBC to shoot in HDTV and then downconvert to SDTV using onboard downconverters in the camera's CCU. The transmission room receives a 525 signal and a 1080i signal via dual transmitters from the control room simultaneously, providing a high-quality picture without generating two separate broadcasts.

The preliminary design consisted of single line drawings, and rack and console elevations. Later, NBC production staff were positioned in a full-size, foam core mock-up of the control room and monitor wall. Because project leaders had the unique opportunity to rebuild the facility, they wanted to make sure the staff would be comfortable and productive without any last-minute surprises.

Now, the considerable effort put into capturing the program in HD has given *The Tonight Show* a competitive edge in quality and preserved the program for future repurposing. A visit to your local Blockbuster or similar videotape rental house will confirm the long-term value of capturing programs in the highest quality possible. People still pay money to see excerpts of 20-year-old *Tea Time Movie* skits from the Carson days.

Good material will always be good material, regardless of how old it may be.

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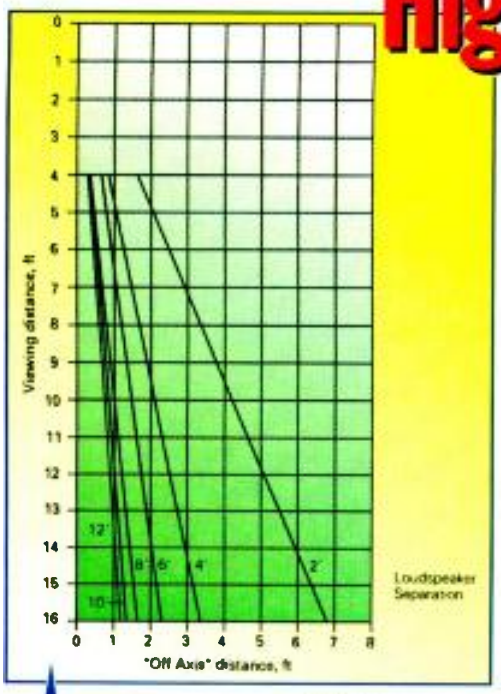


Figure 1. The effects of listener positioning on center image shift.

As new HD products have emerged from the development lab and into the field, users are finding new ways to refine the post-production process. Audio, of course, is an important element in this mix. An ensemble of technologies is now being applied to solve some long-standing problems and to offer the creative community a host of new possibilities.

The key to integrating the disparate technologies of conventional video, film and high-definition requires a suite of technologies that permit the different media to be interchanged and, indeed, intercut. Part-and-parcel of this effort is the audio element, long treated as a stepchild of sorts.

Aural component of visual realism

In any discussion of high-definition video, it is easy to overlook the audio element, even though countless studies have demonstrated the value of sound to an image. Research conducted during the early days of HDTV planning showed that viewers looking at samples of the same video concluded that the one with improved audio had higher resolution and better colorimetry.

Thus, the realism of a video image depends to a great degree on the realism of the accompanying sounds. Particularly in the close viewing of HDTV images, if the audio system is monophonic, the sounds seem to be confined to the center of the screen. As a result, visual and aural senses convey conflicting information.

From the beginning of HDTV system design, it was clear that stereophonic sound must be used. The generally accepted quality standard for high-fidelity audio has been set by the digital compact disc (CD). This medium covers audio frequencies from below 30Hz to above 20kHz, with a dynamic range of 90dB or greater. HDTV could offer no less.

Sound is an important element in the viewing environment. To provide the greatest realism for the audience, the picture and the sound should be complementary, both technically and editorially. The sound system should match the picture in terms of positional information and offer the producer the opportunity to use the spatial field creatively. The sound field can be used effectively to enlarge the picture. A *surround sound* system can further enhance the viewing experience.

Hearing perception

There is a large body of scientific knowledge on how humans localize sound. Most research has been conducted with subjects using earphones to listen to monophonic signals to study *lateralization*. *Localization* in stereophonic listening with loudspeakers is not as well understood, but the research shows the dominant influence of two factors: *interaural amplitude* differences and *interaural time delay*. Of these two properties, time delay is the more influential factor.

Over intervals related to the time it takes for a sound wave to travel around the head from one ear to the other, interaural time clues determine where a listener will perceive the location of sounds. Interaural amplitude differences have a lesser influence. An amplitude effect is simulated in stereo music systems by the action of the stereo balance control, which adjusts the relative gain of the left and right channels. It is also possible to implement stereo balance controls based on time delays, but the required circuitry is more complex.

A listener positioned along the line of symmetry between two loudspeakers will hear the center audio as a phantom or *virtual image* at the center of the stereo stage. Under such conditions, sounds — dialogue, for example — will be spatially coincident with the on-screen image. Unfortunately, this coincidence is lost if the listener is not positioned properly with respect to the loudspeakers. Figure 1 illustrates the sensitivity of listener positioning to aural image shift. As illustrated, if the loudspeakers are placed six feet apart with the listener positioned 10 feet from the speakers, an image shift will occur if the listener changes position (relative to the centerline of the speakers) by just 16 inches.

The data shown in the figure is approximate and will yield different results for different types and sizes of speakers. Also, the effects of room reverberation are not factored into the data. Still, the sensitivity of listener positioning can be seen clearly. Listener positioning is most critical when the loudspeakers are spaced widely, and less critical when they are spaced closely. To limit loudspeaker spacing, however, runs counter to the purpose of widescreen displays. The best solution is to add a third audio channel dedicated exclusively to the transmission of center-channel signals for reproduction by a center loudspeaker positioned at the video display. One should then place left and right speakers apart from the display to emphasize the widescreen effect. The addition of *surround sound* speakers further improves the realism of the aural component of the production.

Matching audio to video

It has been demonstrated that even with no picture to provide visual cues, the ear/brain combination is sensitive to the direction of sound, particularly in an arc in front of and immediately in back of the listener. Even at the sides, listeners are able to locate direction cues with reasonable accuracy. With a large-screen display, visual cues make the accuracy of sound positioning even more important.

If the number of frontal loudspeakers and the associated channels is increased, the acceptable viewing/listening area can be enlarged. Three-channel frontal sound using three loudspeakers provides good stereo listening for three or four viewers, and a 4-channel presentation increases the area even more. The addition of one or more rear channels permits surround sound effects.

Surround sound presentations, when done correctly, significantly improve the viewing experience. For example, consider the presentation of a concert or similar performance in a puhlic hall. Members of the audience, in addition to hearing the direct performance sound from the stage, also receive reflected sound, usually delayed slightly and perhaps diffused, from the huilding surfaces. These acoustic elements give a hall its tonal quality.

If the spatial quality of the reflected sound can be made availahle to the home viewer, the experience will be enhanced greatly. The home viewer will see the stage performance in high definition and hear both the direct and indirect sound, all of which will add to the feeling of being present at the performance.

In sports coverage, much use can be made of positional information. In a tennis match, for example, the umpire's voice would be located in the center sound field — in line with his or her ohserved position — and crowd and amhient sounds would emanate from left and right.

Several methods have been used to successfully convey the surround sound channel(s) in conventional NTSC broadcasts. The Dolhy AC-3 sound system is used in the ATSC DTV system, offering 5.1 channels of audio information to accompany the HDTV image (left, center, right, left surround, right surround, and a low-frequency effects channel).

Making the most of audio

In any video production, there is a great deal of sensitivity to the power of the visual image portrayed through special effects, lighting and directing that huild the scene. All too often, however, audio tends to become separated from the visual element. Achieving a good audio product is difficult because of its suhjective content. There are subtleties in the visual area, understood and manipulated by video specialists, with which an audio specialist might not be aware.

By the same token, there are psychoacoustic subtleties relating to how humans hear and experience the world around them that audio specialists can manipulate to their advantage.

Reverb, for example, is poorly understood; it is more than just echo. This tool can be used creatively to trigger certain psychoacoustic responses in an audience. The hrain will perceive a voice containing some reverb to be louder. Echo has been used for years to effectively change positions and dimensions in audio mixes.

To use such psychoacoustic tools is to work in a delicate and specialized area, and audio is a subjective discipline that is short on absolute answers. One of the reasons it is difficult to achieve good quality sound is because it is hard to define what that is. It is usually easier to quantify video than audio. Most people, given the same video image, come away with the same perception of it. With audio, however, accord is not so easy to come hy. Musical instruments, for example, are harmonically rich and distinctive devices. A violin is not a pure tone; it is a complex halance of textures and harmonics. Audio offers an incredihle palette, and it is acceptahle to be different. Most video images have any number of ahsolute references hy which images can be judged. These references, hy and large, do not exist in audio.

Ideal sound system

Based on the experience of the film industry, HDTV sound should incorporate, at minimum, a 4-channel system with a center channel and surround sound. Figure 2 illustrates the optimum speaker placement for enhancement of the viewing experience. This viewpoint was taken into consideration by the ATSC in its study of the Grand Alliance system.

Under the ATSC DTV sound system standard, complete audio programs are assemhled at the user's receiver from various services sent by the broadcaster. The concept of assemhling services at the user's end was intended to provide for greater flexihility, including various-language multichannel principal programs supplemented with optional services for those with hearing and visual impairments.

A variety of multichannel formats for the main audio services also is provided, adapting the best stereo presentation for a particular program. While writing the standard, authors decided that the principal sound for a program should take up only the digital hit space required by that program. The idea was born that programs fall into production categories and may be classified hy the use of loudspeaker channels. The categories include:

1/0 – one front center channel, no surround. This is most likely to be used for news programs, which have exceedingly strict production time requirements. The advantage in having a distinct monaural mode is that those users with a center channel loudspeaker will hear the presentation over only that one loudspeaker, with an attendant improvement over hearing mono presented over two loudspeakers.

2/0 – conventional 2-channel stereo. Intended principally for existing 2-channel program material, 2/0 is also useful for film production recorded in Dolby Stereo or Ultra Stereo formats with a 4:2:4 amplitude-phase matrix (for which there is an accompanying indicator flag to toggle surround decoding on at the receiver).

3/0 – left, center and right front channels. 3/0 is expected to be used for programs in which stereo is useful hut surround sound effects are not, such as an interview program with a panel of experts.

3/2/.1 – left, center, right front, left and right surround, and a low-frequency effects channel. 3/2/.1 is expected to be used primarily for films and entertainment programming, matching the current motion-picture production practice.

Monitoring

Aural monitoring of program production is a critical element in the production chain. Although the monitor system — with its equalizers, power amplifiers and loudspeakers — is not in the signal path, monitoring under highly standardized conditions has helped the film industry to make an extremely interchangeahle product for many years. With strict monitor standards, there is less variation in program production, and the differences that remain are the result of the director's creative intent. Monitor standards must address the following criteria:

Room acoustics for monitor spaces
Physical loudspeaker arrangement
Loudspeaker and electronics requirements
Electroacoustics performance

The viewer *is* listening

When an audience is experiencing a program — be it a TV show, motion picture or aircraft simulator training session — there is a balance of aural and visual cues. If the production is done right, the audience members will be drawn into the program, putting themselves into the events occurring on the screen. This *suspension of disbelief* is the key to effectively conveying a message, telling a story, or otherwise reaching the audience.

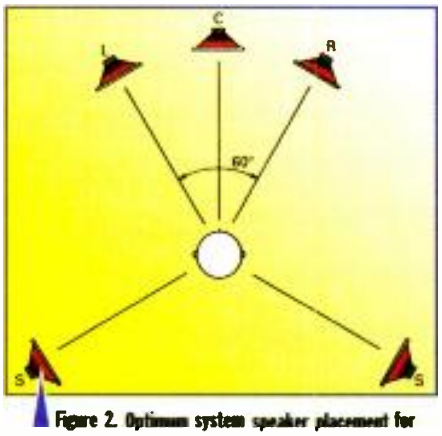


Figure 2. Optimum system speaker placement for HDTV viewing.

Quantel Editbox FX with 24frames/s editing

The Editbox FX has 24frames/s editing capabilities and background plug-ins. Quantel also is introducing the latest stages to its "Step by Step to HD" program. The Editbox FX gives producers and directors a complete set of tools to make high-quality programs, on time and within budget.

In addition to enhanced ergonomics, the 16:9 DTV-ready system also gains powerful effects plug-ins, with background processing via the Quantel *Open Render Engine*. The 24frames/s option for Editbox makes 24frames/s production at any standard, SD or HD, an efficient, practical and economical proposition. Editbox FX also has Clipnet, Quantel's open high-speed multi-format network, as standard. Clipnet operates as a background task, so it enables the foreground operations to continue without interruption.

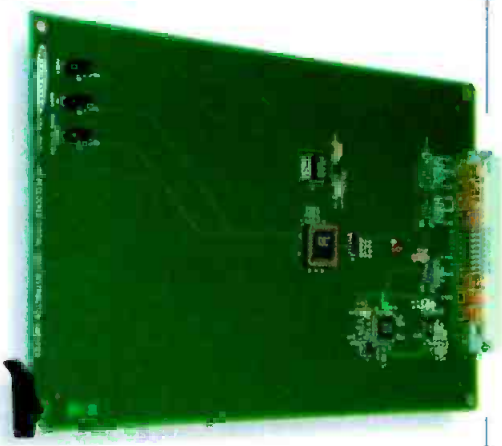
SGI HD I/O board

SGI introduces the HD I/O board for the Silicon Graphics Onyx2 workstation for visual supercomputing and SGI's Origin 2000 server. The HD I/O board enables these systems to generate and accept real-time, uncompressed HDTV content in 1080i and 720p formats. The SGI HD I/O board supports several key ATSC HDTV formats, including 1920x1080i@59.94Hz and 1280x720p@59.94Hz. The board also supports genlock. Other ATSC formats will be supported in staged software releases. The board has a parallel I/O connector, and special cabling is provided to connect to external serial/parallel converters.

Miranda HD interface products

Miranda Technologies' new series of HD interface products are compatible with the company's imaging series of serial digital interfaces. New HD interface products and existing imaging series products can be used with the Miranda Symphonie rack frame, giving users a single system capable of handling HD and serial digital processing functions.

Because the imaging series digital processing products and the new HD interface modules can occupy the same rack frame simultaneously, users gain an unprecedented level of flexibility. Serial digital boards can be swapped out and replaced with HD boards as needed, allowing users to configure their systems in accordance with changing needs.



The first three products in Miranda's HD series include a digital-to-analog converter and two distribution amplifiers. The SDM-801i converts high-definition digital video to component analog video, allowing users to take HD signals and convert them to analog for standard broadcast monitors or computer RGB monitors. The SDA-801i and SDA-802i are standard equalizing amplifiers, providing one HD input and six HD serial digital outputs. The SDA-802i also provides reclocking, which accommodates longer cable lengths.

Tektronix Profile HD server

Supporting both 1080i and 720p formats, the Profile HD server provides quality storage by using industry-standard MPEG compression. The Profile HD server features multichannel architecture, and it supports the same Profile API for application compatibility with current Profile video servers This allows many existing Profile applications to be offered in the HD format, including spot and program replay, time delay and time shifting, and live production.

Features of the Profile HD include up to four video channels — two inputs/two outputs (SMPTE 292 1.5GB/s SDI) — at 1080i/720p, 50/59.94/60Hz. Up to 32 channels of AES/EBU digital audio or Dolby D or Dolby E compressed audio is accommodated. Expandable Fibre Channel RAID Storage (available in 3.5-hour increments) is offered.

Tektronix HD video edge device for ATM

The HD48 video edge technology is intended for remote video collaboration and video trunking and conferencing. The device also opens new opportunities in the transport of high-definition moving imagery for governmental organizations and film or broadcast industries.

The Tektronix HD48 is a SONET/ATM high-definition serial digital video transport system. Its PCI-bus card design allows additional video interface cards to be coupled to the same network interface card (NIC) to facilitate transport of accompanying data on independent ATM channels. This flexible design allows standard definition video or additional audio to be carried on the same OC-48 link.

Other benefits of the video edge device include video clock regeneration, full 10-bit video transport to carry embedded audio and control data, auto sensing of video types and rates, and monitoring of SONET and ATM errors during transport.

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Scalable, NT-based rendering system (40-processor configuration shown).

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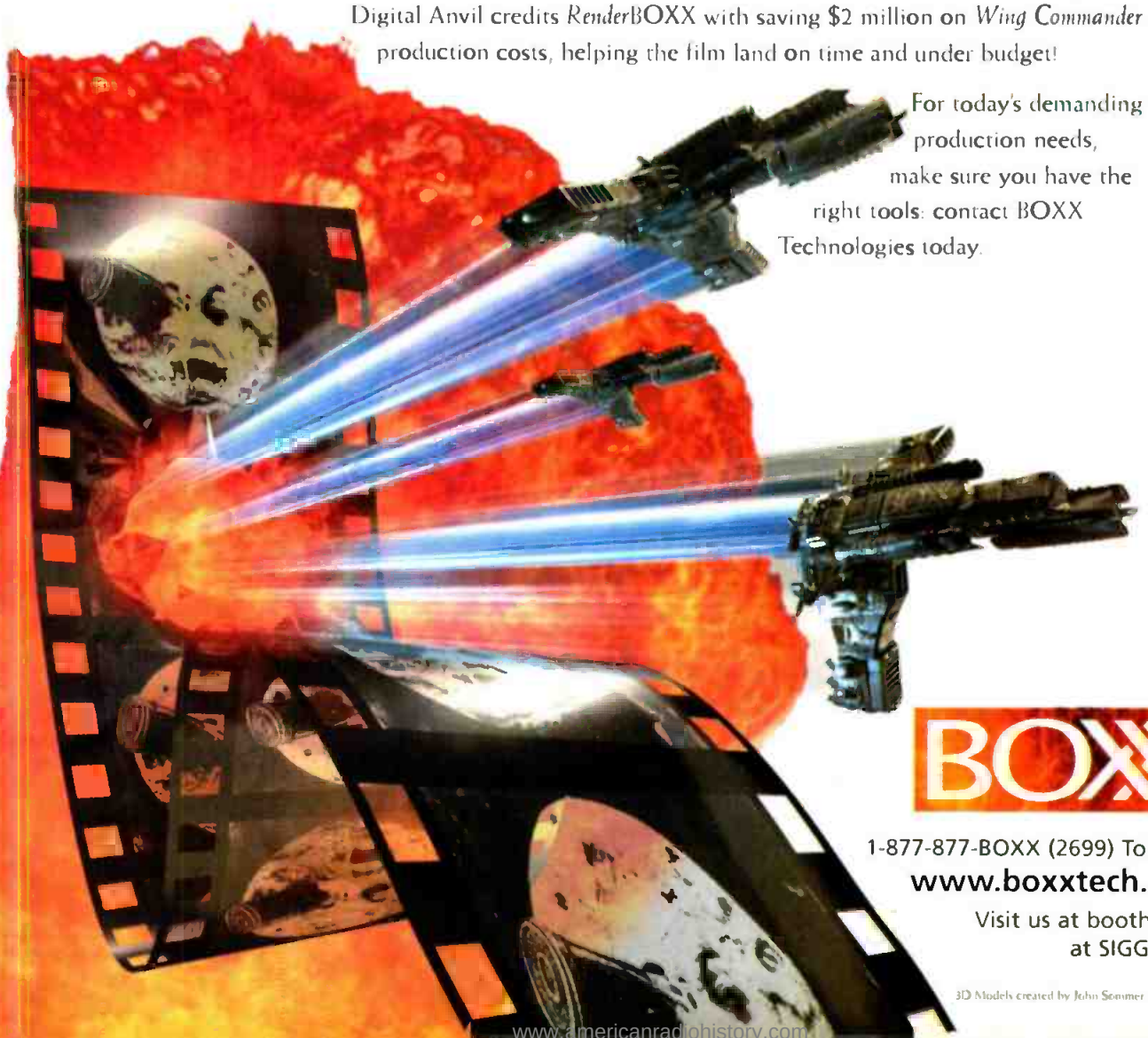

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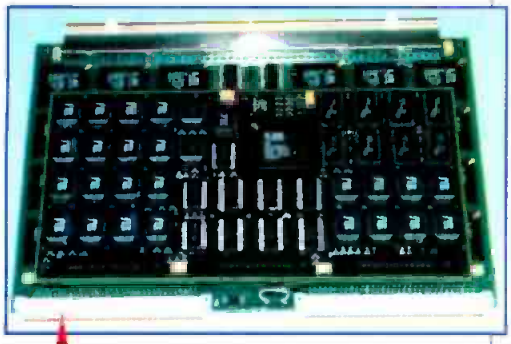
3D Models created by John Sommer

This technology is being made available to OEMs for incorporation into new video and related products.



TeraNex VCA-6110PXC format converter

The VCA-6110PXC is a combination up/downconverter for digital television suitable for broadcast, post-production, film and cable applications. The TeraNex All-Format Converter accepts and delivers SMPTE 259M (270Mb/s serial digital interface) standard definition I/O and SMPTE 292M (1.485GB/s serial digital interface) high-definition I/O. Digital architecture provides end-to-end picture quality for any digital video application.

The VCA-6110PXC represents the fifth generation of image processing solutions developed using TeraNex patented technology, which ensures that the latest algorithms can be uploaded via built-in CD-ROM or Ethernet, and that emerging, non-standard and future formats can be supported without new hardware.

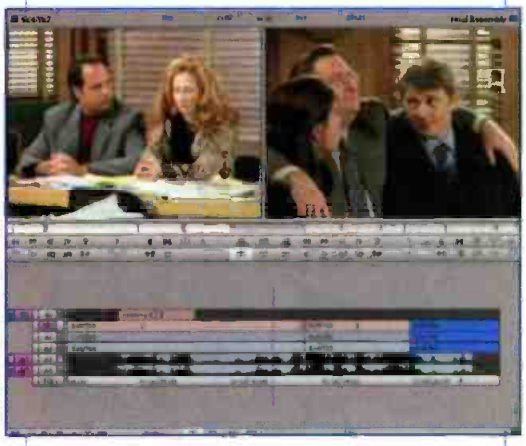
RT-SET Larus 3D virtual studio system, Version 3

The latest release of the Larus system features high-definition capabilities for the production of HDTV programming with improved graphics performance. Version 3 provides the highest resolution graphics required for real-time transmission.

The Pica Virtual Billboard, designed for use in TV and production studios, enables the talent to move freely throughout the set while using a hand-held "blue box" on which live video, stills or 3D graphics can appear. All images seen on the billboard change in the correct perspective in real-time, according to camera movements or movements of the talent holding the billboard. Also provided is seamless integration of innovative third-party portable camera tracking systems for free-moving cameras.

Avid 24P universal editing and mastering

Avid has announced 24P universal editing and mastering capabilities with the next release of its Avid Symphony editorial finishing solution for high-end and prime-time TV projects. High-end content is often shot on 24frames/s formats, such as film, which accounts for 80% of U.S. prime-time programming. Universal mastering enables users to edit 24-frame progressive content in its native format and, at the push of a button, deliver NTSC, PAL, 4:3, 16:9 and letterbox formats. It also will output list formats, such as film cut lists and 24frames/s EDLs for HD conforming. The result: greater speed and efficiency. It eliminates the need for several online sessions to produce multiple format masters. Universal mastering also extends a user's ability to repurpose programming for worldwide distribution.



Faroudja Digital Format Translator

The Digital Format Translator (DFT) provides a modular solution for broadcasters, cable and satellite services seeking to deliver a variety of HDTV and DTV video formats. The latest version of the DFT uses Faroudja's patented technology to convert any 480i signal (NTSC, S-Video, analog, component, D2 or D1) into the most popular of the new DTV formats specified by the ATSC: 480p, 720p or 1080i. It simultaneously converts the aspect ratio of the input image into the 16:9 ratio of the new widescreen TV monitors. The DFT can be controlled by a custom Windows NT-based software package or by the front-panel interface.

Angenieux HD lenses

Angenieux's new series of 2/3-inch lenses are specified for high-definition video cameras. The HD series includes an 11.5x5.3 Cine Style HD lens for "film-style" performance. The 10x5.3 wide-angle lens accommodates general-purpose ENG/EFP applications. Both lenses provide distortion-free images for optimal definition and image clarity.

The Cine Style HD lens delivers images across its 84° horizontal field by 11.5X zoom range. Key features include an f/1.9 aperture with minimum ramping, minimal breathing effect and 0.6m minimum object distance (measured from the film plane). The lens also incorporates a variety of attributes normally found only on high-end film lenses, such as large engravings, a calibrated double focus scale, and iris f-stops. The 11.5x5.3 is also compatible with a variety of matte boxes, filters and motors.

The 10x5.3 features an 84° horizontal field with a 10X zoom range. Additional features include an f/1.9 aperture; minimum ramping; a short 0.3m minimum fo-

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cusing distance; and minimal breathing effect. The lens also features Angenieux's Assisted Internal Focusing (AIF) mechanism for fluid zoom action and an integrated sun shade and UV filter.

NDS E5820 ATSC encoder

The E5820 ATSC Compact (2U) encoder from NDS supports both high-definition and standard-definition operation. It meets the present and future needs of the ATSC broadcaster by supporting the most prevalent SD and HD formats — 480i30, 480p60, 720p60 and 1080i, working in a stand-alone configuration or as part of an integrated system. The encoder can be expanded to include the company's patented noise reduction, which increases picture quality and reduces bit-rate overhead. The E5820 supports closed-captioning via an RS-232 interface.

Viewgraphics VideoPump HD

VideoPump HD is an uncompressed HDTV PCI card. By providing an integrated interface for uncompressed video and audio, the VideoPump transforms high-performance Windows NT PCs and familiar PC-based software applications into HDTV workstations, powerful enough to produce professional, uncompressed results at a reasonable cost.

The VideoPump HD gives post-production and broadcast professionals a comprehensive interface for reliable, real-time access to full-bandwidth, uncompressed, 4:2:2 high-definition serial digital video with embedded audio using a single PCI-64 interface board.

VideoPump HD offers sophisticated support for embedded audio. The board can acquire, de-multiplex and store up to 16 channels of SMPTE 272M embedded audio in main memory, and can transfer SMPTE 291M packets or encode/decode four channels of PCM audio. During playback, audio and video data are multiplexed into the serial digital data stream.

Dolby E encoder

Dolby Laboratories has unveiled its first Dolby E encoder and decoder models. The DP571 Dolby E encoder and DP572 Dolby E decoder were designed to ease the transition from 2-channel to multichannel audio. Broadcasters can distribute up to eight channels of audio or Dolby digital metadata via a single AES/EBU pair, two audio tracks of a digital videotape, digital audiotape or video server.

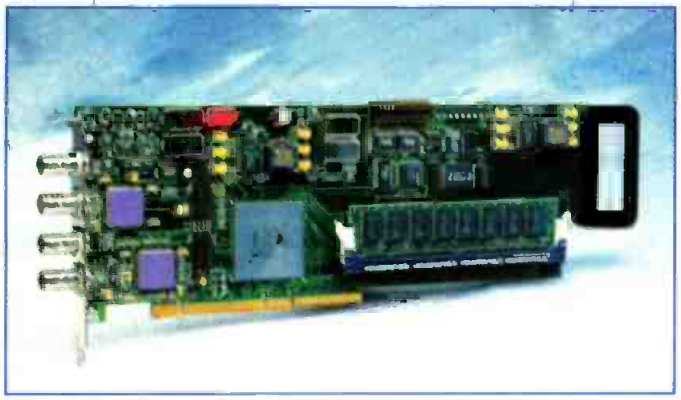
Designed to accommodate standard broadcast operations, Dolby E can tolerate without degradation up to 10 of the tandem encode/decode cycles typically required during the contribution, post-production and distribution stages of a DTV program.

Sierra Design Labs HD 270 HDTV videodisc recorder

Sierra Design Labs, in conjunction with Sony Electronics, introduces the HD 270 DTV/HDTV videodisc recorder. The HD 270 SDTI pr... for fully s...tes Sony's HDCAM HD without gener...set and sets the stage cast and post-pro...DTV applications card facilitates the ...loss in broad-...tions. The ...sion of the bit-rate-reduced HD digital video ...cording to the HDCAM recording form... between the HDW-500 HDCAM VTR a... the Sierra disc recorder via a 270Mb/s SDT... serial interface, thus avoiding the decod-ing/encoding process.

With a simple software switch, the HD 270 allows broadcast and post-production professionals to move between standard uncompressed 8- or 10-bit 4:2:2 video processing and 1080i HDTV processing.

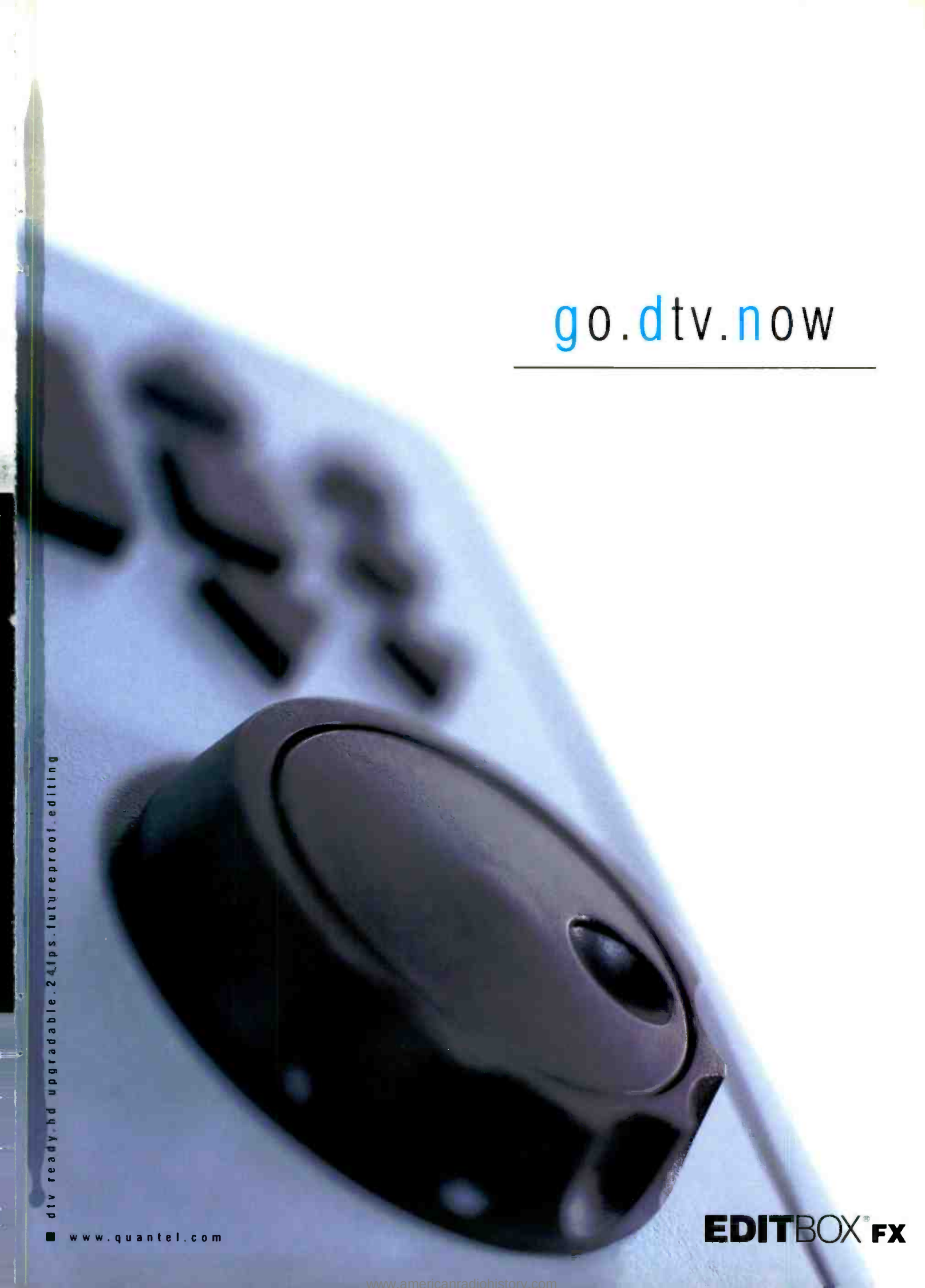
Built upon the industry standard Quickframe, the HD 270 uses Sony's HD SDTI interfaces to transport video with virtually no loss to HDCAM VTRs or to other Quickframes. The HD 270 also incorporates all the features of a standard Quickframe, making it suitable for HD editing, telecine, duplicating, still/clip store, and server for broadcast and playout applications.



Orad CyberSet HD

The CyberSet suite of products includes CyberSet HD and CyberSet Post. The high-definition system supports both 1080i and 720p formats. CyberSet Post combines the advantages of Orad's virtual set production technology with the ultimate quality results of post-production rendering.

CyberSet Post enables the creation of artistic scenes where real actors interact with 3D objects in a virtual set. CyberSet Post can be used for shooting commercials, creative video clips, movie sequences, and special effects. A real-time preview option of the composed video allows the user to get an idea, on the set, of how the composed video will look while giving the actors time to position themselves within the 3D model.



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Digital videotape formats

is another kind of compressed digital VTR format for the Beta family, called Betacam SX. This format uses a higher compression ratio (lower data rate — 18Mb/s) than the Digital Betacam line and is unique in that it uses MPEG-2 compression. Betacam SX uses an I, B, I, B ... frame structure. Because the every other frame is an I frame, the B frames are easier to decode, simplifying editing operations. BetacamSX products feature four 16-bit audio channels and record on 1/2-inch metal particle tape. Timecode, analog cue, and control tracks are also provided.

HD recording

High definition requires a new generation of recording and/or compression technologies to store the increased video and audio data. The first digital VTR capable of recording full-bandwidth, uncompressed high definition was the Sony HDD-1000. These open-reel recorders use one-inch tape (similar to the one-inch C-format recorder). The data rate for these uncompressed HD recorders is approximately 1.2Gb/s. A frame of video is recorded over many adjacent tracks using a tape speed of just over 30 inches/sec. HDD-1000s can record eight digital audio channels and an analog cue track. These machines are supposedly still available by special order.

Another full bit rate HD recorder is available, and has been standardized by SMPTE as D-6. D-6 is a cassette-based VTR using 19mm (3/4-inch) metal particle tape, similar in size to D-1. Significant features of this format include multiple standard HD recording, 1125/60 and 1250/50 (Europe), and the ability to handle 1080 active lines (part of the ATSC standard that was not included in the FCC standard). Also to be included is an uncompressed version of the 1080p/24 format, discussed later.

In addition to the uncompressed HD formats, a whole family of lightly compressed HD recorders has grown up. HDCAM has been developed to support a new HD camcorder. The cam-

Digital videotape formats

corder and the companion editing recorder/player use a combination of subsampling and compression to allow HDTV recording on 1/2-inch metal particle tape. In the camcorder, the data coming from the camera is arranged in a 1920-pixel by 1035-line array structure. The VTR subsamples this video at 1440 samples per line. This subsampling is similar to what is done in the DV system. This 1920 to 1440 subsampling can be indicated by changing the familiar 4:2:2 shorthand to 3:1:1. (Some prefer to use 15:5:5. For more information see "Playing the numbers game," p. 81, *BE*, August 1998.) This subsampled video can now be more easily compressed to fit on a 1/2-inch videotape. A note should be made that even though the camcorder and VTR are based on the Digital Betacam form factor, Digital Betacam tapes will not play in these machines.

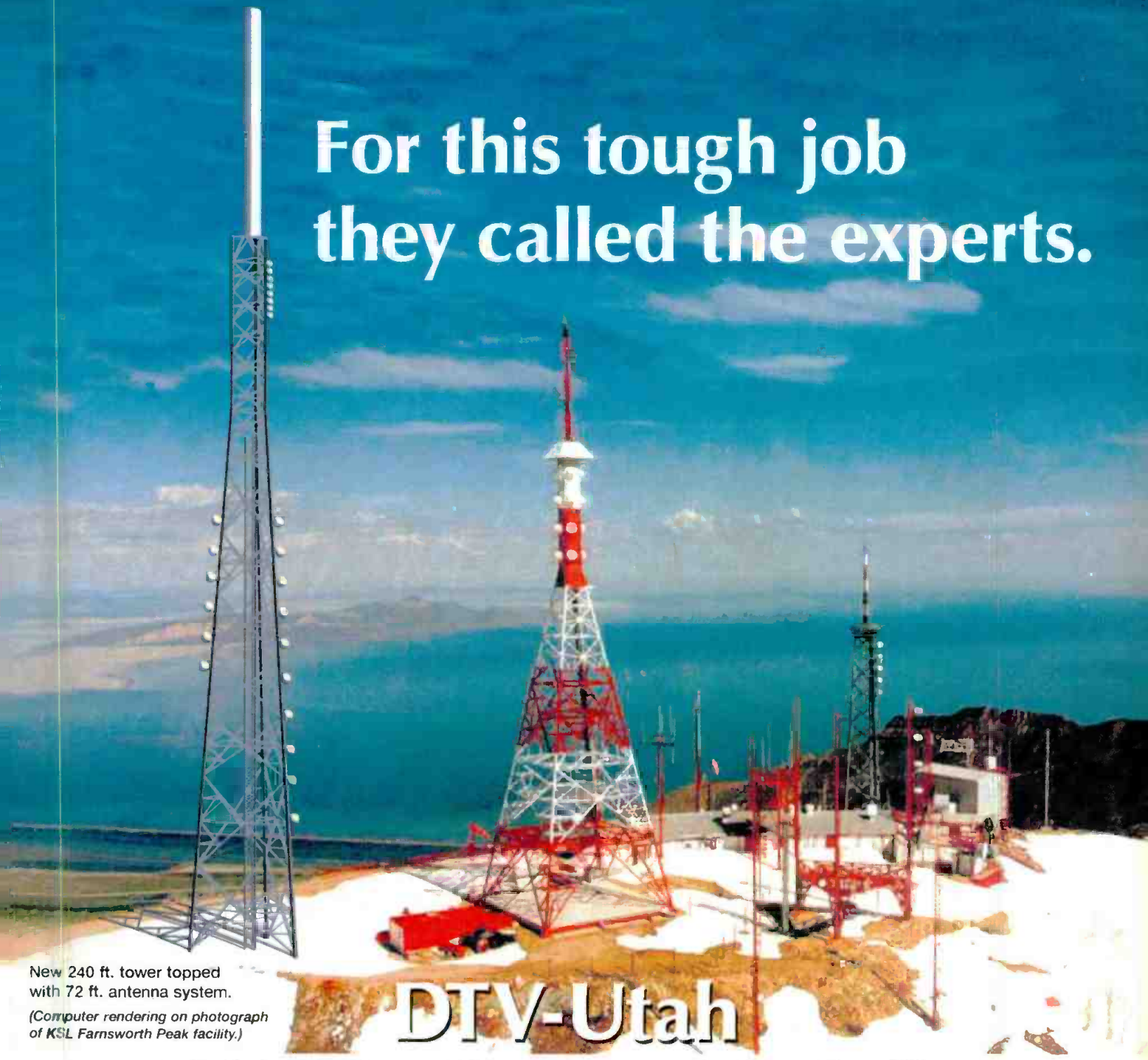
Compression adapters have also been developed to allow high definition and other formats to be recorded on a standard D-5 VTR. One adapter compresses the 1.2Gb/s 1125/60 signal by a ratio of about 4:1 to allow it to be recorded on a D-5 VTR. The D-5 VTR is used primarily as a bit bucket, and the output of the adapter is formatted so it can be transferred using the 360Mb/s interface connection on the D-5 VTR. Four channels of audio are also preserved in the conversion.

Other adapters have been developed to allow progressively scanned 525- and 720-line images to be recorded on a D-5 VTR using a similar bit bucket approach. The 525p system is currently being used in Japan, and the 720p system is being used for HDTV applications. In the newer HD-D5 recorders, the external adapter box has been incorporated into the D-5-sized VTR itself.

Many of the new DV-based compressed digital videotape formats are being scaled up to higher data rates for high-definition use. DVCPRO50 has been scaled up to 100Mb/s for HD applications. This allows more highly compressed HD signals (about 12:1) to be recorded on a DVCPRO tape. The Digital-S application of DV compression has also been extended to 100Mb/s, allowing it to also

JVC's Digital-S format is used in a variety of applications, from production work at Video Production, San Diego, to newsgathering.

For this tough job they called the experts.



New 240 ft. tower topped with 72 ft. antenna system.

(Computer rendering on photograph of KSL Farnsworth Peak facility.)

DTV-Utah

Eight-Station DTV Transmission Facility

When DTV-Utah, a consortium of eight Salt Lake City-based television stations, needed a digital television tower 5,500 feet above the city on KSL-TV's property known as Farnsworth Peak, they awarded a turnkey contract to LeBLANC Broadcast.

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Digital videotape formats

be used for HDTV applications. DVCPRO and Digital-S use an identical DV compression algorithm. While the physical implementation may change, an aggregate system can be built up like building blocks (at least on paper). Every time you add another DV engine you gain increased data rate capacity and two more audio channels. True enough, both 100Mb/s DV-based formats feature eight audio channels.

24Hz recording

Yet another HD production format has developed, spurred on perhaps by the post-production industry. This has led to two videotape formats on which to record these signals. 1080P/24, as the format is sometimes known, is a format that uses the ITU Common Image Format (CIF) of 1920x1080 (WxH) pixels, but at a nominally 24Hz frame rate.

This signal can be recorded on a new version of the D5-HD recorder, tentatively called the HD-3000. 1080p/24 signals can also be expressed in the format 1080p/24sF, which means *segmented frame*. In this process the 24-frame signal is split (i.e., segmented) into two parts which can be recorded on a modified recorder originally intended for interlace scanned signals. The signal appears as if it was an interlaced signal, but both fields come from the same 24Hz (film) frame.

The 1080p/24 format has been greeted with tremendous acceptance by the post-production community. They see it as a format that they can use to edit and perform most operations on film-based material in its original acquisition format (and frame rate) regardless of its ultimate distribution format (and frame rate). This preserves their options for different format video releases later on.

This 24Hz video can be frame doubled to 48Hz, or tripled to 72Hz for display on computer monitors. It can also be converted to 60Hz for viewing on conventional video monitors by adding the 3:2 pulldown process.

This single 24Hz master recording can be converted to all of the popular video release formats, and even some of the not-so-popular ones. SD and HD versions of the same film material may be derived from the 24Hz master in a variety of ways. As mentioned, a 60Hz version can be derived by inserting the 3:2 pulldown sequence. Repeating every frame twice and running the VTR at 25Hz instead of 24Hz can produce a 50Hz version. While this may be considered heresy by some sections of the industry, it is an established and accepted practice in 50Hz countries.

It is important to realize that the development of these VTR formats is not necessarily dependent on a tape-based recording media. Increasingly, the compression schemes used in these recorders are being broken out into technologies that can be applied to hard disk, optical and RAM-based recorders. Perhaps, as they say, a high tide raises all boats, and advances in digital recording technology, including compression, are just as applicable to other recording technologies as they are to tape. Each mediums' strengths must be individually evaluated. ■

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

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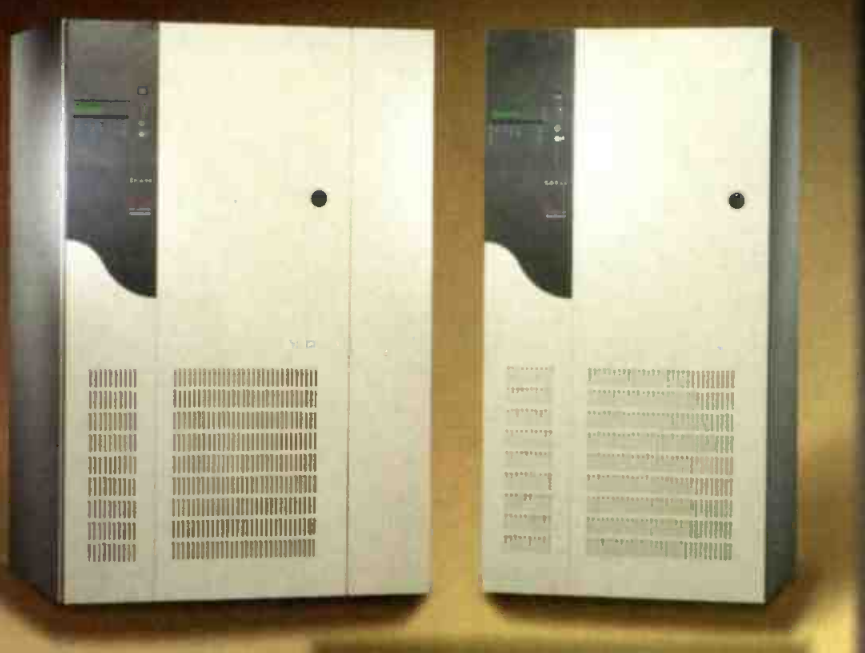

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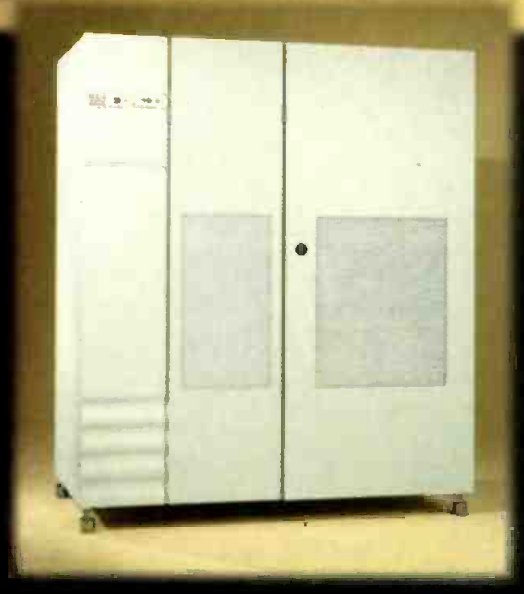

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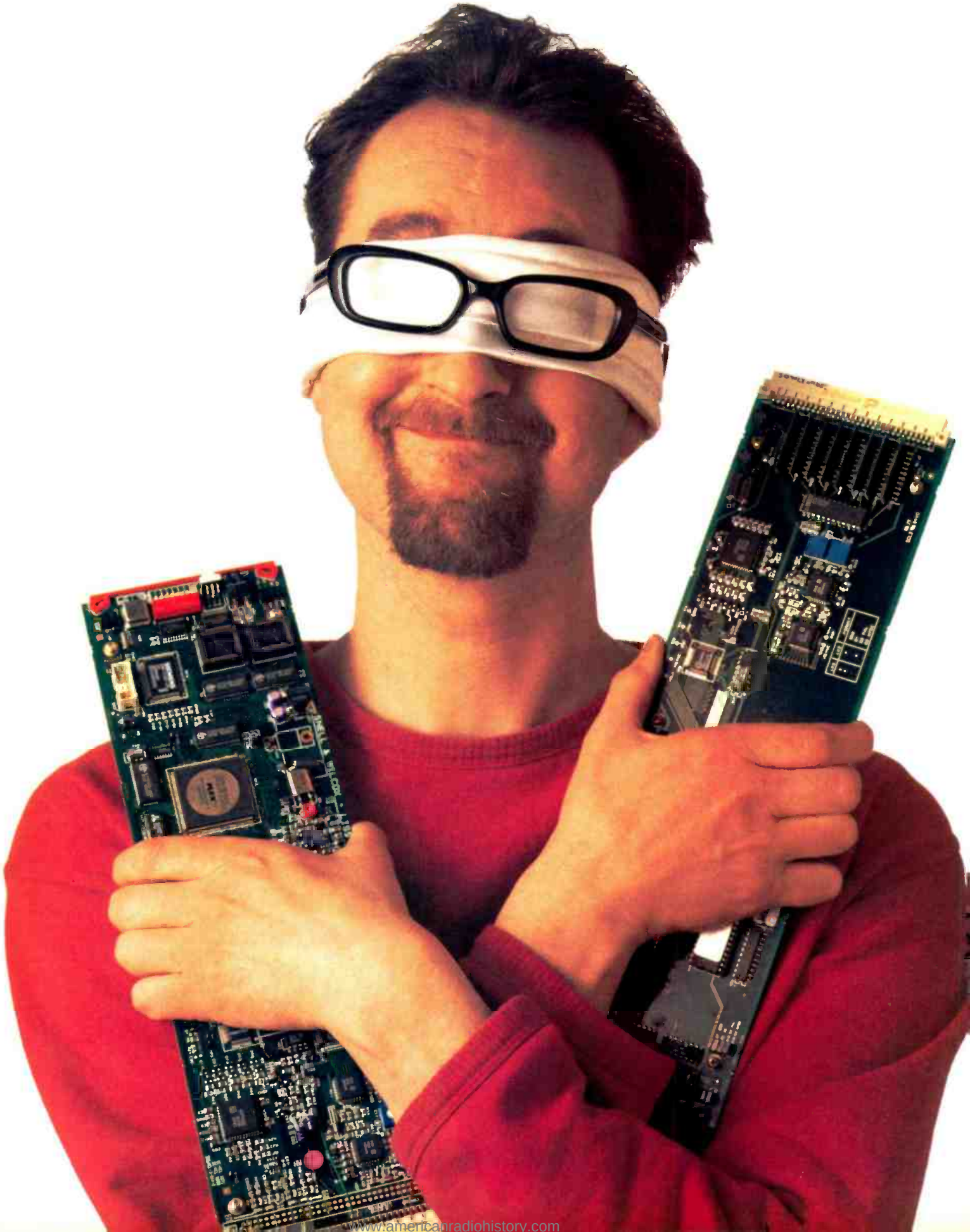

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Field Report

Evolution through feedback: The Chyron iNFiNiT!

BY JOE FLYNN

Since long before the director cue, "Matte font" morphed into "Ready camera two with blind insert on iNFiNiT! AIR," the concept of evolution by insistence has been an integral part of the television broadcast industry. People in this business, graphics people in this particular case, won't settle for, "What can we do today?" They want to know, "What can we do tomorrow?" Insistence upon taking the next step is what has driven the technical industry to provide more flexible and powerful tools.

There is a symbiotic relationship between users and manufacturers. Each drives the other to evolve. We push their equipment to the limits and beyond, while they, in turn, provide the texture upon which we base our creativity, allowing us to discover what our next step should be.

Chyron's iNFiNiT! is celebrating a decade of evolution out in the field. Some of the evolutionary steps have been subtle, like the addition of a cursor alignment utility; others have been major, such as Transform II, SCSI Express, CLYPS, Cel Animation and Multiple Effects. In every case, the efforts have been directed toward bringing television graphics to the next level.

Throughout its decade-long life span, iNFiNiT! has evolved with such features as Transform II and SCSI Express, and incorporated user-friendly options like WiNFiNiT! and Flipbook.

Flipbook and WiNFiNiT! were created as a direct result of the feedback and respond loop. Together they allow iNFiNiT! users to capitalize more flexibly on the capabilities of the system.

Flipbook is a tiny utility that allows a PC or Mac user to create cel animations from sequential 32-bit TGA files. Once created, they can be played back through the iNFiNiT! frame buffers by networking the cel files to the iNFiNiT! over an Ethernet connection.

WiNFiNiT! can be used to operate the iNFiNiT! from a Windows-based PC. It simplifies import and export of RGBA images and allows cut and paste.

The SCSI Express and CLYPS packages provide direct record and playback of video through the iNFiNiT! frame buffers. CLYPS editing can be done easily from the Total Motion Control menu. Pressing ALT RCD allows separate recording of JPEG video and key messages to the same file, resulting in a relatively small collection of loopable video and key messages with a large number of playback configurations available for lower thirds and over-the-shoulders.

The following is a good technique for users who have an iNFiNiT! but don't have a broadcast-quality tape machine. Smaller graphics houses have found they can take advantage of WiNFiNiT!, CLYPS and Dual-User mode to create backdrops. By taking the video and key out from the AIR channel and feeding it directly into the video capture on the PREVIEW channel, Transform II animations can be recorded to CLYPS. Then, using Multiple Effects, CLYPS (as a JPEG message) may be transferred onto one frame buffer; next, two frame buffers can be layered for read effects or cel animation, then Transform is used as the fourth layer.

Transform Capture is part of RGB Tools. This feature captures objects that are transformed to use as characters in a font. While Transform was one of iNFiNiT!'s best features, Transform II moves it forward by giving it a user-friendly interface.

Transform is sometimes referred to as "2-1/2 D" because it allows 2D objects to move in 3D space. Here's how Transform II allowed one iNFiNiT! user to turn an iNFiNiT! "into the first real-time 3D system." The American Music Awards' trophy looks like a glass version of the Transamerica building. Four transparent triangles were used to serve as the pyramid element, and four black rectangles served as the block base. By rotating two each of the triangles and rectangles horizontally 90 degrees, a 3D glass pyramid with an opaque base was created. The trophy image was capable of being spun, sized or moved anywhere on the screen.

As has always been the case, sharing ideas leads to new and better ideas. Chyron's iNFiNiT! is proof positive in a graphics environment.

For more information on Chyron's iNFiNiT!, circle (301) on the Free Info Card. ■

Joe Flynn is an independent creative consultant based in Palm Bay, Fl..

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Fiber optic interconnections

BY KENNETH HUNOLD

From the broadcaster's perspective, fiber optic interconnection has expanded from the domain of the telcos into a medium that broadcasters and other audio and video professionals can use as another strategy for conveying signals throughout their facility. Fiber connections already exist with some proprietary interfaces on modular digital multitrack (MDM) recorders. Many new digital consumer devices such as HDTV set-top boxes include optical interfaces to allow equipment to be interconnected digitally. Fiber optic interconnection offers many attractive features for signal transmission, including small size/low weight, very high bandwidth and reliable performance in "hostile environments."

The fiber medium itself is passive, with the link's functionality being determined by the terminal equipment on either end. The fiber is usually described as "single mode" or "multimode." Very simply, this describes whether the optical signal is directed straight down the fiber (single mode) or whether the signal is allowed to rattle around inside the fiber core (multimode). Generally speaking, single-mode fiber outperforms multimode fiber in terms of distance performance, but this is relative.

When compared to other transmission media (usually copper twisted pair or co/triaxial cable) fiber can be used to transmit information over distances approaching 20 miles (tens of kilometers) compared to several hundred feet (hundreds of meters) for copper. For audio transmission, fiber is being used for transmitting either single or multiple channels of audio over great distances without the bulk and electrical limitations of copper wires (i.e. hum and restricted bandwidth). Several audio channels are multiplexed onto a single, thin strand of fiber. Often the bulk of the cable is merely a protective sheath and jacket to protect the thin fiber and to make it easier to handle.

Because the optical fiber is not electrically conductive, it does not allow ground loops to form when electrical devices with different ground potentials are connected together. The down side of this is that terminal equipment at either end of the fiber must be powered locally. This can be a problem in field installations, where it is common to power a camera or stage microphone splitter remotely from the mobile unit or mix position. To overcome this restriction, composite cables are some-

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times made with fiber and copper "conductors," allowing remote powering of one end of the link from a centrally located point. Care must be taken in this application, because the power connection itself could allow ground loops to occur if not implemented properly.

Fiber is often used to increase the distance over which signals can be transported. Analog and digital video transmission distances can be lengthened. Analog video can be modulated onto a fiber and transported over great distances without the need for equalization for the specific length of the link. Digital video can likewise be carried over distances beyond the customary 300 meters allowed by coaxial cable. Recently interfaces have been developed that allow digital HDTV signals to be transmitted over distances much greater than the usual 100 meters for 1.5Gb/s digital video.

In addition to increasing the distance over which signals may be transported, fiber can be used to increase the throughput of the connection. As with the audio snake application where multiple audio signals are electrically multiplexed and then modulated onto a single fiber, optical multiplexing has allowed multiple signal packages to be optically combined on a single fiber, as well. Typically, Wavelength Division Multiplexing (WDM) has been used to allow different wavelengths, or frequencies, of light to be combined onto a single fiber, allowing the electrical spectrum of an individual fiber modulator to be re-used on the same fiber by another fiber modulator. Usually the wavelengths used have been 1310nm and 1550nm. Dense Wavelength Division Multiplexing (DWDM) allows even more discreet wavelengths on slightly different optical "frequencies" to share the same fiber. This can significantly increase the amount of information that can be carried on a fiber. These techniques have been expanded to allow the interconnection of remote studios and/or transmitter facilities over dark or unused fiber capacity provided by a telecommunications carrier. Such systems can be set up with the terminal equipment under the customer's control, allowing them complete flexibility in the design of the interconnection topology.

Traditionally, the hardest part of implementing a fiber interconnection scheme is terminating the fiber, or putting the connectors on. Often there is more loss in the connectors than in the rest of the cable, so operating distance is limited more by the number of connections than by the length of the path. Over the years there have been significant advances in the design and construction of the fiber connector, and it is now possible for the user to terminate and repair fiber connections in-house or on-site. This is making it almost as easy to work with fiber as it is with copper.

As the data requirements of the broadcaster increase, both in terms of data rate and distance, fiber is becoming an increasingly viable alternative to copper. In some applications, such as HDTV and interfacility links, it is often the only way to go. Broadcasters and computer support groups, as well as location sound and video companies, are increasingly looking to fiber as attractive ways to increase their capacity and efficiency. ■

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

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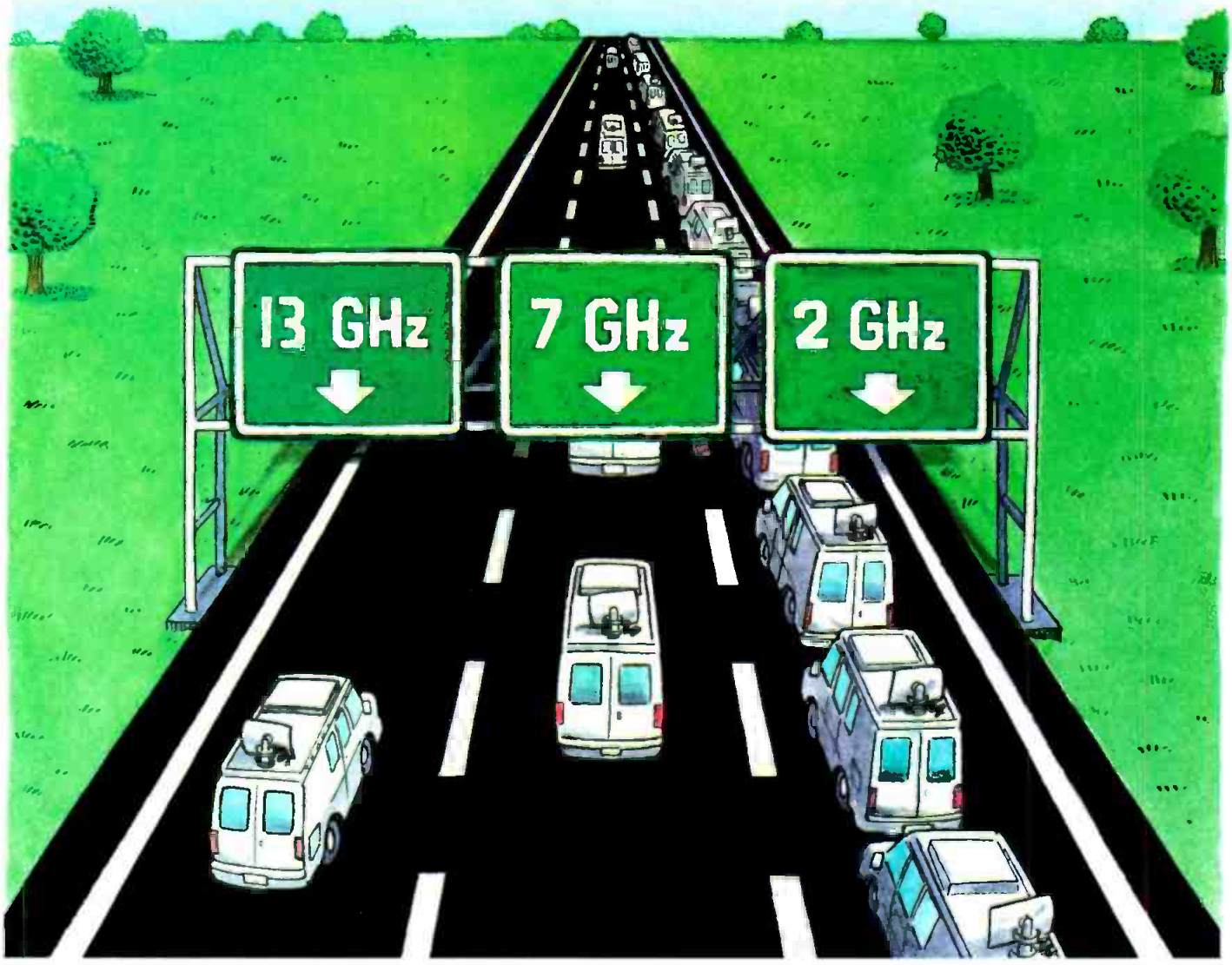

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Desktop DVCPRO VTR

Panasonic AJ-D95DC;has a half-rack size unit that delivers a maximum record/playback time of 92 minutes (184 minutes in DVCPRO); offers a full complement of BNC, XLR and RCA inputs/outputs for video and audio, as well as separate record/playback audio level controls.

800-528-8601; 323-436-3500; fax: 323-436-3660; www.panasonic.com/PBDS

Circle (412) on Free Info Card

Editing console

Winstead Corp. K8571: a three bay console system containing a double wide module; allows for the use of monitors as large as 29 inches; module opening is 24 1/2 " x 38 3/4".

612-944-9050; fax 612-944-1546; www.winsted.com

Circle (415) on Free Info Card

Spectrum analyzer

Tektronix 2715 Option 50: has automated RF measurements for DTV and analog transmission; provides frequency extension to 2.15 GHz to measure down-converted (L-band) satellite signals, as well as to measure VHF/UHF transmitters.

800-547-8949; 503-627-7275; fax: 503-627-7275; www.tektronix.com/VND

Circle (413) on Free Info Card

Hand-held digital and analog signal generator

Hamlet Protean 601 Digi Gen: a multifunction device that produces digital and analog signals in both video and audio; produces up to four channels of embedded audio and analogue reference tone or silence; offer full broadcast CCIR601 processing and 16 test patterns.

44 (0) 1494 793763; fax 44 (0) 1494 791283; www.hamlet.co.uk.

Circle (416) on Free Info Card

Digital/analog viewing monitor

BARCO ADVM 10: a 10-inch digital/analog video monitor designed for digital viewing; features two multistandard analog composite inputs and one S-VHS input that allow simultaneous connection to multiple sources; includes an auto set-up and on-screen display.

800-992-5016; 770-590-3600; fax 770-590-3610; www.barco.com.

Circle (414) on Free Info Card

Programming software

Columbine CJDS Scenario Planner: an add-on product for Columbine's Broadcast Master Suite of scheduling modules; allows TV station's scheduler to store, view and sshare various scenarios of future program schedules.

303-237-4000; fax 303-237-0085; www.cjds.com.

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This ice-cube size camera head delivers broadcast and industrial quality performance in a lightweight, compact package. Plus, its remote head design allows it to be mounted virtually any-where for an entirely new perspective.

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The IK-TU40A camera accepts C-mount lenses and has video outputs for NTSC, S-VHS, R-Y/B-Y and RGB. A 10, 20, or 30 ft. detachable cable, RS-232C personal computer interface for total control of all camera functions. To get the whole picture, call Toshiba at 1-800-344-8446.

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Business Wire

Business highlights from broadcast and production

BY SANDRA FERGUSON, EDITORIAL ASSISTANT

WSYX-TV (Sinclair Communications Inc.), the ABC affiliate in Columbus, OH, purchased more than $1 million of Panasonic's DVCPRO equipment for its news and programming operations. Both WSYX-TV and its local marketing agreement Fox affiliate, WTTE-TV, will use the equipment.

Tektronix won a $2.7 million contract to rebuild KVBC-TV, the NBC affiliate in Las Vegas.

Robert Gilmore Associates Inc. selected JVC Professional's DIGITAL-S products for its new facility on the Boston waterfront.

Leitch announced that the NFL purchased 31 of its VR FORCE video server systems. In related news, Leitch supplied 19 Juno upconverters for a broadcast deal involving the New York Yankees and Madison Square Garden.

Harris will provide HD encoding systems to three A. H. Belo Corp. TV stations set to rollout DTV this year: KMOV (St. Louis), KGW (Portland) and WCNC (Charlotte).

CBS News committed to Sony Betacam SX digital video equipment and recording media valued at $20 million for its New York news studio and 18 news bureaus and offices around the world.

Odetics announced the sale of its new Roswell Facility Management System to WHYY-TV, the number four DMA market public TV station based in Philadelphia.

Tiernan was awarded another contract by Teleglobe Communications Corp. to supply additional TE6 4:2:2/4:2:0 encoders, TDR600S decoders and TUI-10 Universal Interface products.

WRC in Washington, D.C. recently installed the first Solid State Logic Aysis Air console in the U.S.

Solid State Logic announced the following installations of its Aysis Air digital consoles: NBC's WRC-TV in Washington, D.C. and WNET Public Television in New York. National Mobile Television will also install an Aysis Air console in its HD3 mobile unit.

WMUR-TV in New Hampshire is using Vibrint's NewsEdit and FeedClip for hard news editing and news production.

Twentieth Century Fox recently selected three AMS Neve DFC audio consoles.

Miranda announced that CBS affiliate KTVT of Dallas-Ft. Worth is using its Aquila HD upconverter to upconvert standard NTSC signals to 1080i HD.

ONtv of Ontario selected Orad's CyberSet Virtual Set for its live news broadcasts.

Pluto recently made the following announcements: CBS affiliate stations WBZ in Boston, WWJ in Detroit and WBBM in Chicago are using HyperSPACE for their HD playback needs. Dispatch Broadcast Group's TV stations WBNS in Columbus and WTHR in Indianapolis also recently purchased Pluto's HD digital HyperSPACE video recorders.

Silicon Graphics changed its company name to SGI.

Utah Comteck Video LLC, a new routing and distribution switcher company, announced that it acquired the Utah Scientific analog routing switchers and master control system product lines.

Quantegy is celebrating 40 years of manufacturing professional recording media.

Yamaha debuted its Chicago-based North American Pro Audio research and development facility on April 15.

Sony is now shipping its MDR-DS5000 digital headphones.

Tektronix has delivered its Grass Valley 7500 Series synchronous digital audio routers to several networks and stations worldwide.

People

Maxell promoted Don Patrican to executive vice president of sales and marketing for the company's Consumer and Professional Media Products Groups.

Don Patrican

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continued from page 44

and DVCPRO with normal head life and no tape damage. Sony DV/DVCAM metal evaporated (ME) tape is used in millions of consumer and professional camcorders world wide with no problems. DVCPRO uses metal particle (MP) tape. It is used mostly in DVCPRO decks of which there are a much smaller number, around 75,000 units. DVCAM decks can play all the available consumer DV 25 formats without causing any damage to the tape or machine. We have passed the same area of a DV/DVCAM tape over the heads of a VTR 3000 times with 100 percent playback and no picture loss or problem. It should be noted that if a VTR is not originally designed to play multiple formats it may not play them properly, and may leave a collection of deposits on the tape that transfer when placed in other VTRs which can cause performance problems or head clogs. Sony DSR 2000 now plays DV, DV LP, DVCPRO and records/plays DVCAM and plays ME and MP tape formulations because it was designed to.

Robert Ott
Vice President, VTR Products and Marketing
Sony Electronics' Broadcast and Professional Company

Dr Digital Responds:

There you have it. Read into those answers what you want, but something tells me we haven't heard the end of this one. Granted, there wasn't a compatible consumer format, but I don't remember these problems with 1" or 2" VTRs, nor does it seem to exist with analog consumer audio cassettes.

Now, if I understand this:

1) You can't put Sony tape, in a Panasonic VTR and expect it to play correctly — and — it may be abrasive enough to do some damage;

2) If you put Panasonic (or anybody else's) ME tape into a DVCPRO VTR that has used MP tape anytime in the past, and then use that tape in a consumer DV or DVCAM deck, you run the risk of transferring MP particles into deck, possibly causing some damage;

3) Third party tapes are not the answer (neither manufacturer recommended them).

Maybe the issue of compatibility isn't the panacea we once thought it was.

If I buy a Minolta or Nikon 35mm camera I can use Kodak film in it, no problem. When I buy a car from Ford or GM, I can put gas and oil in it from any one of several refineries, again no problem. Maybe the idea of disk-based recording really will work—by the time somebody wins the tape format war all the customers will have found a better way.

I find it interesting that with the sophistication of today's technology, today's products don't seem to be as robust as many of yesteryear's products. I wonder if the science that makes new products operate so close to the edge causes them to cross over and begin to fail very shortly after the warranty runs out. What do you think? Send any questions, comments, etc. to drdigital@compuserve.com. ■

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Terminal Equipment

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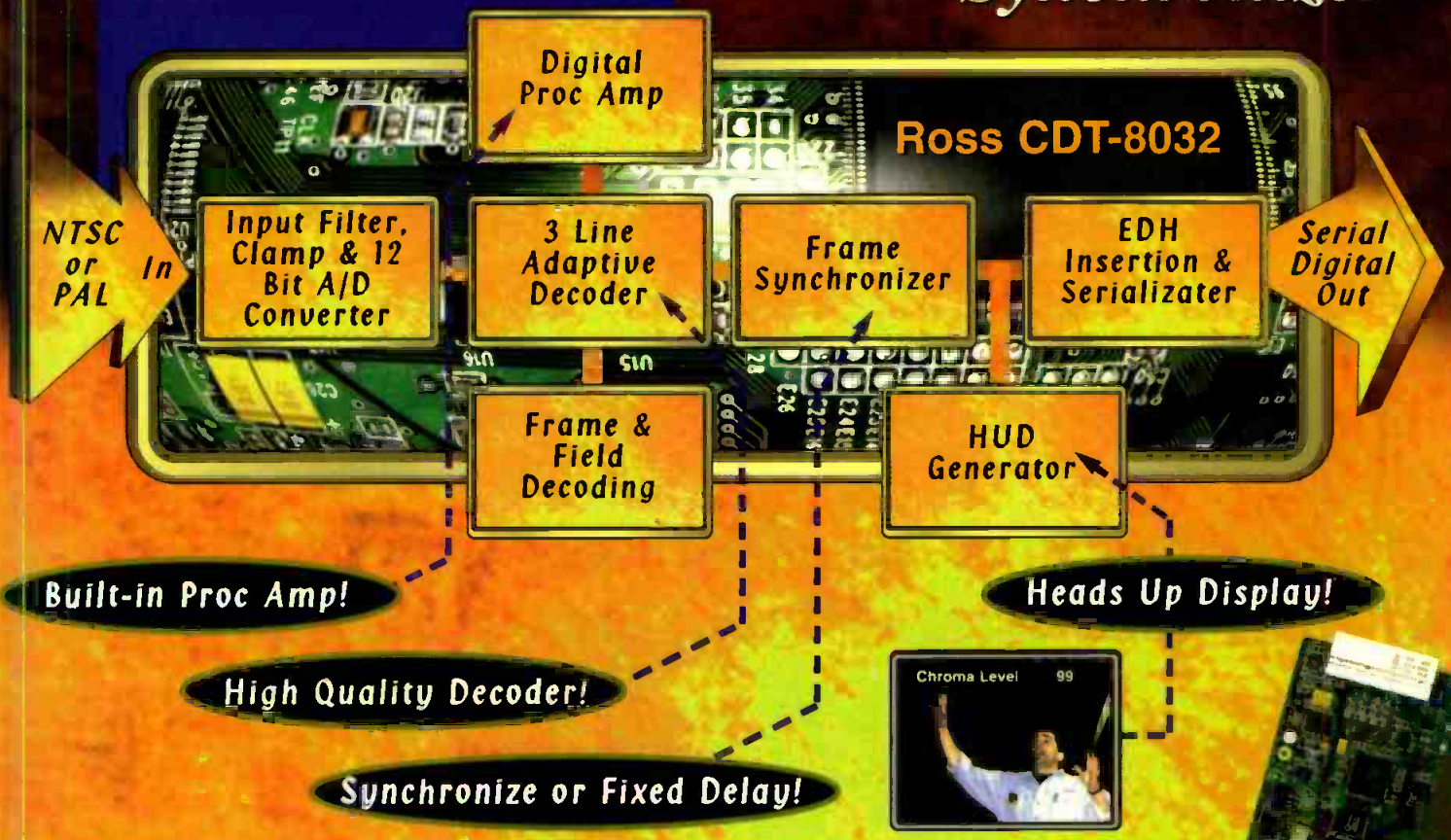

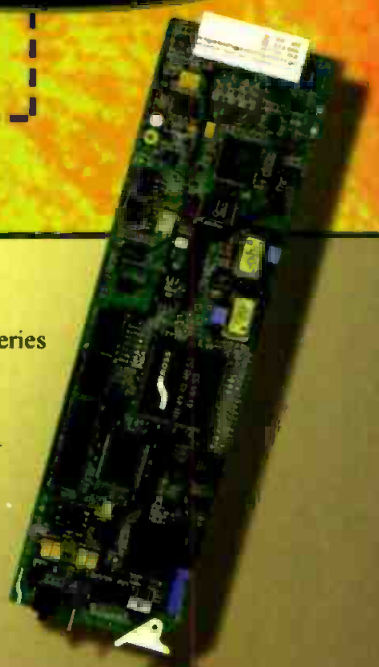

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Be an author of your life story

BY KARE ANDERSON

On the very morning I wrote this column a radio commentator intoned, "Presidential candidate George Bush will be active in making pronouncements in the coming weeks. He wants to define himself before his opponents do it for him."

I passed a billboard on Lombard Street in San Francisco with this message, "Someone is going to win the lottery this week. And it is not going to be you. When will you finally turn to E-Trade?"

Become the best-selling author of your life. Be at least one of the more frequently cited sources of the words most likely to be repeated about you, your work, loved ones and interests — starting now.

How? Get specific about your stories. Consider peeling away the inevitable generalizations you often make about your most familiar topics until you get to the core of your most important life themes. Recognize the essence of each for yourself. Consider first things first to understand your essential life story. Then, and only then, can you begin to consider how to translate it into the incidents and examples that are most meaningful for each person with whom you talk. You can begin with that most telling detail.

Change yourself; change your world. If you become a more vivid storyteller, you affect not only another's picture of you, but what is possible for that person. Why leave it to Stephen Speilberg and Bill Gates to write the most familiar stories of our lives? You, too, can tap the collective unconscious yearnings and desires of people by telling the story that resonates with others everywhere. With no investment in marketing, your call-for-action story may be told around the world and even come back to you . You are, after all, your living legacy. It is only human to look for what is most interesting around us.

You know this more than many people: One of the many bright sides of our world now is that the most vivid messages move with lightning speed to the most places, phones and screens around the world. People are becoming more well known and quoted by coining a phrase that sticks in our minds or characterizes a situation, sentiment or trend: Clint Eastwood ("Make my day."), John Gray (*Men are from Mars . . .*) and John Naisbett (high tech/high touch).

Intel inside

More and more business leaders (from Steve Jobs to Jack Welch) speak so vividly that they become the face of their company, extending the value of their personal brand as well as that of the company's value. In a fast-changing world, you are your most important brand.

By putting their lives on the line, Amnesty International volunteers personally witness atrocities so the rest of the world might stop them. Want to help a cause? Perhaps the most valuable contribution you can make to your favorite cause is by creating the most specifically compelling reason for others to support it.

Perhaps the best gift you can present to someone you respect or love is to tell others about one of that person's most wonderful actions.

If you want a more interesting, options-loaded and meaningful life, make the chapters more enticing, beginning with what you say. Bring the more interesting details to the top of the conversation and the most intriguing parts of others will emerge. People will like that experience and be drawn to you. Whether you want to get the immediate attention of management at the station, attract more support for your project or initiate new friendships, begin with the specific detail that pulls them to your most interesting story.

Consider reading these great story tellers: Dianna Daniels Booher's *Communicate with Confidence: How to Say It Right the First Time and Every Time*; Rosalie Maggio's *How to Say It: Choice Words, Phrases, Sentences, and Paragraphs*; and Roger Ailes's *You Are the Message*.

And finally, here are some "say it better" resources available on the Internet:

Webster's Hypertext Dictionary: m-w.com/netdict.htm

Bartlett's Familiar Quotations: www.columbia.edu/acis/bartleby/bartlett/

Roget's Online Thesaurus: www.thesaurus.com

Dictionary.COM:www2.dictionary.com/dictionary/

Online rhyming dictionary (enter a word, click a button to receive words that rhyme): www.WriteExpress.com/online.html

Quotations: www.starlingtech.com/quotes

Terms: www.epcc.edu/faculty/joeo/terms.only

Acronym Finder: www.mtnds.com/af/

Acronym and Abbreviation List: www.ucc.ie/info/net/acronyms/index.html ■

Kare Anderson is a speaker and author.

Send questions and comments to: kare_anderson@intertec.com

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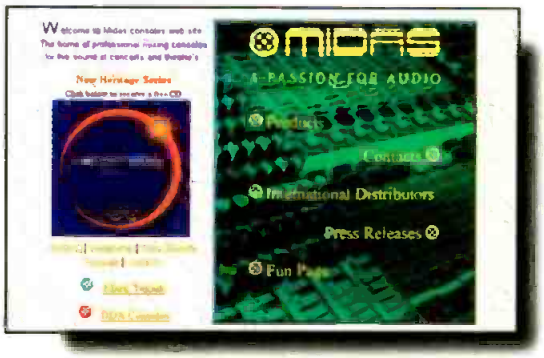

www.midasconsoles.com

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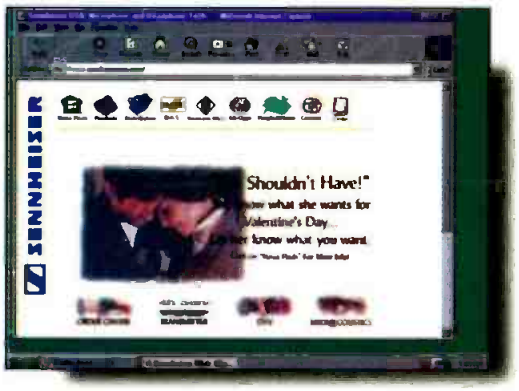
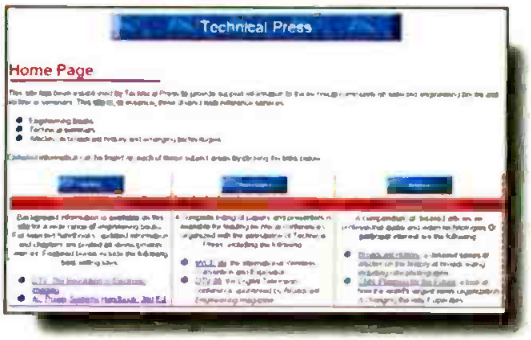


www.sennheiserusa.com

Sennheiser: Established In 1945 in Wedemark, Germany, Sennheiser is an Oscar and Emmy award-winning leader in microphone technology, RF-wireless and infrared sound transmission, headphone transducer technology, and most recently in the development of active noise-cancellation. The company is driven by an innovative and pioneering spirit and is committed to ongoing research, precision engineering and meticulous manufacturing standards.



www.technicalpress.com

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

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3-CCD Digital (DVCAM) Camcorder

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

- Variable servo 10X optical power zoom lens goes from 5.9 to 59mm in 1.7 to 24 seconds. The manual zoom rocker is continuously variable right up to where the digital 20X zoom kicks in.
- Sony's Super Steady Shot reduces high frequency camera shake without compromising image quality. SteadyShot uses horizontal and vertical motion sensors that allow it to work accurately while zooming, moving (even shooting from a car), and shooting in low light conditions.
- Has digital effects including audio and video fade, overlap and Slow Shutter.
- Automatic and manual focus, iris, shutter, gain and white balance. Iris is adjustable in 12 levels from F1.6 to F11, shutter from 1/4 to 1/10,000 of a second in 12 steps. Gain from -3dB to +18dB in 8 steps.
- Zebra Pattern indicator, built-in ND filter.
- Custom Preset function lets you preset, store and recall custom settings for color intensity, white balance (bluish or reddish), sharpness and brightness.
- Stores Photo, Date/Time, Shutter Speed, Iris, Gain and F-stop for easy recall. So if you have to re-shoot, you know your original settings for every scene and frame.
- Records Drop/Non-Drop Frame time code. Time code can be read either as RC time code or as SMPTE time code.
- Has a large 1-inch B&W viewfinder with 550 lines of resolution for easy focusing even in low contrast lighting situations. Separate information sub panel displays time code, battery time, tape remaining and other camcorder functions without cluttering up the viewfinder.
- Records 16-bit/48kHz audio on one stereo track or 12-bit/32kHz with two pairs of stereo tracks (L1/R 1, L2/R2), so you can add stereo music or narration.
- One-point stereo electret condenser mic for clear stereo separation. Directivity can be selected from 0°, 90° & 120°.
- Automatic & manual (20-step) audio level record controls. Monitor audio with headphones or from the LCD panel which has an active VU meter.
- XLR input connectors for mics and audio equipment.

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

DSR-20

DVCAM Player/Recorder

The DSR-20 is a versatile DVCAM VCR with a very compact chassis and a variety of convenient functions for recording, playback and simple editing. It features auto repeat playback, power-on recording/playback, multiple machine control interfaces, AC/DC capability and i.Link (IEEE1394) input and output. And of course, it offers the stunning image and sound quality inherent to the DVCAM format.

DVCAM Quality
- Utilizing the DVCAM format, the DSR-V10 provides the recording/playback quality and reliability required for professional use. It can also play back consumer DV format tapes without any special adapter.
- Provides two selectable audio modes: a two channel mode with 48 kHz/16-bit recording and a four channel mode with 32 kHz/12-bit recording.
- Dual-size cassette mechanism accepts both mini size (up to 40 minutes) and standard size DVCAM tapes (up to 184 minutes) without an adapter.

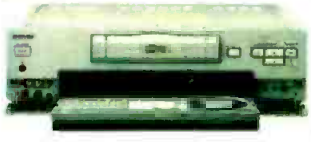
Editing Capability
- Equipped with Control L interface, the DSR-20 can perform simple time code-based editing when connected to another DSR-20 or other similarly equipped VCRs/cameras like the DSR-30, DSR-200A or DSR-PD1. When using the FXE-120 or ES-3 EditStation System, the DSR-20 can serve as a feeder player.
- Has DV (IEEE1394) input and output. When connected to other DV equipped machines, the DSR-20 offers digital dubbing of video, audio and data, without any deterioration of image and sound quality. 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.

Record/Playback Functions
- Automatic repeat function for repeated playback. After reaching either the end of the tape, the first blank portion or the first index point, the DSR-20 automatically rewinds the tape then starts playing back the segment again.
- Power on recording/playback capability for unattended automatic VCR operation. When connected to an external timer and the VCR's TIMER switch is set to REC, the DSR-20 starts recording as soon as power is turned on. Likewise, when the TIMER is set to REPEAT, the VCR goes into Auto Repeat mode and starts playing back the moment power is turned on.
- In addition to Control L, the DSR-20 also incorporates a Control S and RS-232 interface for remote control operation. Basic VCR functions can be controlled from a PC via RS-232, while Control S allows control via the optional DSRM-10 Remote Control. In addition, with the Control S input/output connector, two or more (up to 50) DSR-20's can be daisy-chained and controlled from one DSRM-10 Remote Control.
- External sync input enables synchronized playback with other VCRs. Especially important in A/B roll configurations.

Conveniences
- The DSR-20 be powered by AC or DC. Ideal for mobile applications, the DSR-20 can be connected to a 12V power supply like a car battery or battery belt & powered via the 4-pin XLR DC input.
- Can perform searches for Index Points, which are recorded on the tape as "in-point" marks everytime a recording starts. The DSR-20 can also search for photo data recorded on a DVCAM cassette by the DSR-PD100/200A/300, or where the recording date has been changed.
- Supplied with the RMT-DS20 Wireless Remote for control of basic VCR functions. And again, when two or more VCRs are connected via Control S, they can be simultaneously controlled from one wireless remote by simply sending one command to the master deck.

DSR-30

DVCAM Digital VCR



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

- Records PCM digital audio at either 48kHz (16-bit 2 channel) or at 32kHz (12-bit 4 channel).
- Equipped with Control L, the DSR-30 is 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.

Panasonic

Broadcast & Television Systems

AG-EZ1 3-CCD Digital Video Camcorder

- Digital recording delivers 500 lines of horizontal resolution with no noise. (S/N ratio is 54dB).
- 10:1 power and 20:1 digital zoom lens. Both zooms are adjustable in four speeds (3.5-15 sec.) For extreme close-ups the lens can focus up to 1/4" from the subject.
- Two digital audio modes, choose between two-channel 16-bit stereo recording or two sets of 12-bit stereo.
- Huge 1.5" 180,000 pixel color viewfinder with 400 lines of resolution displays all functions on demand.
- Digital Electronic Image Stabilizer (DEIS) compensates for jittery video. Particularly effective when the digital zoom is employed.
- Variable speed shutter from 1/60—1/8000 of a second.
- Built-in SMPTE time code generator.
- Digital Photo-Shot lets you record a still-frame for six seconds, while audio continues as normal. 290 still pictures can be recorded on a single 30-minute tape. TopScan function finds any shot easily.

$1995

AG-EZ30 World's Smallest 3-CCD Camcorder w/IEEE1394 Interface

The AG-EZ30 combines 3-CCDs and the DV format to deliver a level of picture and sound quality that makes it one of the most advanced camcorders of its kind. Weighing just 1.5 lbs. this incredibly lightweight camcorder also incorporates a large 2.5-inch color LCD monitor and has a host of sophisticated auto functions as well full manual control when required.

- 3-CCDs (270,000 pixels each) with a large light-collecting area give the camera high sensitivity and wide dynamic range. Double-density pixel distribution and a gapless dichroic prism further ensure razor-sharp images and extremely faithful color reproduction.
- Selectable 2-channel 48 kHz/16-bit or 4-channel 32 kHz/12-bit PCM audio recording.
- Built-in stereo mic and external mic input as well.
- 180,000 pixel, 2.5-inch color LCD monitor. Also has a 0.5-inch color viewfinder.
- Digital Image Stabilizer for clear, shake and jitter free shots.
- 12X optical zoom as well as 30X and 120X digital zoom functions. Move from wide-angle to full zoom in 1.3 seconds allowing quick framing while in REC pause.
- Offers six digital effects: Wipe, Mix, Strobe, Gain-Up, B&W and still mode.
- Large-diameter focus ring enables a high level of focusing precision. A Multi-Function Push Dial allows easy setting of the 16-step iris, 5-step gain control (+12dB maximum) and 14-step shutter (up to 1/8000 second). Mic input level can also be set in steps (-20/-10/0/+3/+6 dB).
- Five program AE modes for shooting in a variety of different conditions. There is also a five-mode white balance: Set, Fluorescent, Auto, Indoor and Outdoor.

SONY

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.

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.

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anton bauer

HyTRON 50 Battery

Weighing a mere 31oz (880 grams) and packing 50 Watt-hours of energy - enough to operate a typical ENG camcorder for two hours, the HyTRON 50 is the most advanced lightweight battery in the industry.

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

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

QUAD 2702/2401

Four-Position Power/Chargers

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

FUJINON ENG LENSES

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

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

A15X8EVM Standard Zoom Lens

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

A20X8EVM

Standard /Telephoto Zoom Lens

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

A36X14.5ERD

Super Telephoto Zoom Lens

The longest focal length hand-held style lens to offer AT2 and Inner focus.

GLIDECAM INDUSTRIES

V-16 AND V-20

Camera Stabilization Systems

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

QUICK DIAL 74

sachtler

Tripods & Fluid Heads

DV Systems—Digital Support for Every Budget

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

DV2 System

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

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

DV4 System

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

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

DV6 System

Same as the DV4 PLUS —

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

DV6 System (061D) consists of:
Fluid Head (DV-6), Long Tripod (DA 75), floor spreader (SP 75)

DV8 System

Same as DV6 PLUS —

- Greater load capacity

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

DV12 *Same as DV8 PLUS —* • Great Load Capacity • Fits 100mm tripods

Vinten PRO-130 SYSTEMS

The Pro-130 tripod systems are perfect for today's on the move ENG cameramen. Lightweight, these systems have been specifically designed to provide a wider balance range to suit the latest DV, DVCPRO, DVCAM camcorder and camera/recorder combinations. All systems come complete with the PH-130 fluid pan & tilt head, choice of single or 2-stage ENG tripod, floor spreader and soft carrying case for easy transportation.
The PH-130 pan & tilt head incorporates Vinten's continuously variable LF drag system to provide smooth movement and easy transition into whip pan, together with a factory set balancing mechanism. Both the single-stage and two-stage legs are toggle clamp tripods are made from strong, durable aluminum with excellent height range capabilities.

VISION 8 AND 11 Lightweight Heads For the Future

Superbly engineered and designed for use in professional broadcast, educational and corporate productions, the Vision 8 and Vision 11 simultaneously provide the ultimate in lightweight support with exceptional robustness— even in the toughest shooting conditions.

Vision 8 Pan & Tilt Head

The incredibly lightweight Vision 8 provides smooth shots, whip pan action and quick set-up while supporting up to 23 lbs. Add the single-stage carbon fiber tripod and you have the lightest combination possible for that all important event— without sacrificing the reliability and robustness that you require.

- Simple external adjustment for perfect balance over the full 180° of tilt
- Infinitely variable drag with proven LF technology
- Calibrated drag knobs
- Flick on/flick off Pan and Tilt brakes
- Single rotation counterbalance
- Leveling bubble standard
- Standard 100mm leveling ball • Lightweight, only 5.9 lbs.

Vision 11 Pan & Tilt Head

Slightly heavier the Vision 11 offers additional capacity (up to 29 lbs.) plus it has illuminated controls to allow fast camera balancing and leveling even in poor lighting. Combine with a two-stage carbon fiber or aluminum tripod and you have a package with the biggest height adjustment yet the smallest to carry. Ideal for all ENG assignments.

- Simple external adjustment for perfect balance over the full 180° of tilt
- Infinitely variable drag with proven LF technology
- Back-lit and calibrated drag knobs
- Flick on/flick off Pan and Tilt brakes
- Digital counterbalance readout
- Illuminated leveling bubble • Standard 100mm leveling ball
- High load to weight ratio • Lightweight — only 6.2 lbs

QTV

15" and 17" On Camera Prompters

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

MVP-11

The MVP-11 incorporates QTV's latest design technology for studio and EFP prompting. The MVP-11 features the most advanced circuitry for a prompter of this size. Fully self-contained, it offers high brightness and high resolution that ensures unmatched ease of readability for the speaker. The MVP-11 is powered by AC or DC current utilizing the Sony type NP-1 or Anton Bauer 13-14 volt batteries, allowing on-location as well as studio prompting. It weighs only 19 lbs. including the quick release roller plate for fast mounting and balancing. Below the lens mounting is utilized resulting ideal counter balancing for ease of operation.

MVP-9 Mini Videoprompter

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

PROFESSIONAL VIDEO TAPES

QUICK DIAL 71

FUJI

Professional Grade VHS

PG-30	2.39	PG-60	2.59	PG-120	2.79

Broadcast Grade VHS Box

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

H471S S-VHS Double Coated

ST-30	6.79	ST-60	7.49	ST-120	7.69

M221 HI B Double Coated

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

M321SP Metal Betacam (Box)

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

DP121 DVC PRO

12M (Med.)	7.49	23M	8.79	33M	10.99
63M	19.99	64L (Lg.)			22.50
94L	31.99	123L			39.99

maxell

Hi8 Metal Particle (XRM)

P6-120 XRM	6.99

Broadcast Quality Hi8 Metal Particle

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

P/I PLUS VHS

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

HGX-PLUS VHS (Box)

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

BQ Broadcast Quality VHS (Box)

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

BQ Professional S-VHS (In Box)

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

Betacam SP

B30MSP	14.49	B60MLSP	21.99	B90MLSP	31.99

Panasonic

Mini DV Tape

AY DVM-30	6.49	AY DVM-30 (10 Pack)	ea. 5.99
AY DVM-60	7.99	AY DVM-60 (10 Pack)	ea. 7.49
AY-DVM80			16.99

DVCPRO

AJ-P12M (Medium)	6.99	AJ-P23M	9.99
AJ-P33M	11.19	AJ-P66M	19.49
AJ-P64L (Large)	20.99	AJ-P94L	30.99
AJ-P126L			44.99

SONY

Hi-8 Professional Metal Video Cassettes

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

PR Series Professional Grade VHS

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

PM Series Premier Grade Professional VHS

T-60PM	3.99

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

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

MQ Master Quality S-VHS (In Box)

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

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

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

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

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

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

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

BCT Metal Betacam SP Broadcast Master (Box)

BCT-5M (small)	12.29	BCT-10M (small)	13.29
BCT-20M (small)	13.99	BCT-30M (small)	14.99
BCT-30M (small) (50 Pack)			ea. 13.99
BCT-30ML	21.49	BCT-60ML	23.49
BCT-9DML			34.99

Mini DV Tape

DVM-30EXM w/Chip	14.99	DVM-60EXM w/Chip	17.99
DVM-30EX "No Chip"	12.99	DVM-60EX "No Chip"	13.99
DVM-30PR "No Chip"	9.99	DVM-60PR "No Chip"	10.49

Full Size DV Tape with Memory Chip

DV-120MEM	25.89	DV-180MEM	29.99

PDV Series Professional DVCAM Tape

PDVM-12ME (Mini)	15.25	PDVM-22ME (Mini)	16.50
PDVM-32ME (Mini)	17.25	PDVM-40ME (Mini)	18.49
PDV-94ME (Standard)	33.49	PDV-124ME (Standard)	37.99
PDV-184ME (Standard)	44.95	PDVN-64N	24.95

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NewTek

Calibar 3-Oz. Pocket-Sized Test Generator

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

$349

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

CHYRON PC-CODI & PC Scribe

Text and Graphics Generator and Video Titling Software

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

PC-CODI Hardware:

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

PC-Scribe Software:

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

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

TRUEVISION/Avid

TARGA 1000/MCXpress NT

Professional Video Production Workstation

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

TARGA 1000 Features:

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

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

MCXpress Features:

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

TARGA 1000/MCXpress Turnkey Systems:

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

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

KNOX VIDEO

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

Video/Audio Matrix Routing Switchers

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

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

LEADER

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

5860C WAVEFORM MONITOR

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

5850C VECTORSCOPE

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

5100 4-Channel Component / Composite WAVEFORM

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

5100D Digital Waveform/Vectorscope

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

5870 Waveform/Vectorscope w/SCH and Line Select

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

5872A Combination Waveform/Vectorscope

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

5864A Waveform Monitor

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

5854 Vectorscope

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

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

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Classifieds Help Wanted

MASTER CONTROL OPERATOR - Applicants will be considered who have previous experience as Master Control Operator. Must be familiar with affiliate operations, satellite and microwave equipment. Knowledge of NTSC standards required. Must be willing to work nights/weekends and overtime as needed. To apply, send cover letter and resume to Human Resources Director, ABC25 WJXX, Inc., 7025 A.C. Skinner Pkwy, Jacksonville, FL 32256. Fax (904) 332-2527. No phone calls accepted.

KU-BAND TRUCK OPERATOR: Boston's finest production and transmission facility is looking for an experienced SNG Truck operator. We are presently building a state of the art Ku-band uplink vehicle with digital and analogue capabilities. We are looking for experience, client skills and a proactive personality. This is a unique opportunity for the right player to become a part of a great team. References required. Fax cover letter and resume to 617-926-1794 or call 800-452-5565.

Classifieds Help Wanted

TURNER STUDIOS

ENGINEERING/MAINTENANCE

Turner Studios is building a world-class digital post/production facility and has the following positions available:

MANAGER OF STUDIO ENGINEERING
Min. 5 years exp. in managing live television production events.

MAINTENANCE ENGINEER - EDITORIAL
Maintenance in an edit-support role. Tape maintenance exp. desired. Troubleshooting to component level. Min. 5 years exp.

MAINTENANCE ENGINEER-GRAPHICS/EFFECTS
Maintenance exp. in graphics-related television environments. Computer networking exp. a plus. Troubleshooting to component level. Min. 5 years exp.

Come be a part of our team!
Kevin B. Shorter
Vice President of Engineering
Turner Studios
1050 TechWood Drive NW
Atlanta, GA 30318

MAINTANCE ENGINEER: WAND-TV in Decatur, Ill. needs to hire a staff engineer with RF knowledge and UHF experience. John Redman our transmitter and electrical expert is retiring. We are a twenty four hour ABC station in the very center of Illinois. The person we hire would be at the transmitter a few times a week and the studio with the rest of the maintenance staff the rest of the time. We have a Harris BT110U transmitter and would expect the person we hire to be able to troubleshoot, repair to the component level, and responsibly work under pressure., being on call. We would expect that the individual would be capable of migrating their expertise to the coming digital world. This is a full time job with company benefits. Send resume to WAND-TV, 904 Southside Dr., Decatur, Il. 62521, attn: Chief Engineer. We are an EOE employer.

VIDEO-EIC for new corporate all digital broadcast facility in Manhattan. Administrative and hands-on skills for all technical functions. Requires a broad range of technical experience and the ability to function in a corporate environment. Start August 1. Send detailed resume and references to PO box 248, Tuckahoe, NY 10707.

AUDIO TECHNICIAN: position at NASA/Dryden, Edwards AFB, CA. Capable of operating and maintaining multi-channel mixing boards, various microphones (including wireless) and PA amplifiers, audio cassette decks, portable audio systems, various hand held radios, radio paging equipment, intercom systems. Capable of producing studio quality products. Troubleshoot to a component level. Good written and oral communication. 6-10 years experience. EOE. Send resumes attn: (BCVT) SPARTA, Inc., 244 E. Ave. K-4, Lancaster, CA 93535 Fax #661-723-1379.

BROADCAST TECHNICIAN: Requires a minimum of 5-yr. experience working at a major market TV broadcast facility. Must possess the 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.

REGIONAL SALES MANAGER: TeraNex, Inc.: TeraNex is a provider of high performance image processing solutions for the most demanding high definition and Digital Television requirements. TeraNet products will market the most advanced format & standards conversion, and compression pre-processing products. Regional Sales Manager Job requires 5+ years of Direct Sales Experience to the Broadcast and Post Production Communities. Must have prior experience in managing System Integrators and Independent Representatives Strong understanding of computer technology. Requires excellent communication and presentation skills. Proficiency in MS Office. Competitive Salary and Benefits. Positions available in New York, Los Angeles, and Chicago. Send resume and salary requirements to Blair Johnson, TeraNex, Inc., 7800 Southland Blvd., Suite 250, Orlando, FL 32809 or email to Blair Johnson @Teranex.com.

MASTER CONTROL SUPERVISOR: wanted for HD/Digital facility. Responsibilities include development of digital/HDTV production facility, preparing schedules, training, quality control and daily operations. Qualified candidates must have a solid technical background, minimum of five (5) years master control switching experience. Bachelor's degree in related field preferred. Reply to Blind Box. Personal/Confidential, Classified Ad Coordinator, Broadcast Engineering Magazine, Dept. #793, 9800 Metcalf, Overland Park, KS 66212-2215.

ASSISTANT CHIEF ENGINEER: KTEN-TV, an NBC affiliate in the Sherman, TX/Ada market, seeks a full time Assistant Chief Engineer. Candidate must have a minimum of one year experience as an assistant chief engineer or equivalent experience. Candidate should posses working knowledge of transmitters, microwave, digital storage and routing, station operations including; master control, production, traffic and news. Above average computer and technical skills are necessary. Candidate must be able to repair all electronic studio and transmitter equipment. Reply to: Chief Engineer, KTEN-TV, PO box 1068, Denison, TX 75021. KTEN-TV is an Equal Opportunity Employer.

MAINTENANCE ENGINEER: NBC affiliate in E. Peoria, IL has an opening for an experienced Maintenance Engineer. Applicant should have strong component level troubleshooting skills with an eye for detail and a Can-Do attitude. Responsibilities include the installation and maintenance of all facility equipment including Avid editing, Phillips switching, Sony LMS, and JVC and Sony VTRs and cameras. Knowledge of P.C.s and networking a plus. UHF RF background desired. A minimum 5 years of broadcast maintenance experience is required. SBE certification a plus. This is an IBEW union position. Send resume to: WEEK-TV, Dennis Riley, 2907 Springfield Road, E. Peoria, IL 61611, Email: 309-698-9335

Classifieds Help Wanted

BROADCAST VIDEO TECHNICIAN: position at NASA/Dryden, Edwards AFB, CA. Capable of operating and maintaining at least three of the following: 3 chip ENG cameras, Beta SP video tape machines, non-linear & linear edit systems, microwave and other broadcast video support equipment, i.e. A/V routing switchers. Troubleshoot to a component level. Familiar with utilizing CAD programs. Good written and oral communication. 6-10 years experience. EOE. Send resumes attn: (BCVT) SPARTA, Inc., 244 E. Ave. K-4, Lancaster, CA 93535 Fax #661-723-1379.

RF DESIGN ENGINNER POSITION: Location: Colorado or northern California (your choice) Description: Design and development of next generation RF products, including Apex derivatives and new low power platform designs. Coninually improve product performance as well as design spin-off products to meet new customer's needs. Provide technical supervision to support personnel and be responsible for the administration duties of a small group. Handle complex engineering assignments and field application support with little supervision. Work with Reliability, Quality, Test Engineering and customers as necessary. Experience/Skills Required: BSEE and/or equivalent years of experience in RF design engineering; prefer 5+ years of related design engineerin experience; knowledge in process design; area of expertise is generally betweeen and including AM and FM broadcast bands (500kHz - 107MHz) and TV broadcast bands (50MHz - 800MHz); ability to communicate in speech and writing; experience in Type II and III level projects; good understanding of ECO process; RF product knowledge. Salary: wide open Contact: Charlie Wirt, phone: 512.255.5518 or email resume to: charliejazz@yahoo.com

KNVA-TV seeks highly motivated Master-Control Operator to fill overnight position. Experience in Television is preferred, computer experience is a must. Applications will be accepted until June 27, 1999. Send your current resume to 908 West MLK, Austin, Texas. 78701. E.O.E, no phone calls please.

TURNER STUDIOS

DIRECTOR OF TECHNICAL OPERATIONS

Reports to VP of Engineering for Turner Studios. Responsible for technical readiness of Turner Studios. Must have proven engineering management skills and ability to consolidate varied Turner Studios Engineering departments and activities. Ability to manage an overview of Turner Studios Engineering global needs, and present strategic and unified solutions. Must have the ability to create engineering project budgets and timelines, and track related accounting details. Experience in television systems design/installation, and television systems engineering/maintenance a must.

Minimum of five years experience at network level television engineering or post/production engineering, with a minimum of a two-year associate degree in electronic technology or equivalent. Must be a resourceful self-starter with ability to make decisions. Must have ability to find creative solutions to television problems. Must possess good organizational skills and be capable of reviewing and supervising management-level engineers.

Please send all contact information to:

Kevin B. Shorter
Vice President of Engineering
Turner Studios
1050 Techwood Drive NW
Atlanta, GA 30318

CHIEF ENGINEER, KETN - Kern Educational Telecommunications Network is a unique and highly successful operation that offers a full spectrum of services including broadcast television (PBS CP), radio, satellite network and production. We are seeking a hands-on Chief Engineer to plan and supervise the operation, maintenance and repair of TV facilities, transmitters, microwave, satellite uplink, ITFS, etc. Experience with digital video systems and DTV a plus. Licenses or certificates: FCC Commercial General Class Radiotelephone Operator's or FCC Restricted Radiotelephone Operator's Permit; SBE desirable. BS degree in electrical engineering, plus four years experience in broadcast engineering; or eight years experience in broadcast engineering. One year supervisory experience. Salary $4848-$5875 per month. Maximum entry level $5337. Filing deadline 8/9/99. To request an application, contact Personnel Services, Kern County Supt. of Schools, 1300 17th St., Bakersfield, CA 93301, phone (661) 636-4747.

Interested in
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If you have incredible sales talent and drive, we have two unique opportunities. As **National Accounts Manager**, you will use radio knowledge, technical ability, and consultative sales approach to market Broadcast Electronics' industry leading products to the top companies in radio. As **Senior Account Manager,** you will use your radio expertise to sell directly to stations in your exclusive territory. You will be a high profile member of our overachieving sales team. Your compensation will be among the best in the industry, and your effort and result will earn you the opportunity to advance as we grow.

Fax Res & Cover to VPSM
603-794-8494

TELECINE MAINTENANCE ENGINEER - Four Media Company, a leader in the post-production industry is seeking a telecine engineer for the graveyard shift. Experience in telecine systems, Rack-Cintel, Ursa Diamond. Duties include: Hands-on maintenance of the telecine systems and session support. Excellent benefits package. Fax resume to (818) 840-7389.

Classifieds Help Wanted

SONY

Contract/Consultant Opportunities

Always wanted to work with an undisputed World Leader? Here's a chance to work with the best in the business. Opportunities available immediately for state-of-the-art turnkey broadcast production and play-out projects. Requires full time presence at Sony's facilities in San Jose, CA. to start. Travel to job site will be required, especially during the installation and testing stages of the project.

Sr. Level Video Systems Design Engineer

Job Code: BEM-LM-7704233

Job requires 5+ years' professional exp in the design, operation, testing and maintenance of large scale digital video and audio production and broadcast facilities. Job duties focus on the design of floor plans, equipment rack and patch bay elevations; and signal flow diagrams. Must be computer savvy, have in-depth knowledge of MS Windows and Excel, and have a strong electronics background. AutoCAD, LAN/WAN, ATSC, MPEG-2, AC-3 and video server experience a plus.

Project Managers

Job Code: BEM-DO-7704233

Job duties focus on the management of resources to execute fully-integrated broadcast systems. Must complete projects on time and within budget using your 5+ years' exp in project management in broadcast/production systems.

Please forward your resume, indicating job code, to: Sony Electronics Inc., 3300 Zanker Road, MD #SJ2C2, San Jose, CA 95134-1901. Fax 408/955-5166 or e-mail sj_jobs@mail.sel.sony.com. EOE/M/F/D/V

www.sony.com/jobs

ENGINEERS

CNN
THE WORLD'S NEWS LEADER

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
TBS is an equal opportunity employer

WDAY-TV: Has an opening for a Broadcast Engineer. The position is for a technician in electronic repair. Experience in the field of broadcasting preferred. Person must have: 1) Minimum 2 years degree or experience in electronics. 2) Must be good with computers. 3) A good driving record. Send resume to Tom Thompson at WDAY-TV, Box 2466, Fargo, ND 58108 or Fax 701-241-5368. E.O.E.

BROADCAST MAINTENANCE TECHNICIAN: Requires self starter having experience with Beta, VPR-3, PC's and other studio equipment maintenance. Experience with microwave, satellite, VHF & UHF transmitters, CADD ability and FCC General Class License preferred. Contact Charles Hofer, Manager of Engineering Maintenance, WTNH-TV, 8 Elm Street, New Haven, CT 06510. No phone calls please. EOE.

Broadcast Engineers

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 systems and master control environment. Must be able to work on a rotating shift schedule. **Position Code SME**

IT ENGINEER- Must be able to install and maintain broadcast computer based equipment. Applicants should have a basic knowledge of video/audio systems in a television environment. Experience working with Tektronix Profiles, Avid Media Composer and HP Mediastream systems is essential. Must be proficient with PC hardware, server and network architecture. Possess knowledge of Newsroom computer systems and non-linear editing. Expertise in various operating systems for MAC and PC based platforms. Please include salary history/requirements. **Position Code ITE**

RF MAINTENANCE ENGINEER- Must be able to perform the following duties: install and maintain RF related equipment in a studio, transmitter and remote site environment. Must be able to work on VHF/UHF solid state transmitters and all associated transmitter equipment. Ability to align and repair microwave TX/RX and all wireless equipment such as microphones and IFB. Knowledge of FCC rules and regulations. You must possess knowledge of analog/digital systems and a minimum of five years broadcast television experience. Applicants must be able to do component level repair and work well under pressure. **Position Code RFM**

Candidates should have an engineering degree or equivalent technical training. SBE/FCC certification is 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 (with position code) to **Kurt Hanson, WABC-TV, 7 Lincoln Square, New York, NY 10023.** No telephone calls or faxes please. We are an equal opportunity employer.

abc 7

Check out the *Broadcast Engineering* web site for career opportunities!
www.broadcastengineering.com

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EOM

Digital international

BY PAUL MCGOLDRICK

It used to be that you could go to different cities in the world and find different stores with unique items; nowadays everything is everywhere. Not just fast food joints, but major stores are repeated anywhere there are customers with money to spend. So, in the same pattern of proliferation, I shouldn't have been surprised at seeing the television programs overseas in the last couple of years. While I was sitting in relations' houses in the U.K. recently, the kids in one house were watching MTV while the 16:9 receiver in another was displaying digital terrestrial broadcasting.

While we might be jealous of the digital status quo already attained in the UK, it doesn't mean user penetration is high enough for the program suppliers. The most noticeable thing about the fight to increase the number of customers, and the competition between different delivery systems in the UK, is the battle is focusing mostly on the set-top box (STB).

Digital delivery

While I was over there, Rupert Murdoch, a veteran of monopolies, threw a major wrench into the equation. He is now giving away the STB instead of selling it for about $320. BSkyB (Sky Digital) offers the normal terrestrial channels free and has different packages up to a full-blown 200 channels. Maybe this loss leader will persuade more of the 3.5 million existing Sky subscribers (analog) to go digital rather the only 500,000 so far. Yes, satellite antennas are everywhere but mostly, it seems, on lower-cost housing (although I did notice one discreetly mounted in Windsor Castle).

One of the other delivery systems is a UHF terrestrial transmission system offering 30 channels received on the same antenna the customer previously used for off-air analog. ONdigital has the benefit of being really easy to switch service to — but with a more limited program choice. They do have the exclusive rights to ITV2 (the second commercial program network) which started last month. That may have something to do with the fact that ONdigital is co-owned by ITV giants Granada and Carlton. The STB for ONdigital sold for $320 but is now free — to match BSkyB.

The third delivery system is cable. There are three major vendors but only one has an operation in each city that is wired. Although the systems are 50-channel analog at present, they are all converting to digital before the end of 1999. Program numbers will rival Sky and there will be no equipment to buy. One little extra thrown-in is a free telephone line on the cable — something that costs $170 a year from British Telecom. That probably explains why some of my relations have gone to the cable solution.

Can you imagine trusting your telephone line in downtown America to your local cable company? In my case there are four splices in the cable before it even gets to the pole across the road; most of the equipment was installed nearly 30 years ago and I don't trust them for my video. I certainly wouldn't rely on them for a 911 call. Cable is available to about 11 million homes in the UK with about 3 million signed up. The three largest vendors are CableTel, Cable and Wireless, and Telewest. AT&T is a player with C&W, while Microsoft has recently put over $3 billion into Telewest in its continuing thrust to own a significant part of the cable business worldwide.

Committed to digital

Despite the confusing nature of the offerings in the UK, it shows there is a commitment to digital, something we have not seen over here. While the nature of the digital offerings makes no pretense to be high definition today, there are plans for such upgrades. Must carry is not an issue; all the vendors know that they have to carry all the existing terrestrial channels, otherwise they would not get any subscribers. The viewer base in the UK would not tolerate being unable to easily receive its daily dose of programs such as *Coronation Street* and *EastEnders*. Even the programming generated for Sky's channels are carried by the other systems. Can you even imagine that scenario over here?

And there is another alternative in the UK that simply has never existed as a culture in the U.S. Since the restart of television after WWII it has been possible to rent televisions in the UK. It allowed people to obtain receivers when they were financially unable to, and it significantly helped accelerate the conversion of viewers to color when those services started at the end of the '60s. Viewers unsure about the best digital supply chain or worried that there might be an ultimate winner can simply rent the necessary equipment for about $3 a month.

The ultimate winner will depend on program content. Whether it is sports or pay-for-view, the viewers will go for the system that delivers the programs they want. Have you heard me say "Technology does not sell" before? What is noticeably absent in the U.K. and other countries is a real interest in home theater arrangements. Pumping "CD" quality out of the STBs is a wasted exercise at the moment, even in those homes that fully embrace digital. That psyche I do not understand as I find the experience of audio in the new systems to be paramount to enjoying the program material. ■

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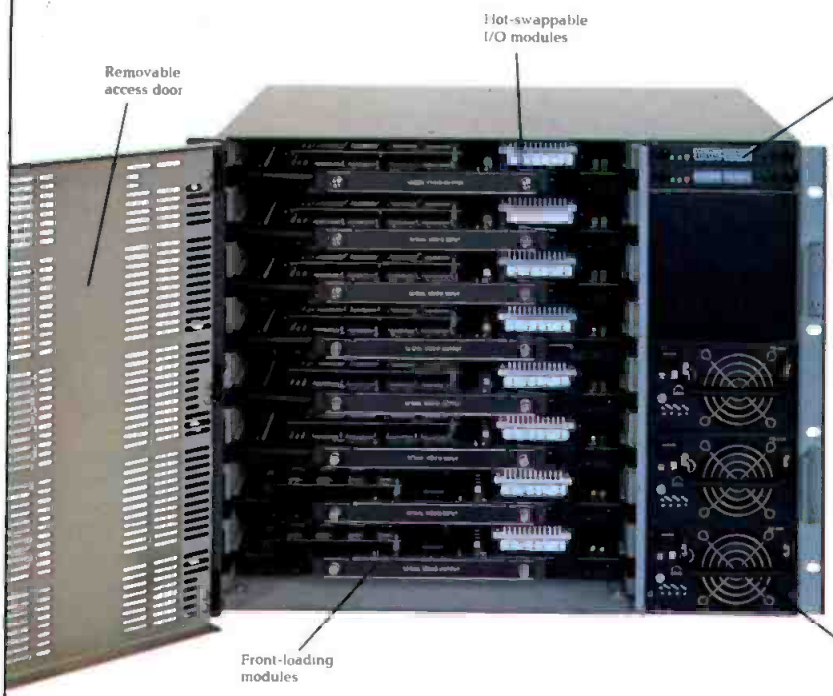

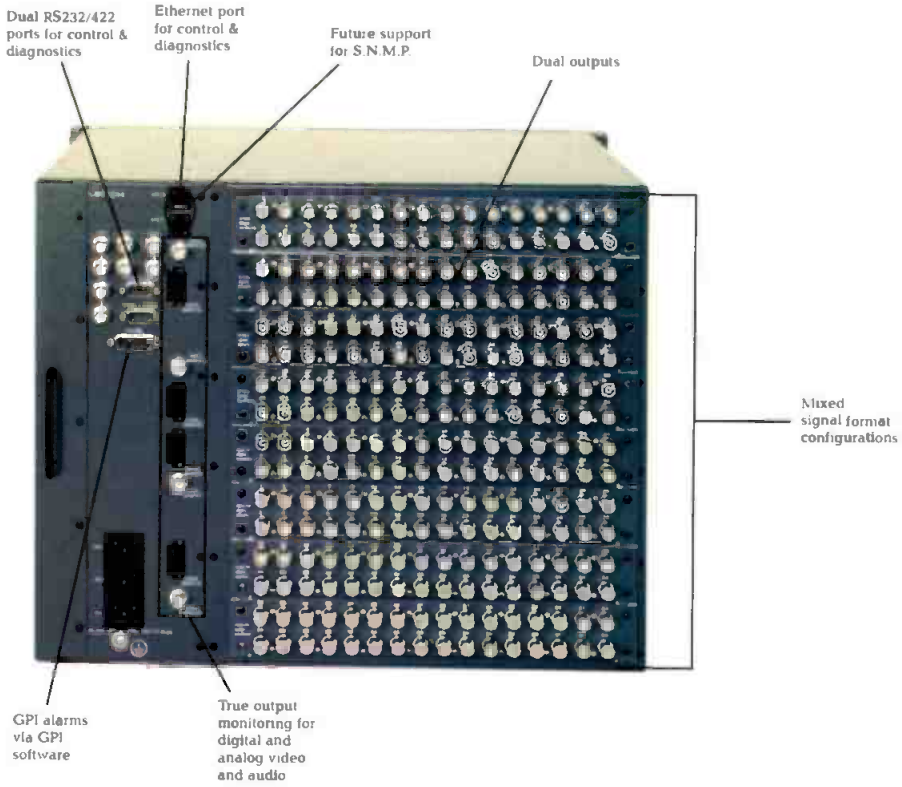

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