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SEPTEMBER 2000

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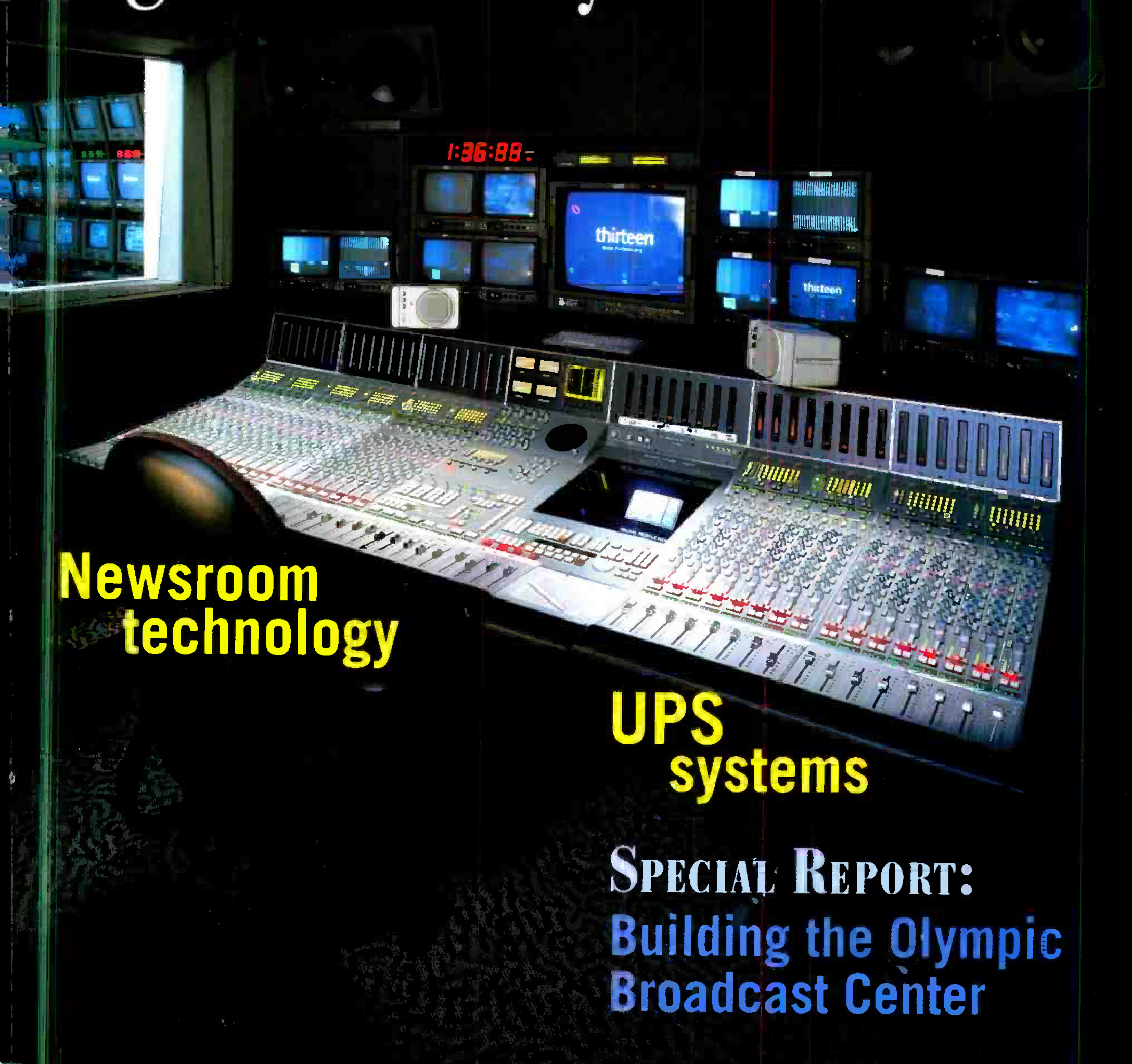
THE JOURNAL OF DIGITAL TELEVISION®

Digital Audio Systems



Newsroom technology

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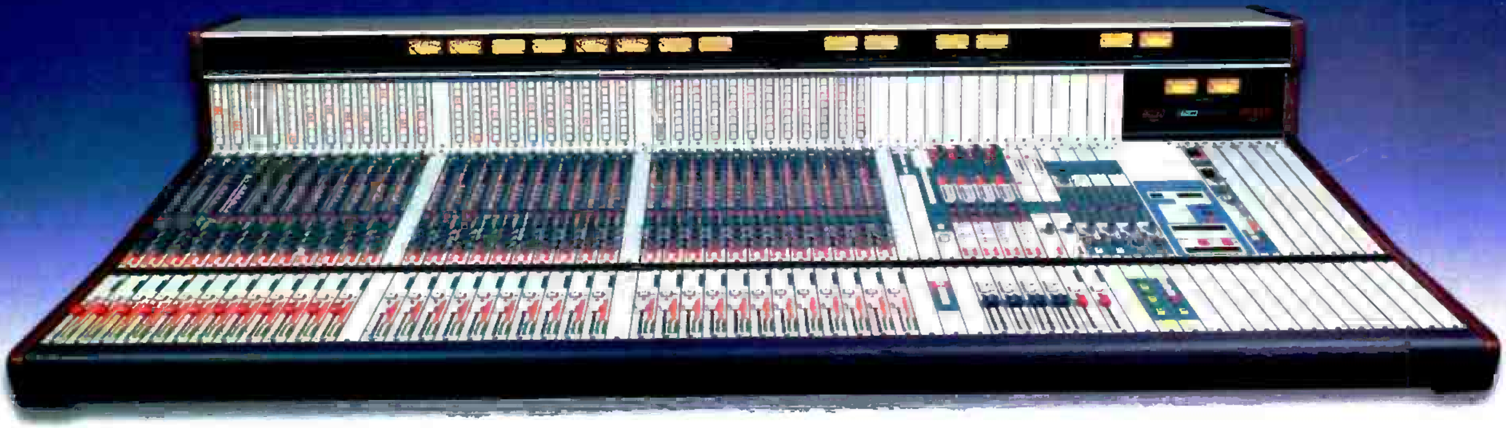
LIVE AUDIO for TV



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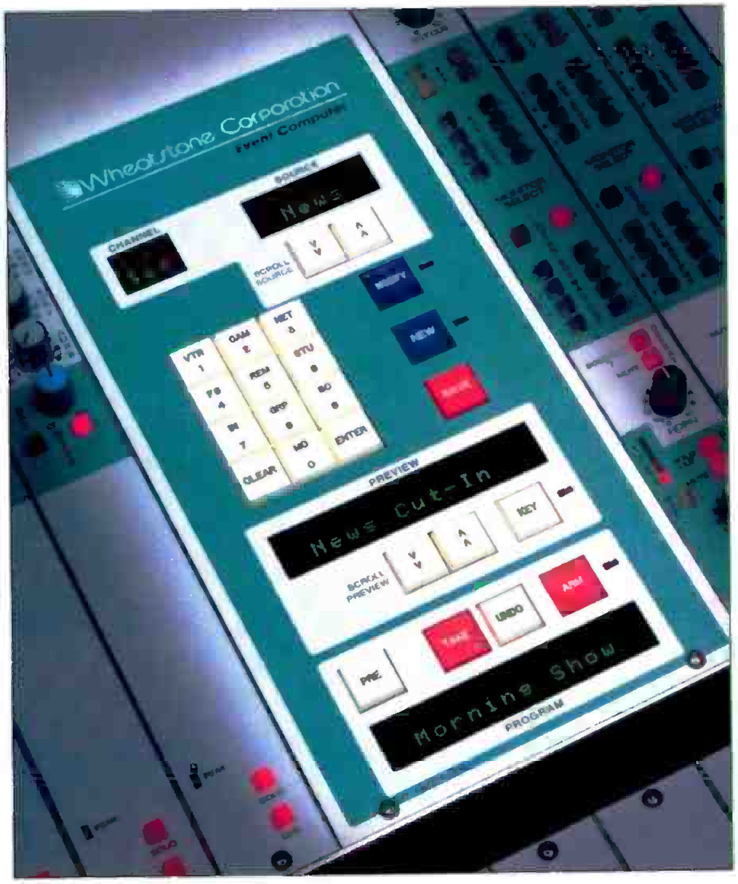

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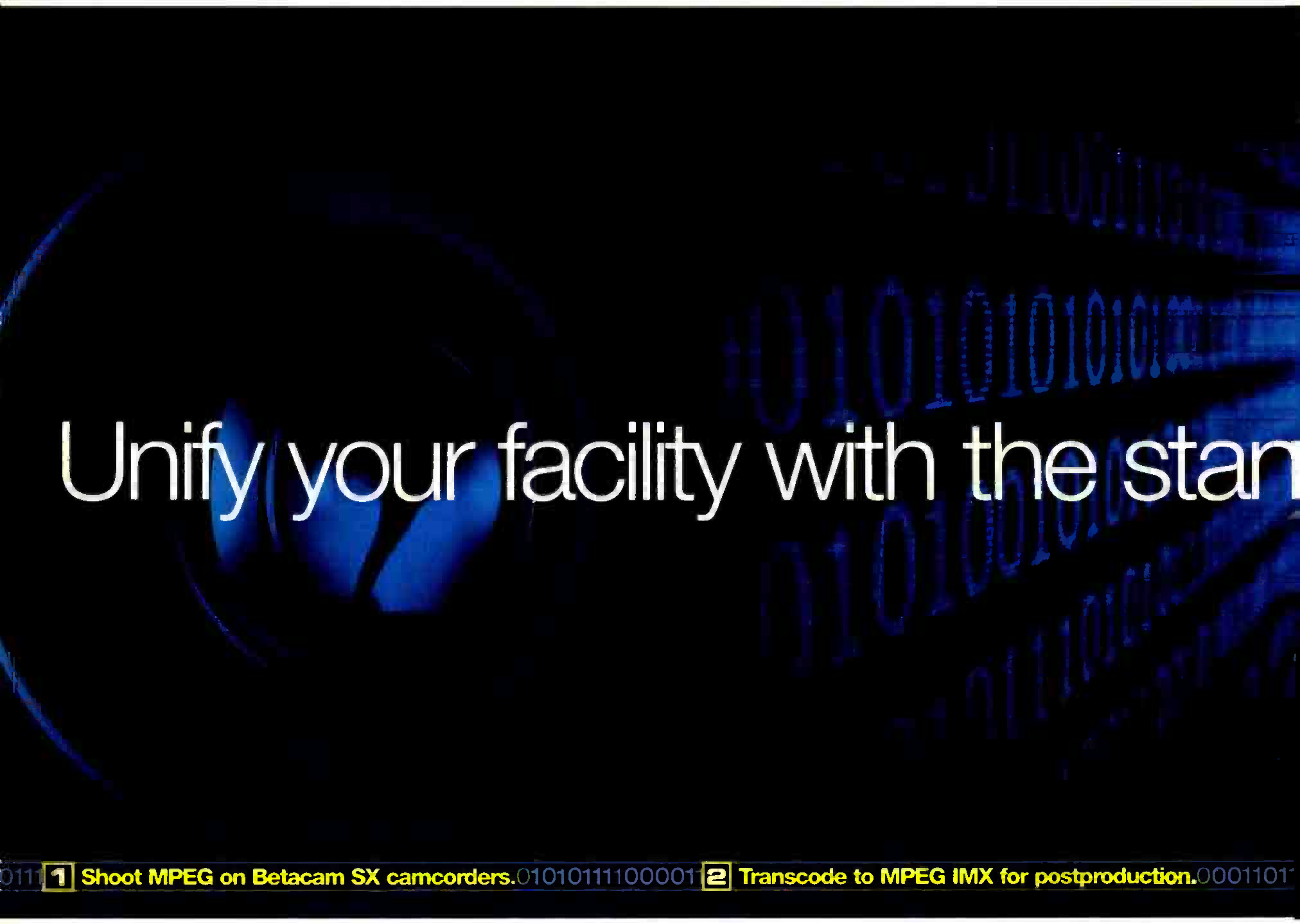
MPEG IMX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September 2000
Volume 42
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IN THIS ISSUE

Features

Beyond the Headlines

Digital Handbook

(continued on page 8)

Your crew gets the shot first.

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before your editor leaves the edit bay.

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ON THE COVER: *Post Production Suite at KRIV-TV Houston, TX. The room provides a full range of post production features and capability for the station's staff. Photo credit: Aker/Zvonkovic Photography, Houston, Texas.*

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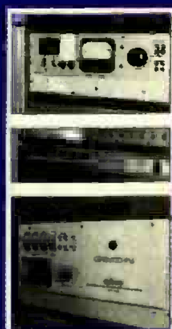
Questions? Contact:

Jim Saladin
jim_saladin@intertec.com
913/967-1905 fax

FREEZE FRAME

A look at the technology that shaped this industry.

Do you remember?



How's your audio history? The art and science of audio processing advanced greatly in the late '70s and early '80s. While the roots of the technology lay in tubes, solid-state devices inspired designers to create new products. Can you complete the following product names of these famous audio processing devices?

Gates _____ Devil

CBS _____

Orban _____

You must get all three answers correct to be in the drawing for a *Broadcast Engineering* T-shirt. Submit entries to: brad_dick@intertec.com by Oct. 30.

Editorial

Finishing is enough

I've been to the "top of the mountain." Pike's Peak to be specific. You see, I am one of those insane people who run marathons. For those unfamiliar with the sport, a marathon is 26.2 miles. Last month's marathon took me to the 14,110-foot summit of Pike's Peak and back down again.

This year's race up the mountain turned out to be one of those times where nature (your body) reminds you that your previous personal best times are history. While I've completed the race five previous times, that experience counted for little this year.

At 7 a.m. the starting gun sounds and we begin jogging up Manitou Avenue towards the Cog Railway and onto Barr Trail. The first mile begins a long process of separating the real runners from normal folks. The starting elevation is 6300 feet, and the trail climbs to 9000 feet in only four miles! And this is only the second hardest part of the race.

The toughest part of the race, emotionally and physically, is the last mile just prior to the summit. If you're a typical eight-minute per mile runner, this last mile to the peak will take you more than an hour. In fact, it takes most runners as long to reach the halfway point in this race as it would for them to finish a typical marathon.

I've always prided myself on being fairly fast, but this year the other runners seem to be getting faster. One of my first clues was verbal. By mile two, there appeared to be a never-ending chain of people telling me "on your left" as they passed. I got so tired of hearing those three words I wanted to scream. I would have too if I'd just had enough breath. In previous races, I was the passer. This year, I was the passee.

For the first two hours of the race, I tried to comfort myself that those passing me were younger. I just kept saying to myself, "They're younger than me. They're younger than me." Then the runners got older, more my age. By mile five, the people passing me were, how shall I say it, *old*. And then, there were the women who'd been passing me from mile one. It's okay when they're 20, but as that gray-haired lady (Gawd, she must have been 60) passed, reality settled in. This was not going to be a new personal best. It was looking like a new personal worst.

By mile eight, I was reduced to a rapid walk. I took some solace that no one else was running either. Okay, so maybe some did walk a little faster, but the number of fellow runners crying "on your left" became small. By the time I had reached the upper face of the mountain, I was 12 miles into the race and at 13,000 feet. Running at this altitude means just moving. If you're moving, you get credit for running, but no one really is.

After about two and a half hours, if you're among the faster runners, you're within a mile or so of the summit. Shouts of "runner" are heard as fellow runners warn of an approaching racer. That means a runner is about to pass you going down the mountain.

Here you are, feeling like death warmed over. You can barely breath. You're cold, exhausted and your legs feel like tree stumps. You're only one mile from the top, but it's well over an hour away. Now you hear "runner" and you realize here come the race leaders. These guys have already reached the summit and are coming back down. They will finish the race three to five hours ahead of you!

Believe me, it's a humbling experience.

As I leaned into the rocks making way for these guys careening down the mountain, I was reminded I'd never be (or ever was) in their class. I'd never come across the finish line first, and I'd probably never again have a sub six-hour Pike's Peak marathon.

But you know what? When I crossed that finish line, some seven and one-half hours after I'd started, I was handed the same medal they gave the first guy. It said "Finisher" and that was enough for me.

Brad Dick

Brad Dick, editor

Send comments to:
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Solving the Digital Puzzle

Miranda

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Reader Feedback

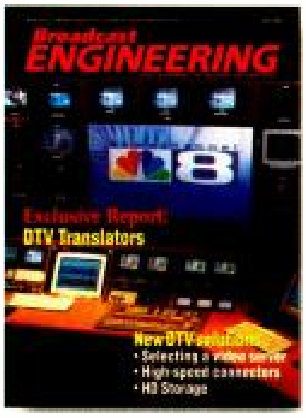
Format battles

Hi Paul,

Just a quick comment on your article that mentioned lip-sync problems on certain DVDs. I have yet to see this problem and I can't believe how good the video quality is on DVDs. As owner of both a laser disc player and an S-VHS video recorder, I can say that these formats are not even close to the quality of DVD. Laser Disc video artifacts almost always made me not want to watch the film, and S-VHS is a pain. It works, but I can tell the difference between the source and the copy. Surely you were not serious when you said LD and S-VHS were ahead of their time, since the formats are clearly inferior to DVD. If you were serious I would like to see a demonstration of your superior LD and S-VHS format. I don't think you can pull it off.

Best regards,

WAYNE SONNYLAL



Paul McGoldrick responds:

I did not intend to even mildly suggest that either LD or S-VHS approach the quality of DVD. DVD is absolutely staggering compared to the quality of what has preceded it. But at the time they were released both LD and S-VHS were a great deal better than VHS. LD had support from the content industry but failed to get the support of the general consumer. S-VHS failed to get the support of the content providers, and the consumer was turned off by the higher price of the decks and tape. The latter was allowed because of the stupid trick played on the tape carrier preventing VHS/S-VHS tape compatibility — unless you knew the trick.

I would certainly not go back to either product.

Thanks for reading.

Conditional access for OTA

Dear Mr. Gilmer,

I found your article, "Conditional access for DTV" interesting and would like to know how this applies to OTA broadcasting. Could you tell me how to obtain more information on building a simple CA system?

Best regards,

TINA TAN

Brad Gilmer responds:

Thank you for your inquiry regarding conditional access for DTV. The general situation is this: About eight months ago, the ATSC adopted a standard for Conditional Access. The standard includes use of the National Renewable Security Standard or NRSS. NRSS allows the use of both SmartCards and PCMCIA cards. You can download a copy of the standard at www.atsc.org/Standards/A70/A_70_with_Amendment.doc.

The scrambling methodology is proprietary, and varies from manufacturer to manufacturer. The good news is that these systems may provide new revenue streams for the broadcaster. The bad news is that these proprietary systems are not interoperable, and it is likely that separate SmartCards or PCMCIA cards would be required for each vendor.

As far as I know, there is no implementation of this standard available in the market yet. It is difficult to find in-depth information on how these security systems work, for obvious reasons. I recommend you contact the manufacturers directly. It is unlikely you will receive more than a very high-level explanation.

More Web information

Dear Editor:

Your April 2000 issue was excellent and informative. Articles such as "Video over IP," "Understanding ATM," and "Weather graphics systems" were extremely useful for a television engineer like me. I'm looking forward to more coverage on Webcasting and getting TV signals onto the Internet. Will you have some?

Warm regards,

P. MURALI
STATION ENGINEER
DOORDARSHAN, INDIA

Editor responds:

Thank you for your letter. Stay tuned, you'll be seeing a lot more coverage of Web and streaming issues in upcoming issues of Broadcast Engineering. *Recent streaming/web articles were included in the August issue and this September issue, and a "how to" piece is coming up in December. You can access previous issues on our website at: www.broadcastengineering.com.*

Last month's Freeze Frame

In June, we asked readers to identify the three portable cameras and recording formats introduced at the 1981 NAB convention. The RCA Hawkeye was given as a hint. What were the other two? It was a tough question as no one supplied a complete answer. For you historians, here's the answer.

Ikegami demonstrated the CV-One, a 1/4-inch recording format that was then called Video Recorder/Camera (VRC), at the 1981 NAB convention. Panasonic and RCA had similar format versions, but they were actually the same camera. RCA called it the Hawkeye, while Panasonic had yet to give their unit a public name, merely referring to it as the Panasonic 1/2-inch VRC. Both shared the same recording mechanism. The RCA Hawkeye was available with either 1/2-inch Staticons or 1/2-inch Plumbicons, while the Panasonic unit used 2/3-inch tubes. Many people confused this format with other products introduced at later conventions.

See page 8 for this month's Freeze Frame question. ■

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News

DTV rabbit's foot

BY LARRY BLOOMFIELD

Two clear messages came from recent Congressional hearings on the stalled transition to digital: The industry must quickly resolve reception problems, and broadcasters must offer high-definition programming as part of their new services.

While hearings were being held, the FCC's biennial review was placed on the back burner. It is nearly certain that little will happen on that front until after Maximum Service Television concludes its Washington, D.C., reception tests. Even then, little movement is expected with national elections just around the corner.

While the hearings focused, in part, on the debate over COFDM and 8VSB, they did little to dispel the uncertainty regarding the ATSC standard.

ATSC proponents did succeed in receiving signals from Washington, D.C., area DTV stations, but they set up their antennas in a window. The COFDM system used a much simpler antenna well inside the room's walls.

One attendee said he was just waiting for someone to ask for the ATSC antenna to be co-located with the COFDM antenna, but the request never came.

While the differences between 8VSB and COFDM were being aired, the Congressional committee ultimately charged 8VSB proponents with resolving the outstanding 8VSB reception problems.

Rep. Billy Tauzin, chairman of the House Subcommittee on Telecommunications, Trade and Consumer Protection, chaired the hearings. Tauzin's spokesperson Ken Johnson said the hearings were an attempt to "nudge" the industry into quickly resolving the modulation standard debate.

"We need a standard where people don't need to move their antennas from room to room and then rub a rabbit's foot."

"Clearly there's a lot at stake. Broadcasters will be spending millions of dollars making the transition to digital, and frankly we've got to get this right the first time," Johnson said.

"The 8VSB guys are telling us they're going to be able to resolve the interference problems," said Johnson. "It's important that they do that. The clock is ticking." Adding, "We need a standard where people don't need to move their antennas from room to room and then rub a rabbit's foot."

The hearing shows that there still remain some differences between proponents of the two competing standards. According to Johnson, Congressman Tauzin's message to those in attendance was clear. "Let's get this worked out before we have a chaotic situation in the marketplace." Johnson continued, "So from that standpoint, it was a productive hearing in that the proponents of both standards had an opportunity to make their case as to what would work best in the marketplace."

Motorola and NxtWave have on more than one occasion reported that they had the necessary fixes and patches to alleviate the more severe problems being encountered in 8VSB reception, particularly multipath. "I think that they acknowledge the current standard needs refinement, and they assured us that they will improve their products to the point where they will be accepted and embraced by the American public," Johnson said.

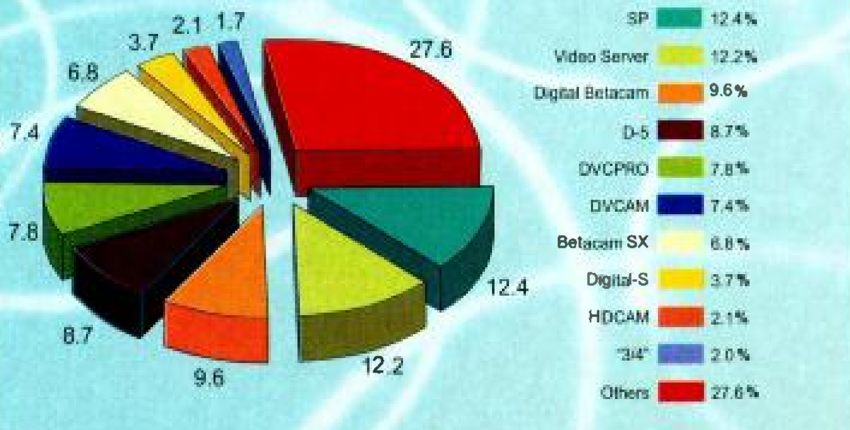
Johnson said Tauzin is insistent upon "getting it right the first time.

FRAME GRAB

A look at the issues driving today's technology

Disk-based media now 2nd most popular storage format

Leading formats used across all applications.



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"I think back to when the Sony Betamax was first introduced to the marketplace. From many people's perspective, it was technologically superior to VHS. But what happened to the Betamax? Like with a lot of people, it's still stuck in my closet, gathering dust. We don't want to see that happen to digital television as well."

While third- and fourth-generation receivers have improved performance, reception problems still exist. Johnson said receiver manufacturers assured Tauzin that reception problems would be resolved within six months or so. Tauzin is willing to grant the industry time to resolve reception problems before asking the FCC or the Congress to intercede.

"Again, this is a marketplace problem that needs to be resolved in the marketplace, if possible," Johnson said.

During the hearings, Tauzin stressed the importance of broadcasters offering some high-definition programming. "If broadcasters retreat on their promise to provide at least some HDTV, they are going to run the risk of losing some of that spectrum, which was loaned them by the federal government," he said.

Some broadcasters have talked about leasing out or selling off some of their digital capability to other services. When asked about this issue, Johnson said, "We've heard a number of broadcasters talking about selling or leasing part or all that spectrum. It's not theirs to lease or sell." ■

Six in one

Digital television offers broadcasters a number of interesting possibilities. One of them is the ability to transmit multiple standard-definition channels within 6MHz. Depending on the quality of service the broadcaster is willing to settle for on each channel, they can run as many channels as they wish.

This is accomplished through a technology known as statistical multiplexing (stat-muxing). The two more common forms of multiplexing are variable bit rate (VBR) and constant bit rate (CBR).

VBR is utilizing whatever bandwidth is required, up to the limits, as the complexity of the transmitted material demands, with nothing else added.

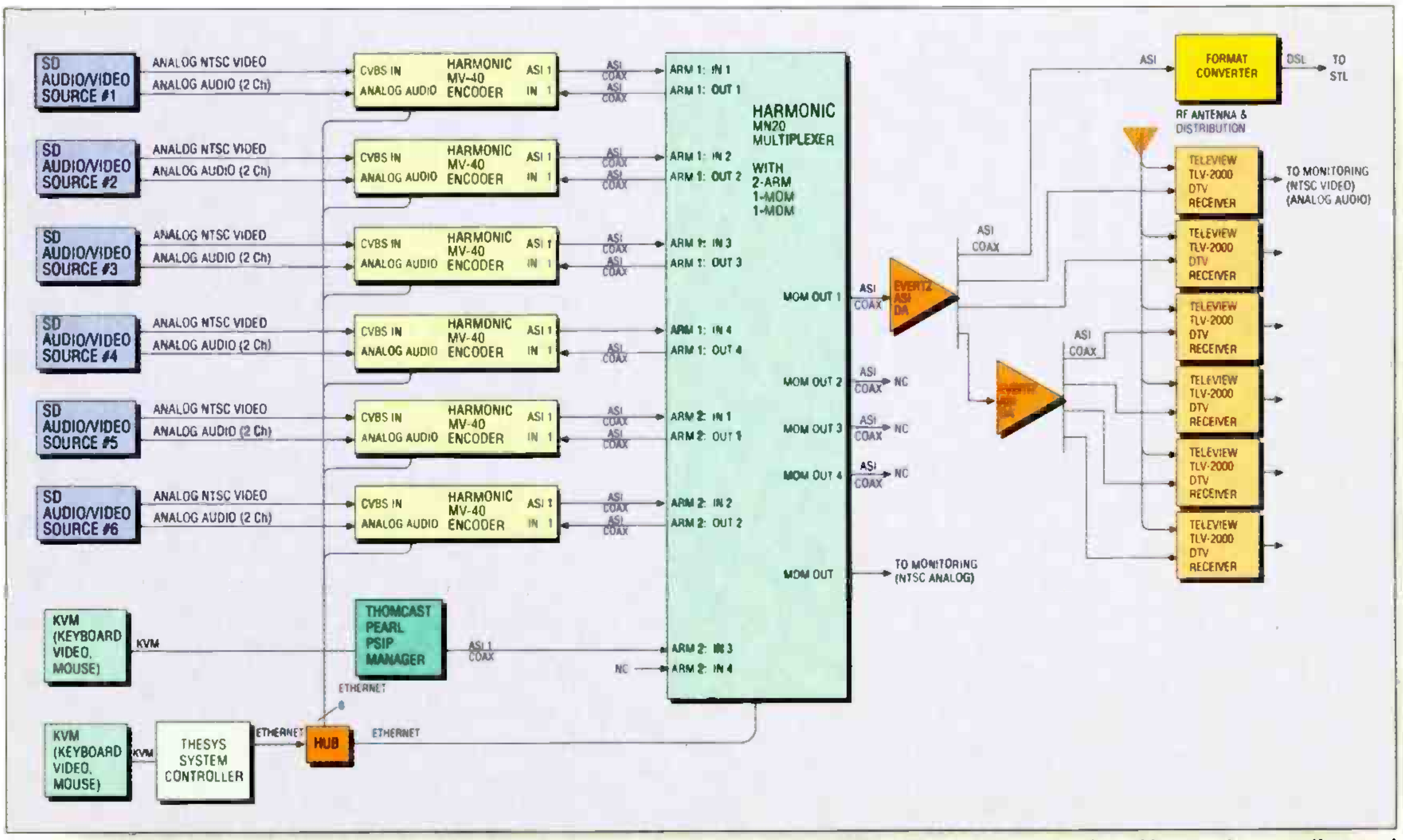
The CBR works the same way except those portions of the bandwidth that are not being utilized by the transmitted material are stuffed with filler bits that literally do nothing except occupy space and time.

Stat-muxing looks at all the digital information to be sent and fills the entire bandwidth, according to statistical analysis of what is required and what is being sent. Relying heavily on buffers at both ends of the transport stream, all the digital information usually gets sent down the transport stream. This entire process relies very heavily on the controlling feature known as PSIP, or Program and System Information Protocol.

Several stations, including one in Detroit and one in San Francisco, are transmitting one high-definition program channel and an additional channel or two of standard-definition material, all within their 19.34Mb/s.

In early June of this year, Paxson announced its Chicago station would be the first digital television station to multicast six network feeds on its digital television station. WCPX-DT, operating on Channel 46, will multicast six channels 24 hours a day. The itinerary will be three channels of the PAX network, consisting of the local, central time zone on the primary feed with the East Coast and West Coast feeds on Channels 2 and 3 respectively. The other three channels will consist of the Worship Network, Praise Television Network and the Total Living Network (TLN), a Chicago-based TV network, on Channels 4, 5 and 6.

Through the use of multiple output



Paxson's WCPX-DT is multicasting six channels of progamming in its allotted 6MHz. The stations employs Harmonic encoding and multiplexing equipment, Evertz DAs and Thomcast's Pearl PSIP manager.

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servers and other program sources, the program material is fed into DiviCom/Harmonic encoders, the outputs of which are fed into the statistical multiplexer along with the output of the Thomcast Pearl PSIP generator. The output of the multiplexer is a fully compliant ATSC transport stream at 19.34Mb/s.

This 19.34Mb/s stream is then fed into two Evertz distribution amplifiers (DA) that drive a Teleview DTV receiver for monitoring of both the feed to the transmitter and the off-air signal. They also drive a Thomcast Turquoise ASI to SMPTE 310M stream converter. The SMPTE 310M is then carried via the Studio to Transmitter (STL) radio link to the transmitter where it is fed into the exciter of the Thomcast DTV transmitter. The accompanying diagram shows how all this is laid out.

Paxson has entered a strategic relationship with NBC. It will be interesting to see how much of the 2000 Olympics from Sydney will be carried. ■

Little camera – big show

ABC used a new unobtrusive digital camera in taping its newest venture into reality-based programming, "Hopkins 24/7."

For the taping at John Hopkins Medical Center, ABC chose the Sony DSR PD100A, a compact digital format camera new to the market at that time. The tiny size allowed producers to capture critical moments without being invasive, which resulted in a real look into the hospital subculture.

To do a show centered on a hospital and its patients, the first considerations are to protect the privacy of the individuals involved and to be as unobtrusive as possible. This meant no multiple-person crews, large ominous television cameras glaring at the patients or special lighting. Self-contained units were a must.

The nature of this kind of program required a camera that was simple to use — one that a non-technical person would have little difficulty with. The field producers had to be as unobtrusive as possible in their efforts to capture the real view of day-to-day patient, doctor and staff relationships and, at the same time, be able to operate the equipment as close to how a seasoned professional would as possible. The PD100A's size worked well in places in places like the Emergency and Operating rooms, where space was an issue. It also allowed patients and doctors as close to normal interaction without a glaring camera lens on them. The digital capability also allowed producers to edit, on site, the hundreds of hours of tape and make storyline decisions early in the process.

The same cameras have been used successfully for other news and documentary projects. ABC utilized a total of eight of these hand-held devices, shooting over a thousand hours worth of tape, which has been pared down to a six-hour long series for television and a 10-hour series for cable.

ABC producers chose Sony DSR PD100A cameras for the taping of its documentary "Hopkins 24/7" because of their small, unobtrusive size and simple operation.

Small, near consumer-type camcorders have been used for some time in the production of television shows. It wasn't too long ago that Metromedia utilized Hi-8 cameras to shoot some of its sitcoms. The ABC technical staff noted the quality of pictures these Sony DV format cameras put out rivals the quality of some of the larger format ENG and field production equipment in use today and exceeds what most analog equipment can produce. Sony made minor modifications to these cameras to develop an even newer model that incorporates the XLR audio connectors installed on the PD100As.

One of the biggest challenges came from the wireless microphones. In addition to the microphone mounted on the camera, they utilized an RF microphone with the receiver on the camera as well. It was necessary to select an RF system where the receiver would not substantially add to the bulk of the camera itself.

The other major problem encountered in these kinds of situations is lighting. Color temperature from one shot to the next varies significantly. The Sony cameras didn't seem to have any problem tracking and compensating for the different color temperatures. When adjustments were necessary, they were simple enough that the non-technical operators could perform them with little or no trouble.

All the DV tape was edited on an Avid Unity with three terabytes of storage. This gave the producers plenty of space to effortlessly store the thousand hours shot, keep the assembled material on-board in a digital format and still have room for moving around in the storage environment. ■

FCC issues new rules for audio, video descriptors

Accommodations for those with auditory and visual impairments were given a boost by the FCC this summer as the result of two separate actions taken by the agency. The first requires 50 hours per calendar quarter (roughly four hours per week) of descriptive prime time and/or children's programming.

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The description of the video involves the insertion into a TV program of narrated descriptions describing elements of the action that are not otherwise reflected in the dialogue, such as the movement of a person in the scene. The description will typically be provided through the use of the secondary audio programming (SAP) channel, so that it is audible only on that channel when it is activated through a TV set or VCR with those capabilities. These 50 hours per calendar quarter should not have any serious impact on a station's current use of the SAP channel, on which many stations offer multilingual services for programs they carry.

Broadcasters affiliated with the four major networks, ABC, CBS, Fox and NBC in the top 25 television markets will be required to provide this service. Other stations that get programming, regardless of the market size, will be required to "pass through" any video description it receives from a programmer, provided the station is technically capable to do so. These same conditions will be applied to cable and satellite services as well.

In addition to these network offerings of description, the FCC has also mandated multi-video programming distributors, such as cable and satellite systems with 50,000 or more subscribers, provide video description of the same amount and type of programming on each of the top five non-broadcast networks that they carry.

The top 25 markets are those as determined by the Nielson-designated market areas, or DMA rankings. The multichannel purveyors' determination will be made by national prime time audiences' share.

These rules will apply to analog television only at this time. The FCC did say that it expects ultimately to require digital broadcasters to include video description, but said that it wouldn't consider that issue until there had been further experience with both digital broadcasting and the new video descriptive services.

With the implementation of digital television, the FCC was required to update its rules to fulfill its obligations under the Act. In the Report and Order adopted by the FCC, it has incorporated sections of the industrial standard EIA-708-B, "Digital Television (DTV) Closed Captioning" into its rules.

The new standard provides instructions for the encoding, delivery and display of closed captioning information for digital television systems. The commission said that it would require manufacturers to include compliant DTV closed captioning decoder circuitry in DTV devices by July 1, 2002.

Devices covered under the rules include DTV sets with integrated widescreen displays measuring at least 7.8 inches vertically, DTV sets withconventional displays measuring at least 13 inches vertically, and stand-alone DTV tuners, whether or not they are marketed with display screens.

The new standard of closed captioning provides for more options and features than are available in the current system. Viewers will be allowed to choose and alter the color, size and font of the captioning and to choose between multiple streams of captioning, such as "easy reader" or alternate language captioning. ■

SEND
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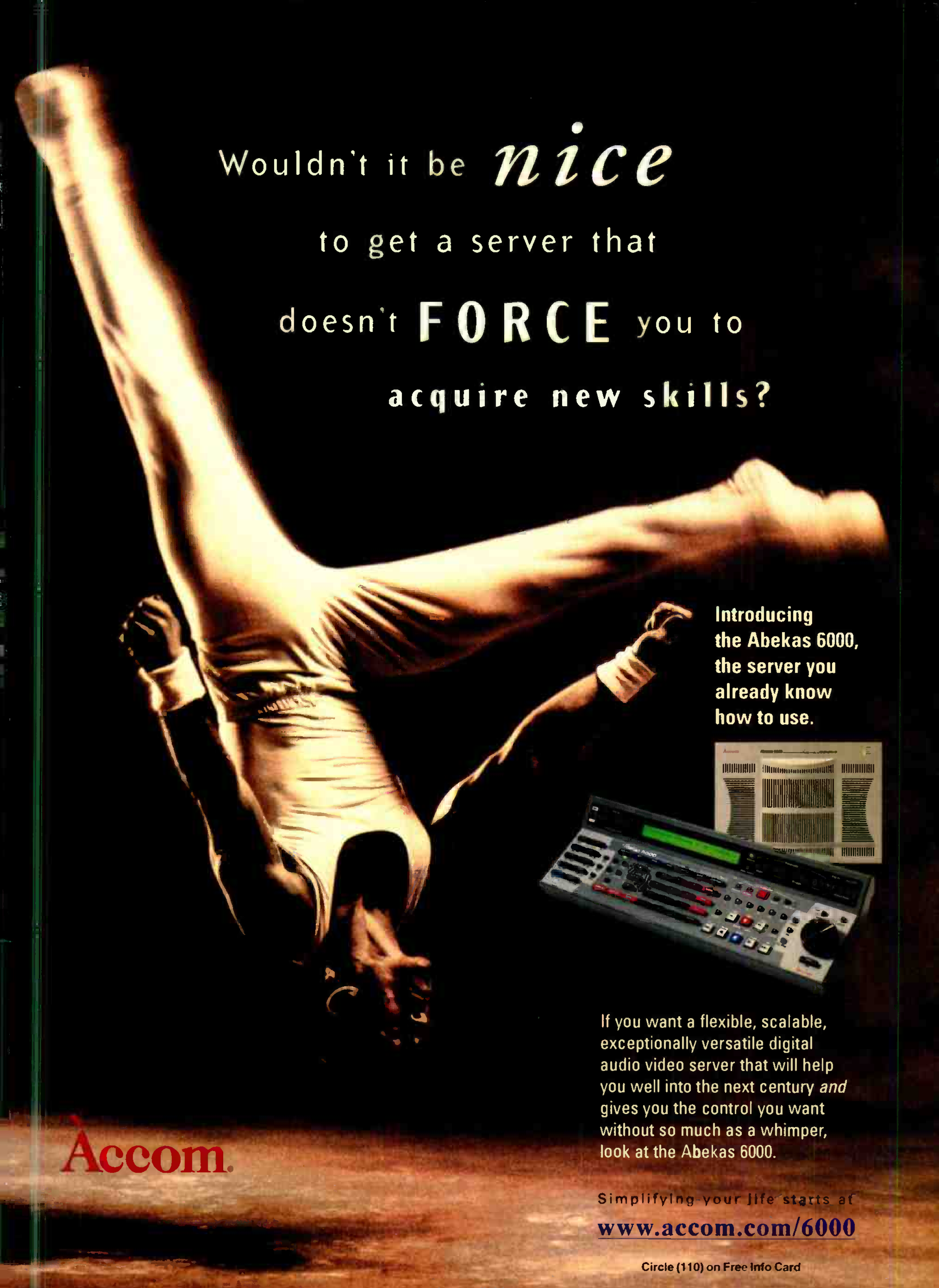
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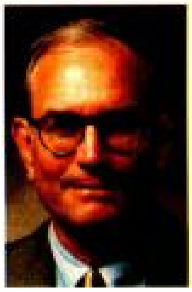


TV auxiliary frequencies disappearing

BY HARRY C. MARTIN

The FCC has adopted procedures for the forced removal of TV broadcast auxiliaries from the 1990- to 2025MHz band, and it has taken back the new broadcast auxiliary spectrum it allocated at 2110- to 2130MHz. In addition, the FCC has rechannelized the remaining 2025- to 2110MHz band into narrower channels. These will require further development of digital compression techniques and may ultimately only be capable of handling digital transmissions. The FCC has also decided to permit government space research, space operations and Earth-exploration satellite services to share the 2025- to 2110MHz band with broadcast auxiliary facilities on a co-primary basis.

The Broadcast Auxiliary Service (BAS) currently operates throughout the 1990- to 2110MHz band. In 1997, the Commission reallocated the 1990- to 2025MHz portion of the band to the Mobile Satellite Service (MSS) for use by mobile phone and wireless services. Congress later mandated that the 2110- to 2130MHz spectrum the FCC had allocated to the broadcast auxiliary service instead be auctioned to new services to balance the federal budget.

Phase I of the forced removal of broadcast auxiliaries from the 1990- to 2025MHz band will make the 1990- to 2008MHz portion of the band available to early MSS operators. Phase II will make the remaining 2008- to 2025MHz portion available when Phase I spectrum is no longer sufficient. Starting this month, new broadcast auxiliary licenses will only be granted in the 2008- to 2110MHz band.

During the next 10 years, MSS operators will be required to pay all costs of moving existing broadcast auxiliaries. After that, any remaining broadcast auxiliaries will have to vacate the band upon six months' notice from an MSS operator, without any compensation. A two-year mandatory negotiation period for MSS operators and broadcast auxiliary licensees in the 1990- to 2008MHz band in the top 30 markets to agree upon relocation costs starts next month. Subsequently, mandatory negotiation periods will commence for smaller markets and the 2008- to 2025MHz portion of the band.

Once Phase II begins, all broadcast auxiliaries in the 2025- to 2110MHz band in markets 31 to 100 must operate on 14.5MHz channels. By the end of Phase II, all broadcast auxiliaries will be operating on even narrower 12.4- or 12.1MHz channels. New techniques for maximizing the available spectrum will be required to use the narrower channels. Experimental operations show that it is possible to carry a signal in a 12MHz channel with digital equipment, but not necessarily with analog equipment.

Relocation from channels 60-69

The auction of TV channels 60 through 69 to a new 700MHz wireless voice and data telecommunications service has been moved from September 2000 to March 2001. The successful bidders will be required to protect incumbent full-power TV broadcasters on channels 59 through 69 from interference until those broadcasters migrate to channels 2 through 51.

A principal concern of the 700MHz parties is that the transition will be delayed past the Dec. 31, 2006, DTV transition deadline because the FCC is authorized to permit TV stations to occupy their analog channels until there is 85 percent DTV set penetration in a market. Potential bidders are concerned that a delay might lower the economic value of the spectrum. In light of this concern, the FCC will consider voluntary agreements between incumbent broadcasters and 700MHz providers to move broadcasters to a core channel prior to the deadline. Agreements would involve payment of the broadcasters' costs of channel relocation and perhaps additional costs. Now, in a recent order, the Commission has clarified the criteria it will use to evaluate such voluntary channel relocation agreements and has outlined the provisions that would trigger a regulatory presumption in favor of approval.

The Commission has established a rebuttable presumption that agreements are in the public interest if the change to the TV station's channel would:

- make new or expanded wireless services available to the public;
- clear frequencies for the provision of public safety services; or
- result in the provision of wireless services to rural or underserved communities.

The applicant would also need to show that grant of the request would not result in any one of the following:

- loss of any of the four TV stations in the DMA with the largest audience;
- loss of the sole service licensed to a community; or
- loss of a community's sole service on a channel reserved for non-commercial service.

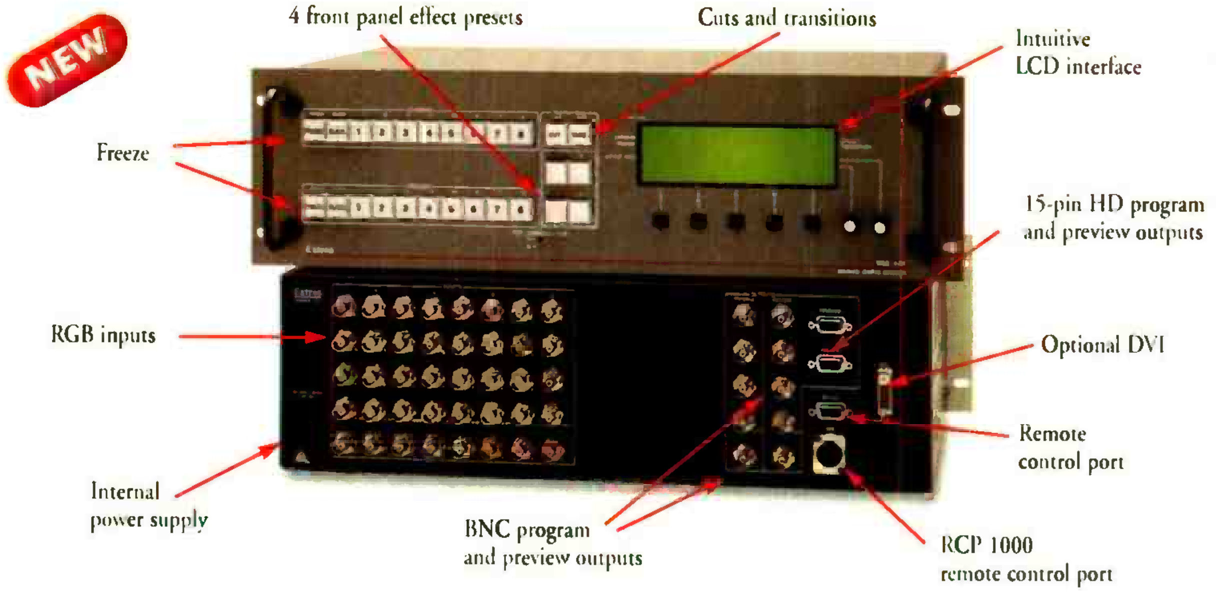
Where a request does not meet these criteria, the Commission will review the agreement to determine exceptions. ■

Dateline

Annual regulatory fees are due no later than Sept. 20, 2000. Oct. 2, 2000, is the deadline for filing the EEO Annual Employment Report (Form 395-B).

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

Send questions and comments to: harry_martin@intertec.com



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- Brightness, contrast, horizontal & vertical shift, horizontal & vertical centering, freeze frame, eight user-selectable levels of horizontal filtering, and five user-selectable levels of vertical filtering
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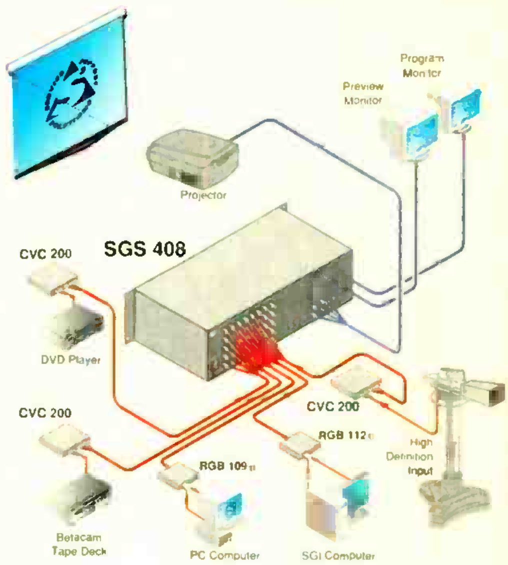

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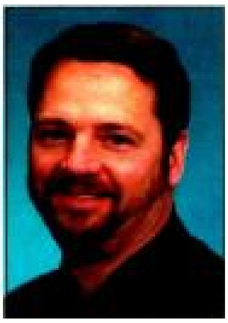
Is a systems integrator for you?

JIM SALADIN, SENIOR ASSOCIATE EDITOR

There was a time in this industry when, except in the case of an extremely large facility, a station upgrade would have been handled by staff engineers almost out of hand. However, with the influx of computers and the increasingly high technological level of digital systems, an upgrade using only staff is becoming a rare animal indeed.

Has it gotten to the point where technology's curve is progressing so rapidly that the average engineering staff can no longer hope to keep up? We turn to Ed William, director of engineering for KPDX in Portland, and to Greg Doyle, president of systems integrator Doyle Technology Consultants for answers to this month's question: "*When rebuilding television broadcast and production facilities, is it possible for a station to go it alone?*" ■

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



VENDOR

Greg Doyle, Doyle Technology Consultants

In some cases, partial rebuilds can be done in-house when a few racks of equipment are involved. Small edit bays and conversion of the NTSC analog output of master control to be DTVcompliant are examples.

However, many facilities need a much more extensive rebuild, including the possibility of a new infrastructure design due to technology migration and changes in your broadcast business model. It is in this situation that outside resources should be considered. Here's why:

• **Technology migration:** Many facilities have composite analog infrastructures that are 15 to 20 years old. Of course, several technology changes have occurred in this period. A vendor-neutral design consultant can be invaluable when it comes to making technology decisions because they bring expertise from several projects and vendor relationships as you develop your project.

• **Design and build expertise:** Even if you are only looking for design consultation for a project, it is important to use a consultant that has design/build experience.There is often a gap between theoretical functionality and real-world implementation of new equipment. A good design consultant/systems integrator brings experience to the process resulting in a much smoother project development.

• **Technical programming:** Technical programming assesses project feasibility and serves as a great communication tool for engineering to present to management for review. During this phase of planning you will receive real-world project planning, not only for technical systems, but for building support infrastructure, mechanical and electrical planning.

• **Architectural programming:** The design consultant/systems integrator provides assistance to the architectural team in designing the facility, including power requirements, cable management and HVAC planning. As the facility is under construction, regular site visits providing architectural coordination and administration can occur. If last minute changes in infrastructure are required, this level of coordination will help to complete construction on time and on budget.

• **Documentation:** A good design consultant/systems integrator will provide both electronic and hard copy documentation (CAD "as built" drawing, wire lists, etc.) Troubleshooting effectiveness is greatly enhanced through the use of this documentation.

• **System integration:** A quality installation is one of the most important elements of a technical project. A good integrator will bring skill sets that provide efficient, clean installations that readily adapt to changing technologies. Strict standards for wire management cable labeling and specification conformance will be maintained. A systems integrator will typically provide technical teams with expertise in system commissioning, testing and proof of performance.

• **Professional project management:** Professionally trained project managers manage budgets, confirm and track timelines and the associated tasks, coordinate team members and resources. Good design consultant/systems integrators can demonstrate a track record of successful management of several large projects. Compare the size and scope of your project against the potential SI's resume.

• **Resource availability:** For the past several years, engineering staffs have been cut or undergone hiring freezes. Budget constraints and vendor-supported "board swap" maintenance have contributed to this. In the case of a new facility model, the complete design and build requirement can total 8000 to 20,000 man hours beyond standard daily engineering operations at the facility.

Weigh each of these issues carefully before deciding to go it alone. If you do have the technical expertise, time and resources to perform each of these tasks internally, it can be rewarding and possibly save you money. Good systems integrators are very much in demand. Bring the SI to the project during the planning stages to ensure an efficient and successful project. ■

Greg Doyle is president of Doyle Technology Consultants, Redmond, WA.

EXPERT

Ed Williams, CSTE, KPDX, Portland, OR

KPDX engineering finished up the core build for the station's new digital broadcast facility just before Memorial Day weekend. The cutover happened seamlessly, without one second of lost airtime or one penny of lost advertising revenue.

We chose not to utilize the services of a full service systems integrator for this particular station build. Our project involved specification, design and installation of all systems for a new 45,000 square-foot building, including master control, post production, studios, DTV transmitter and systems, etc.

Why not use a systems integrator? The original reasons were many: budget, time constraints, overall design philosophy and, admittedly, old-fashioned pride.

Our decision was mostly based on budgetary concerns. A project of this scope delivers "sticker shock" when the first bids come in. Resist the temptation to save up front and leave misery and discontent in your wake later.

Challenges that arose for us included unclear deadlines, unpredictable construction slippage and even final design. We began wiring and rack installation four months before building completion. We were working in hard hats every day and maneuvering around ironworkers, electricians and painters to get the job done – assuming some part of the job hadn't slipped. You can't install computers when the racks are being bombarded with drywall dust every day. Uncertainty like this can wreak havoc with a systems integrator's schedule and thus, their price – this also contributed to our avoidance of integrator involvement.

While a full service systems integrator may not be necessary for every job, paying for outside expertise in some areas can really streamline things. We had a unique situation. First, we were working with a brand new building. We did not have an in-house news department to service. We weren't bringing vast portions of our old plant with us, so we skipped a lot of cutover headaches. What new technology we did incorporate was researched before we committed to it. You can never place too much emphasis on an in-house demonstration of desired equipment, either. Unfortunately, this took time and added to the schedule pressures.

If you insist on not using an integrator for a project, consider using one for a portion of it. Spend your money on the things that are hard set and fully formed. Hire a superior cabling crew – this point cannot be emphasized enough. Set specific deadlines for the major elements and have a plan in place for what happens when, not if, you miss the deadline. Pay a design consultant to gather research for you and to help with recommendations on the more "esoteric" things.

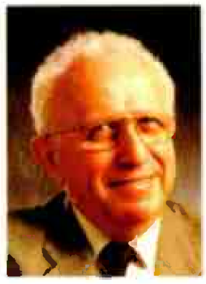
It is nearly impossible for an in-house engineering team to orchestrate a complex move or rebuild. Systems integrators are a necessity on large projects with tight deadlines. For moderate projects that can be sectioned and segmented, a well run in-house engineering team can still do the job. The use of outside talent is well warranted if for no other reason than it allows the station engineers to see their families occasionally and avoid burn out. ■

Ed Williams is director of engineering for Fox 49 KPDX in Portland, OR.

Transition to Digital

Colorimetry

BY MICHAEL ROBIN



In the 17th century, two scientists devoted their time to the study of light: Isaac Newton and Christian Huyghens. While trying to fend off falling apples, Newton carried out many experiments and found that white light is a homogeneous mixture of an infinite number of colors ranging from red to yellow and green through blue to violet. He demonstrated this concept by directing daylight through a narrow slit onto a triangular glass prism. The ray that emerges from the prism is a divergent beam of light containing no trace of white but, instead, a continuous sequence of colors. (See Figure 1.) He also demonstrated that the white light could be re-created by passing the divergent beam through a second prism. He assumed that light was composed of colored particles whose paths were deviated differently by his prism. Huyghens carried out other types of experiments and deduced that such phenomena as interference could only be explained by assuming that light was an oscillatory wavelike phenomenon. These two scientists could not reconcile their opinions concerning the nature of light.

Color perception is associated with a specific set of 6 million to 7 million cells called cones.

In the 19th century, various studies led to a better understanding of light. The studies culminated with the work of James Clerk Maxwell, who introduced the concept of electromagnetic waves consisting of an electric field travelling in space with a related magnetic field. The two fields are at an angle of 90 degrees. (See Figure 2.) The concept of electromagnetic radiation grouped together many natural phenomena, as shown in Figure 3. As can be seen, the segment of the spectrum visible to the human eye occupies approximately one octave, from 380nm to 760nm (1nm = 10^{-7}cm). A perceived color is associated with every wavelength. Maxwell's studies predicted the use of radio electromagnetic waves for the transmission of information — a prediction that culminated with Heinrich Hertz's experiments and Guglielmo Marconi's radio transmissions. These studies and practical applications demonstrated to the scientific world the wavelike nature of light as part of the wider electromagnetic spectrum.

Further experiments resulted in the discovery of the photoelectric effect where light shining on a photo sensor generates an electrical current. This phenomenon could only be explained by the existence of light particles called photons, which impart their energy to atoms and force electrons to travel in an electrical conductor. Reluctantly, scientists of both camps had to concede that the electromagnetic radiation has a dual nature: corpuscular and wavelike. Luminaries Max Planck and Albert Einstein predicted this.

Human visual system characteristics

The human visual system (HVS) perceives light by associating colors (or hues), a perception artifact, to frequencies. The eye has maximum sensitivity at the green color and lesser sensitivity at red and blue.

Color perception is associated with a specific set of 6 million to 7 million cells called cones. Studies indicate that there are specialized types of cones responding to red or green or blue stimuli. The cone cells have a low

FRAME GRAB

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The number of technologies in the home is on the upswing.

	1996*	1998	2000
Do you ...	%	%	%
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Use a computer	58	61	68
Have a home computer	36	43	59
Go online	21	36	54
Have a ...			
Cell phone	24	—	53
Pager	—	—	24
Satellite dish	6	—	18
DVD player	—	—	16
Palm Pilot	—	—	5

*Figures for home computer, cell phone and satellite dish are from June 1995.

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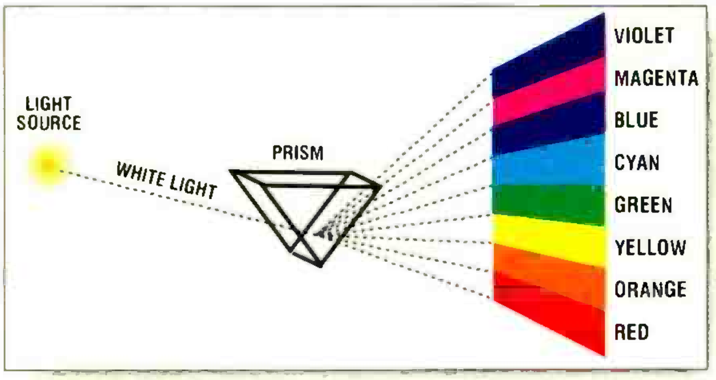


Figure 1. When passed through a prism, white light can be split into spectral colors.

sensitivity resulting in achromatic (no color) perception at low light intensities. They also have a low sensitivity to picture detail.

The implementation of the DTV standard will require a fair amount of format conversions.

Low-light intensity achromatic light perception, as well as picture detail, is due to a second type of cell called a rod. There are between 110 million and 130 million rods. Rods have a high sensitivity and afford a high resolution of picture detail.

The CIE color diagram

The 20th century witnessed an explosion in the recording and reproduction of still (photographs) and moving (television and film) images. Among the early preoccupations of the dream factories (Hollywood and others) was the correct reproduction of colors. In 1932, a group of scientists under the umbrella of CIE (Comité International de l'Eclairage or International Lighting Committee) developed a bi-dimensional (x, y) representation of the visible colors, the so-called CIE diagram, shown in Figure 4. This diagram allows users to specify colors by assigning values to x and y variables. All visible colors are confined inside a horseshoe-shaped area. Saturated colors occupy positions on the curve. Lower saturation colors occupy positions nearer to the center of the display. In addition to defining colors, the CIE diagram identifies white light as a set of x and y values describing a point in the central area of the diagram. Various standards define white using different pairs of x, y coordinates related to the temperature to which a black body has to be raised to generate the specific white.

Colorimetry standards in color television

Color television relies on the light properties that control the visual sensations known as brightness, hue and saturation. All visible colors of the spectrum can be generated by a proper combination of three primary colors. The definition of a group of three primary colors is that adding any two could generate none of the three. The process of generating various colors using three primary color sources is called additive color mix. All light sources generate additive colors.

The photographic reproduction of colors is based on the subtractive color process. Here a white light illuminating a colored surface results in all wavelengths being absorbed except one which is reflected and identifies the color of the object.

The television primary colors are red with a wavelength of 700nm, green with a wavelength of 546.1nm and blue with a wavelength of 435.8nm. Any other set of primary colors could have been used but the

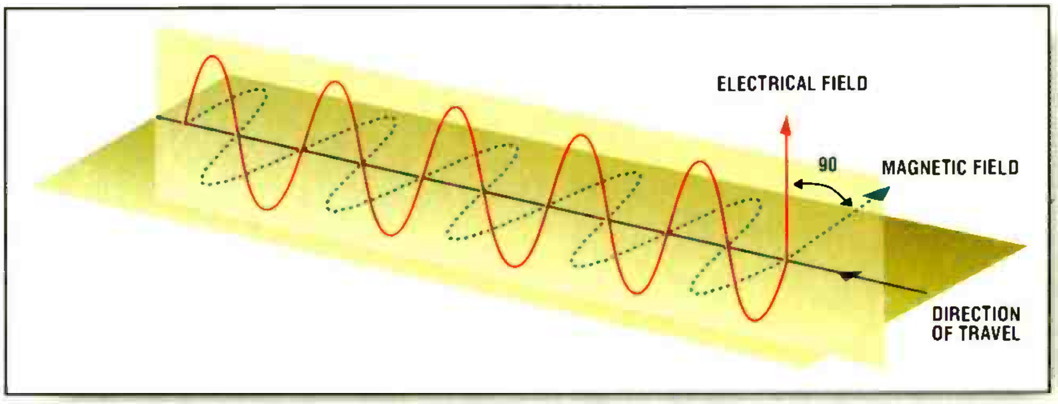


Figure 2. Electromagnetic waves travel as an electrical wave and a magnetic wave on two seperate planes at a 90 degree angle.

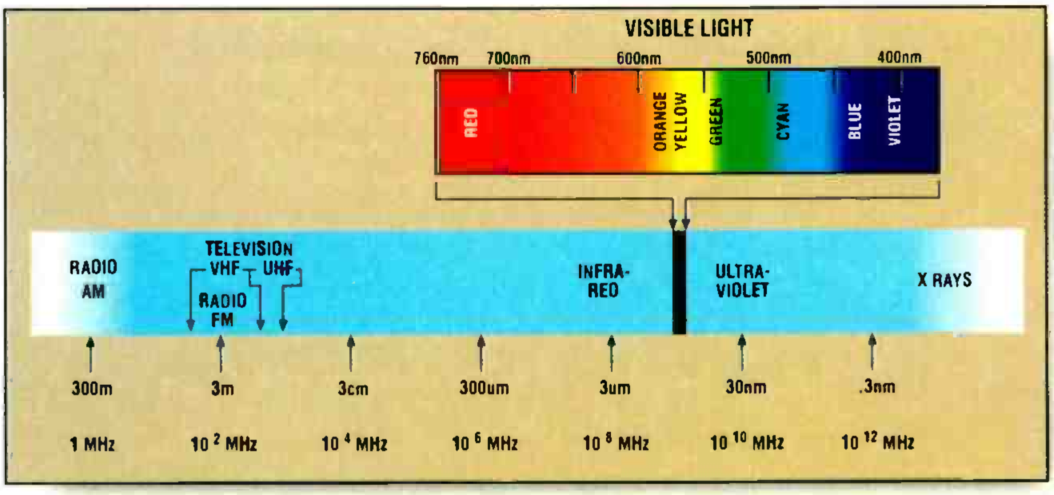


Figure 3. The spectrum of electromagnetic radiation includes the AM & FM radio bands, VHF and UHF television frequencies as well as visible light.

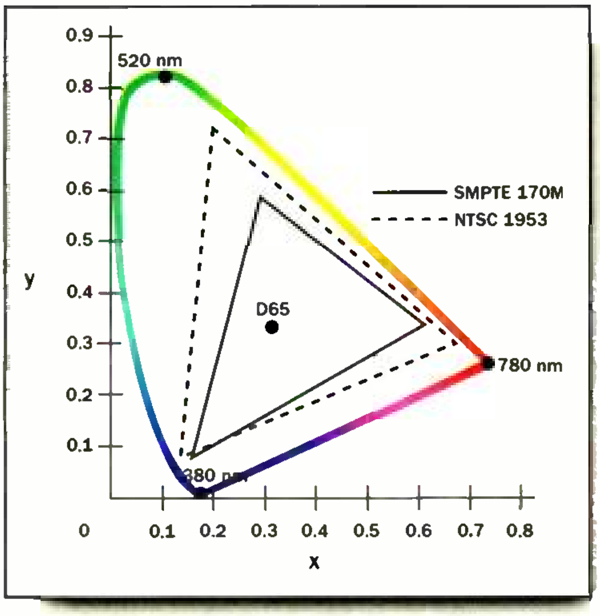


Figure 4. The CIE color diagram is representative of all visible colors. The chart above includes the primary red, blue and green colors used for SMPTE 170M and those chosen in 1953 for NTSC.

choice was determined by the ease with which (in 1953) efficient red-, green- and blue-colored phosphors could be manufactured.

The x, y coordinates of the chosen phosphors delineate a phosphor color triangle.

Several television colorimetry standards coexist and are detailed in Table 1. These standards define the following:

- *The x, y coordinates of the color primaries and of the reference white*: This involves the specification of the x and y coordinates representing the primary colors and the reference white.
- *The luminance equation*: This involves the specification of the matrix coefficients related to the R, G and B primary signals.
- *The color-difference equations*: This involves the specification of the matrix coefficients related to the R, G and B primary signals.
- *The transfer characteristics*: The transfer characteristic of the CRT is inherently nonlinear. To achieve an overall linear transfer characteristic, the nonlinearity of the CRT is compensated for elsewhere in the system. Historically, the compensation is carried out in the camera and is referred to as gamma correction. This results in red, green and blue signals predistorted to match the reference characteristic of the CRT. More recent standards specify complex mathematical expressions that are applied to linear R, G and B signals to compensate for defined CRT nonlinearities. The transfer standards will eventually have to be revisited to reflect the appearance of non-CRT display technologies featuring linear transfer characteristics.

The ITU-R.BT.470-4 (NTSC 1953) defines parameters of the NTSC color television system adopted in 1953 for transmission in the U.S. These parameters reflected the CRT technologies in existence at the time. Early versions of the PAL and SECAM systems used the same parameters. Later CRT technologies used phosphors with different chromaticities requiring a review and update of the colorimetry standards. The ITU-R.BT.470-4 (PAL B, G) used different parameters. The NTSC specifications were reissued in 1995 as SMPTE 170M and used parameters very similar to those used for PAL and SECAM. SMPTE 240M reflects the parameters chosen for the legacy analog HDTV standard using a total of 1125 lines with 1035 active lines. The ITU-R.BT.709 standard is the currently preferred version.

Signals using the legacy NTSC 1953 standard differ considerably from the newer standards that have smaller differences. The implementation of the DTV standard will require a fair amount of format conversions. In order to avoid color changes in the process, the input and output signal format colorimetry parameters will have to be considered and recalculated as required. ■

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

Standard	COLOR PRIMARIES: PRIMARY	x	y	Transfer characteristics (gamma)	Matrix coefficients
ITU-R BT.470-4 (NTSC 1953)	Red	0.670	0.330	Gamma = 2.2	$E'_Y = 0.59E'_G + 0.11E'_B + 0.30E'_R$
	Green	0.210	0.710		$E'_{B-Y} = -0.331E'_G + 0.500E'_B - 0.169E'_R$
	Blue	0.140	0.080		$E'_{R-Y} = -0.421E'_G - 0.079E'_B + 0.500E'_R$
	White (C)	0.310	0.310		
ITU-R BT.470-4 (PAL B,G)	Red	0.640	0.330	Gamma = 2.8	$E'_Y = 0.587E'_G + 0.114E'_B + 0.299E'_R$
	Green	0.290	0.600		$E'_{B-Y} = -0.331E'_G + 0.500E'_B - 0.169E'_R$
	Blue	0.150	0.060		$E'_{R-Y} = -0.419E'_G - 0.081E'_B + 0.500E'_R$
	White (D65)	0.313	0.329		
SMPTE 170M (NTSC 1995)	Red	0.630	0.340	$V = 1.099Lc^{0.45} - 0.099$ for $1 \geq Lc \geq 0.018$	$E'_Y = 0.587E'_G + 0.114E'_B + 0.299E'_R$
	Green	0.310	0.595	$V = 4.5Lc$ for $0.018 \geq Lc \geq 0$	$E'_{B-Y} = -0.331E'_G + 0.500E'_B - 0.169E'_R$
	Blue	0.155	0.070		$E'_{R-Y} = -0.419E'_G - 0.081E'_B + 0.500E'_R$
	White (D65)	0.3127	0.329		
SMPTE 240M	Red	0.630	0.340	$V = 1.1115Lc^{0.45} - 0.1115$ for $1 \geq Lc \geq 0.0228$	$E'_Y = 0.701E'_G + 0.87E'_B + 0.212E'_R$
	Green	0.310	0.595	$V = 4.0Lc$ for $0.0228 \geq Lc \geq 0$	$E'_{B-Y} = -0.384E'_G + 0.500E'_B - 0.116E'_R$
	Blue	0.155	0.070		$E'_{R-Y} = -0.445E'_G - 0.055E'_B + 0.500E'_R$
	White (D65)	0.3127	0.329		
ITU-R BT.709	Red	0.640	0.330	$V = 1.099Lc^{0.45} - 0.099$ for $1 \geq Lc \geq 0.018$	$E'_Y = 0.7152E'_G + 0.0722E'_B + 0.2126E'_R$
	Green	0.300	0.600	$V = 4.5Lc$ for $0.018 \geq Lc \geq 0$	$E'_{B-Y} = -0.386E'_G + 0.500E'_B - 0.115E'_R$
	Blue	0.150	0.060		$E'_{R-Y} = -0.454E'_G - 0.046E'_B + 0.500E'_R$
	White (D65)	0.3127	0.329		

Table 1. Details of the various colorimetry standards used for television production.

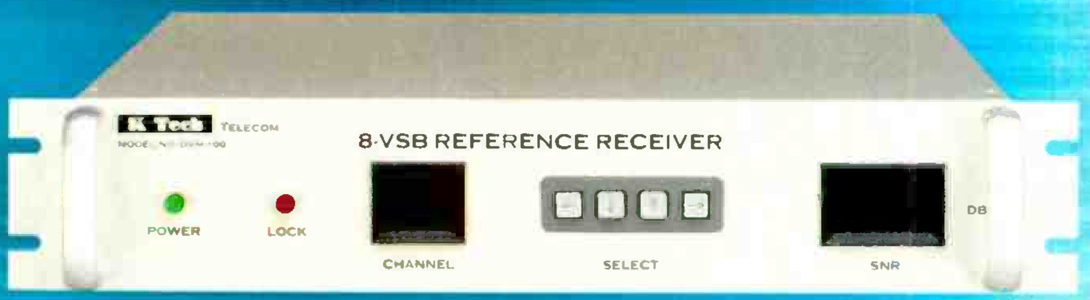
DOES YOUR PROFESSIONAL ATSC RECEIVER DO THESE?

Inputs:

RF CH2 - CH69
DVB-ASI
DVB-SPI (LVDS)
SMPTE-310M

Outputs:

DVB-ASI
DVB-SPI (LVDS)
SMPTE-310M
ATSC Video Decoding To 60MBPS
RGBHV (1080i, 720p, 480p, 480i)
HD-SDI Option (SMPTE-292m)
NTSC (SDI, S-Video, BNC)
AC-3 Audio (XLR)
Analog Audio L&R (XLR)
VGA Monitor
PSIP Display
EPG Display



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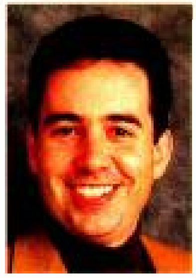


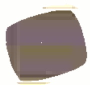
Interactive television for terrestrial broadcasters

BY BRAD GILMER

Interactive Television (iTV) is a hot topic these days. Almost all the heavy hitters — Microsoft, Intel, Sony and AOL — have made major investments in iTV. The major television networks and cable companies are participating in one way or another. Companies such as webtv, Liberate Technologies, Mixed Signals Technologies and Wink Communications are at the forefront, providing a first look at the interactive future.

This month's article focuses on interactive television for terrestrial broadcasters, with an emphasis on what is happening today. We will examine one interactive set-top box, webtv, employed in one environment, analog terrestrial broadcast.

webtv



If you have seen a webtv demonstration, or have a webtv box, you may recognize the icon on the left. This icon appears on the television screen when the webtv set-top box (STB) recognizes that valid webtv interactive content is present. Clicking on the icon starts the interactive session.

A typical webtv STB installation is shown in Figure 1. Note that in this example, a program with interactive content may be recorded and played back later. (This is only true for systems using Transport A, as will be discussed.)

Transporting interactive data

iTV involves moving data along with normal program content. Two data channels are typically employed in an iTV connection. One is the vertical blanking interval, or VBI (lines at the top of the television raster that are not normally displayed on a television set), and the other is a "backchannel," usually a telephone line.

The VBI is typically used to send triggers and links. The backchannel is used to retrieve interactive content to be displayed on the television screen.

In 1990, Congress passed the Television Decoder Circuitry Act. This legislation requires that all television transmission systems must pass closed caption data encoded in line 21 of the vertical interval from its source to the end viewer. While the original intent of the act was to provide closed captioning for the hearing impaired, the act opened up a data path from the broadcaster to the home. webtv uses this link to send interactive data to its STBs using the Text-2 channel of line 21.

There is a lot going on in line 21 of the vertical interval. There are four caption channels (CC-1 through CC-4), four data channels (Text-1 through Text-4), and another service called XDS or Extended Data Services. All of these channels are multiplexed on line 21. Field one of line 21 is used for CC-1, CC-2, Text-1 and Text-2. Field two of line 21 is used for CC-3, CC-4, Text-3, Text-4 and XDS.

Making matters more interesting, the bandwidth of this channel is limited. The line 21 full-field data rate is 840 bits per second, or 120 characters per second (7 bits per character). Because captions and text (CC-1 and Text-2) are only in field one, the data rate is half or 420 bits per second (approximately 60 characters per second). The available bandwidth is divided between all of the services in line 21 on a priority order. CC-1 is highest, and Text-2 is the lowest. The bandwidth used by captions varies greatly depending upon the show. Typically, captions use about 25 percent of the available bandwidth, but a very verbose show can take up to 75 percent or more.

Typically, captions use about 25 percent of the available bandwidth, but a verbose show can take up to 75 percent or more.

The data formatting, protocol and channel priority of data encoded in line 21 of the vertical interval is described in the EIA-608 standard. Generally speaking, captions and data encoded in line 21 operate according to Transport A, as described in the ATVEF specification described below.

EIA-608 specifies that closed captioning data takes precedence over all other data. Given the restrictions on available bandwidth in the channel, synchronizing interactive data to the video while giving priority to closed caption data can be challenging.

The ATVEF specification has two transport mechanisms: Transport A and Transport B. Transport B is another method of transmitting data in the vertical interval. Transport B can use any available VBI lines.

A combination of standards, Internet requests for comment (RFC), and trade association specifications set the data rate for encoding data using Transport B, which operates at a higher data rate than Transport A. Transport B has one limitation for the consumer — it will not survive recording on a VCR. Transport A will.

Transport B has a data rate of approximately 10.5kb/s per line. Deriving this number is a little complicated. The Advanced Television Enhancement Forum (ATVEF) Transport B has no bandwidth limitations, since the specification is transport independent. However, using Internet RFC 2728,

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Transport B can be encoded into one or more lines in the VBI using the North American Basic Teletext Specification, EIA-516 (NABTS) encoding waveform.

There is a significant challenge to using Transport B. Transport B is not protected by the Television Decoder Circuitry Act. Therefore, it may not be carried all the way from your station to the home. In many cities, cable systems maintain ownership of the vertical interval with the exception of line 21. They can strip any data on lines other than line 21 and insert their own data. In any case, cable systems are under no obligation to deliver your vertical interval to the home unless you have a contract with the system that specifically guarantees this right. Benefits of Transport B are that it has much higher bandwidth, and that there is not a requirement to give priority to closed captioning data.

As a practical matter, many broadcasters will find that the vertical interval is a very busy place and that multiplexing iTV data on line 21 using Transport A may be the best solution available.

Unfortunately, any VBI transport mechanism is a one-way link. It is not possible for the viewer to transmit messages or responses from the STB back to the station using this path. The most common way for viewers to get a return connection (commonly called a backchannel) is to use a dial-up telephone connection to the Internet. This provides a two-way path between the STB and a website dedicated to providing interactive content.

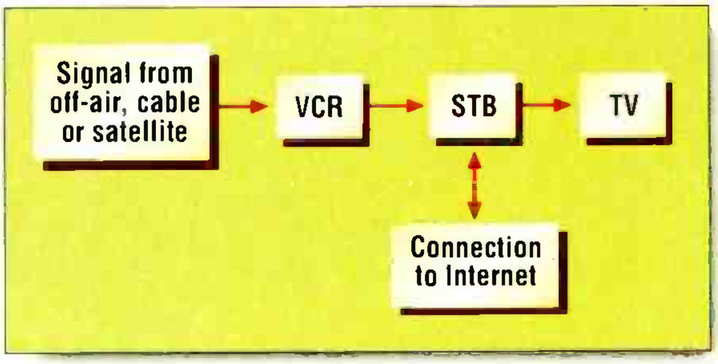

Figure 1. A typical interactive television setup uses an Internet-connected set-top box between the VCR and the TV. Some interactive systems allow for analog recording of interactive signals. In these cases, the set-top box is before the VCR.

Under the covers

It may help to look at a specific example. Our example will be the game show Jeopardy running on webtv using Transport A, line 21.

When an interactive program begins, a special trigger is sent using Text-2. This trigger tells the STB that interactive content is available. The STB superimposes the interactive icon on the television screen. When the viewer selects the interactive icon, the STB initiates a connection to the Internet. Once connected, the STB downloads all of the interactive content for that particular Jeopardy show. Once the interactive content is downloaded into the STB, it shifts display modes. The television picture is reduced in size, and a portion of the screen is dedicated to interactive content. From this point on, the viewer uses the controls of the STB to interact with the game and to attempt to provide answers along with the contestants on the show.

As the show progresses, various triggers and links are transmitted in real time in the vertical interval. These cues change the display and control functions such as moving on to the next question and answer and revealing answers.

Once the STB enters interactive mode, the viewer is essentially looking at a webpage that has been provided over the Internet. HTML, Java scripts, Cascading Style Sheets and other typical Web authoring techniques are used to change the content of the page. Other iTV environments may employ different processes.

Authoring interactive content

Authoring iTV content, which typically takes place in two steps, is quite different from authoring a typical webpage. A designer determines the look and feel of iTV, and appropriate page backgrounds are developed. Triggers and links are then added for each specific show.

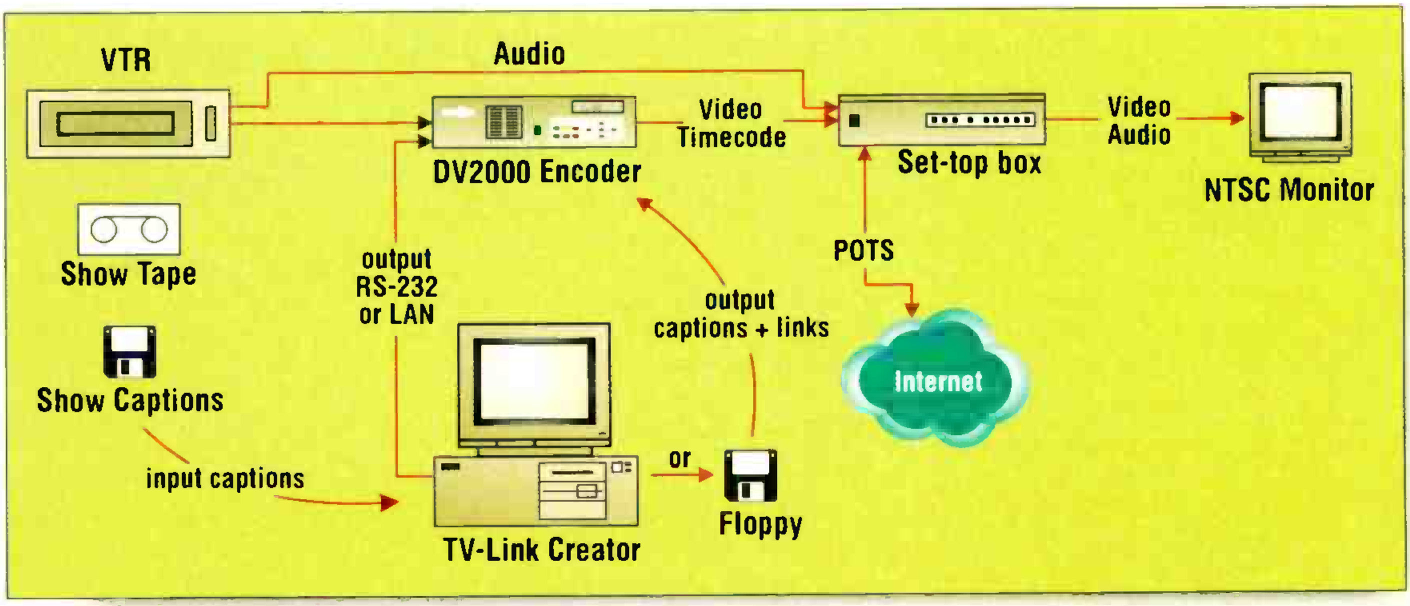

Figure 2. Authoring interactive content includes a two-step process that takes previously encoded captions and adds interactive content through an encoding system and software.


The champ
went down in
1 minute, 25 seconds.....

Once the show is finished, it is delivered to an iTV workstation running software such as TV Link Creator by Mixed Signals. The workstation has inputs for video and timecode from the VTR. The workstation takes in a disk file containing closed captions that were prepared earlier. As the iTV workstation operator views the program, he inserts triggers and links at the appropriate times. (The software resolves conflicts between closed captions and iTV content.) At the end of the process, the operator can either write out a new disk file containing both closed captions and iTV content or encode the combined closed captions and iTV cues into a new tape using a Mixed Signals DV2000 encoder. In any case, the closed caption and iTV data are usually encoded into the vertical interval for later playback. In some cases, the disk file is played out to air through a caption server during playback of the show.

Once the STB enters interactive mode, the viewer is essentially looking at a webpage that has been provided over the Internet.

This article has focused on one example of what is possible today. There are other iTV systems available, such as the one produced by Wink Communications. (Not to be confused with WINK-TV of Fort Myers, FL. WINK started out in 1938 with WINK Radio at 1240 AM. WINK-TV is continually getting calls for Wink Communications and has asked that I make you aware of the difference.) Wink Communications has been working on interactive television solutions for many years. Its current focus is on interactivity and e-commerce solutions for television. Another vendor of interactive solutions is Liberate Technologies. New companies are entering the market all the time.

Bandwidth limitations place restrictions on the current capabilities of iTV. As DTV becomes more common, and high-speed cable, satellite and DSL technologies make their way into the home, the interactive TV experience is sure to change. New creative possibilities will arise. By studying the current technology you can get some idea of where iTV is headed.

Brad Gilmer is president of Gilmer & Associates and is executive director of the Advanced Authoring Format Association.

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

......Unfortunately, the signal went down in 1 minute, 23.

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Ask Dr. Digital

Pick a color, any color

BY STEVE EPSTEIN, TECHNICAL EDITOR

Getting cameras to match can be a never-ending task. Especially if the cameras aren't identical to start with. However, what if you discover that none of the cameras you're trying to align seem to respond properly to the same color chart? That question was recently submitted by a *Broadcast Engineering* reader:

Please settle a long-running debate regarding the Sony Color Pattern Chart used with PTB500. Red is 104 degrees. What is the correct phase angle of the color following red? If it is magenta, it doesn't seem to register with any three-CCD camera I have used. All three-CCD (sub-broadcast) cameras I have tested on this chart have given a different phase on this color — the best being 85 degrees, and the worst 110 degrees. I have bought two Sony color charts with same result. What is this color? What chart do you suggest I use with Sony PTB 500 for testing three-CCD color cameras?

Rx

I turned this one over to Sony's camera expert, Larry Thorpe, vice president of acquisition systems. Here is what Larry had to say:

"My understanding is that the chart is made by a Japanese third party, the same one that makes the other PTB charts. It is obviously made of strips of filter film, similar to Kodak Wratten filters. We do not know the details of spectral response, and therefore cannot begin to specify various camera responses. Further, we have no information on camera colorimetry among cameras in the business and industrial categories. These specifications are simply not published by any manufacturer. Such information is notoriously unavailable from those design groups.

In my opinion, the best use of that chart is strictly for side-by-side comparisons among the same model. Various models will have different responses due to IR filters, lenses, CCD chip generation and a variety of other details.

I recommend use of the MacBeth ColorChecker chart and lights for colorimetry tests due to the built-in grayscale, many more and more useful colors, less possibility of systematic errors in the PTB (filters, lamp, mirror and diffuser condition as well as adjustment and reference calibration instrument). Again, comparison testing is useful, but absolute colorimetry is a difficult and elusive goal beyond any real need in checking inexpensive cameras."

Dr. Digital responds:

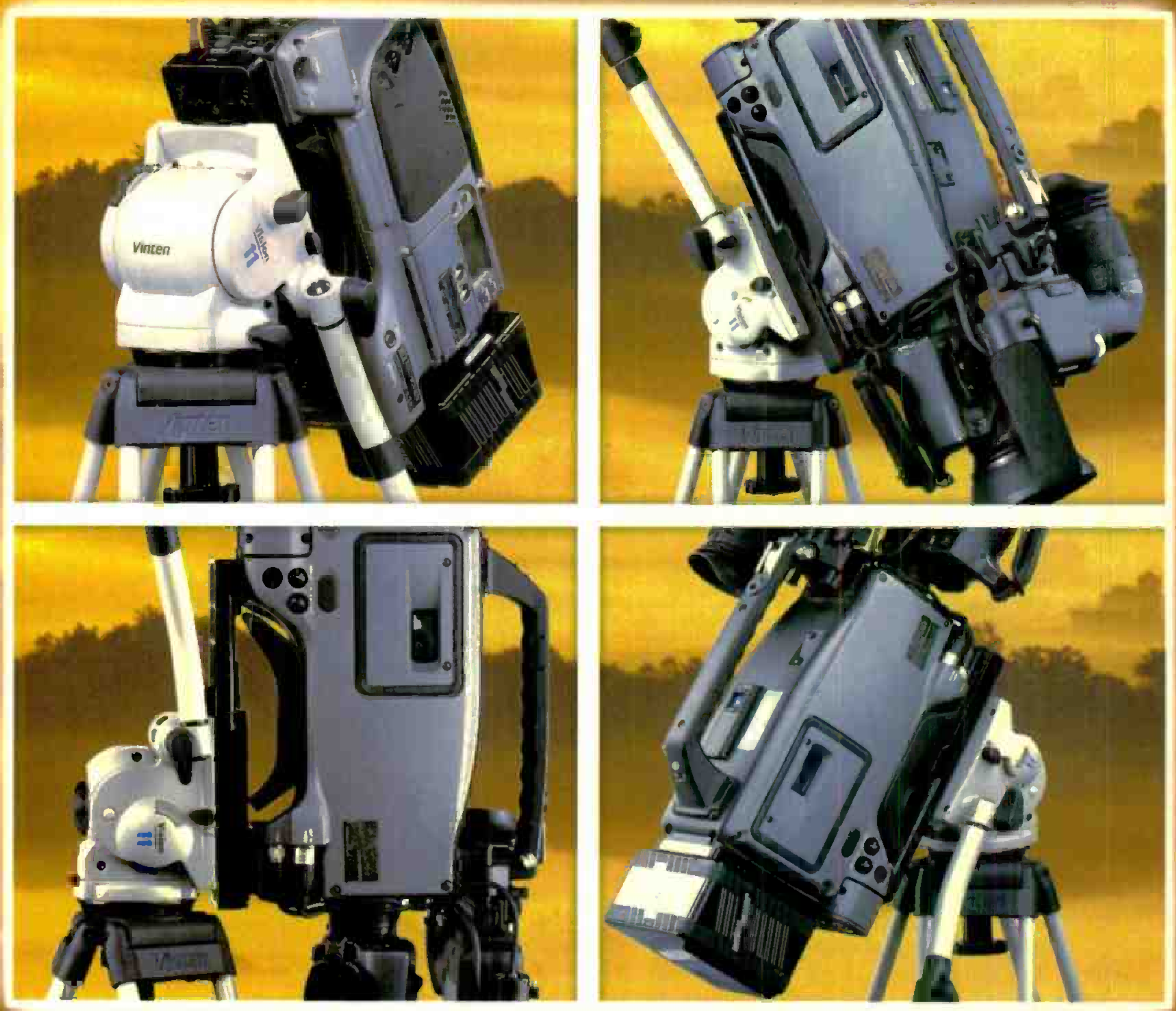
Matching the grayscale response of older tube cameras, even of the same make and model, was often a challenge. We used to avoid putting more than one color monitor in a production room because getting two color monitors to match perfectly was nearly impossible. Getting a perfect color match between different makes and models of today's digital cameras may be asking a bit too much. Jerry Cohen (then at JVC) once detailed the various compromises made when designing three-CCD color cameras (*BE* July 1993). Send me an email with your fax number and I will get a copy to you.

It is easy to test equipment to death while failing to notice the simple things like the camera focus is wrong, or the mic is picking up fan noise from a nearby computer.

Getting lost in the numbers

With all of today's digital equipment, it is sometimes easy to get lost in the numbers — audio sampling rates to 96kHz, hard drives capable of handling more than 100GB, HD data rates at 1.5Gb/s. It is easy to test equipment to death while failing to notice the simple things like the camera focus is wrong, or the mic is picking up fan noise from a nearby computer. Old cars can easily do the speed limit on today's highways, and old analog equipment can make high-quality pictures in today's digital world. In the end, it is the quality of sound and picture that make the difference, especially when combined with compelling content. How many times have we watched the footage of the Tacoma Narrows bridge, Zapruder's 8mm film of the Kennedy assassination or the archive footage of the final moments of the Hindenburg? Two of the three were black and white. The third is so grainy it is difficult to make out. But those images are forever etched in our minds because of the content, not the color or resolution.

As usual, your comments and suggestions are welcome. Drop me a note at drdigital@compuserve.com. ■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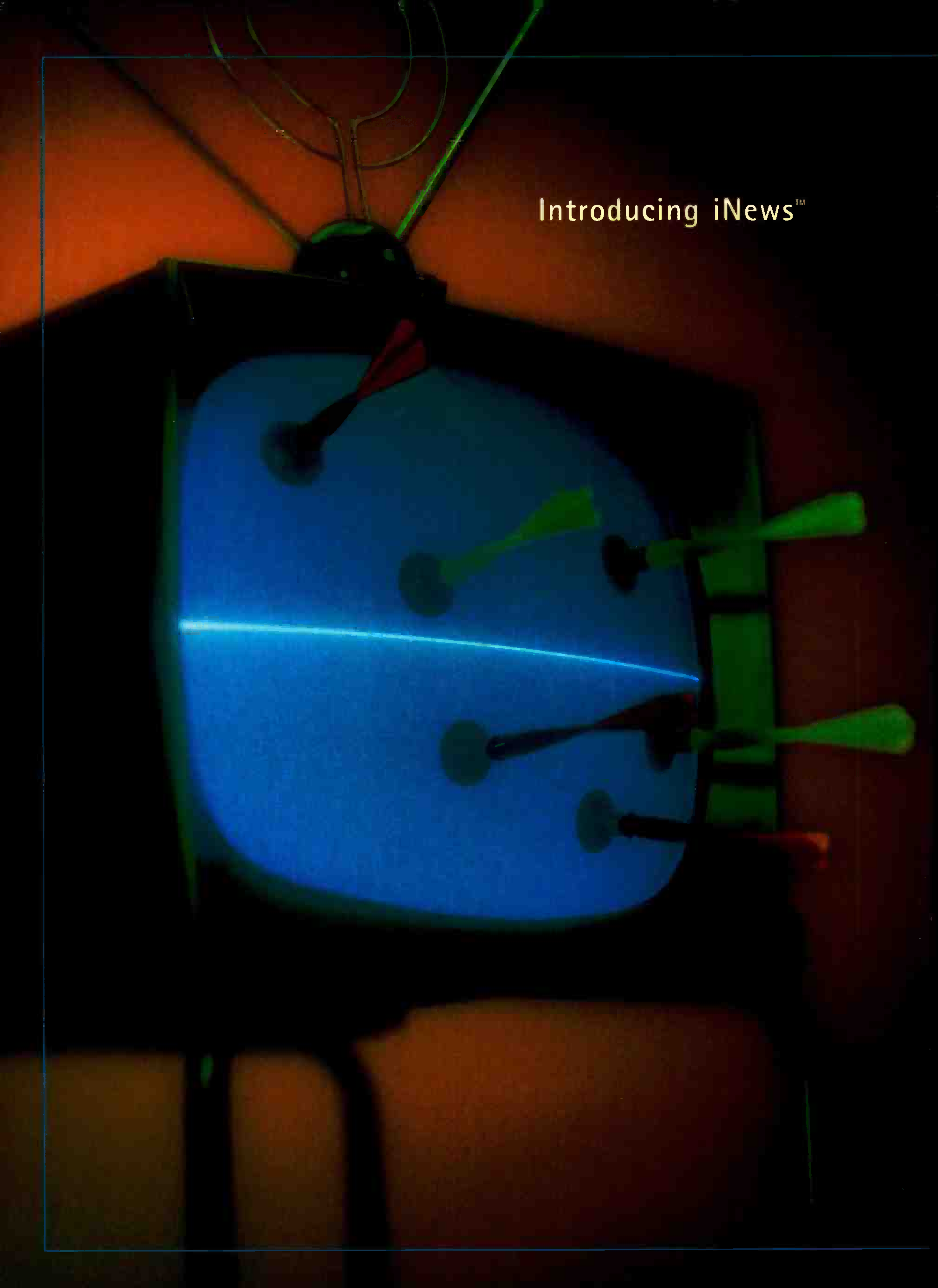
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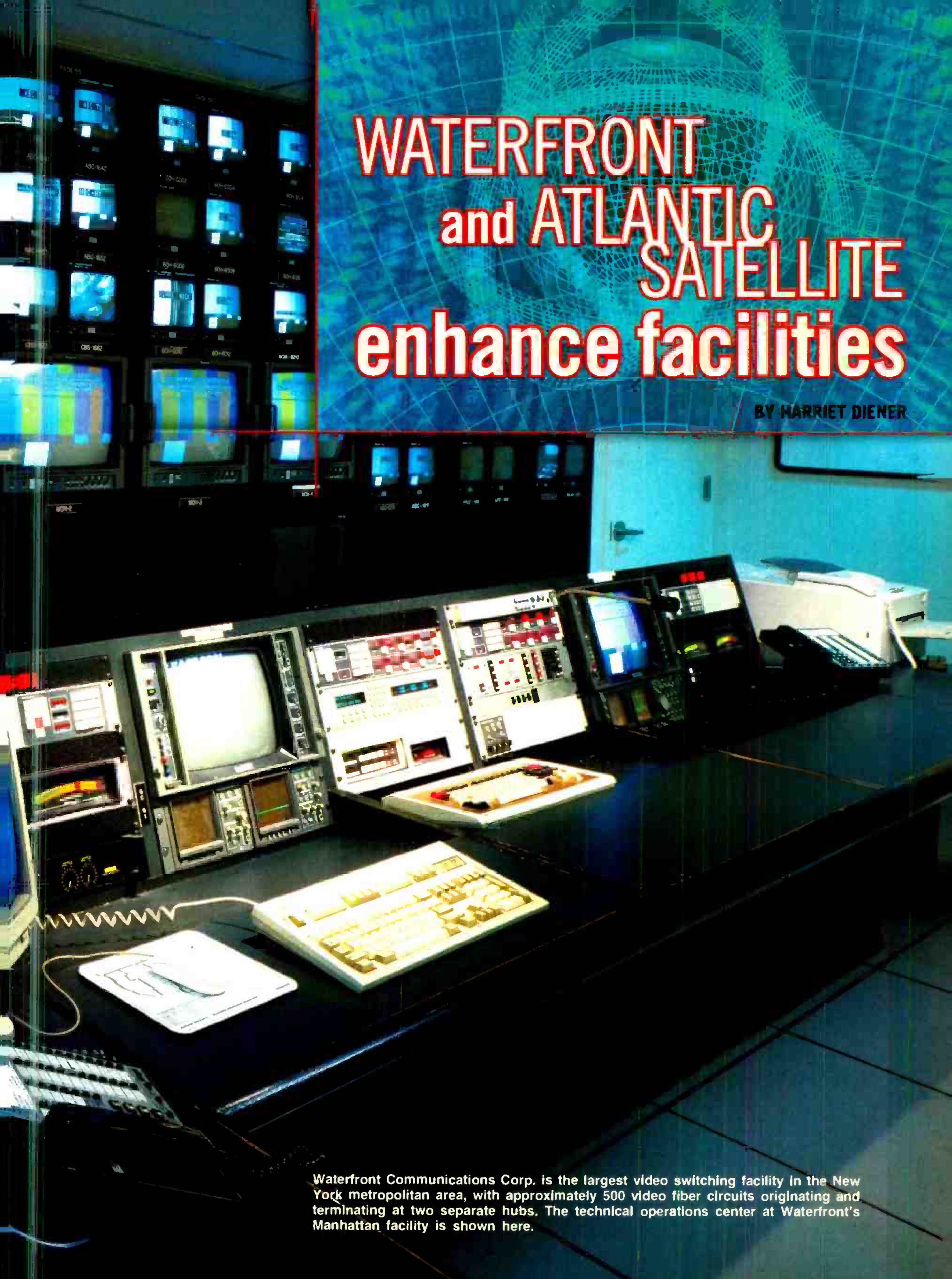
SYSTEMS DESIGN SHOWCASE

Waterfront Communications Corporation recently marked 15 years in the video switching industry with its most ambitious expansion to date. Waterfront specializes in video switching, quality control, last-mile connections, remote transmission, production and audio/visual services to the broadcast, cable and corporate television industries. The company services its substantial customer base from two Manhattan switching facilities and a site in Washington, D.C. Additionally, it offers enhanced capabilities via its relationship with Atlantic Satellite Communications Inc., a sister company and major teleport with facilities in Tappan, NY, and Northvale, NJ.

Initially established in 1985 as a microwave distribution company, the emerging availability of fiber optic connectivity in key New York City locations propelled Waterfront as a significant player in point-to-point video delivery. It began offering switching services in 1990 when it installed a 64x64 Di-Tech router in the Paramount Building in New York. The company simultaneously launched a secondary facility equipped with a 32x32 Di-Tech router in lower Manhattan.

WATERFRONT and ATLANTIC SATELLITE enhance facilities

BY HARRIET DIENER



Waterfront Communications Corp. is the largest video switching facility in the New York metropolitan area, with approximately 500 video fiber circuits originating and terminating at two separate hubs. The technical operations center at Waterfront's Manhattan facility is shown here.

WATERFRONT and ATLANTIC SATELLITE enhance facilities

As the need for video switching services increased dramatically in the metropolitan area, the demands on Waterfront's infrastructure surpassed the original router capabilities. Sub-router solutions were employed with the installation of a 32x32 Di-Tech router. However, significant growth necessitated the permanent solution of a larger capacity router.

In 1995, Waterfront moved to its current location — 545 Fifth Ave. in the heart of midtown Manhattan — and doubled its capacity with the installation of a 128x128 Grass Valley Group Series 7000 Router. The older secondary facility was upgraded with a 64x64 Di-Tech Router in 1997 and doubled again in 1999 with a 128x128 Grass Valley Group Series 7000 router from the original Fifth Avenue installation.

Waterfront is now the largest video switching facility in the New York metropolitan area. An elaborate network of analog and digital video fiber loops originates and terminates at Waterfront's switching hubs. This diverse fiber network guarantees that Waterfront's and Atlantic's clients enjoy uninterrupted service in the event of failures.

The heart of a switching facility is based upon its routing capabilities, and thus each expansion has been predicated upon the installation of a larger router. Waterfront's most recent and ambitious increase in capacity is a reflection of current industry trends and sensible consideration of future technology. While the evolution to digital television is inevitable, analog still dominates input and output signal transmission. The decision was made, therefore, to install a router that would enable Waterfront to conform to present analog technologies and transform into a digital router. The signal wiring and supporting infrastructure are capable of accommodating both analog and digital signals, allowing the analog router's chassis to be repurposed for digital as the need for analog circuits wanes.

Waterfront's expansion has been consistent with the increased demand of broadcast video service in the metropolitan area. In early 2000, Waterfront significantly expanded its video router capacity again with the installation of a 256x256 Philips Venus analog router with a 64x64 serial digital layer at 545 Fifth Ave. Waterfront populates 190x190 of the analog router, allowing the remainder for future expansion.

Waterfront's network is now comprised of approximately 500 video fiber circuits originating or terminating in either hub.

Waterfront selected the Philips Venus router for its primary facility following an intense evaluation process. All potential routers were delivered to Waterfront for demonstrations and configured to simulate authentic situations. The engineering department and the operators who would actually interface with the router defined the criteria. The significant factor in the decision was the ability to convert router portions from analog to digital without interrupting customers. Other required features included the ability to automatically route signals through format converters, an operator-friendly control board, the potential to upgrade with emerging technologies, control-system protection, redundant power supplies and hot-swappable circuit boards. Control pneumonics were required to conform to Waterfront's identification scheme, and it was imperative that replacement cards be made available within 24 hours. A supportive and knowledgeable service department was also high on the priority list. The Philips router met or exceeded all parameters and brought additional flexibility to the upgrade.

The ability for Waterfront to remain "live" during the installation was a critical factor in the expansion process. Waterfront chose the services of system integrator A. F. Associates Inc. to achieve the demands of the project and ensure that service was never interrupted. Waterfront's diverse client base and the very nature of its business requires consistent service, even during system upgrades. A. F. Associates' experience with moving "on-air" operations enabled the crossover to the new router system to be

Waterfront's router support wiring rack room.

roads.

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accomplished seamlessly during a slim 48-hour window of opportunity.

Acting as its own general contractor, Waterfront allowed ample time for contractors to perform without impeding each other's work. A great deal of office real estate needed to be reallocated to accommodate the significantly expanded router system. The first step was to hire an architect to evaluate the space, design the technical facilities and provide for people comforts. The architect furnished drawings to comply with Waterfront's requirements, supplied a blueprint and ensured that building codes were met.

Following the demolition and carpentry phase, a mechanical engineer was employed to assess the HVAC systems for current acceptability and future expansion, including the proper placement of air ducts and power requirements. The mechanical engineer also determined the impact of the new equipment on the existing UPS system, ensured that the facility conformed to the fire codes in the area, facilitated the raised floor installation and obtained the necessary permits.

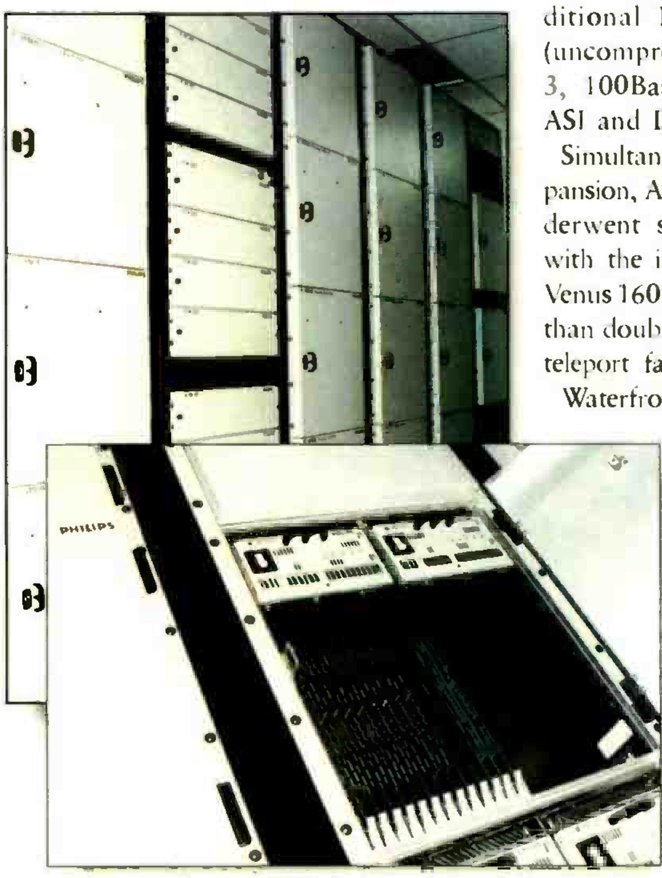
Waterfront's network is now comprised of approximately 500 video fiber circuits originating or terminating in either hub. The switching hubs enable customers to access an array of different formats or quality transport systems that deliver broadcast quality signals.

Waterfront also expanded its fiber backbone to Atlantic Satellite Communications in Northvale, NJ — one of the largest satellite service providers in the metropolitan area. Atlantic Satellite is a single source supplier of satellite transmission services, videotape facilities and support services to the broadcast and cable television industries. Utilizing dark fiber along with ADC DV6000 fiber transport equipment, the two facilities are now connected with state-of-the-art technology giving Waterfront expansion capabilities in various bandwidth formats including traditional NTSC, serial digital (uncompressed 270Mb/s), DS-3, 100Base-T Ethernet, DVB-ASI and DS-1.

Atlantic Satellite is linked by 50 digital fiber lines to Waterfront facilities, and the uplink service utilizes Waterfront for delivery of video. Atlantic Satellite's satellite receiver rack is shown here.

Simultaneous to Waterfront's expansion, Atlantic Satellite also underwent substantial expansion with the installation of a Philips Venus 160x128 analog router, more than doubling transmission at the teleport facility.

Waterfront and Atlantic Satellite have 50 digital fiber lines between the two facilities. Forty percent of the two companies' total workload is achieved by complementing each other's services. Most of Atlantic Satellite's uplink transmissions utilize Waterfront's switching services in Manhattan for the first- and last-mile connection. Together Waterfront and Atlantic Satellite possess the ability to deliver multiple video transport formats to their clients at a low cost. ■



Waterfront expanded its routing capabilities with a 256x256 Philips Venus analog/digital video router.

Harriet Diener is an industry consultant based on the East Coast. Jerry O'Donnell contributed information to this article.

Design team

Waterfront Communications and Atlantic Satellite Communications:

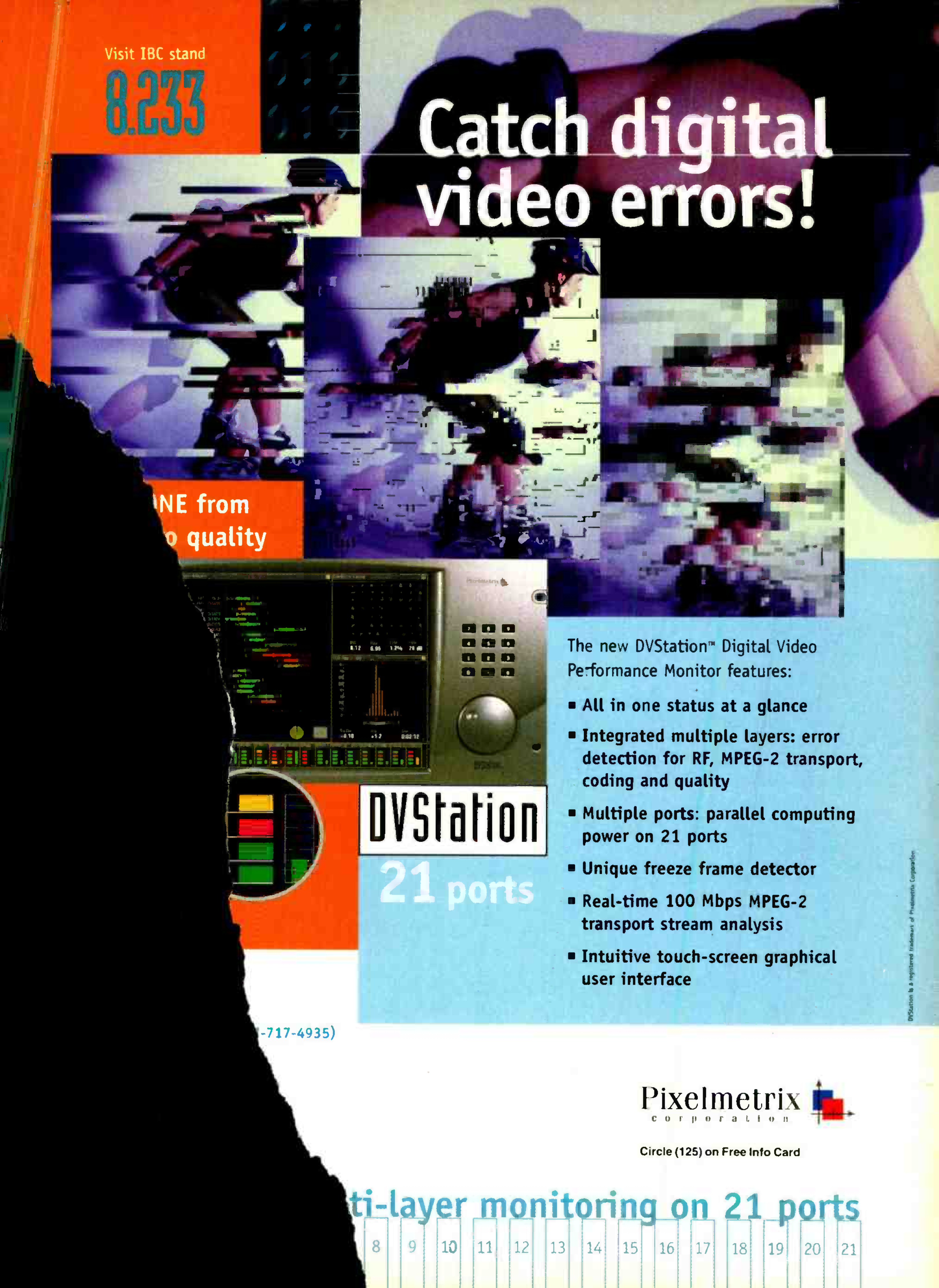
- Frank Luperella, senior vice president and general manager
- Jerry O'Donnell, vice president of network engineering

A.F. Associates:

- Tom Canavan, president
- Jim McGrath, senior vice president of engineering and technology
- Nand Ganesh, project leader/engineer

Equipment list

- Philips Venus Router running Jupiter software V.5
- Benchmark DA-102 audio distribution amplifiers
- Grass Valley 8506 video distribution amplifiers
- Philips controllers
- Grass Valley Series 7000 router
- CP 3830 controllers for Philips router
- VM 3000A control processor for BTS router
- CB 3000 control buffer



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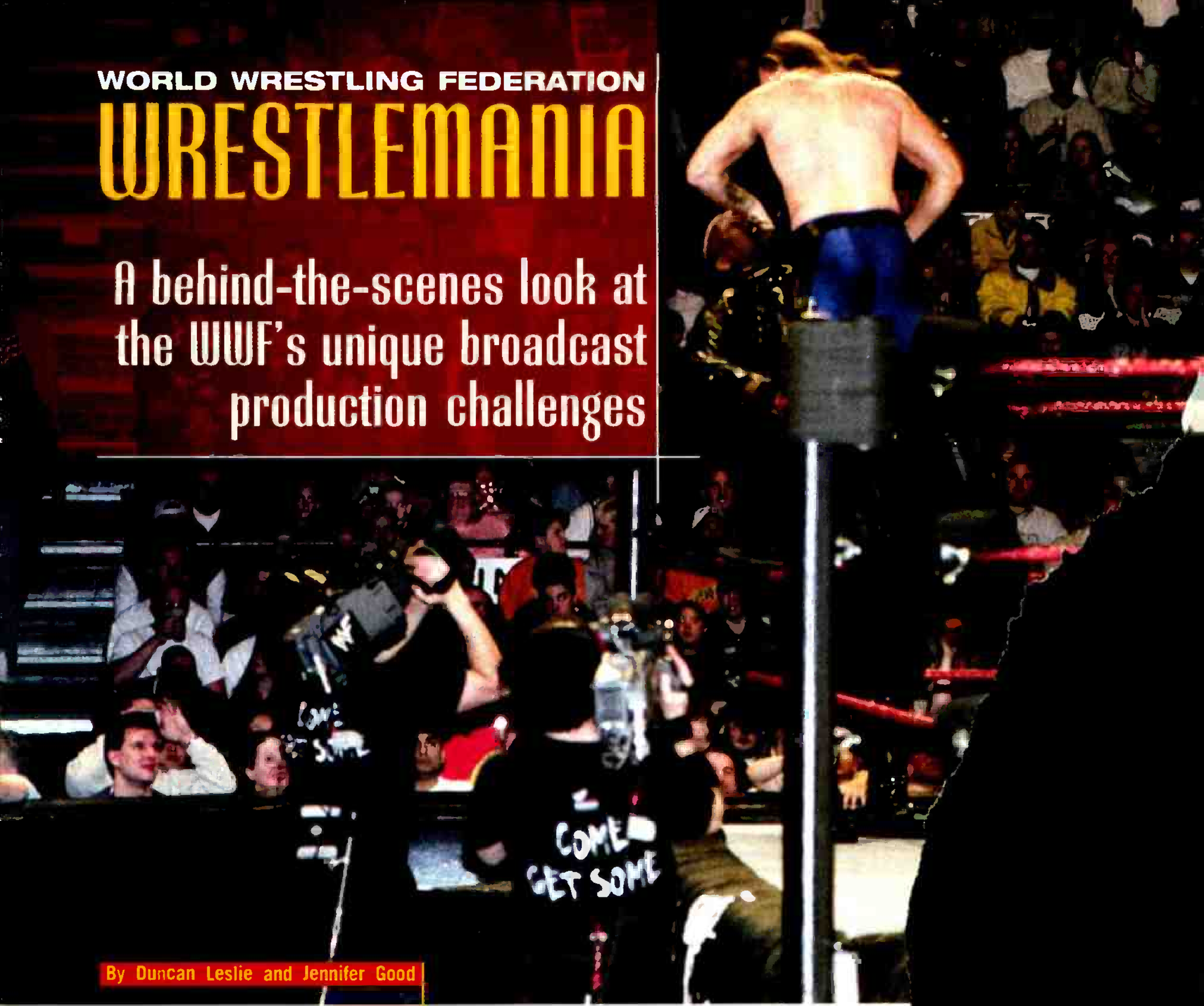
A behind-the-scenes look at the WWF's unique broadcast production challenges



By Duncan Leslie and Jennifer Good

While WWFE events are scripted and venues pre-rigged with mics, cameras and monitors for crucial shots, production crews often give themselves extra lengths of cable for mobility.

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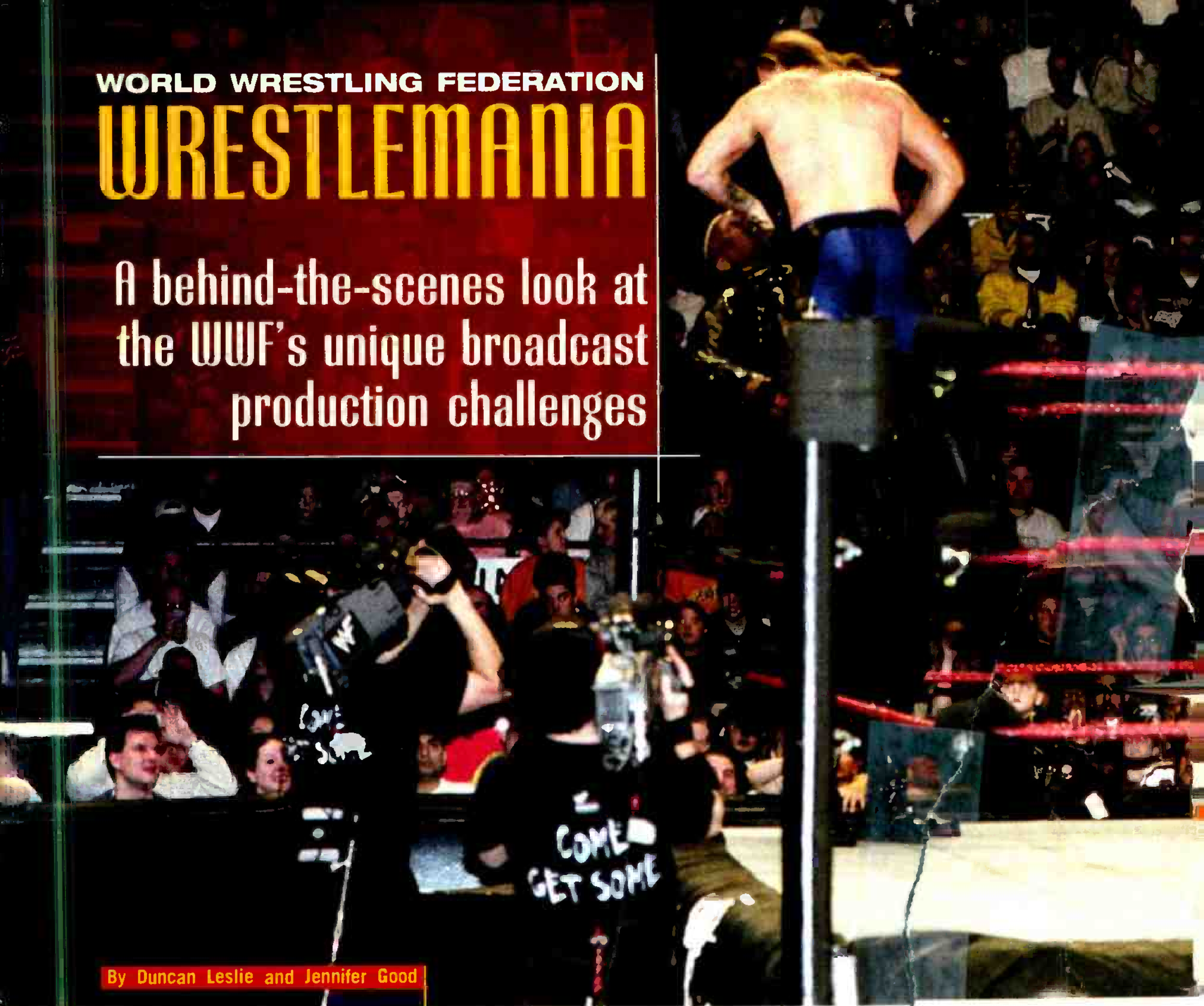

By Duncan Leslie and Jennifer Good

While WWFE events are scripted and venues pre-rigged with mics, cameras and monitors for crucial shots, production crews often give themselves extra lengths of cable for mobility.

WWF wrestler Stone Cold Steve Austin once hijacked a Zamboni and drove it into the arena, which was planned. What hadn't been planned was when he backed up over the audio transmission cables to the satellite truck, severing them. Until a spare was run, the live broadcast had no audio.

Another time, the crew and cameras were soaked by a beer-spraying fire hose so that the servos on two of the lenses stuck. For a few segments the camera crew had to be the camera's iris, pushing and pulling the focus manually.

Zamboni-proof cables and liquid-resistant cameras are just two examples of the extensive production equipment inventory required for a typical live World Wrestling Federation Entertainment (WWFE) event. But then again, there's nothing really typical about a WWFE broadcast. WWFE productions are hybrid events equal parts sports and rock 'n' roll with a good measure of the unknown mixed in as well.

With sports or a rock concert, the action is confined to one area: the playing field or stage. For a normal sporting event, cameras are set up in the arena and shots are blocked out. Football, for example, stays on a grid. Wrestling, however, goes all over — and outside — the arena, and producers must adhere to a storyline.

In addition to these challenges, the production staff must meet a grueling production schedule that includes 116 televised events per year. These include RAW, the top-rated live, two-hour show on USA; Smackdown!, a live-to-tape, two-hour show on UPN; Livewire, Superstar and Sunday Night Heat on USA; and two syndicated one-hour shows — Jakked and Metal.

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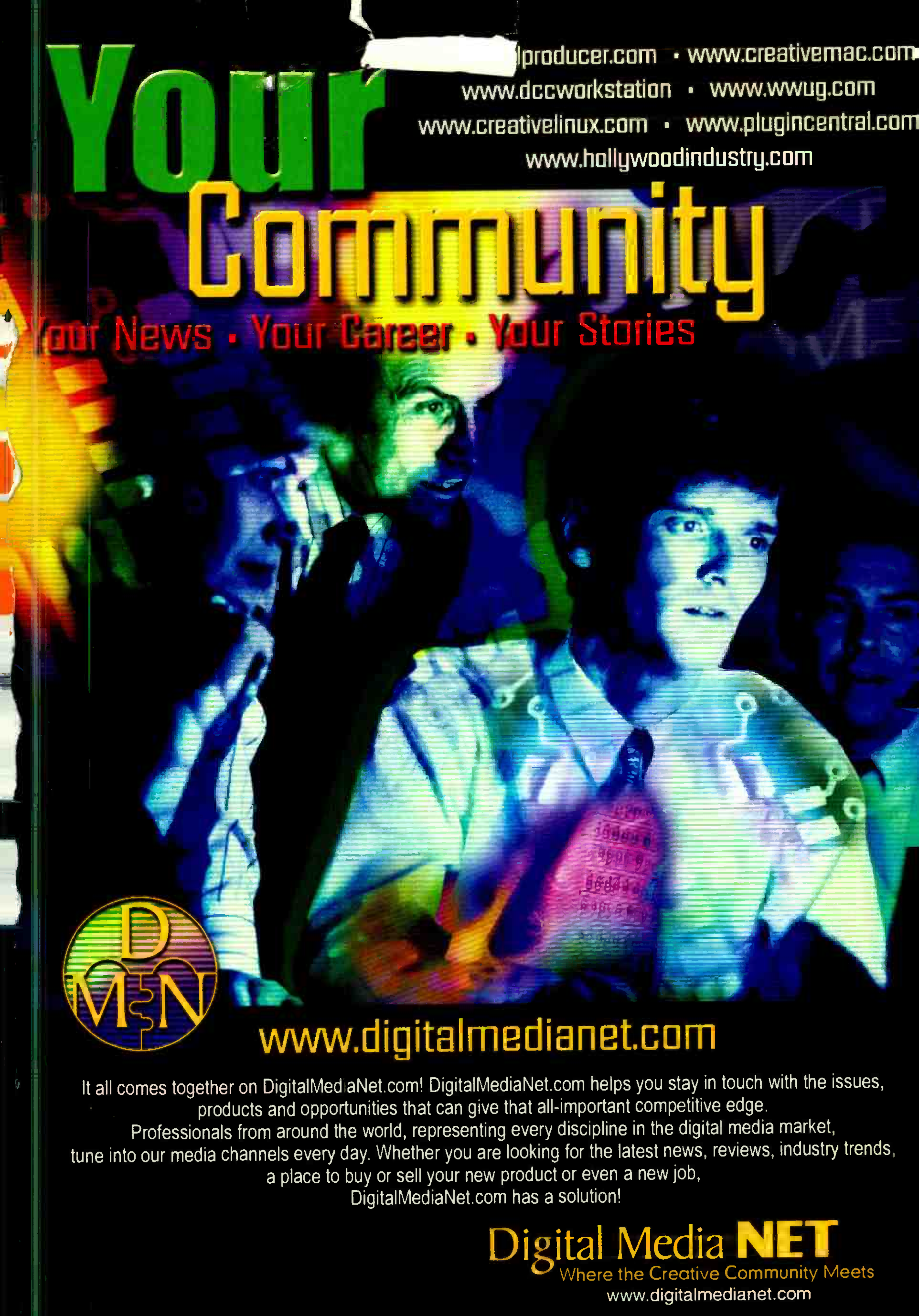
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One recent week's workload encompassed 13 hours of live television production that needed to be finished within six days. The vast majority of the time, producers set, shoot and strike the same day, which is rare in this industry, especially for back-to-back events.

The focus of the "set" is the wrestling ring in the middle of an arena. Smaller, but still important, components include a large lighting truss hung above the ring and a metal stage wrestlers walk down. Production crews rig the ring, stage and truss with cameras, mics, monitors and other equipment. For any WWFE event, there is a multitude of RF equipment being used — mics, headsets, lavalier mics. There are also about 100 different video feeds all over the building, all controlled through the remote truck. Three ENG crews cover certain parts of storylines.

Cabling is always a challenge because it's different from arena to arena. The dressing rooms are also cabled right to the truck. So, what we normally do is homerun probably 6000 or 7000 feet of cable per event. These arenas aren't set up for that. They're sports venues. Some arenas are very cable-friendly, where the trucks can park close to the event floor. Some are not, so you have to run 400 feet just to get in the arena. If an event is pre-cabled, production crews try to utilize as much of the coax, triax and XLR drops as are available, and if that doesn't work, then they turn to homeruns.

WWFE employs a Grass Valley Group Kalypso production switcher in its Supershooter 8 production truck.

The fact that the action in the ring is scripted provides a slight advantage, but crews still have to remain on their toes and expect the unexpected. Knowing in advance where some of this stuff is going to happen is helpful to production, but production crews allow themselves another 50 feet of slack, because you never know.

WWFE's production team was put to the extreme test during WWFE's annual Wrestlemania event, the equivalent of the Super Bowl. But this year's production added a new wrinkle. More than just the main event, this year's Wrestlemania — held at The Pond in Anaheim, CA — comprised a whole weekend of events, rather than just one day of television broadcasting. This year we had a 12-hour PPV broadcast offering eight hours of a "pre-game show," the three-hour PPV Wrestlemania event itself and an hour "post-game show."

WWFE relies on Chyron iNFiNiT! and Accom DVEOUS/Attache systems to provide graphics, animation and replays.

The fact that the action in the ring is scripted provides a slight advantage, but crews still have to remain on their toes and expect the unexpected.

To coordinate all these segments, WWFE brought in three remote production trucks, instead of the usual single truck used at all events. Basically, three events were going on at the same time. At the Anaheim Convention Center, one production truck covered local portions of the show, with the tape rolls and all transmissions going through that


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truck. At The Pond, where Wrestlemania was occurring, two trucks were operating: One was a sub truck for All Day Long and the other was the main Wrestlemania and USA Network truck.

These three trucks had to be tied together for transmission and communication. On paper, the event was fairly straightforward, except for tethering all the transmissions together. The logistics were worked out in an empty convention center. However, with 10,000 people in the seats, it became very complicated to shoot, because there were so many people around and nobody could hear.

The "pre-game show" was a retrospective look at the history of Wrestlemania. It was an interesting show to compile, because it not only outlined the history of WWFE, storylines and character development, but it also chronicled the development of our television product.

One of the daunting aspects of this year's Wrestlemania was for every hour of the pre-game show, there were approximately 40 minutes on tape and 20 minutes live, which translates to about six hours of highly produced material that needed to be created in the month before the event.

The continuous coverage that WWFE's crews pulled off for Wrestlemania represented an extraordinary effort and, while no WWFE event is common, there are ways to lessen the strain.

For every production, 90 percent of the equipment is set in advance. There is a jib camera, three hard cameras and four handheld cameras tethered to the truck every time. Three ENG packages are always backstage and production crews always hang speaker clusters. There are also various points of audio and video connectivity to pyrotechnics, lighting, screens, etc. So there is a technical "shell," which is added to for each event.

Another thing that's unique about the broadcast production is that, unlike sports, there isn't an off-season that allows us to sit back and evolve a new theme. We're on all the time, as our product evolves. It's a daunting assignment.

In the middle of this constant on-air activity, we're also faced with the challenge of continually updating our technology. We have always prided ourselves on using the best technology available. But it can be a two-headed monster, at times, making our remote production match with the capabilities of our in-house audio/video production teams. WWFE productions employ Chyron iNFiNiT! graphics systems, GVG Kalypso and GVG 4000 production switchers, Leitch still store and a PESA routing switcher. Production crews continually strive to achieve parity on the road with the tools available at the headquarters in Stamford. We're always sending information back and forth via satellite prior to live events. They'll do something in post and send it by satellite or fiber to us, and we'll integrate it into the show; or we'll send something that we shot, and they'll sweeten it and send it back to us.

Cabling is always a challenge because it's different from arena to arena.

WWFE has also migrated to newer digital formats as aggressively as possible. A decade or so ago, mostly analog one-inch tape was used in our trucks. Now it's Sony Digital Betacam. We've purchased Sony 790, 900 and 950 cameras in our truck, so we basically have a compatible optical block situation. We are extremely aggressive in utilizing the latest technology in our TV positions. An Accom four-channel DVEOUS/Attache system was also recently purchased and definitely added pizzazz to our production in terms of replay moves and animations that can be added in our production, our lower-thirds and our graphics, which is one of our strongest areas.

In terms of audio, at each event more than 100 inputs are mixed through Calrec Q2 and Soundcraft Spirit consoles, because we have so many specific audio sources to record and to mix. The base platform is 104 inputs, but sometimes the numbers reach 120 or 130.

It is challenging — creatively, logistically and technically. But we pride ourselves on getting the job done no matter what.

WWFE uses Digital Betacam and Sony 790, 900 and 950 cameras for acquistion.

Duncan Leslie is manager of production logistics and Jennifer Good is coordinating producer for WWF Entertainment.

Transmission & Distribution

More thoughts on DTV transmitters

BY DON MARKLEY

By now, every transmitter technician and chief engineer who passes the basic broadcasters' physical exam (can hear thunder and eat mush) has gazed at the current crop of DTV transmitters. This has been done with emotions that varied from fear to outright lust, depending upon the degree to which a new challenge appeals to each individual. Because that first exposure has past, it may be time to sit back and think about just how to make that decision as to which transmitter to buy.

First, the power needed has probably been determined based on a combination of the allocated power, the facilities sought through maximization, and the antenna system initially selected through discussions with the station's consulting engineer. The proposed power level will have a great deal to do with the transmitter choice, especially when choosing between solid-state and vacuum technology. If the station will be running a megawatt from an omni-directional antenna, the cost of solid-state transmitters will probably be prohibitive. On the other end of the scale, solid-state is an excellent choice for transmitters at or below 5kW average power.

Let's look at what is offered. You've got your air-cooled solid-state boxes, your liquid-cooled solid-state boxes, and you've got your big IOTs cooled by liquid, vapor or air. You've got your short tubes that are liquid cooled and your more conventional looking tubes that are cooled by air. You also have some variations of klystrons combined with tubelike parts. The sum of it is that they all work — they make RF to be delivered to the antenna. To the author's knowledge, there really aren't any transmitters from the better-known manufacturers that could be considered to be really bad. That being the case, there are still a number of things to be considered that should influence your purchasing decision.

The obvious first consideration is performance. While all the accepted transmitters will make RF and will look good into a dummy load, just what has been done to make them perform at their absolute best? For example, much has been said in DTV discussions about the group delay inherent in the antenna, transmission line and, in some cases, combiners. It isn't enough to simply correct for distortions in the driver and amplifier stages. A complete system should also provide correction for distortions to the signal that are introduced by the radiating system. If this is not done, the perceived bit-error rate at the receiver is increased, which lowers the margin before the signal is lost and, in reality, reduces the effective service area. Some exciters provide such correction capability. Unfortunately, they are not the least expensive on the market but, the extra cost may well be acceptable if the overall service is improved.

Almost everyone now has full-blown computers buried inside the transmitter to control everything from system monitoring to signal correction circuits. What happens when one of those computers develops a little glitch and needs to be rebooted? Everyone who has spent any time at all with a computer knows that they all hiccup on occasion whether caused by voltage transients, improperly applied fingers on the keyboard or an incorrectly read file from the hard drive. In such instances – either the old CTRL-ALT-DEL combination is applied or a full push the power button shutdown is needed to restore sanity to the computer. When such reboots are needed for the computer in the transmitter, will the system stay on the air? Will the correction settings be lost and, if so, how quickly will the system return to a properly corrected

FRAME GRAB
A look at consumer side of DTV.

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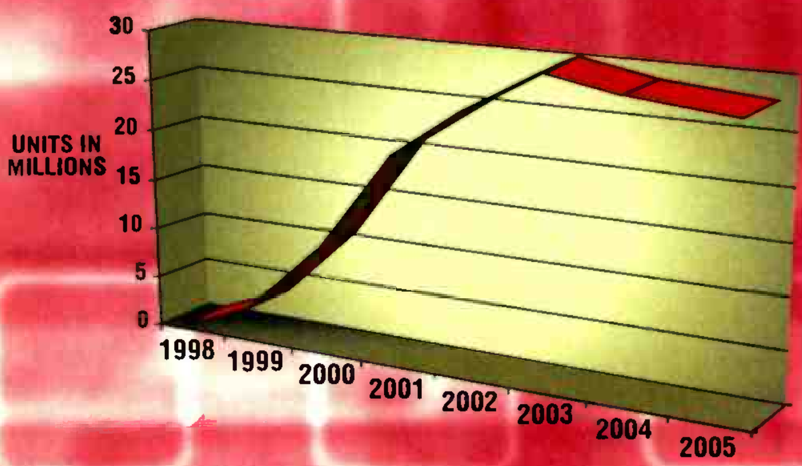

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state? The transmitter itself should stay on the air and provide reasonable quality RF during such control problems or even during failure of the computer. The number of little systems in the transmitter that can take it off the air should be as low as possible for maximum on-air time.

One really big area to investigate is just how well the transmitter will be supported by its manufacturer. First, does the manufacturer provide a school for the model of transmitter you will be using? Is that school actually taught by knowledgeable engineers or by some technician that isn't needed elsewhere? Do the training materials adequately cover the circuits in the transmitter down to the component level? After all, it should be possible for the transmitter staff to repair most of the circuit boards, not simply swap them out for new ones. All of the transmitter crew should attend the school. That will probably require attendance at more than one session which, in turn, means that the school needs to be offered more often than once per year. Last but not least, the cost of the school should be included in the transmitter price.

The next item of customer support is actual technical assistance and parts availability. No manufacturer is worth a tinker's dam without 24-hour-a-day, 365-day-a-year technical assistance. If you can't call at 3 a.m. from a mountaintop in West Elbow, MT, and get someone on the line in a reasonable time that can provide you with real help, get a different manufacturer. It's as simple as that.

That leads to the next phase, which involves repair parts. Everything considered a reasonably necessary repair part in that transmitter should be available for immediate shipment to get you back on the air as quickly as possible. If that is not the case, look for a different manufacturer.

In addition to the obvious consideration of the initial cost of a transmitter, what will be the operating costs for the system? That involves the expected life of the amplifier devices with their cost, the expenses for other consumables like coolant and the amount of power that the system will consume from the line. It should be possible to come up with a fairly accurate budget to determine just how much the system will cost the station on an annual basis and to use that information with the original price to determine the actual cost of generating RF.

Finally, the manufacturer should willingly provide you with a list of users of the model of transmitter you are considering. Call a few stations and talk to the chief engineer about his experiences. Was the transmitter reasonable to install, how reliable has it been, what have been his experiences when dealing with the factory, what problems has he encountered and would he buy the same box again. There is an old saying about asking someone who owns one. It certainly applies to the biggest single piece of equipment at the station. ■

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

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

24p post production

BY TERRY BROWN

By now, most readers are aware of the various DTV formats being broadcast let alone the number of possible formats in the famous ATSC Table 3. When the networks made their announcements regarding the DTV formats they would be adopting, the post-production industry was stunned. It would be unrealistic for a post-production services company to build facilities for each possible format. In addition to this new dilemma, there has been an ongoing effort since the mid-80s to electronically generate high-quality foreign distribution masters. The basic economic model of episodic television tells us that if a particular series expects to come out ahead financially, it must not only have successful foreign sales, but be marketable in domestic syndication as well. For the owners of a particular a show or series, consideration must be given to the format requirements for the first run network delivery, a 25 frame per second version for international distribution and an unknown format for future syndication.

LaserPacific Media Corp., a post-production facility in Hollywood, CA, quickly concluded that because nearly 99 percent of episodic television shows are shot on film, and film runs at 24 frames per second (24fps), post production should be done at 24fps. The post process should also use the highest spatial resolution from Table 3 to assure that only cross or downconversions are needed to create the final products.

In 1998, LaserPacific embarked on a mission to put together a 1920x1080, 24P post-production system. It partnered with Sony, Philips, NVision, Evertz, Digital Vision, daVinci and others to fast track a system that would be ready for the 1999-2000 season.

Review of the post process

In episodic production, as well as long-form "made for television" movies, picture and sound are captured by a dual system. The film camera is capturing picture at 24fps while an audio recording device captures the sound on typically a tape format along with a sync reference. Today the audio recorder is either a Nagra 1/4" with center track timecode or a digital audio tape device (DAT, DA-88 etc.). The timecode recorded on the audio device normally runs at 30fps.

24p post production allows post facilities to create a universal master for international distribution, first run and future syndication. The HD Edit-1, one of two HD, multi-frame rate edit rooms at LaserPacific Hollywood, is shown here.

In post, the film is put on a telecine and run at 23.976fps. By adding a 2:3 pulldown sequence (see side bar), the temporal rate is converted to 59.94 fields per second allowing recording on a 29.97fps recorder. The production sound element is "resolved" to 29.97fps so that its speed is reduced by the same .1 percent as the film. Picture and track are synchronized with a device similar to an edit controller and recorded to a telecine master tape.

The offline editing system (nonlinear and mostly Avid-type systems) are very flexible devices that allow editors to work with a database of clips instead of the timecode numbers associated with the telecine masters. The database relates picture and sound to other information such as scene and take numbers, film keycode numbers, camera roll numbers, production sound roll numbers, shoot dates, etc. The database must track the telecine-master timecode as well as the original production sound timecode. The burden for generating these databases has been put on the post production facility. Over the years, systems have been developed by LaserPacific and others to automate some of these logging tasks. Data is collected as a snapshot of a single point in time for each take transferred. Real-time data, such as the film code and timecodes are logged automatically with the use of electronic readers that send data to a central computer. Non-real-time data is entered by the telecine operator. The offline systems also have the capability of capturing or digitizing only the original film frames running at 23.976fps embedded in the 29.97fps video. This requires the database to have knowledge of the timecode-to-pulldown relationship of the video. Normally, the database snapshots or records are taken at a telecine-master timecode number associated to an "A" frame. Once completed the database provides a map to the picture, sound and timecode of the

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telecine master element. Since some of the database systems are proprietary, a common interchange ASCII file format called Flex was developed.

Once the editor completed the final cut, two edit decision lists (EDLs) are exported from the offline system's database. One represents the video and audio from the telecine master source tapes and the other is audio or track only and points back to the original production tapes. The first EDL is used for the online assembly process where the high quality masters are used to re-conform the show. The second EDL goes to the post sound dialog editor who will assemble the track from the production tapes, then clean up and smooth out the track removing background noises, replacing dialog, etc. Music and effects are added to create a final track that will be married back to the final video element later.

Once the online edit is complete the "Edited Master" is given a final timing (film term for color correction) to visually smooth the transitions of the edit points and create the final "look" of the show.

Once the "Color Timed Master" is created the final audio track from post sound can be "laid back" replacing the scratch track of the master. The show can now be titled and final network "air" tapes can be made.

1920x1080, 24p basics

Film is transferred to tape at a one-to-one, frame for frame relationship along with production audio. No longer is the complexity of 2:3 a part of the telecine process. All editing, effects and titling are done in the 24p domain. The result is a product that is essentially the same as if the post process were done entirely on film. At this point 2:3 pulldown can be added to create a 60i or 60p version, at either the current or reduced spatial resolution. The product can also be run a 4 percent higher temporal rate to create a 25-frame (or 50i) version.

The dirty details

From the previous paragraph, it sounds like 24p post production is a "no brainer." Unfortunately, we must coexist with a 30-frame world and this coexistence can add tremendous complexity to the process. The majority of the offline edit systems in use today are 30-frame based. In most cases, either a 3/4-inch or Betacam SP tape are used to "input" or "digitize" the material into the system. Most post-production sound facilities also use systems that are based on 30-frame timecode and thus the production sound is recorded with 30fps code.

Much of the complexity happens during the telecine process. Remember, when the film is transferred it is synchronized with production sound and recorded onto the telecine master while simultaneously generating a database for the offline system. In this case we have production audio timecode running at 29.97fps while the telecine master is recording at 23.976fps, which is the same speed the film is running at. In order to guarantee frame accurate timecode capture by the logging system, the sync word of both timecodes must be in phase at the capture point. To achieve this two pieces of equipment need to be modified from traditional methods of operation. First the facility's master sync system needed the ability to lock the house 525/59.94Hz reference with a 1080/23.976Hz (actually 47.952Hz is used). These two rates have a coincidence every 10 fields or six times per second. LaserPacific went to NVision to modify their existing sync generator to genlock to a 525/59.94Hz master reference and output 525/59.94Hz, 1080/47.452Hz, 625/47.952Hz and a 6Hz pulse that is the vertical coincidence point of the three references. daVinci modified their TLC telecine controller system to use 6Hz coincidence point to start two time lines, one for the 29.97fps machines and one for the 23.976fps ones. This made it possible to guarantee proper timecode sync word phase at the capture point. LaserPacific helped develop and uses an Evertz 9025 encoder and "Tracker" logging system. This system also uses the 6Hz relationship to qualify the data captures.

Another hurdle is that offline edit systems are still based on 30fps (29.97fps) standard definition. This requires the telecine master to be converted to normal 525/29.97fps video by adding 2:3 pulldown and downconverting. Further, a convention for mapping between 24-frame and 30-frame timecode is needed. A Flex file is exported from the telecine logging system to be sent along with the 3/4-inch tape to the offline editor. In order to generate this file, the system must convert the 24-frame timecode on the telecine master to 30-frame and know what the pulldown will be when the downconversion is made. To achieve this it was decided early on that pulldown would be mapped to timecode and that except for the final Network delivery tape, all interim 30-frame timecode would be non-drop. This allows a simple convention of 24-frame to 30-frame timecode mapping as shown in Figure 1. The timecode numbers are identical at each whole second. Notice the modulo 4 to modulo 5 relationship between seconds that correspond to "A" frames in the pulldown sequence. The daVinci TLC and Evertz logging system edit and log only on valid, pseudo "A" frame timecode numbers (frames 00, 04, 08, 12, 16, 20). When the Flex file is exported, the mod 4 numbers are converted to their mod 5 equivalents (00, 05, 10, 15, 20, 25). Remember, because of the way the synchronizer works, these pseudo "A" frame timecode numbers are also points where the 30-frame audio numbers will be accurate.

From the offline editor's point of view, nothing changes when working on a 24p show. The 30-frame tape is digitized into the system. Using the Flex database, only the original 24 frames are captured. When editing is complete, the same two EDLs are exported from the system. The post-sound facility continues to work as before. The big difference comes during the online conform session. The 30-frame list must be converted back to 24-frame, but the simple timecode mapping convention used in telecine cannot be used. Since a 24fps frame is longer in time compared to a 1/30fps frame, simple timecode mapping would cause run-time errors to accumulate at each

	A					A					A					A					A					A				
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24	0	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12	13	14	14	15	16	17	18	18	19	20	21	22	22	23

Figure 1. 30-frame to 24-frame timecode map.

edit points. The 24-frame version would slowly become longer causing sound sync problems. LaserPacific and others have written conversion programs that keep track of these time deltas and trim edit points by a frame every so often to keep picture in sync with sound. Once the EDL is converted, the online assemble proceeds as normal.

Once the online is complete the tape to tape timing (color correction) is performed and a 24p color timed master is made ready for the track to be laid back. Once again, a daVinci TLC is used to synchronize the 24fps picture element with the 30fps sound element. Titles are added and the final master is ready for the Network delivery tape to be made.

The magic tape machine

For the 24p system to be successful, a tape machine was needed that was versatile, flexible and easy to use. Engineering teams from LaserPacific and Sony's factory in Atsugi, spent eight months defining and testing the HDW-F500 HDCAM machine. To be versatile the machine needed to record and playback multiple temporal rates including 23.976p, 24p, 25p, 29.97p, 30p, 50i, 59.94i and 60i. The machine further needed to crossplay between certain rates. When cross playing between two rates, audio is resampled to maintain 48kHz on output and in some cases, timecode is remapped. The machine was also specified to add 2:3 pulldown when in either the 23.98p or 24p mode allowing not only 1080/59.94i outputs but downconverted 601 outputs as well. These outputs have embedded audio and timecode that have been delayed to compensate for the processing delays of the 2:3 pulldown adder. When making final network delivery dubs from a 24p master it is also possible to convert the code to drop frame, specifying a sync point number where the native code and output code match. This would normally be an even hour. Once specified the output code is gear-toothed and increments/decrements at the appropriate rate.

Telecine suites are a crucial link in creating a 24 p master, syncing timecode, audio and generating a database for offline editing systems. LaserPacific's Telecine 1 (one of four Philips Spirit bays) was built as a multiformat mastering room.

The utility of 24p

24p post production is an elegant solution that creates a universal master. The master can be played at 25fps for foreign delivery and either cross- or downconverted for first run and future syndication. It does require some discipline to achieve the highest quality product. One of the major disciplines is treating the production as if it were being done entirely on film. That is to say, all elements must have a 24fps temporal rate. At this time there in no easy way to convert material with 29.97fps temporal rates (or 59.92 field rate temporal rates) to 23.98fps without artifacts. There are companies working on products with sophisticated motion estimation and blurring processing that may provide solutions in the future.

There are still many computer graphic effects houses that do not have 24p HD tape machines requiring systems like Sierra Design Lab's HD DDR to record the 24p material and then transfer to a standard computer environment. This allows standard graphics files to be delivered with the impediment of being much slower than real time. The problem here is that at 4.5MB to 6MB/frame (depending on whether YUV/4:2:2 or RGB files are created) a large amount of storage is needed.

One of the big debates is over aspect ratio compatibility. As long as we have to live in both the 4:3 and 16:9 worlds, decisions must be made as to how to create one master that "feels right" in both formats. The most common method is to frame to 4:3 while protecting the entire 16:9 area- no grips in the picture or edge of set. Another method is to frame for 4:3. Then when the transfer to high definition is made the image is vertically compressed so that the 4:3 image fills the 16:9 frame. During the editorial process the actors look short and fat but when the downconversion is made for standard-definition delivery, the original 4:3 is restored. The 16:9 delivery is then expanded vertically with a common top, if there are any small dogs a foot level the image can be "tilt and scanned" in a DVE device.

Facility design is also more complex as not only are there multiple and different outputs from machines but due to the various temporal rates the machines operate at, more reference signals are needed. As many as eight references may be needed to be sent to a tape machine or edit room. At LaserPacific, we elected to implement a reference router to cut down on the volumes of cables needed. There is work within SMPTE to define the next generation sync system, one that could have essence of all appropriate references on one cable.

Routing systems become more complex as now one machine can have, the primary HD SDI output, a second HD SDI output with pulldown, a third with standard-definition 601 and even a monitoring NTSC-encoded output. Control systems must be intelligent to

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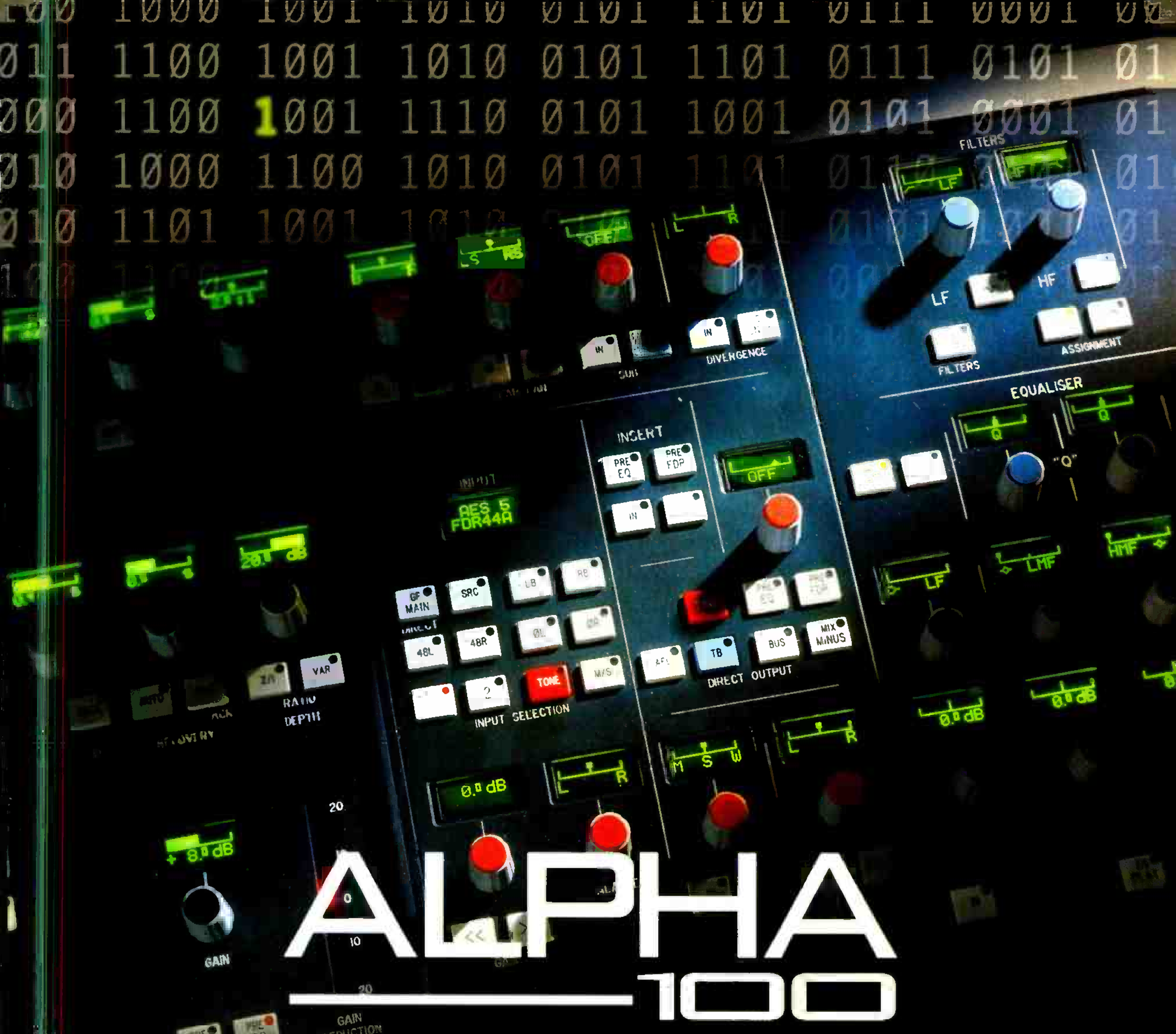
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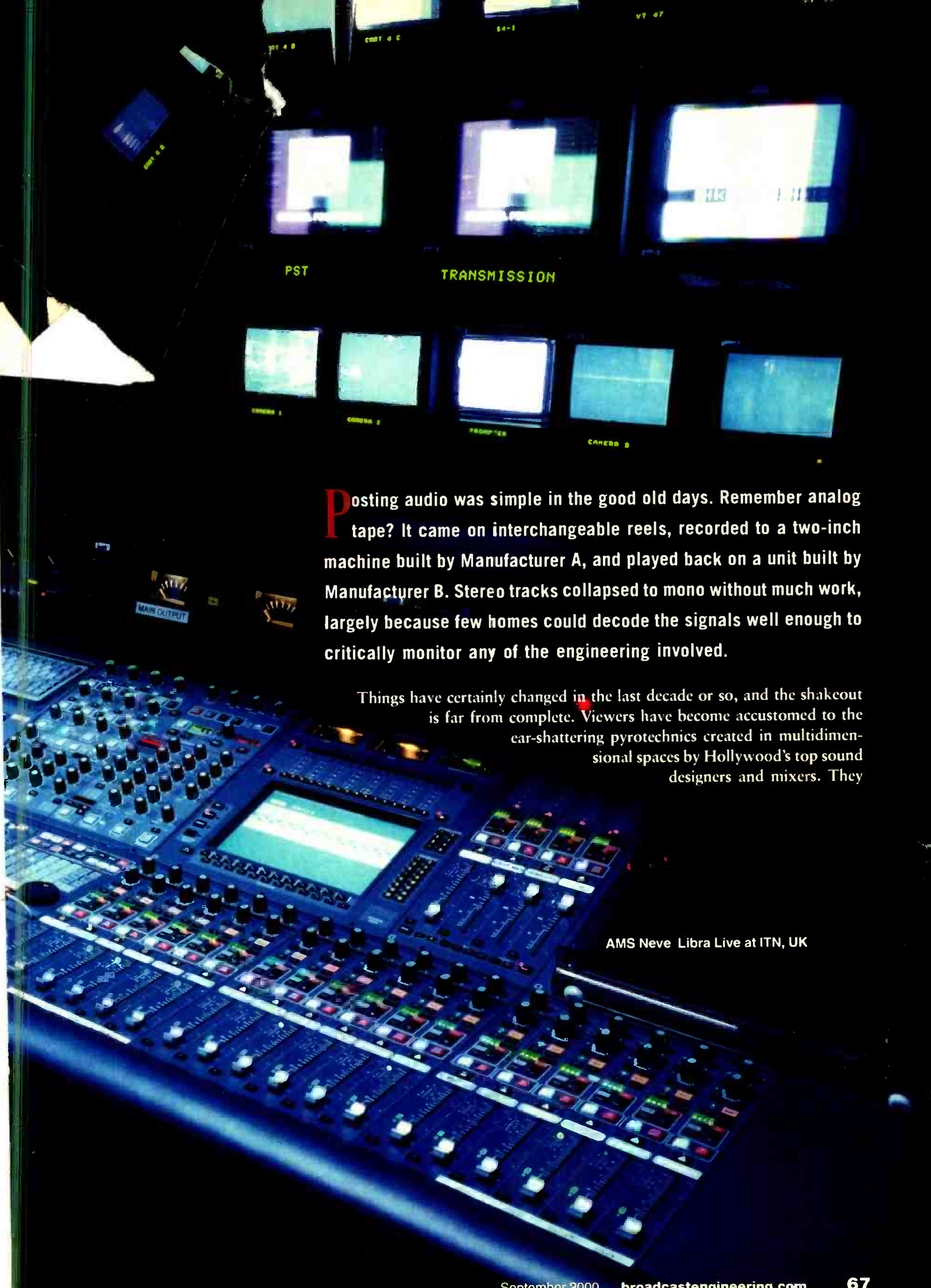
DIGITAL AUDIO SYSTEMS

BY GARY ESKOW



Posting audio was simple in the good old days. Remember analog tape? It came on interchangeable reels, recorded to a two-inch machine built by Manufacturer A, and played back on a unit built by Manufacturer B. Stereo tracks collapsed to mono without much work, largely because few homes could decode the signals well enough to critically monitor any of the engineering involved.

Things have certainly changed in the last decade or so, and the shakeout is far from complete. Viewers have become accustomed to the ear-shattering pyrotechnics created in multidimensional spaces by Hollywood's top sound designers and mixers. They

AMS Neve Libra Live at ITN, UK

Facilities thrive or fail to survive on the decisions they make with regard to the purchase of digital technology. What distinguishes a workstation that costs $5000 (like the Emu-Ensoniq PARIS) from a fully loaded, $20,000 ProTools rig or a stand-alone DAW. Interestingly enough, not sound quality. Converters that change analog signals into digital ones and vice versa come in a wide price range, but the overall level of technology

Much Music's main audio control room in Toronto. Based on a Studer D950 digital console and Genelec 5.1 surround monitoring, the Pilchner Schoustal-designed studios have recorded many hit groups.

DIGITAL AUDIO SYSTEMS

expect similar quality in the home, and the proliferation of home theater systems capable of reproducing powerful 5.1 mixes has upped the ante for content providers and broadcasters. In addition, the FCC and Congress have taken a fairly stern position: Existing broadcasters are allocated extra TV channels in exchange for beginning digital broadcasts by the year 2003

developed to the point where multiple ADATs could exchange audio through a thin wire, which Alesis called *lightpipe*. This protocol is now widely used in the audio industry to keep audio in the digital realm as it goes from records to digital audio workstations and digital consoles.

Nowadays, almost every workstation can import audio through a variety of

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DIGITAL AUDIO SYSTEMS

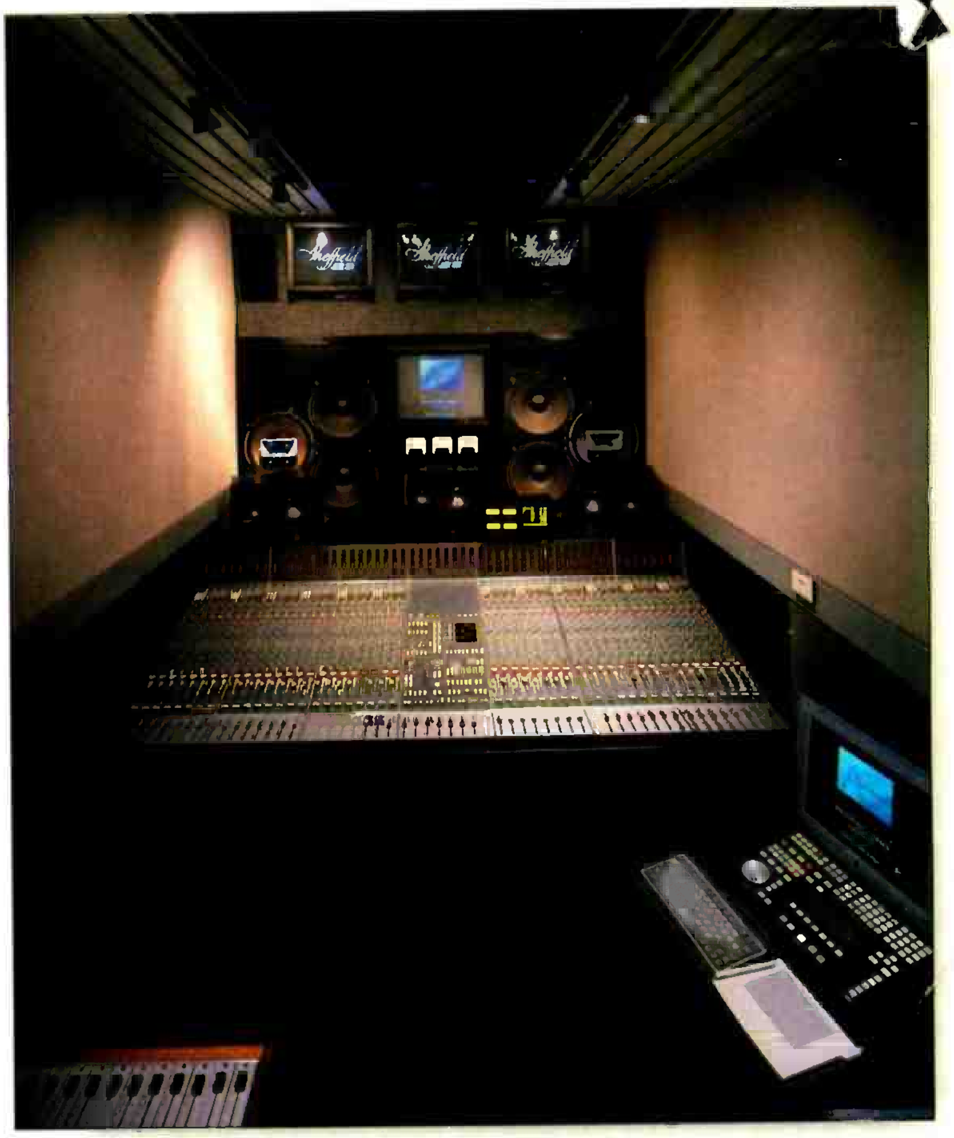
of post houses. Otari made a strategic decision not to turn the Radar into a DAW, but these units do execute seamless and phase balanced cross fades between tracks, as do high-end workstations. MDMs offering 24-bit recording and costing much less than the Radar are now on the market. Do they handle cross fades as well? If not, will the presence of a small amount of digital artifacts be noticeable to the average listener? Will clients be willing to pay a higher hourly rate to ensure that the audio they post digitally will archive to a standard that may not be revealed in the average playback situation today but may be revealed in the equipment of tomorrow?

Digital consoles

The line separating DAWs from digital consoles has softened. Following the release of the Mackie HUI, DigiDesign released its own mixing surface for ProTools. ProControl costs about three times more than an HUI, but it has some distinct advantages. Perhaps the two greatest ones are the fact that ProControl incorporates moving faders, a must for many audio mixers, and has the ability to cascade multiple units together. Like the HUI, a ProControl has eight fader strips. Put three of these together and the user has an impressive 24-fader ProTools mixer. For the project music studio and smaller post room this kind of setup is alluring, a fact not lost on other manufacturers. Fairlight, for one, has borrowed from this example with its recent line of integrated workstations and mixing surfaces.

Still, the A rooms you'll post in at major facilities will most likely center around large boards derived from the film-style console model, and there are no shortage of new boards coming to market. Why?

Many people overlook the simple fact that digital consoles became affordable when manufacturers found creative ways to limit the number of physical parts required to handle the work involved. "Layering" became the critical concept. In theory, a console that has only two physical strips could execute a stereo mix derived from an unlimited number of sources, providing that the board



Sheffield Audio Video Productions was the first company to install a Solid State Logic Axiom-MT digital console in a remote truck.

had inputs for them all. By assigning this pair of faders to different input sources at different times, each recorder input, for example, could be EQ'd and processed. In this model, the computer is updated after each pass and the mixer moves on down the line to another single or pair of sources. This is theoretically possible and cheap, but unwieldy. After experimenting with stripped down boards the pendulum has now swung back in the higher-end markets. Engineers pleaded for consoles that combine the functions of digital technology with the look, feel and easy access to all parameters for the maximum number of channels that their earlier, analog counterparts offered. For engineers operating under extraordinary pressure, simply being able to strap in an outboard piece of processing gear through an aux bus physically connected to a channel that is handling a specific input, for example, is paramount.

Any console that has at least six physical outputs and lets the operator assign a given channel to any one of them can be advertised as a Surround Sound console. Many of the lower-priced digital boards do, in fact, make this claim. But what's really required to create convincing multichannel audio using digital signal processing, and do all of these consoles have the tools to do the job? When you sit in a theater and experience the terror of being in the middle of a battle, with tanks rolling by you, mortar rounds exploding in the rear and bullets whistling past your head, you're experiencing the work of a top Hollywood audio team. A sound designer, probably with at least one assistant, has most likely gone into the field to record some sounds as building blocks, come back to his or her DAW, laid these sounds across multiple tracks and added in some effects off of library CDs. After extensive DSP manipulation, these sound effects (competing with a composer's score, no doubt) will make it to the sound stage where a head mixer and his team will weave them into the final Surround mix. What's the point? You can be sure that all of the reverbs and echo effects that are helping place you in a convincing multidimensional space in the theatre are being panned across the speaker field along with the sounds themselves. Most of the lower-priced digital consoles cannot pan effects like their higher-priced counterparts. So, if the most listeners' points of reference are movies that pan effects as well as the sounds themselves, is it accurate to refer to boards that cannot handle audio in this fashion as Surround Sound consoles?

Mixing in 5.1

The shift from stereo to 5.1 and even 7.1 mixing involves more than simply throwing more speakers into a control room. On both the creative and technical levels, this migration requires learning, experimentation and a re-definition of the rules of the game. The fundamental concept is that we're now mixing this digital audio in a true three dimensional space. Rather than a repository for left-over or ambient effects, the back speakers have become critical to the way a viewer experiences a film."

Mixers are using the full audio field to create a wider perception of space than can be presented on the relatively small screens that even the larger home theater systems offer. 5.1 audio allows a break from traditional, 2D space. Instead, it is now possible to synthesize spaces, putting the listener into our environment, not the other way around.

Digital audio at its best, the so-called "CD quality," was considered optimized when it reached the 16-bit, 44.1kHz spec years ago. It is now generally accepted that the average ear can hear the quality distinction between audio tracked to these specs and material recorded at 20 or 24 bits (bit depth refers to the number of discrete volume steps captured) and sample rates that are twice or even four times higher than the current standard. Do these absolute standards convert into pressure from musicians and filmmakers to record their work using new technology? If current broadcast and playback systems haven't caught up with these standards, how much sense does it make for studio owners to invest in equipment when its only current use will be as an archival medium? If you're an audio post facility owner, these are some of the questions you're sweating over.

Facilities thrive or fail to survive on the decisions they make with regard to the purchase of digital technology.

Broadcasting digital audio

Consumers have been enjoying multi-speaker digital audio for the last decade or so, but the Dolby Surround Pro-Logic systems they've experienced are somewhat limited. The technology lets a broadcaster send out a two-channel signal that the home equipment decodes into four channels of audio content.

Although the rear material is played back through a pair of speakers, the signal is mono and limited in bandwidth.

Dolby Digital is a completely new technology. It can take from one to 5.1 channels of material and encode it into a single low bit-rate stream using a Dolby Digital encoder. This requires special equipment in the home, where a Dolby Digital decoder extracts the content. The benefits are real and should be apparent to nearly all listeners, because the audio played back is full-bandwidth in all the channels, and every channel is fully discrete. But will consumers really want to pay the extra money for this enhanced listening experience, or will they balk at what they might feel is the force feeding of expensive new technologies?

The reality is that audio for broadcast is in a shakeout period. In a sense we're dealing with both the horse and plow and interstellar rocketry at the same time. Technology exists that yields digital fidelity of extraordinary detail, but no one has the equipment to play it back; and we're just starting to lay down the tracks for the trains that will one day deliver this product. The order in which we take the steps that will universally increase the level of digital audio, from the theater to individual homes across the country, is still being sorted. The days of analog audio, though, are certainly passing, and rapidly so. ■

Sony's OXF-R3 Oxford digital console at the Staples Center in Los Angeles easily handles a variety of projects, including the recent Democratic convention broadcasts.

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

Rapidly growing Internet audiences and a move toward centralized operations demand that today's newsrooms be more technically and operationally efficient than ever. Photo courtesy Digital Systems Technology.

New newsrooms require more than new equipment

By Steve Sullivan

Planning a newsroom upgrade? If so, here's an imperative consideration for today's newsrooms: Any upgrade must be done with the Internet in mind. That means that in addition to new equipment, you will also be looking at new operational paradigms.

Stations have invested years and dollars in creating their valuable on-air brands. Although on-air product should still be a primary concern, these days it shouldn't be the only one. There are new audiences ready to embrace a brand once it becomes available through other channels of delivery.

Consider the rapid saturation of broadband in the United States. Kinetic Strategies, a broadband research firm, reported in June 2000 that North American multiple system operators pushed past the 3 million mark for cable modem customers, with more than 7000 new customers coming online every day. Add to that the equally rapid deployment of high-speed DSL connections and the recent introduction of satellite interactive terminals (SITs), which provide homes with direct, high-speed Internet connectivity via satellite, and you see that computers are becoming more viable as delivery systems for news product.

To take advantage of this multichannel environment, a news organization must be technically prepared to provide news for these new audiences. But it requires more than simple technical readiness. It requires you to reconsider how you work.

The appetite for news is at an all-time high. Stations are no longer only competing against local television stations. There are more than 30 regional or local 24-hour cable news channels scattered throughout the United States. Newspapers and radio stations now have an easy way to embellish their existing content with video and/or animation on the Web.

Stations are even confronted with new, Web-only competitors that are being born every day. In many cases these competitors are people who neither understand nor care about how broadcasters have traditionally created shows. What they do understand is that they have a huge, built-in audience, and there are computer-centric production solutions available at a fraction of the cost of traditional broadcast equipment. As one veteran broadcast executive puts it, "Nobody's watching pixels. They're only watching programs for their content." If something is compelling, they'll watch it.

"Nobody's watching pixels. They're only watching programs for their content."

Keeping up with this barrage of competition and the voracious demand for content doesn't mean going out and hiring more people. It means adopting a different way of thinking about your approach to business. This can result in some radical changes to the way you use your people and the way you produce your newscast.

Back to our original question about planning an upgrade. When the time comes, don't start with a simple tit-for-tat changeout of equipment. First, determine your content needs. Second, set your production processes. Third, take a look at the technology that will help you best accomplish the first two steps.

Monitoring a newscast at Ackerley's KGET-TV in Bakersfield, CA. Photo courtesy Ackerley.

Virtual news organization

Few media companies match the content output of Tribune Company (*Editor's note*: the author is the former managing editor for Tribune Regional Broadcasting). Its broadcasting division now owns 22 television and four radio stations. Its publishing unit operates 11 major daily newspapers and oversees operation of two 24-hour local cable news channels. In addition to its traditional businesses, Tribune is a major partner in the iBlast datacasting consortium. The company also has broadband partnerships with AT&T in several of its markets. There are Internet sites for almost every one of its stations and papers. For years, a guiding principal of the company has been to create content once and find multiple uses for it across all its properties.

Everything Tribune Broadcasting does must be geared to fit into this enormous virtual news organization that the company has created. It is currently in the process of negotiating a deal to connect all the company's properties with broadband ATM capacity. The ATM network will unify a system that is currently a mixed bag of fiber links, frame relays, and microwave and satellite feeds.

Tribune's flagship station, WGN-TV, Chicago, began switching over to a new newsroom in early August. The new facility is geared to play into the company-wide emphasis on digital, computer-based systems. For character generation, WGN is using Chyron iNFiNiTs that have a Media Object Server interface to allow for transforms and more complex moves. The editing system is a combination of Sony DNE2000s and DNE700s. The server is a 16-port Sony NewsBase that is running MAV-2000s. The proxy high/low resolution desktop editor is Sony's ClipEdit. WGN is using Proximity's Xenomax for graphics translation and searching.

A key component to WGN's upgrade is a conversion from a NewStar newsroom editorial system to AP Broadcast Technology's ENPS System. WGN's ENPS workstations will be networked with more than 1500 other ENPS workstations throughout the company, in both the broadcast and publishing newsrooms. ENPS has an open-architecture system that follows familiar network standards and protocols. ENPS also offers a powerful search engine, which ties into another key element of the company's virtual news network.

In 1999, Tribune unveiled the Tribune Control System, a Java program that works with standard browsers through the company's existing WAN. The system gives users remote-control access to equipment and content throughout the company's various news organizations.

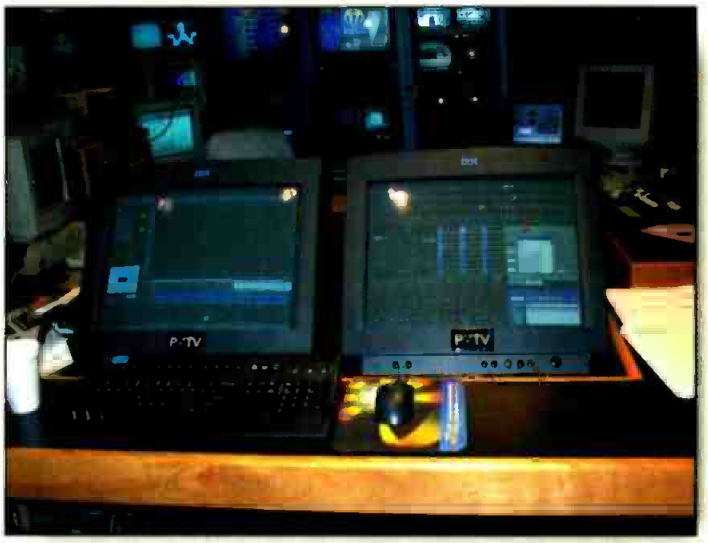
The system allows authorized Tribune journalists in the company's many newsrooms to remotely control equipment or access content housed on file servers.

While the system isn't designed to replace any equipment that is already in use, it can represent cost savings when the company is building or re-equipping facilities. When the company upgraded WXMI-TV in Grand Rapids, MI, instead of putting routing panels in each of the station's eight edit bays, they installed the control system. The total cost was about $5000.

The company is currently on its third version of the control system and is talking with vendors about making more products interoperable with it. They are working on expanding the system so that it can switch virtual circuits over the company's planned ATM backbone.

If the journalists don't have to spend as much time editing or tracking down content, they have more time to focus on content, allowing them to enrich the ultimate product.

All this means, however, that the overall process changes.



Ackerley's KGET relies on ParkerVision's Studio News system to streamline newscast production. Photo courtesy Parkervision.

Adapting the process

Seattle-based Ackerley Group has become a leader in modifying traditional processes to fit the times. Its television broadcasting segment, the AK TV Group, owns or operates under management agreements 17 television stations in California, New York, Washington, Oregon and Alaska. The company's markets fall within the 50-200 DMA range.

The distinguishing characteristic of AK TV's ownership strategy is that the stations are clustered into regional station groups. This clustering, following a pattern more closely associated with radio station group ownership, allows for a number of business operations within the regions to be consolidated.

In early 1999, AK TV introduced a concept it calls *Digital CentralCasting*. This process allows AK TV to deliver digital programming to multiple stations for slightly more than the cost of a digital system for one station.

Ackerley developed the idea for Digital Centralcasting in 1997 when the TV group was faced with replacing its aging equipment and moving toward a digital environment. Replacing equipment on a one-for-one basis, especially in the group's small markets, would have been cost prohibitive. The company took a look at what radio was doing with centralizing back-office operations within its clusters and decided to move recording, playback, traffic, billing, accounting and parts of programming to more centralized locations. Each station was then considered a "spoke" within the cluster, supported by the central location and able to focus on local issues, such as news, sales and community involvement.

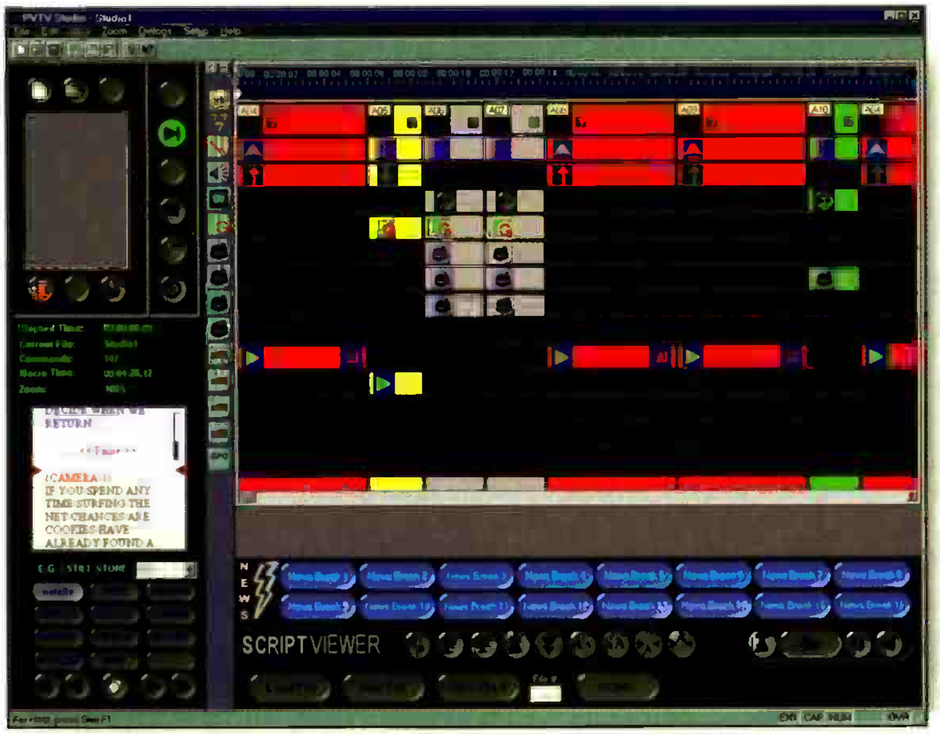
The hub of each region, known as Central Server+, houses a SeaChange server with a 250-hour storage capacity and an automated tilt-rack tape storage system using DVCPRO decks and tape in a robotic carriage system handling programming over a half-hour long. The tilt rack is used for bulk-fed syndicated programming that will be used by only one station within the region.

Stations around the globe are transitioning to server-based production facilities, which provide them with more efficient and widespread use of their content. Photo courtesy Ackerley.

Ackerley spent considerably more money building the Central Server+ facility than it would have upgrading a single station. However, when you consider the Central Server+ handles the consolidated needs of up to five stations, it becomes an economical investment for the group. All the stations within the region are provided with a digital signal from one location, and the group was able to buy server storage in bulk, thus driving down the overall costs.

AK TV's news operations tend to be small but productive. The centralcasting environment gives them a way to share content among the stations in the region. The stations are connected by fiber to the Central Server+. The stations all use AP's Newscenter editorial system and each newsroom can check rundowns from the other stations to see what content is available. This built-in news loop maximizes AK TV's programming efficiencies within each of its regions.

Another way Ackerley is building efficiencies into its news product is by using the ParkerVision PVTV system, which automates news production so that fewer people can handle the production load within the stations. It's important to point out that AK TV's motives are not to remove people from their studio jobs. In the markets the group serves, technical talent is not always easy to find. Systems such as PVTV cut down on the number of people required to put a quality newscast on air.



The Transition Macro timeline in ParkerVision's Studio News system lets producers preview pre-programmed newscasts so mistakes can be eliminated before air.

Once the news has been gathered, an entire newscast can be assembled and run with only a producer and director. The producer and director can even piece together the newscast and preview it before air. If there are changes to be made, the system allows them to do so in a nonlinear fashion by laying in all the elements on a timeline. The PVTV system also controls a separate graphics system, tape decks, audio switcher, teleprompter, DVE and cameras. The system plays back in 601 and AES digital.

Computer-centric technology

An important outcome of the technical efficiencies that come from systems such as PVTV is that stations can drive down operational overhead and increase journalistic content. By shifting resources that were once focused merely on production, you can use technology to streamline the production process, thus allowing you to refocus on content production.

Nobody would confuse CNN with a local broadcast news organization. However, local broadcasters can do well by looking at CNN as a model for their own facility upgrades. In addition to its own flagship news channels, CNN is also the primary consultant for other media groups around the world that are building their own news channels in the CNN mold.

CNN's engineering executives consider the quality of images in the newer,

Ackerley's 11 television stations are linked by Central Server+ facilities, which allows group stations to share digital news content. The master control room for KGET-TV, Bakersfield, CA, is shown here.

Master Control at KHON-TV in Honolulu, HI, on the air in 1999. Photo courtesy Digital Systems Technology.

creates the initial template design, anyone can produce a template-based graphic for use within a story. The system allows reporters and producers to plug data into the templates and, as the story airs, the graphic appears with the prescribed look for that particular newscast. This process allows graphic artists to devote their skills to creating more sophisticated images.

Another valuable feature of such systems is that they can create a central database, making any graphic created easily shareable throughout a group, building in yet more efficiencies of equipment and manpower.

inexpensive digital formats to be very close to the traditional formats. Not only do they see the prices of digital solutions to be more attractive, they also feel that the computer-centric solutions solving their television, broadband and Internet issues in one elegant swoop.

Journalists don't have to spend as much time editing or tracking down content.

CNN's computer-centric approach to editing employs DVCPRO storage and places a great deal of faith in multi-skilled people throughout their facilities.

As part of its overall technology plan, CNN replaced its analog tape-based equipment in its Atlanta headquarters with a Sony digital server-based system for storage and playback. As video is fed into the system, it is split simultaneously into low- and high-resolution paths. A metadata tag is attached to all video ingested into the system, alerting users of source information or usage restrictions. The low-resolution video is faster to browse and is available on desktops throughout CNN's various newsrooms. The high-resolution, broadcast-quality video is used for editing, playback and long-term storage.

CNN also emphasizes the efficiencies that are now available through template-driven graphics systems. Their system of choice today is the vi[z]rt Pilot System, which houses an Everest renderer. Used in the most efficient manner, the product represents a character generator, a still store and a DVE. When used to its full extent it can reduce the dependency on a switcher. It is run off an SGI Onyx computer with an Oracle 8.0 database. The Pilot System provides 601 quality and can be fitted with a high-definition output board if needed. The software is format independent, taking only a few minutes to switch from standard to high definition.

One of the benefits of Pilot is that it relieves the graphic artist of the mundane chore of preparing simple graphics for shows. Once the artist

A new paradigm

Many of the computer-centric solutions empower the non-technical person with tools previously handled by skilled labor at the station. This doesn't necessarily foreshadow the end of the road for skilled technicians. What it does mean, though, is that you can take a fresh look at news processes and how resources are employed – both on the people side and the equipment side. You're looking for higher quality and greater quantity to take advantage of the multiple channels available to you.

While there are excellent and economical components on the market, there may not be one complete system solution for your needs. Again, evaluate your content needs and the type of process you want to put into practice. Then shop around for the best technical solution to match those needs.

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UPS SYSTEMS

in which there is plenty of power available, and others in which there is not. But won't the power grid get power from areas of surplus to areas lacking? In some instances our national power grid is not built to move enough power from where it is generated to where it is needed.

Some claim that brownouts and roving blackouts are inevitable. Your facility's ability to generate its own power could become as important as your transmitter. Even if these predictions are too dire or you are just lucky and don't suffer any power outages, it is probable that minor power "events" are more likely to occur in the near future. Thus, even if you have a generator, you had better think of ways to smooth out these outside events so they don't become events inside your facility. Review your UPS capabilities. As computers have increasingly wedged their way into our operations, we need to install UPS systems to protect them from power "glitches." Nothing is as annoying as watching the PC that is holding your event log reboot in the middle of a break. IBM claims that an average computer is subjected to more than 120 power events per month. Bell Labs has found that 87 percent of these events are voltage sags (brownouts), 7 percent are spikes, 5 percent are blackouts and 1 percent are over-voltage occurrences.

Most of us have seen operations where small UPS systems litter the available floor space. As more and more systems are installed in facilities that require UPS backup, many facilities are moving away from many little "distributed" UPS systems to large systems that backup a large portion of the facility, or even the entire power system. A disadvantage of the small UPS approach is that often it is discovered that they aren't working only when their services are called for (UPS batteries generally last three to six years). A large UPS system generally makes it known, usually by irritating beeps, when it detects a problem. These large systems also provide more backup power per buck than scattered smaller ones. Larger systems can be installed upstream where 208V or higher service exists. The higher voltage means less current is involved for a given power, and thus IR losses and even physical sizes are more manageable. Additionally, many large systems allow for enough power overhead and a system architecture like that of a solid state transmitter so that failures don't bring the whole system down, they just lower capacity. Some smaller systems have optional switches that allow two systems to be mirrored.

The are two basic types of UPS. The first is known as an offline UPS. (See Figure 1.) Power coming in is split into two paths. One path is through a relay, or more likely a solid-state switching device, and out the UPS to the load. The second path is to a rectifier to charge the unit's batteries. If power into this UPS fails, the switching device opens the direct path from incoming power to load and closes a path coming from the battery, though an inverter, and out to the load. Such a switching operation can happen fairly fast — as short as a couple of microseconds. Even low-cost units can make the switch in well under 100 microseconds. The very nature of this approach means that very little power conditioning can take place, and what there is will most likely be passive in nature. Some have metal-oxide-varistors (MOV), which can shunt high-frequency voltage spikes to ground. MOVs become less effective the more they are used. Therefore some systems have multiple MOVs. Toroidal choke coils are also often used to minimize stay RF and other high-frequency noise. Low-end UPS systems tend to use the offline approach.

Higher end systems use a second approach, which is known as the online or serial UPS. (See Figure 2.) This architecture has incoming power rectified and feeding the system's batteries at all times. The battery in turn feeds a downstream inverter, which powers the load. The big advantage is that a battery is the ultimate in low pass filters. Events on the input side generally are not seen on the output side. In addition, the load does not see sags and over-voltage events. In both offline and online systems, the path through rectifier, battery and inverter is known as double conversion. This approach creates large harmonics, up to 30 percent of total current. It has a power factor around 80 percent and consumes up to 20 percent of the input power. As we will see later, new technology is improving these specs.

How long a UPS can support its load with input power gone or under a brown-

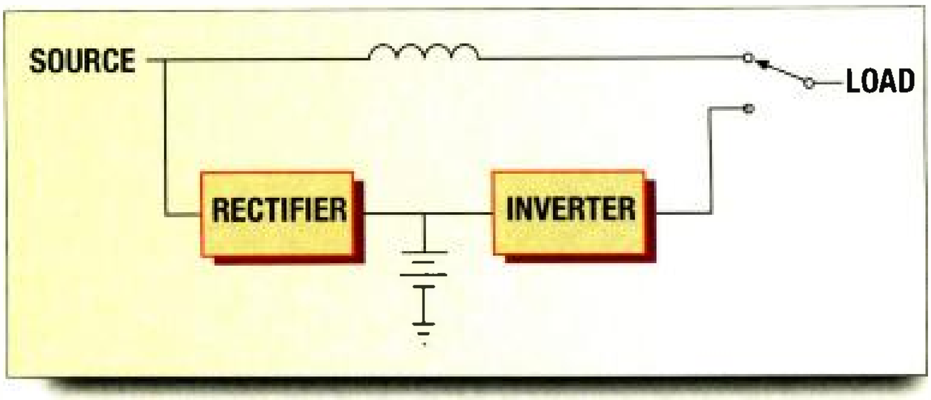


Figure 1. Lower-end UPS systems are likely to employ an offline UPS configuration, which simply opens the path from the battery in the event of a power failure.

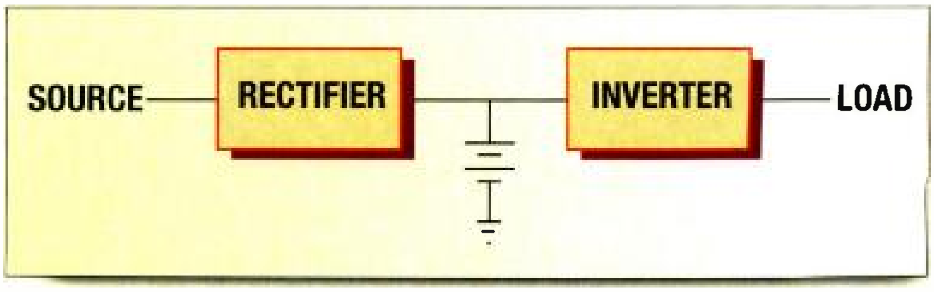
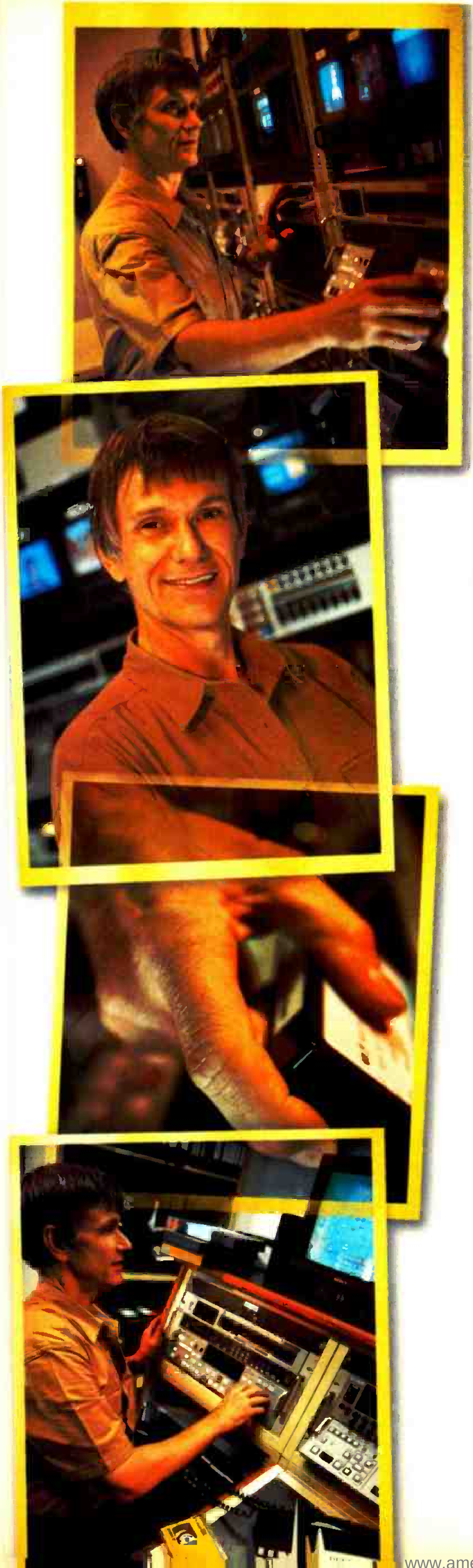


Figure 2. In an online configuration, incoming power is fed to the system's battery at all times, providing an effective low pass filter.

SONY



"As great as Betacam SX machines are, Sony support is even better."

— Tom Alexander, Engineer, WFAA-TV Dallas

"Sony really understands what it takes to keep a station running," says Tom Alexander, engineer at WFAA-TV, the Dallas ABC affiliate. "If you need a part, they ship it. If you have a question, they answer it. If you have a problem, they solve it."

Alexander also values Betacam SX® performance, including the way digital MPEG-2 4:2:2 acquisition fits with DTV broadcasting. He likes the low noise and low light capability of the DNW-9WS camcorder. The laptop convenience of the DNW-A25 editing recorder. And he really appreciates the playback compatibility with Betacam® and Betacam SP® tapes.

"After years of success with Betacam SP equipment, this was the next logical step," explains Alexander. "We just pulled our Betacam SP machines out of the racks and put in the Betacam SX gear. And the new VTRs play back all our Betacam SP archival tapes. This must be the world's easiest digital upgrade."

But for Alexander, the bottom line is how Sony can complete the picture. "The way Sony supports me, why would I consider anyone else?"

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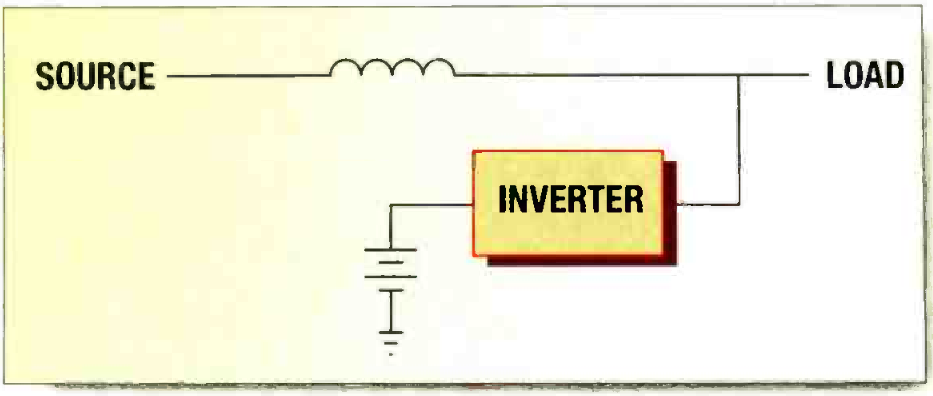

Figure 3. In a single conversion UPS, separate rectifiers and inverters are replaced by an inverter/rectifier that passes power both to the battery and back out again to load.

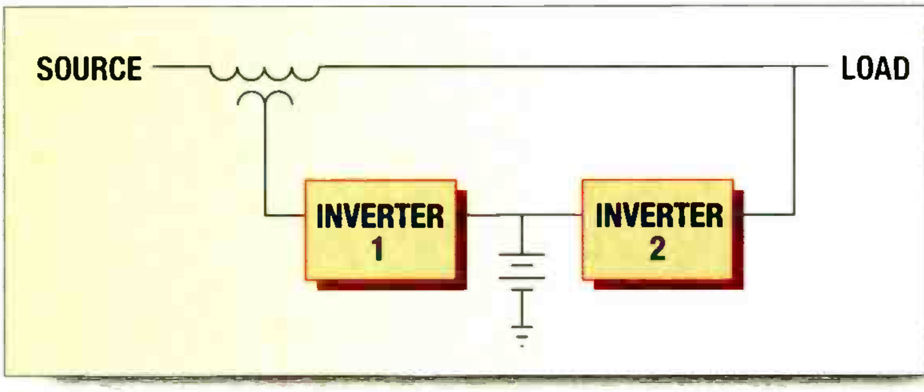

Figure 4. In a delta conversion configuration, a second two-way inverter can either add voltage to the tranformer tap or act as an additional load to lower the current out.

out situation is obviously a function of the unit's battery capacity. In large systems, there is usually a separate cabinet to house the batteries. This cabinet can easily outweigh the rest of the system. Units with 100 KVA capability and only five minutes of battery power under full load can have battery (and cabinet) weight close to 3000 lbs.

Today most batteries are sealed cells. This means that there is no dangerous out-gassing as the cells charge. UPS efficiency ranges from 70 percent up to near 100 percent. This means that with large systems, the heat load can become significant. The higher the heat in the battery cabinet the shorter the battery life. Whereas small UPS unit batteries might last six years, well-maintained batteries in large systems can last 10 years. Excessive heat can cut that life span to one-third of that.

The reliability of a system that is powering your entire, or at least a significant portion, of your operation, is a key factor. Serviceability is just as important. The system can't fail in a way that power is lost. Even if it manages to go offline, you must be able to fix the failure without having to power down.

The simplest way to accommodate for those two requirements is to install a bypass switch. Many installations do that no matter what, but many systems today are designed to prevent failure and repair from interrupting power. Selecting a modular system accomplishes this. A UPS can be designed to have a separate "isolation" module. This module by itself will simply pass input power through to the output through a set of isolation transformers if it is the only module. Add an electronics module and a battery module and the isolation module will direct incoming power to the battery module (which includes a power module containing the inverter, rectifier and charger) if directed to do so by the electronics module. With this approach you can change out batteries and electronics and not interrupt power to the load. Of course, an isolation module by itself will not perform any active power conditioning or backup. The only single point of failure is if something catastrophic happened to the isolation module. To cover you in such a case, there are systems that allow for an additional isolation module. The modular approach also accommodates scaling of the system; it is generally easier to add capacity. Some systems have physical architecture to let you add power modules in conjunction with batteries. This building block approach lets a UPS system grow in capacity.

As you would expect, UPS systems are not transparent to the source power or to the load. Many UPS units have power factors that are not unity. This means that the kW rating is less than the KVA rating. Some have power factors as low as .8, no matter what the load is. Some

The amount of backup time available to a facility depends on the power available from its battery bank. Shown above is a section of the available batteries at the International Broadcasting Center at the Sydney Olympics. (See page 94.) Photo courtesy Telstra.

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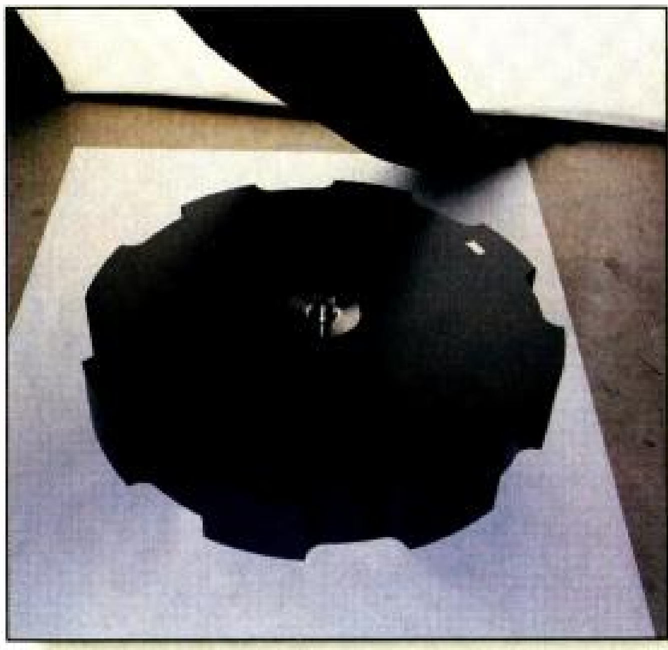
units now offer unity power factors. That means that a 100KVA unit with a unity power factor actually delivers 100kW. UPS systems will also distort the mains (power in) to some extent. The thyristor rectifiers used by many will back feed harmonics back onto the mains. These harmonics must be eliminated to meet EMC requirements (FCC part 15). These harmonics reduce efficiency and their filtering adds to the thermal load. As stated earlier, older systems can produce harmonic current that is 30 percent of the total output. Newer units are well under 10 percent. New designs are allowing for increased efficiency and lower distortion to the load and the mains supplying the UPS with power.

A newer approach is called the single conversion UPS. (See Figure 3.) There is no longer a separate rectifier and inverter, there is only the inverter. The inverter is designed to work in both directions. In the path from the battery to the load it works as usual, it converts DC to AC. But when the battery is not needed, AC from the mains, which is also supplying the load, passes through the inverter in the opposite direction and, as such, the AC is converted to DC to charge the batteries. This approach is much more efficient as the input rectifier stage is replaced. It is almost an offline system, except that the batteries are acting as large capacitors to help regulate the output at all times. But because most of the power is straight from the mains, harmonic content from the inverter is far less. A drawback is that the power factor seen by the main is a function of the load.

The latest design approach is the delta conversion UPS, an enhancement of the single conversion approach. (See Figure 4.) Delta conversion adds a second two-way inverter between a transformer tap on the input and the batteries. When input mains are in spec and the batteries are not charging, the two inverters are essentially out of the circuit, and thus input power goes straight to the load. If the input voltage is low, the input side inverter (1) adds power back to the transformer tap to bring it back up. If input current is low the output inverter (2) adds power. If input voltage is high, the input inverter acts as an additional load to pull it down. If input current is high, the output inverter acts as an additional load to lower the current out. The input inverter works to maintain correct output voltage, while the output inverter works to maintain correct output current. Thus, when input current or voltage is out of spec, the two inverters in the delta conversion system act just like the old double conversion system, except that they only double convert the error, and not the whole load, so the losses to correct incorrect input values are substantially less. The invert/convert also acts as a load or source in such a way as to vectorally correct voltage and current phase differences, thus keeping the power factor at unity. If the input voltage is in spec, the efficiency of the unit is nearly 100 percent.

The latest "chicken little" scenario facing our industry is our fate under power deregulation.



The flywheel is at the heart of the Cat UPS system shown on p. 78, helping prevent disruptions from power anomalies.

Large UPS systems present challenges to their designers. When the UPS is a significant percentage of the load on a generator, the UPS must be designed to work with the generator. Large UPS systems can't dump all of the load back onto a generator wholesale after the generator is up to speed. If the generator didn't out and out stall, the oscillating generator frequency changes as the generator control system damped out the large load change would play havoc with your equipment. Plus, the control system of the UPS might compound the inherent difficulties by taking itself off the generator as a load due to the resulting voltage and frequency changes. When the generator became stable again, the UPS coming back on as a load quickly might start the failure process all over again. In fact, this interaction might have a resonance that continues the lack of instability indefinitely. To prevent this scenario, large UPS systems behave as slowly changing loads. Once the UPS has sensed that the generator has come up to speed and is in spec, it transfers its load from its batteries to the generator slowly. This ramp-in time can be set to be close to a minute long. However, 20 seconds is generally enough.

When input power fails, and before the generator is up to speed, the UPS determines the frequency of the power out to the load. When the generator is up to speed, its own frequency will most likely be slightly different than the UPS. The UPS should be able to gracefully slew to the generator's frequency. The rate of slew is set depending on the type of load. Mechanical devices, motor and other devices with extensive inertia need to be slewed to the new frequency slower than purely electronic loads. Slew rates can generally be set to be as fast as multiple hertz per second, or as slow as a fraction of a hertz per second. Typical-

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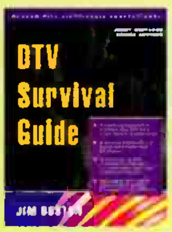
ly, 1 Hz/sec is set. The range for frequency tolerance can be set on most systems also. Even when the load is slowly transferred to the generator by the UPS, the generator will slow slightly resulting in a slight frequency drop. Most equipment today isn't particularly power-frequency dependent. Settings as wide as three to five cycles are common. Remember that the same situation occurs when the shore power is available again. This means that the generator must run long enough to recharge the batteries so that the switch back is uninterrupted too. When determining how much load your generator must handle from the UPS, it is important to consider the additional load from the UPS as it recharges its batteries. This charging load can be significant.

While most of us have worked among small UPS systems for many years now, most new television facilities are investing in large-scale UPS systems. These large systems can deliver backup power for well under $1000/KVA with a few minutes of backup capability. Longer backup capability can quickly double the costs per KVA. Large systems are designed to work with generators to provide smooth transitions between shore and generator power. Like any insurance we buy, let's hope we seldom need it. ■

Jim Boston is an engineer with The Evers Group, San Jose, CA.



The *DTV Survival Guide* provides readers with experienced guidance in the planning and building new digital facilities. The book also examines the many new opportunities and potential pitfalls that DTV technology brings to the industry. *The DTV Survial Guide* is available from the publisher by calling 800-262-4729 or through many booksellers.

How utility deregulation will affect the broadcast industry

BY ALAN KATZ

Walk the floor of any broadcasting trade show and you can't miss the explosion of digital solutions in what was once an analog industry. While this digital convergence revolution is expanding industry content, services and profits, it also has an Achilles heal. Unlike traditional analog equipment, digital devices are far less forgiving of any power quality interruptions.

A typical piece of computer-based equipment is designed to sustain a power interruption of eight milliseconds. Longer interruptions lead to more severe consequences with recovery times and consequences ranging from minutes to many hours in the case of a nonlinear editing deck or a large multi-server system.

While microprocessors are becoming more power efficient, their total power consumption is skyrocketing along with their processing capacity, with many new high-end systems consuming thousands of watts. 10 years ago, a typical CPU consumed 10W, now it is up to 100W. The amount of data transmitted and stored also is doubling every 12-18 months. More data storage means more infrastructure and energy consumption.

When a broadcast facility uses digital technology, it becomes a sitting duck for power anomalies, which are becoming more frequent (most businesses report at least three to five per year with many more subcycle interruptions). Deregulation also has brought uncertainty in the power industry. Deciding who will own and control what has resulted in a disincentive for utilities to invest in maintaining the aging power distribution grid.

Also plaguing utilities is the fact that computers and electronic devices grew unexpectedly to consume 10% of our nation's four trillion kWh of electrical production. That's more power than used by the steel and auto industries combined. This has led to a shortage of power especially during peak demand hours. Utilities try to manage the shortage by purchasing power from the 15,000 other generating stations sharing the national electrical grid.

Unfortunately, you can't always buy your way out of a power shortage. Many metropolitan transmission systems are often saturated and cannot accommodate the importation of extra power. To manage these peak demand periods, utilities may drop the line voltage below critical levels for computers (brownouts), which are designed for only 10% line voltage drop, or impose rolling blackouts — shutting power off in selected areas (usually residential) for a few hours at a time.

For broadcasters, UPSs (uninterruptible power supplies) and generators protect against the threat of power quality incidents. UPSs are necessary to condition power (ensuring consistent voltage and power quality) and guard against subcycle and short power interruptions while generators provide protection against longer outages (greater than 10-20 minutes). UPSs can be small and economical enough to protect specific sensitive equipment or in the case of many facilities, a large UPS can protect the entire facility. One thing is certain: Digital convergence and the proliferation of power sensitive equipment is here to stay making reliable high quality power an essential part of any broadcast operation.

Alan Katz is product manager for MGE UPS Systems.

BY BILL BURKE AND MIKE PALMER

NewsTech: STORAGE FOR NEWS

The economic gains to be realized by the repurposing of content have made online, integrated storage systems a must for news operations. Photo courtesy Associated Press.

For all the time, effort and money it takes broadcast networks and stations to acuire media assets, often those assets are not treated so well. Tapes get lost the very day they are shot or aired. When the media moves to archive, the challenge of finding it and making it useful again increases.

While there is a rough correlation between the size of the news organization and its ability to catalog, store and retrieve items, probably all news organizations face the question: how can I best store and manage my media?

Some modestly sized stations struggle with masses of dusty tapes and ill-sorted, handwritten index cards alongside graphics lists that are outdated as soon as they are printed. Networks and major-market stations, those with more resources, might have the people to carefully log and store their media. But how can they make that index and the content it represents easily available to hundreds of correspondents and producers scattered across the nation and world?

Video and stills become objects that can be easily transferred and stored on laptop computers and wireless handheld devices.

We see broadcasters around the world achieving new efficiencies by integrating news editorial systems with production equipment, but they also want this integration and server technology to make media assets easier to track, retrieve and share, even after the items are moved off today's shelf.

Asking some key questions is a first step in implementing a media management strategy.

• How much material do I want to be able to air immediately?

• When I am through with this material, where do I want to put it and how quickly do I want to get it back?

• How much do I want to know about this material? The more media I have, the more descriptive information I need to store for each object so I can find it in the future.

• From how many places do I need to play this material? Do I need to do so simultaneously? Are these places in the same facility or are they geographically diverse?

• How much do I want to spend?

Answers to these questions will help frame the media management plan and other key server decisions, such as the choice of a unified vs. distributed video storage model.

In the distributed model, media storage is shared among more than one machine and capacity is increased by adding more servers. All are interconnected, so material can be moved among them. The advantage is diversity and redundancy in the case of hardware problems, along with the ability to dedicate a single machine to a particular production process. Potential disadvantages include possible delays in moving material from one server to another when needed and the difficulties of tracking and storing multiple copies of the same clip.

Multiple server systems can also make integration with desktop production systems more complicated because clients have to point to several machines in order to get to and manipulate their material. Generally, distributed server systems work best in concert with facility control or automation systems, which handle the processing involved in transferring objects between machines.

Adding more storage space (hard drives) to a single system expands unified systems. The number of inputs and outputs can generally be changed independently of the amount of storage available. All users have access to all objects simultaneously without the need for copy or dub requests between machine islands. This reduces the complexity required to integrate other machines and that required to link servers to the newsroom computer system.

Though RAID and redundant critical system components heavily protect all of the unified systems, this design still does not offer the same amount of protection as multiple independent servers. Another potential downside is cost, because some unified systems are significantly more expensive than their distributed cousins.

Accomplishing these goals will mean profound changes in the newsroom, including a major shift in how one thinks about media assets. Terms such as "video" and "still" become merely semantic distinctions. Video and stills become objects that can be easily transferred over wide area networks, stored on laptop computers and even on wireless handheld devices.

The current system of producing news on bits of audio and videotape has many flexibilities, not to mention an obviously dominating constituency in terms of rolled-out production product. In addition, it is likely, according to what we see in early integration plans around the world, that tape will continue to be the short-term solution for at least a news organization's archives. Though an older technology, tape is hard to beat for sheer density of storage per unit space.

But for daily news production, efficiencies in the object-oriented media storage system will be too tempting to resist.

What is a media object?

In very general terms, an object is like an envelope into which you have dropped a videotape or maybe a photo. For convenience, you put a label on the front of the envelope describing what is

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The nice thing about simple envelopes and labels is that, ignoring size, they all can be handled the same way. You can mail an envelope containing video as easily as you can mail an envelope containing a photo. The post office does not care.

Similarly, a file cabinet that can hold photos can also store video. Within the context of a newsroom editorial system, as long as a system can handle an envelope (object) the system does not care what is inside. An object-oriented newsroom system can allow users to view, edit, move and store objects such as still stores, CGs, video, audio and automation events all in the same way: as files stored on a computer.

Once a user learns how to include a CG in a script, they have also learned how to place still stores and video, too. These possibilities can radically transform the way a typical news organization does business — leading to significant new efficiencies.

At the heart of this transformation is a key enabling object technology: the MOS (Media Object Server) protocol, a common way for media and newsroom systems to exchange information over local or wide area network links. MOS has been developed in a partnership between newsroom computer vendors and key suppliers of broadcast production equipment.

Although now primarily in use at single sites, extensions of MOS will soon open up exciting options for news organizations with stations or outposts across the nation and world. These extensions will also facilitate the movement of media assets from broadcast stations to newspaper and Internet content partners.

For example, using media servers, MOS and the object storage model, producers in regional news centers could send playlists to MOS servers hundreds of miles away. They could move media items from server to server just by dragging and dropping a MOS pointer into a script. The goal is to create a virtual worldwide or nationwide newsroom that makes the best use of resources, no matter where they are.

Moving media around transparently and automatically retrieving it from an archive — near-term or long-term — is more than just a technical challenge. From an editorial point of view, one must also deal with issues of sources, compensation and rights. Where did the pictures come from, and who took them? Will there be an extra charge for using them elsewhere or again, or are certain stations prevented from using those media resources?

Manufacturers are already working to address this issue by moving forward plans to convey extensive contextual information — metadata — along with the object itself.

In the AP newsroom model, the editorial script or assignment item from the planner will be the root of this metadata chain. The assignment editor will create a story/planner item,

Where did the pictures come from, and who took them?

which will be linked to its script counterpart. As the story/script moves through the system, video, audio, stills and CG are added, each with its own collection of associated metadata — descriptive notes, durations, embargoes and the like. It is all kept together, and will keep growing as new, "derived" versions of the story are created for newspapers or the Internet.

A good way of thinking about this model is the menu one gets when right-clicking on a file in Windows, especially in Windows 2000. What you see is a listing of information about that file, some of which you can control, and some of which is "read-only." The key point is that it is all in one place, and it all moves with the file wherever it goes, an essential requirement for managing data and media on a large scale.

Although issues of metadata and workflow in a media object environment are somewhat distant, it is important to consider them as the media plan evolves. Regardless of what method or mode you choose to store your media, the method of storing, moving and retrieving it has to fit into the news production workflow. Without that human integration, the system will take longer to fulfill its promise of making the tough job of news just a little easier. ■

Metadata is added to content at each stage of production, so that as video, audio, stills and CG are added, all pertinent information is kept in one package.

Bill Burke is ENPS product manager, and Mike Palmer is broadcast technology development manager for the Associated Press.


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The International Broadcast Center:

Bringing the Sydney 2000 OLYMPICS to the WORLD

by Steve Sullivan

More than 12,000 rights holders and 190 broadcast groups plan to use the International Broadcast Center during the 2000 Sydney Olympics. Photos courtesy Telstra.

It sounds like a couch potato's dream come true: Every second of Summer Olympics action available on a wall with more than 400 monitors. It's not a dream, but it's also not a place where you're likely to see spectators spread out on sofas. What is being touted as the world's largest monitor wall is part of the International Broadcast Center (IBC) in Sydney, Australia's Olympic Park.

The IBC will be the headquarters and hub of operations for the event's host broadcaster, The Sydney Olympic Broadcasting Organisation (SOBO). SOBO is expecting more than 190 television and radio broadcast groups with more than 12,000 accredited rights holders to use the IBC during the 17-day Summer Olympic Games. These broadcasters

will be sending their signals to a world audience estimated near 25 billion.

To handle the design and integration of the IBC, SOBO selected broadcast engineering firm GeneSys International (GSI), a wholly owned subsidiary of MCSi Inc. This is an unprecedented third-consecutive Olympics IBC integration project for GSI. The company provided similar services for in 1996 for the Summer Games in its hometown of Atlanta, and then again in 1998 for the Nagano, Japan Winter Games.

According to GSI, the key to a successful IBC is to keep it simple and save the bells and whistles for use at the venues. The company's goals are to provide the best possible system for the operators and the deliver the highest quality picture to the viewers.

The largest IBC to date

For GSI, the Sydney facility is considerably larger than either of the previous two IBCs. The 70,000-square meter, $475.5 million (U.S.) facility will accommodate an average working population of 6500 people. The facility houses studios, control operations, logistics, quality control and engineering. In addition to being the operational nerve center, the IBC contains office space for SOBO administration, as well as retail shops and restaurants.

In spite of the size of the installation, GSI engineers say the facility is not all that sophisticated – there's just a lot of equipment in one place. The equipment to be accommodated by the IBC includes more than 780 cameras, (including Panasonic's AJ-D910WA digital field production camcorders, AQ-235W full-featured studio cameras, AQ-23WU handheld cameras, and Philips LDK 23HS high-speed cameras); 1000 DVCPRO50 digital VTRs (including AJ-D960 slow-motion studio recorders, AJ-D950 studio VTRs, AJ-D940 slow-motion players, AJ-D95 half-rack size studio recorders and AJ-LT95 laptop editors); Videotek test equipment (including VSG-204 digital sync generators, TVM-821 digital oscilloscopes and TVM-710 analog scopes); and Clear-Com's Matrix Plus digital intercoms. In addition to the wall of 402 monitors, almost 4000 production monitors are also expected to be in use.

The facility is not all that sophisticated – there's just a lot of equipment in one place.

Even under the best of circumstances, integration of a project of this scale is daunting. But the Olympics can present its own set of unique challenges. Chief among them is the fact that most of the equipment and racks are designed and engineered in separate cities, then transported and integrated to the remote site. In most cases, the racks had to be wired without the equipment, which was shipped from various locations to Sydney after the racks were installed in the IBC in February. The complete installation must be fully tested prior to transportation because once it arrives on site, with more than a million meters of cable running throughout the IBC, there is no time to compensate for wiring errors. Once the Olympic torch is lit, everything has to work perfectly.

Multiformat planning

This is the first truly multiformat IBC. Although D-2 was offered as an option in Nagano, the format had very few takers. In Sydney, the distribution system is a combination of 625 SDI and PAL analog, with audio distribution in either analog or embedded in the SDI datastream. Radio distribution is strictly analog.

The IBC control room, or the Transmission and Distribution Center (TDC), is where you find the massive wall of monitors. Electronics are housed in approximately 70 racks. An additional 26 racks contain the fiber patch panels and alarm equipment for Australian telecommunications firm, Telstra. Telstra's codecs are housed with the broadcast terminal equipment for easy access. Telstra uses a separate switch room for its PABX, cellular service equipment and other systems.

A giant distribution center

World broadcasters rent space in the IBC and receive a bundle of cables with video and audio feeds. Coverage of more than 300 events from the 15 Olympic Park venues will be fed via Telstra fiber back to the IBC. The TDC receives 40 analog and 20 SDI feeds from the venues. PAL-equipped OB

The satellite dish farm on the outskirts of Sydney channels video traffic from Australia.

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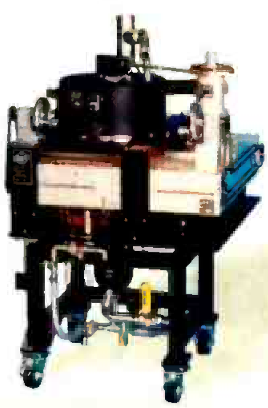

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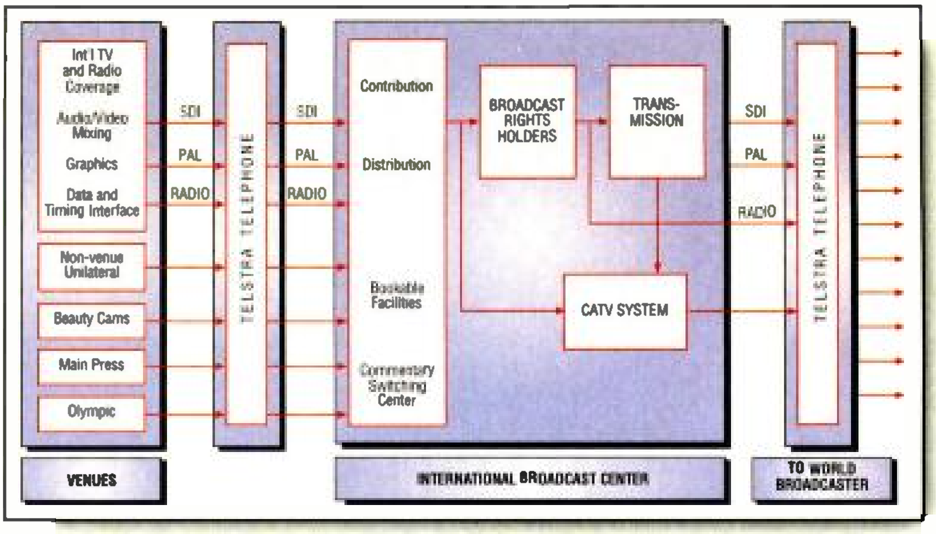
units primarily produce the venue feeds. The exceptions are feeds from productions in the Super Dome and Stadium Australia, which is SDI with analog audio. The IBC is co-located with these two venues so the control room complex for its production is adjacent to the IBC and the feeds require only 300 meters of 7731A coax.

On the input side – referred to in Australia as the contribution – there are also approximately 250 combined analog and SDI unilateral circuits booked for the various rights holders.

Most of the equipment and racks are designed and engineered in separate cities.

The SDI circuits are converted to PAL and the audio de-multiplexed for monitoring purposes only. On the transmission side, there are nearly 175 circuits.

The input signals are run through patch panels for quality control checks, then sent through distribution amplifiers to demarcation panels to the broadcasters. They then take those signals, do voiceovers, add their own graphics, and send them back to the IBC transmission area, where they are delivered back to the home country via whatever path the broadcaster has arranged.



Content flows from the various venues to the IBC, then from the IBC to the individual rights holders via Telstra fiber and codecs.

The use of routers is generally limited to monitoring only. None of the routers are used in the critical program paths, which are hardwired or patched. The 40 distribution channels are frame synchronized by 40 Digibus systems each containing PAL-to-SDI decoding, SDI frame sync, audio delay and embedding and re-encoding into PAL. The routers are all multiformat, PAL, SDI and analog audio. They range from 64x32 to 128x32.

The commentary circuits from the venues come into the IBC's Commentary Switching Center (CSC). The IBC matrix is a 296-port system, most of it being used for four-wire switching. A rights holder's commentary travels the four-wire circuit to the CSC, then is passed on to the rights holder studio area and ultimately to the broadcaster's home country.

The IBC also houses a limited number of bookable edit suites and a format-conversion room.

The world's largest staging event

For GSI, the Sydney games began months ago. Planning began as soon as the Nagano Winter Games concluded two years ago. It shipped wire racks over in February to begin installation and wiring. Third-party equipment is installed and then starting a month the games commence, everything is turned on for a 30-day burn-in period to make sure all the bugs are out of the system. For the duration of the games, GSI has an eight-person maintenance staff on-site 20 hours each day. As soon as the last broadcaster signs off from Sydney, everything comes out and is returned to its supplier.

Like many of the athletes participating in the games, as soon as the torch burns out in Sydney, GSI will begin preparing for the next Olympics. GSI will take what it learned in Sydney and incorporate that into its bid for the 2002 Winter Games in Salt Lake City. ■

As accessed by the earth station control room, satellites in the Pacific, Asian Pacific and Indian Ocean regions provide distribution for feeds from Olympic broadcasters.

Steve Sullivan is co-founder of the Advanced Interactive Media Group, LLC.

The author would like to thank Ed Matthews, LaVaughn Thompson, Pat Matthews, Sean Matthews, David Priester of GSI; Christian Mitchell of MCSi; and Melissa Fleming of SOBO for their help on this article.

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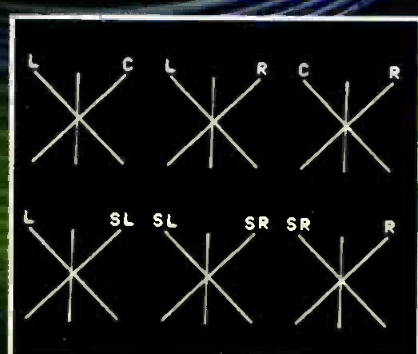

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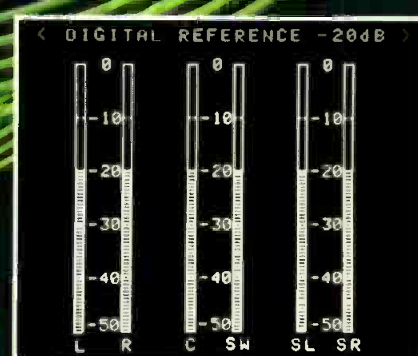

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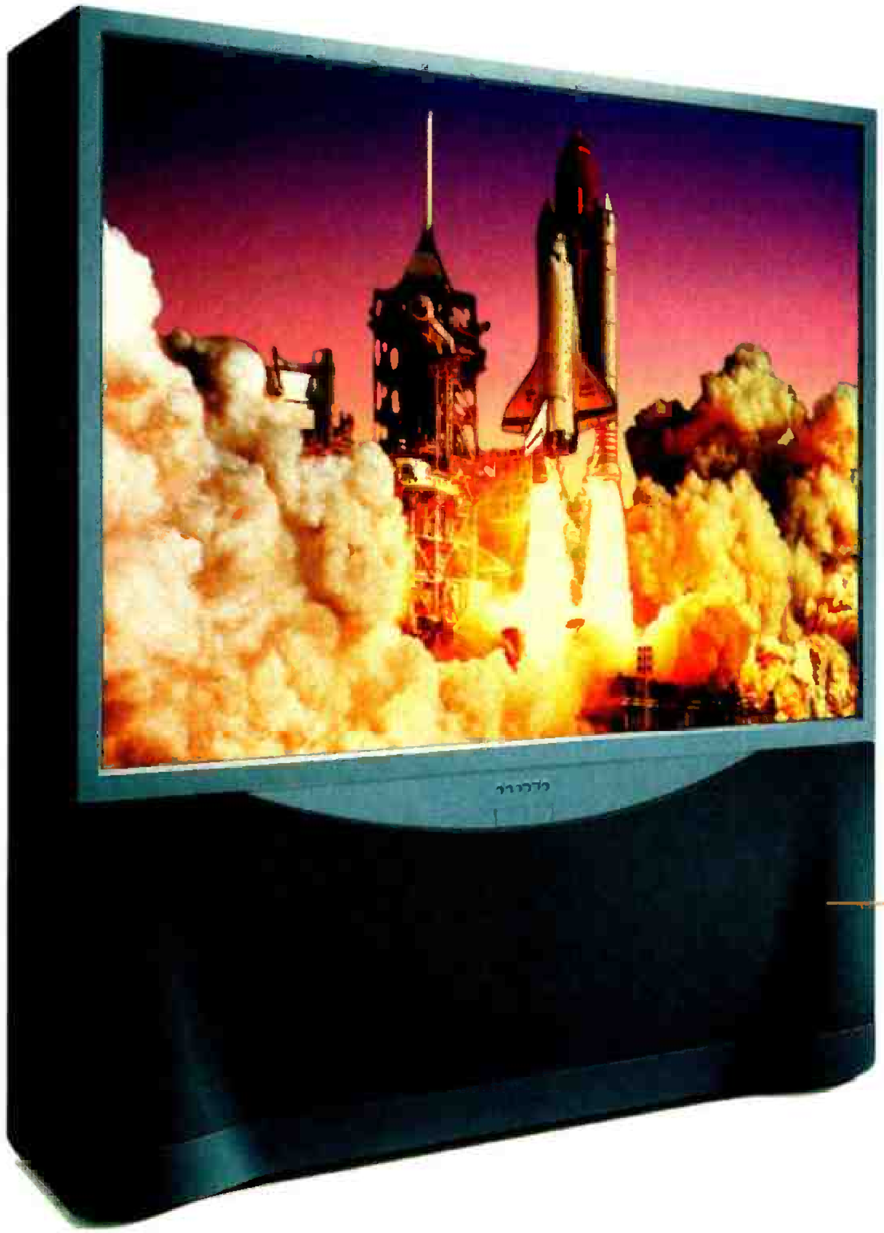

Solving the DTV Chip Puzzle

BY DAVE CRATE AND DAVE PIVIN

After decades of producing analog TVs, set manufacturers are experts at refining their products. With the arrival of digital television (DTV), they are faced with an enormous technology shift as well as a tight timeframe to cost-effectively deliver new sets.

Digital television technology can provide consumers with enhanced audio/visual entertainment. To meet these requirements, video may be encoded in a variety of sizes, frame rates and aspect ratios. Sound can vary from simple stereo to six channels. Data can also be included to enhance the experience.

DTV can be described as either SDTV or HDTV. SDTV is equivalent to today's NTSC with a 4:3 or 16:9 aspect ratio and up to 300,000 picture elements, while HDTV provides a 16:9 aspect ratio and up to 2 million picture elements. DTV hardware must accommodate high-speed digital data as well as sensitive analog signals. Software must interact with new standards such as MPEG-2, Dolby Digital, closed-captioning, conditional access and program guides.

To aid the DTV transition, TV makers need a system-level solution, a combination of chips and software — a small module, with a simple interface, that can be inserted into the existing analog TV chassis. Placed between the tuner and the display electronics, it would provide sound and picture from the incoming digital signal. It's practically as simple as the TV makers just putting the module in existing TVs and selling them as DTVs.

Fundamental changes

With the introduction of the ATSC DTV standard and an FCC mandate that the major markets begin transmitting DTV, more than 100 cities have DTV service. Unfortunately, the number of sets capable of viewing these broadcasts is miniscule compared to the 20 million new analog sets sold each year. To date, most of the DTV sets sold are expensive, on average over $4000. These sets are focused on the HD applications that require a dramatically more expensive display than is found in most living rooms today. As a result, there is a demand for an alternative to these high-priced sets.

Another factor in this transition is the broadcaster's desire to simply take the NTSC content and repeat it on the DTV channels. Digitally produced content can be dramatically better than what is broadcast over analog TV today.

The challenge

Implementing DTV has turned out to be a real challenge for TV designers, manufacturers and broadcasters. Besides the fact that they have had to wait while standards were solidified, there is


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considerable new technology involved. Also, as with any new technology, the dynamics of economies-of-scale are not apparent. Established, cost-reduced solutions do not exist, making the price point of digital television prohibitive for most consumers. Market dynamics beg for a low-cost alternative to get DTV off the ground, a solution that allows the TV OEM to hit the price point driving volume. The ideal solution would have a small premium over an analog TV: under $1000 and probably under $500 before the average consumer will buy one. The solution must rely on the opportunity to leverage years of investment in refining the standard analog display, combined with an inexpensive modular add-in to create a hybrid receiver capable of presenting all analog NTSC and digital ATSC broadcasts.

One solution that could accelerate the implementation of digital TV is a module that can be inserted into a conventional TV chassis to take the IF output signal from the tuner and convert it into video and audio signals that can be handled by the existing display electronics and sound system. This can be done because the average analog chassis is capable of higher picture quality if the source is digital video.

This solution's requirements were crafted to minimize the impact on the TV OEM and designed to keep the interface simple and follow the signal conventions of an analog TV chassis.

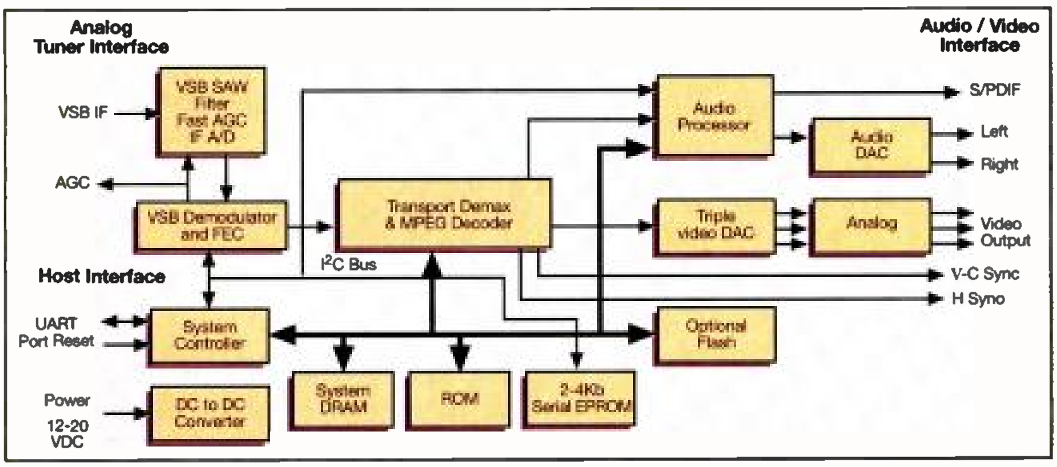
The host TV controls the module and receives status through either a two-wire serial or I2C port. This makes control of the module a matter of using an existing or easily implemented two-wire channel driven by the host TV's microcontroller.

The module is designed to use the same tuner, which is possible as long as certain minimum electrical requirements are met by the tuner, such as band-matching, phase noise and other common criteria.

The decoded video connects directly into the video drivers, which may now alternate between the standard NTSC video and the digital video signal, whether that is composite, component or S-video.

The M-DTV module

The overall architecture of the M-DTV module (see Figure 1) consists of four main sections: the ATSC receiver (VSB demodulator and FEC), the legacy converter (Transport demux and MPEG decoder for ATSC-to-NTSC conversions), digital audio and the system processor, which oversees the system and the interaction of its components.



M-DTV module includes an ATSC receiver, a legacy converter, digital audio and a system processor to oversee the system.

The ATSC receiver section is comprised of an IF strip that includes three gain stages (one variable) interspersed with two SAW filters and a high-speed ADC, which then directly feeds the MCT2100 demodulator chip with 10-bit digital samples of the input. IF-to-baseband downconversion is not directly performed. The ADC undersamples the IF signals, and the MCT2100 has the ability to discern the baseband signal from the undersampling aliases. The IF strip has an overall gain of approximately 10dB to 50dB that is controlled by the AGC signal from the MCT2100. The gain requirement varies with the input signal strength, a weaker signal requiring more gain to provide a constant level at the ADC sampling gates. The TV's tuner must provide 0dB to 30dB of gain prior to the module.

To aid the DTV transition, TV makers need a system-level solution.

The ATSC-to-NTSC converter consists of the MCT4000, memory, DACs and amplifiers. The chip receives the MPEG transport stream from the receiver section and parses it to glean video, audio and program data. The video data is decoded and simultaneously down-converted from any of the 18 ATSC formats to NTSC. The three video DACs then convert the 10-bit data to generate one of the several available video formats: composite, S-video, RGB or YPbPr.

The system processor is a Motorola MPC850 PowerPC, which controls the interplay of the three other sections and processes the input from the host TV.

Minimizing the impact on the TV OEM

TV OEMs are accustomed to building on last year's model. They are familiar with taking a known platform and making relatively small modifications to improve performance and provide additional features. With a modular approach to DTV reception, this methodology is largely preserved, requiring only the assimilation of a larger tuner device into the chassis while preserving the primary circuit board, power supply, display electronics and overall internal architecture of the set. This approach minimizes the TV OEM's investment in the new technology, while reusing analog chassis designs and preserving that investment. ■

Dave Pivin is product portfolio manager for Motorola Semiconductor Product Sector Entertainment Solutions Division, and Dave Crate is on the technical staff of the Motorola DTV operations in Chandler, AZ.

Figure 2. 24p to 60i pulldown chart

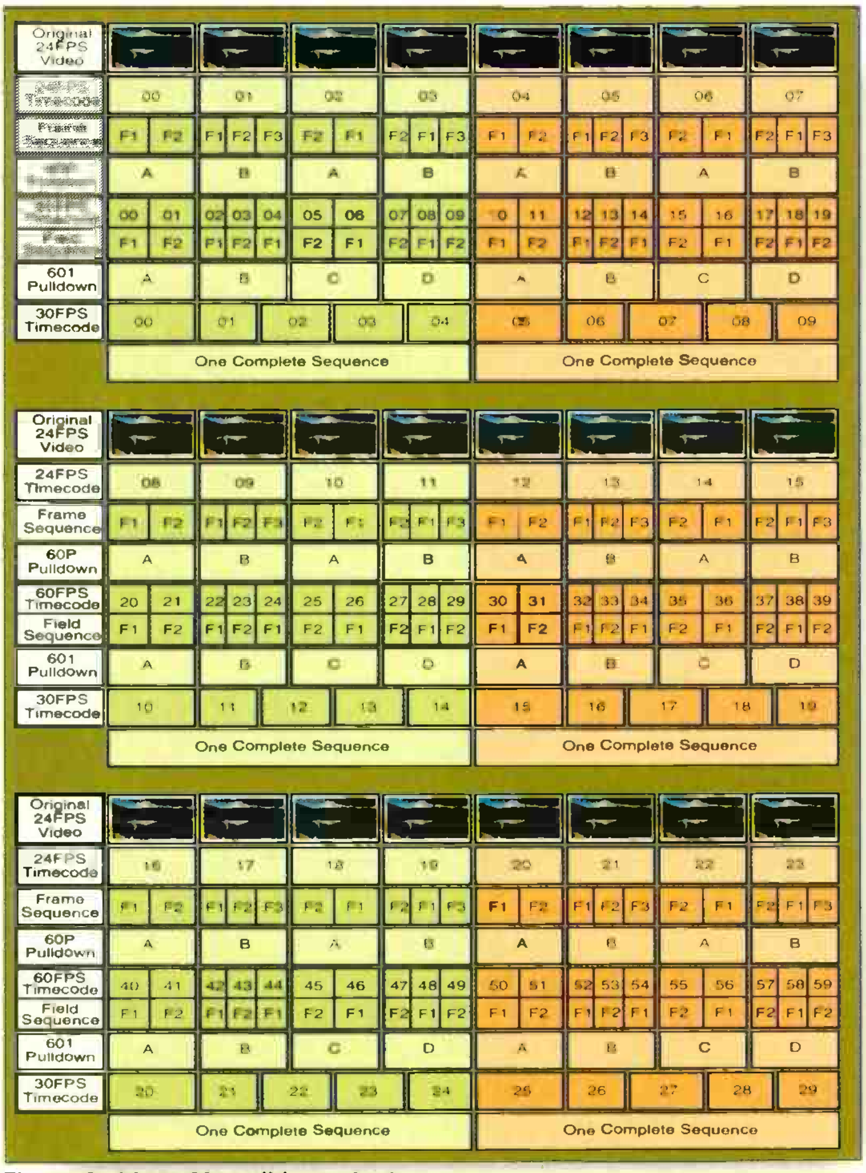


Figure 3. 24p to 60p pulldown chart

CONTINUED FROM PAGE 64

route signals to appropriate destinations.

Caveats aside, producing a project in 1920x1080, 24p is certainly in the best interest of the content owner as it adds value in the form of flexibility in delivery. Even recording back to film will yield excellent quality. Although the technology is barely a year old, the pieces needed to build a 24p facility are available and more solutions are arriving all the time.

Terry Brown is chief engineer for LaserPacific, Hollywood, CA.

2:3 pulldown

2:3 pulldown, or as it is more commonly known, "3:2" pulldown, indicates a pattern by which 24 progressive (film) frames per second are mapped into 60 fields per second. There are four progressive frames to every 10 fields. This sequence is broken into four frame-to-field groupings normally labeled "A," "B," "C" and "D." At one time in the early 1980s the "A" frame was a three-field sequence starting with Field 1 followed by a two-field sequence starting with field 2. Hence the name 3:2 pulldown. Today, an "A" frame is described as a two-field sequence beginning on Field 1. Figure 2 shows the pulldown sequence for a one-second interval. Notice that for every source frame there is either a two- or three-field sequence, starting on either a field 1 or field 2. The "A," "B," "C" and "D" frames indicate where the original progressive frames fall in the 60-field sequence. There are two places in the sequence where a video frame will have information from two progressive film frames. One is the "B to C" transition and the other is the "C to D." It should also be noted that it is custom and practice to map timecode numbers to pulldown frames. An "A" frame is normally mapped to a frame 00 timecode with a modulo 5 sequence for 30 frame code and modulo 4 sequence for 24. Figure 2 shows the relationship of the 24 and 30 frame codes as they relate to the pulldown sequence.

In the case of a 60p-frame system, Figure 3 shows a similar relationship. Notice there are only "A" and "B" pulldown frames.

Applied Technology

Telex's BTR-800 wireless intercom system

BY RALPH STRADER

Wireless intercoms have been a broadcast staple for more than 25 years, but the systems in use today bear little resemblance to their predecessors. The first systems employed separate beltpacks for the transmitter and the receiver and were awkward to use, a drawback in broadcast production environments requiring mobility and ease of use. As wireless technology has evolved, systems have been designed that meet the real-life needs of the working broadcast professional.

Perhaps the biggest benefit of wireless intercoms is they allow users to "cut the cable" of hard-wired partyline systems and move about freely within the system's operational range. A wireless intercom is a partyline intercom system, and good quality systems can be seamlessly attached to existing hard-wired communications systems commonly used in broadcast facilities. Quality wireless intercoms offer a distinct advantage over traditional two-way radios in that they offer a more natural full-duplex operation. This enables all users on the system to speak and hear other users simultaneously without "covering" other users' transmissions.

The demands of modern broadcast productions make the full-duplex operation of wireless intercom systems an absolute necessity for stage managers, lighting and audio technicians, or any professional who has to deal with the breakneck speed and complexity of television productions.

The spread of digital television and the ever-increasing number of wireless users have made it more difficult to find channels for wireless intercoms in the available frequency spectrum. The spectrum has gotten a lot smaller, especially considering the re-allocation of four channels for public safety use and the upcoming re-allocation of UHF TV channels 60 through 69. Broadcast professionals have to consider such factors as the compatibility of frequencies with each other, as well as how to best avoid interference with local TV transmitters.

Unlike wireless microphones that operate only in one direction, wireless intercoms have more specific frequency spectrum requirements because of the relationship between the transmitter and receiver frequencies. Each intercom (if it is to be full-duplex) must have at least one system transmitter frequency that broadcasts to all beltpacks and one receiver frequency for each individual beltpack in the system. For a four-beltpack system (known as a four-up), this means a minimum of five frequencies.

Each beltpack must have a receiver set to the base transmit frequency and a transmitter set to its own unique receiver in the base. Due to a phenomenon called desensing, these two frequencies must have a fairly large frequency separation, typically at least 12MHz for UHF systems, or the transmitter will interfere with the receiver's operation.

The answer to the frequency problem is to utilize a digitally-synthesized, frequency-agile system. That may sound simple enough in theory but, in reality, designing such a product is a different matter. It must not only incorporate a superior design with high-quality filtering to withstand the rigors of an overcrowded frequency spectrum, but it must also offer an ergonomically designed user interface that allows ease of frequency selection and operation. End users must experience the same ease of operation they get from their existing two-wire beltpacks.

Wireless intercoms have been a broadcast staple for more than 25 years, but the systems in use today bear little resemblance to their predecessors.

To date, the chief limitation to most wireless intercoms (other than finding available spectrum) has been that they are inherently one channel in nature while the most common hard-wired intercom system from RTS (used in virtually all TV broadcast trucks and facilities) is two-channel by nature. Two-channel operation allows users to switch easily from one intercom channel to another. This allows a stage manager, for instance, to communicate with the producer and then switch over to the director circuit as necessary. Two-channel operation has become the hard-wired industry standard, and users who have increasingly relied on wireless intercoms must be able to employ that technology in wireless form without having to deal with huge racks full of equipment.

Wireless intercom systems that can operate in high RF environments must not only offer interference-resistant operation, but must utilize design techniques that will not interfere with

other wireless equipment like wireless microphones and IFBs. Also, one key to a wireless intercom's successful operation and coexistence with DTV will be its ability to avoid strong, local TV stations, as well as coordinate multiple frequencies. This holds true whether the system is VHF or UHF, fixed-frequency, frequency-agile or synthesized. Utilizing the minimum power necessary is absolutely critical if wireless intercoms are to coexist with other low-power wireless equipment. The utilization of intelligent systems that reduce beltpack transmitter power levels as they get closer to the base station can greatly decrease the harmful interference associated with wireless communications gear.

Perhaps the biggest benefit of wireless intercoms is they allow users to "cut the cable" of hard-wired partyline systems and move about freely within the system's operational range.

Future wireless intercoms will need to provide users with frequency agility, high-end filtering, RF power management, ease of use, two-channel operation, extended battery life, a small, lightweight beltpack and a user interface that allows operational and frequency parameters to be easily set and checked without the use of external equipment such as a laptop computer or special interface box.

The Telex BTR-800 system offers these features. It is able to draw on Telex's long history in the development of innovative wireless intercoms. For example, the Telex BTR500/600 wireless intercoms were designed to resist interference from broadband systems and are targeted toward fixed installations with high RF environments. The majority of the BTR-800's applications will be targeted toward the high-end television broadcast entertainment industry. Among the key benefits of the BTR-800 are UHF frequency agility, two-channel operation, a smaller beltpack, 1RU base station, reliable audio routing and, always important, a low cost.

As wireless intercom applications for broadcast professionals continue to grow more complex and challenging, the need for products that can meet these challenges will also grow accordingly. The Telex BTR-800 is just the latest example of this trend. ■

For more information on Telex's BTR-800, circle (450) on Free Info Card.

Ralph Strader is director of broadcast products for Telex Communications.

ViaCast IP multicasting: The answer to broadband content delivery

BY DOUGLAS MEDINA

For years, conventional television signals have been broadcast via satellite. For example, networks broadcast programming to cable headends and network affiliates around the country for delivery to home. Now the same is happening to media-rich Internet content such as video, voice, audio and data. The Internet is becoming a true broadcast medium. Using satellite IP multicasting technology, Internet content is being broadcast to Internet headends in order to bring content closer to the end user for a richer, more TV-like Internet experience. Traditional broadcasters can benefit from Internet-oriented technology for applications ranging from digital ad insertion to convergence of data with conventional programming, often called enhanced TV.

How many times have you watched a streaming video on the Web and encountered a jittery screen moving slower than the audio? Usually, the poor quality of the images is a result of overburdened terrestrially-based Internet backbones. An additional problem is point-to-point transmissions, in which servers and Internet connections are overtaxed because content providers must constantly resend broadband content to every requesting user.

Before Web surfers can get a TV-quality experience on the PC, service providers have to get more broadband content to users. The existing terrestrial infrastructure is too narrow to let more than a trickle of data through. That's the problem. But where do companies turn to find a solution?

The answer is broadband networking technology, Internet Protocol (IP) encapsulation and multicasting of broadband content. In multicasting, IP encapsulation is used to package the broadband content for transmission via satellite so that sophisticated content can be created one time and beamed simultaneously to multiple users. Media-rich content that would normally clog terrestrial lines, only allowing a fractional amount to actually leak through, is now delivered at high speeds via satellite to the edge of the Internet.

IP multicasting technology solutions

Regardless of the underlying infrastructure, IP multicasting works by sending data from one point to multiple points. Data can be transmitted via satellite, cable, terrestrial wireless or other land-based networks. Encapsulating and compressing the data reduces its overall size and the amount of bandwidth needed. Unlike point-to-point transmission, multicasting allows a packet to be sent from one location to numerous locations simultaneously, resulting in cost-effective and efficient delivery.

IP multicasting works by sending data from one point to multiple points.

The use of a DVB-based IP multicast satellite solution enhances the multimedia IP broadcast by bypassing the choked terrestrial Internet backbones. Through powerful media streaming servers, together with a broadband satellite receiver, the content is brought closer to end users in order to dramatically improve their Web experience.

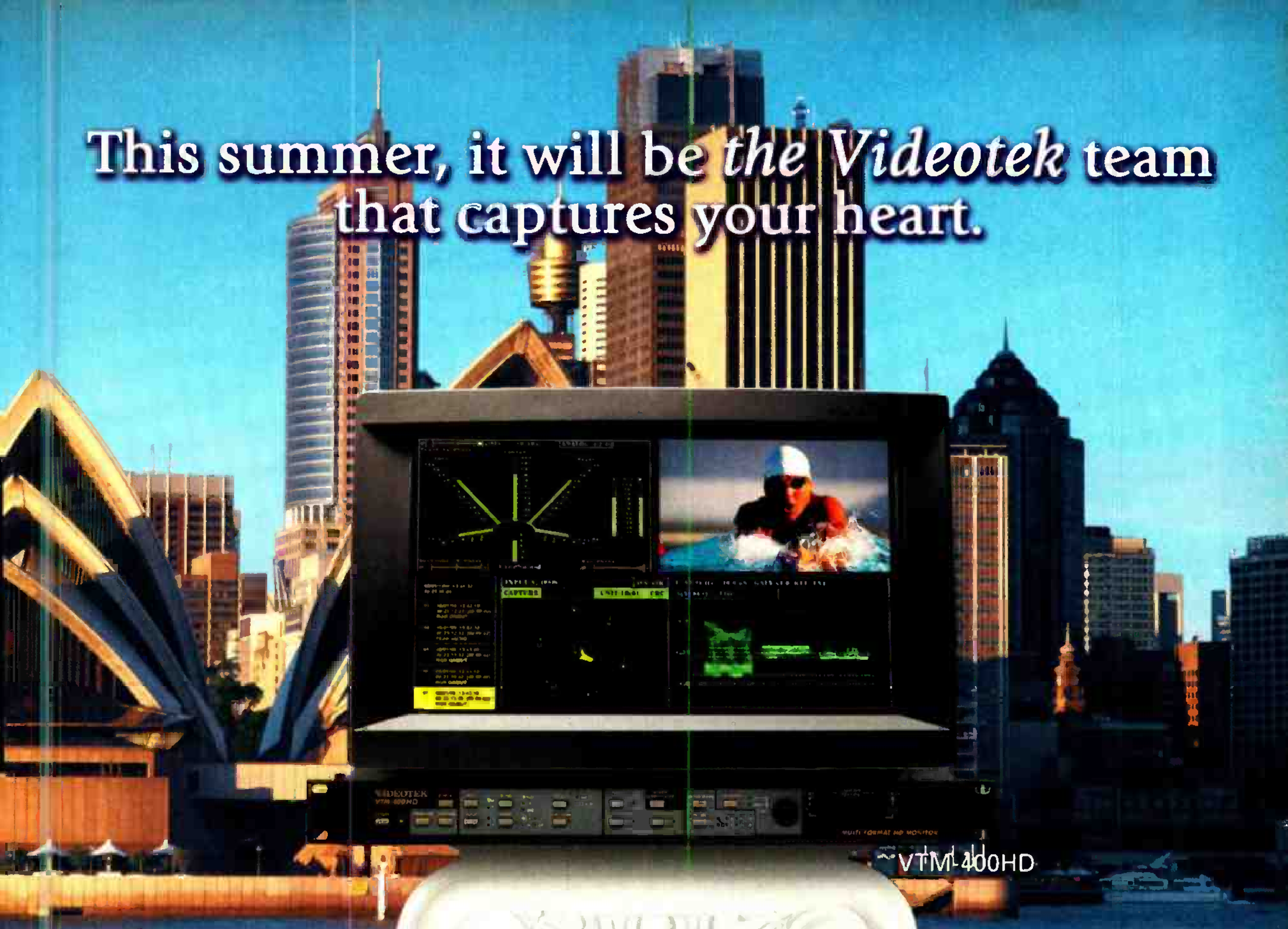
By embracing the IP and DVB standards, content providers, ISPs and other groups can deliver broadband content such as broadcast-quality audio and video. As such, the standards have become the *de facto* high-speed data transmission technology, which is already at work in the broadcast environment. For example, Williams-Vyvx uses IP multicasting for its digital ad insertion broadcast clients.

Digital ad insertion via satellite

Williams-Vyvx provides digitized commercials from advertising agencies to over 700 TV stations in almost every media market in the U.S. Prior to IP multicasting, Williams-Vyvx received advertisements from its customers, manually cut tapes from a master tape, and then distributed the tapes to the individual TV stations. Although the initial quality of the video was excellent, the viability of these tapes was short term. The boxing and shipping of the tapes was also very expensive. Williams-Vyvx identified IP multicasting satellite technology as a better solution for distributing broadcast-quality TV commercials.

So Williams-Vyvx changed the format of the video advertisements to digital and created a better method of transmission. Next, Williams-Vyvx installed a receiver and satellite uplink device at its headquarters in Oklahoma, as well as a receiver and downlink at the numerous TV stations receiving the content. Williams-Vyvx chose ViaCast's Forte DVB IP Gateway and IP-COMPANION satellite router for their end-to-end solution. Combined, the two make for a comprehensive end-to-end broadband solution. Furthermore, their embedded network appliance designs offer reliability and simple provisioning of broadband content delivery. Using IP multicasting to transmit and receive video advertisements, TV stations can now store the content in digital form, significantly improving its shelf life.

The Forte "carrier class" Gateway was the right choice for providing media-rich broadband IP content streams from the Williams-Vyvx satellite uplink facility to the numerous TV stations. The Forte's multiprotocol encapsulation (MPE) solution delivered IP data directly for output to the IP-COMPANION receiver over satellite, at



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speeds of up to 45Mb/s. The Gateway's fully embedded (non-NT-based) operating system allowed changes in quality of service and service type in real time, without the service outages incurred in rebooting an NT-class machine. This embedded design eliminated common problems such as blue screen lock-ups and incompatible application software often associated with NT-based gateway and receiver products generally available in the marketplace today.

The IP-COMPANION satellite router works by receiving satellite signals and outputting IP data via an Ethernet 10/100Base-T interface to a desktop, LAN or Internet headend. In addition, for ease of management, the IP-COMPANION can be controlled remotely from the Web and supports full SNMP and HTTP management capabilities.

The DVB standard for simultaneous data broadcast to different locations allows high quality digital ad insertion to take place in real time with a better video image. The MPE technology was used for both the encoding and transmission of the video by Williams-Vyvx, and by the TV stations to receive and decode the content. Implementing the solution on both the encoding and receiving ends allowed Williams-Vyvx to leverage its full bandwidth. In fact, because the company had use of a full satellite transponder, the transmission could reach speeds of up to 45Mb/s.

Satellites are becoming the most efficient way to pass broadcast-quality content — making the Internet a true broadcast medium.

The future of IP multicasting: Internet and interactivity

Down the road, program originators will benefit from IP multicasting. Broadband content can be encapsulated as IP at the origination end and transmitted via satellite to broadcast networks, cable headends or ISPs domestically and internationally. At the headend, the content can be stored on caching servers. Replicating websites and foregoing terrestrial hops that delay access allows Web surfers to experience a faster Internet.

This revolution is underway now. Industry analysts expect the content distribution and caching industry to reach $2.2 billion by 2002.

Although IP multicasting solutions are available to address broadband content delivery problems today, the technology is evolving rapidly. No company currently uses all of their bandwidth capabilities. Satellites are becoming the most efficient way to pass broadcast-quality content — making the Internet a true broadcast medium. ■

For more information on ViaCast's IP multicasting solutions, circle (454) on Free Info Card.

Douglas Medina is vice president of marketing for ViaCast Networks. He can be reached via e-mail at dmedina@viacasting.com.

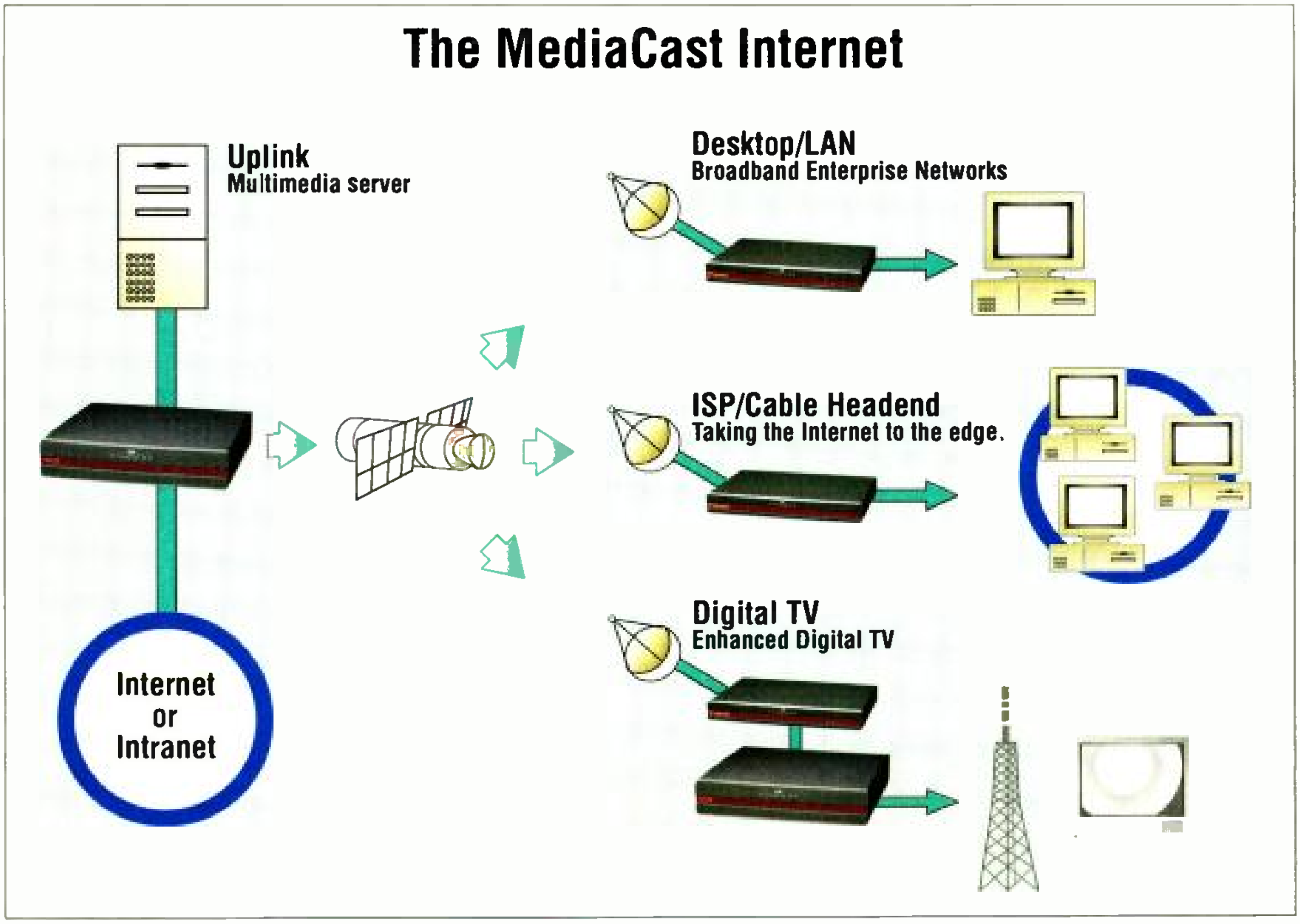

Figure 1. In multicasting applications, data is transferred from the Forte gateway to the IP-COMPANION via satellite and output as IP data via an Ethernet 10/100BaseT interface to a desktop, LAN or Internet headend.

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Transmission line: The do's and don'ts of proper installation

BY WILLIAM BROOKS AND BOB LEONARD

Will you be one of those whose DTV antenna and rigid line run must go in at the height of DTV crunch time? You may be forced to utilize a second-tier crew. Even if you've been fortunate in booking a top installation service, remember that they will be under heavy time pressure and possibly nearing exhaustion.

To protect yourself, you should understand the basics of proper rigid transmission line layout, installation and maintenance so that you can supervise and inspect your new RF system properly. This article will fill you in on what you need to know.

Proper layout for the run

Rigid transmission lines expand significantly when power is applied. To prevent buckling, they must be suspended from spring-type hangers. When the long vertical run expands, a bending moment will be applied to the horizontal run that can fracture the miter welds on the bottom elbow unless the horizontal run is also able to move freely. To avoid this overstress, lay out a minimum length for the horizontal run relative to the vertical run (as shown in Table 1) and insist on reinforced elbows throughout.

Even if you've been fortunate in booking a top installation service, remember that they will be under heavy time pressure and possibly nearing exhaustion.

Placement of the bottom elbow is also critical to avoid interfering with any tower members. Figure a differential expansion of ½-inch per 100 ft between the copper of the line and the steel of the tower, over a temperature range of -25°F (-32°C) to +125°F (+52°C), based on the ambient temperature. The minimum number of elbows needed is usually four: three at the top and one at the bottom. In today's world of crowded towers, six or even eight elbows seem to be the norm. But elbows add cost and installation time and do nothing to improve signal quality. A top-down installation may help you avoid large elbow complexes.

Recommended Minimum Length of Horizontal Run, feet				
Vertical Run, feet	Rigid Line Size			
	4-1/16"	6-1/8"	7-3/16"	8-3/16"
100	15	20	20	20
500	35	40	40	40
1000	40	50	55	60
1500	50	60	60	70
2000	60	70	75	80

Table 1. To avoid fracturing the miter welds on the bottom elbow, lay out the horizontal run to the recommended minimum length relative to the vertical run as shown in this table.

Minimum Distance to Lowest Vertical Spring Hanger vs. Length of Horizontal Run, feet				
Horizontal Run, feet	Rigid Line Size			
	4-1/16"	6-1/8"	7-3/16"	8-3/16"
20	6	9	10	12
40	8	11	14	15
60	9	13	16	17
80	9	14	18	19
100	10	16	19	21

Table 2. To allow the lower portion of the vertical run enough flexibility to absorb thermal movement from the horizontal run, the minimum distance from the horizontal run to the lowest vertical spring hanger should be selected from this table.

Standard rigid line comes in sections 20 feet long, and special broadband line comes in sections of variable length averaging just under 20 feet. In either case, pre-ordered variable lengths or field cut sections will probably be needed to make everything fit. Field cuts are preferable because they are measured and made on the spot. Variable lengths result in a delay in installation while the factory makes them up and delivers them.

Installation sequence

Installation may begin at either the top or bottom of the tower. The uppermost vertical section is attached with rigid hangers and the vertical pieces below it with spring hangers. When starting installation at the bottom of the tower, temporary rigid hangers are used on the first vertical line section installed and removed after the permanent rigid hanger(s) has been installed on the top vertical line section to avoid damage to the line. Follow manufacturer's instructions as to orientation of the line sections during installation.

Hanger considerations

Standard hanger spacing is every 10 feet. The minimum distance from the horizontal run to the lowest vertical spring hanger depends on the length of the horizontal run. Follow the spacing given in Table 2.

Make sure the crew aligns all hangers properly so that free travel is maintained and the line will be straight. Verify that the installers are using torque wrenches to torque the


Belden

hardware. (You'll also need torque wrenches to tighten the flange bolts on the line itself.)

Vertical spring hangers require adjustment of their spring tensions to match the weight they are supporting (proportional to line length), compensated for ambient temperature at installation. This is done by stretching the spring(s) for each hanger to a preset length and setting by tightening one or more hose clamps around the line. Since there is considerable variation between different sizes and brands of line, make sure the crew consults the manufacturer's installation instructions for your exact material.

A lateral brace must be installed at the bottom of the vertical run to restrict lateral movement while permitting free travel vertically and horizontally. The sections of the horizontal run are hung from three-point suspension hangers every 10 feet. These hangers have springs that permit the horizontal run to dip when the vertical run expands. Finally, the rigid line should be double wrapped where it passes through the wall feed-through to form a watertight seal, and the feed-through halves should be caulked all around the edge.

In an effective rigid line installation, the minimum length of a horizontal run of rigid transmission line (shown above) and the minimum distance to the lowest vertical spring hanger must be carefully calculated to compensate for expansion and contraction in the vertical and horizontal runs.

Hoisting and connecting

If any section of your line is dented, bent, has bad welds or is wet inside, don't install it. (A good policy is to order only transmission line components that are 100 percent pressure tested at the factory.) Discard any damaged O-rings that you see.

Make sure the crew removes all burrs from field-cut sections, on both inner and outer conductors. Watch that flanges are soldered on carefully.

Don't let the riggers leave until you pressurize the line, verify that it holds pressure, obtain acceptable electrical test results and complete antenna tuning.

Never hoist coupled sections of line. The flange welds aren't designed to withstand such stress. Watch to be sure the crew doesn't force sections together. If something doesn't fit, stop the installation to check for correct hanger alignment, etc. Make sure every O-ring is fully seated in its groove before tightening.

Tightening the flange bolts properly is troublesome but necessary. Don't let the crew get lazy here or try to cut corners to save time. Bolts should be snugged alternately, as near to 180 degrees apart as possible (exactly 180 degrees for an even number of bolts) and tightened to the manufacturer's specified torque using the same alternate sequence. Be sure not to exceed the manufacturer's torque specifications.

Most importantly, don't let the riggers leave until you pressurize the line, verify that it holds pressure, obtain acceptable electrical test results and complete antenna tuning.

Testing

When installation is complete, the rigid line system must be purged to ensure dryness, using nitrogen bottles or other pressurization methods such as an automatic membrane dehydrator or an automatic membrane nitrogen generator. Purge the line with a minimum of three volumes of nitrogen or dry air. Pressurize it immediately, without exceeding the pressure rating of any component, and monitor carefully for leaks 24 hours later. Correct any leaks found.

Perform all electrical tests at once. Start by attaching a tuned test adapter to a predetermined break point and an additional adapter for a tuned termination load at the end of the run under test. With a vector network analyzer, do a sweep test across the channel using the frequency domain to show overall return loss/VSWR. Next, transform to the time domain to reveal impedance mismatches in the line causing high VSWR, such as a split or bent inner conductor. Use a broader frequency range (±25MHz equal to four TV channels) in the time domain to magnify the flange connections and highlight any poor joints. Once each run has been optimized separately, the full run should be tweaked to obtain the most favorable performance. Finally, verify that the line is holding pressure and apply power.

Inner conductor issues

If using rigid line with sliding contacts (including watchband spring line), record the need to replace the bullets every seven years. If using bellows-type line, no replacement is required since the bullets do not slide.

That's it. You can now look forward to years of successful broadcasting. ■

For more information on Andrew Corp's transmission line, circle (453) on Free Info Card.

William Brooks is a product specialist in broadcast products and Bob Leonard is a former product line manager of broadcast transmission line products for Andrew Corp.

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Tektronix's AVDC100: Lip-sync error correction

BY TOM TUCKER

Broadcasters today have a variety of issues to deal with, all of which require a great deal of their time and consideration. However, in an era where the cost of coming in behind a competitor can be huge, being first to market with a quality product is critical.

That's where maintaining the audio-to-video timing relationship of a television production can be so important and one of the biggest challenges to delivering a quality viewing experience to the customer.

Even in the "all-digital" facility, analog and digital often coexist in a hybrid arrangement requiring some level of separate video and audio signal processing.

Even in the "all-digital" facility, analog and digital often coexist in a hybrid arrangement requiring some level of separate video and audio signal processing. Routing considerations are also involved that, if not properly accomplished, can result in a mismatch of the video and audio timing. Timing variations in the network and video processing delays can be another source of lip-sync errors in programming generated outside of the broadcast facility and then later backhauled to the studio for final editing and distribution.

Tektronix's AVDC100 uses digital watermarking technology to correct audio-to-video delay introduced during distribution of content.

A new solution to the problem of monitoring and correcting lip-sync errors caused by factors outside of the broadcast plant is now available from Tektronix with the AVDC100 audio-to-video delay monitor and correction product. The AVDC100 is a totally new concept in controlling lip-sync errors. Imagine if, at the point of program creation, a time reference representing the program audio could be embedded in the live video signal. This embedded audio reference would then provide a permanent reference for later retiming of the audio and video signals in the event lip-sync errors developed during distribution of the program. This is exactly what the Tektronix AVDC100 accomplishes with the use of digital video watermarking technology.

Digital watermarking

Digital watermarking is a well-known buzzword for a technology that is most often associated with the identification and copyright protection of intellectual property on the Internet. Originally developed in the mid-90s to protect still images, it is now being applied to other digital media including web music, DVD and digital television broadcasts. Basic digital watermarking technology uses an arrangement of low-level patterns, representing digital bits, to encode extremely low-level ID information. This pattern embedded within a video signal creates an identification mark that's invisible to the viewer but easily decoded by the copyright owner for positive proof of ownership. The AVDC100 uses digital watermarking technology to record the desired audio-to-video timing relationship by encoding the program video signal with an audio reference code derived from the audio program's natural envelope signature. At any point downstream another AVDC100 can decode the digital watermark from the program video and recover the audio timing reference for comparison to the program audio signal. Time shifts between the watermarked audio timing reference and the original audio signal indicate lip-sync error. The system measures the lip-sync error and uses the measurement to control an internal audio delay

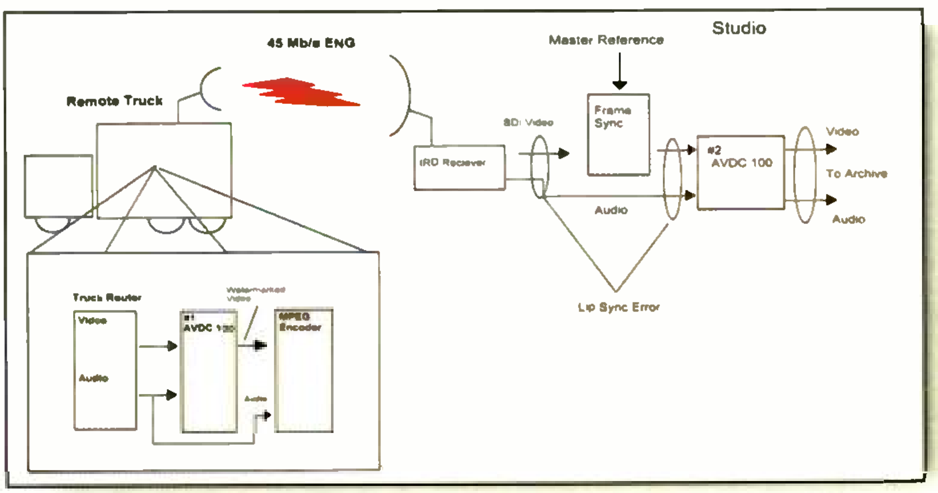
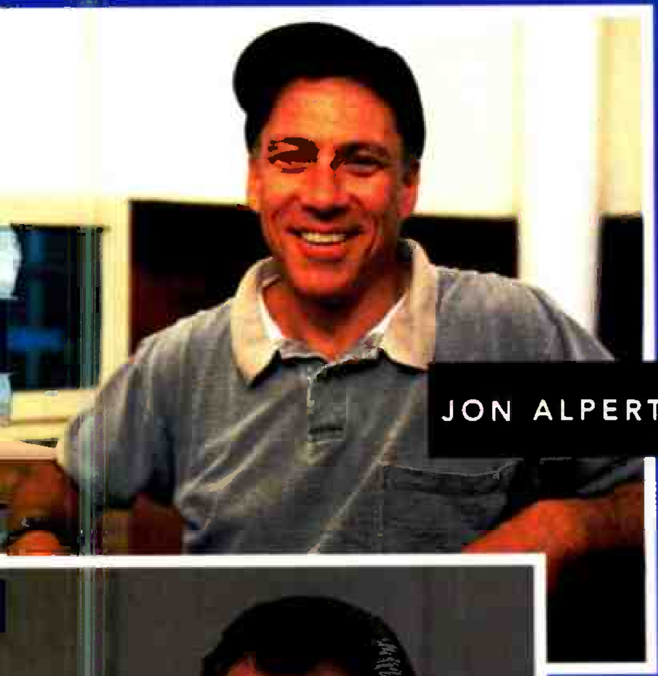


Figure 1. Two AVDC100s utilized together to monitor and correct lip-sync in remote production. One system operates in encoder mode in a remote production truck, and the other is installed in the studio in decode and lip-sync correct mode.

have said ter ourselves.

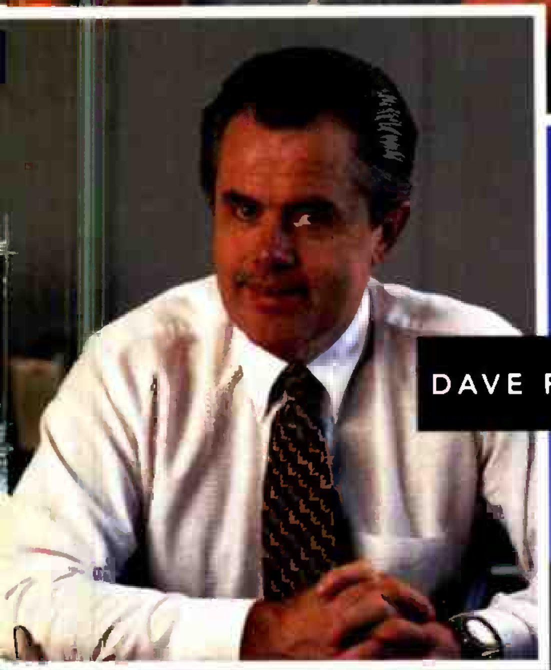


I just returned from shooting in one of the dustiest environments in America, the South Dakota Badlands. My DVCPRO camcorder worked great. I haven't lost a shooting day in the two years I've been using DVCPRO, that says it all.

I travel around the globe shooting documentaries. No matter where I am in the world, I call Panasonic and they straighten everything out.

Shooting with a lighter camcorder and the format's "shirt-pocket-sized" tapes provides me with many benefits. A lighter weight camcorder allows me to do more things in one day. If you do it all yourself, and I do, you can be more productive and creative.

JON ALPERT NINE-TIME EMMY AWARD-WINNING CAMERAMAN AND REPORTER



Two years ago, KOLD, Tucson, AZ, served as our test bed for DVCPRO. Arizona is a very hot and dusty place. DVCPRO has meet the challenge at KOLD and at our other stations, and has proven extremely reliable. DVCPRO has been very reliable at Raycom with no signs of major failure. No news is good news here.

Panasonic has responded quickly every time we've called. They have gotten right on top of the few issues we've had. Panasonic is very responsive to our questions, doing all you could ask.

To us, value is the combination of product cost and its cost to operate. DVCPRO has been superb. We're very pleased with the original cost and the cost of maintenance and repair. DVCPRO is properly priced. We didn't have surprises like with competitive products. We originally evaluated warranty costs, product cost, spare parts costs, everything, and Panasonic met and continues to meet our requirements.

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