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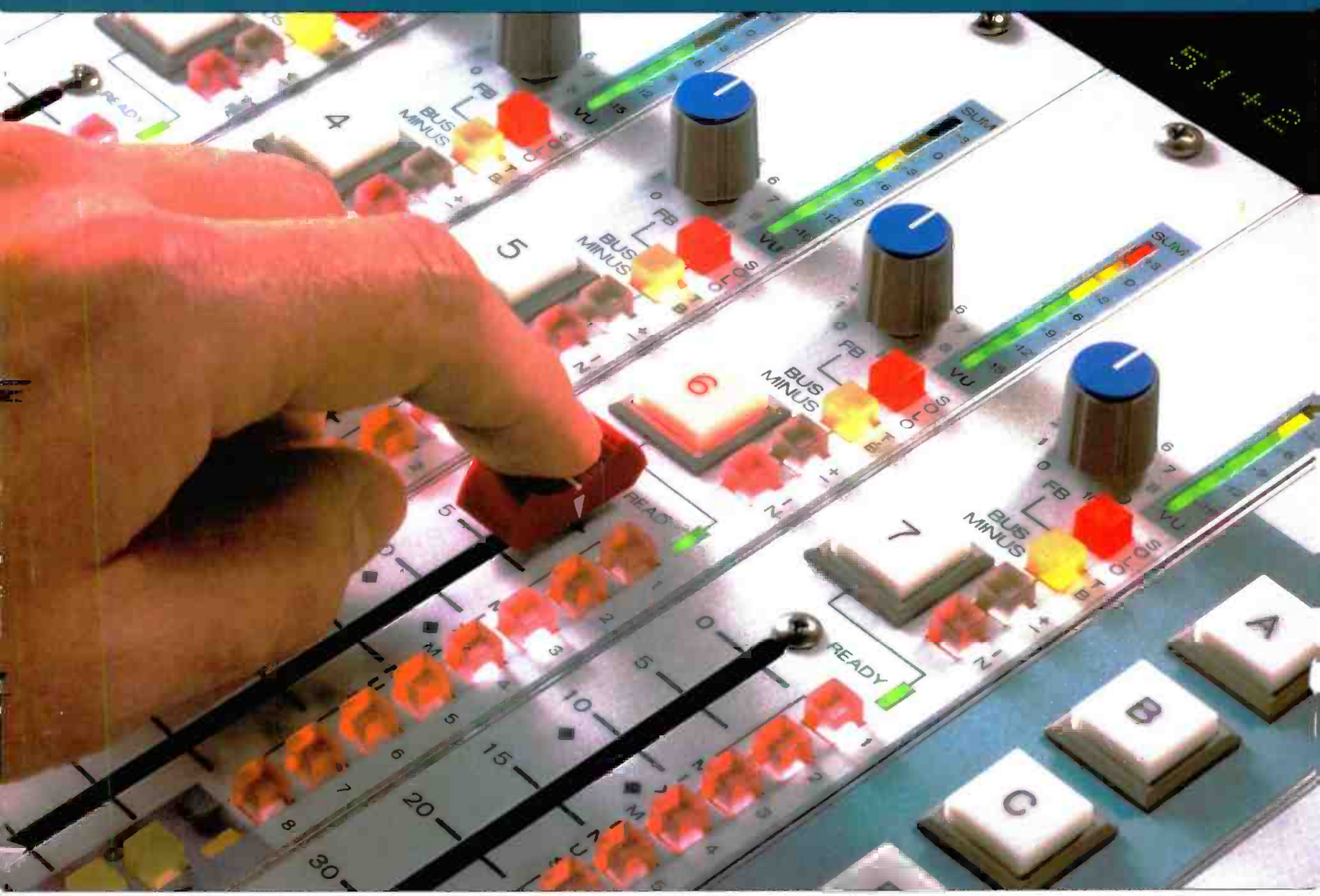

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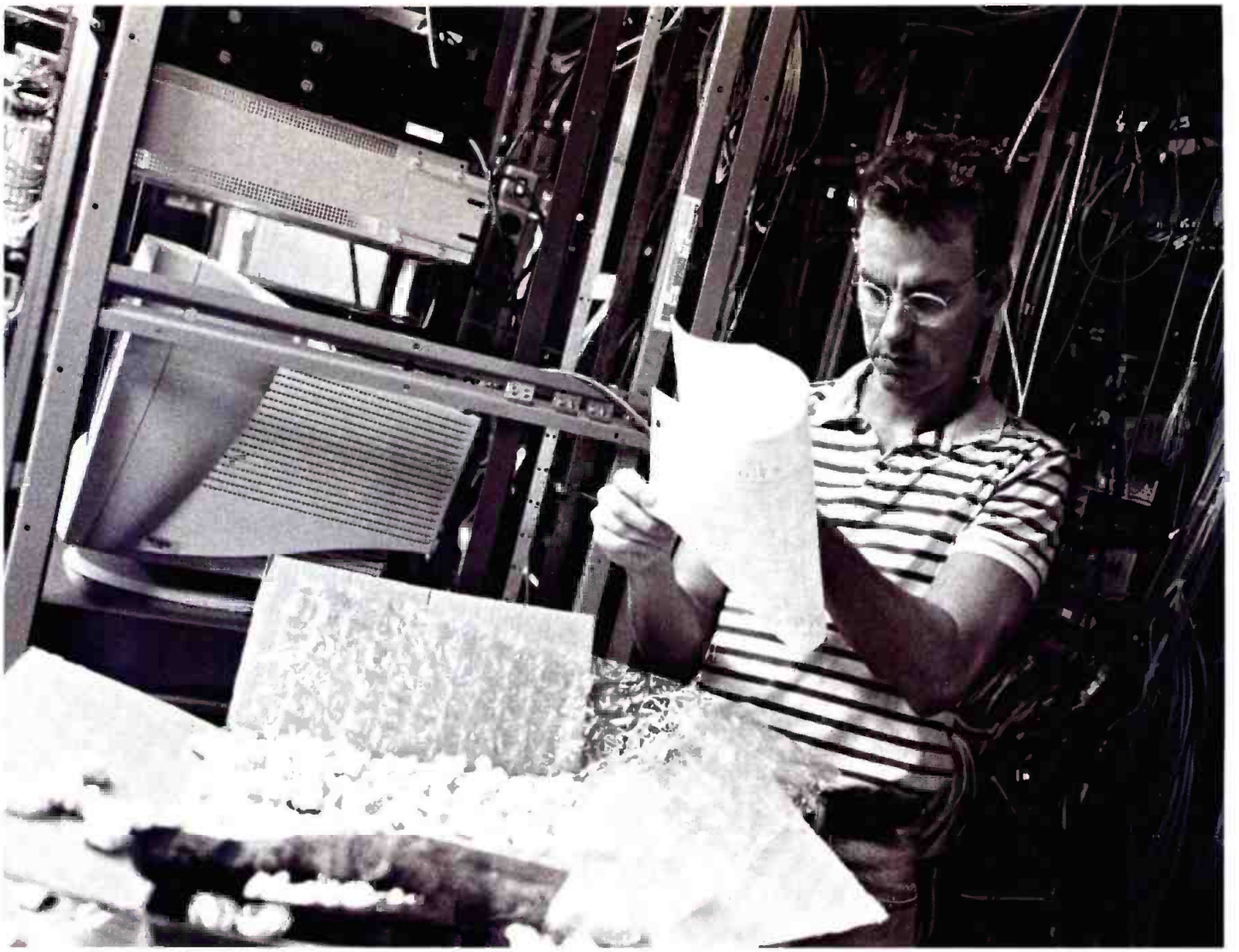

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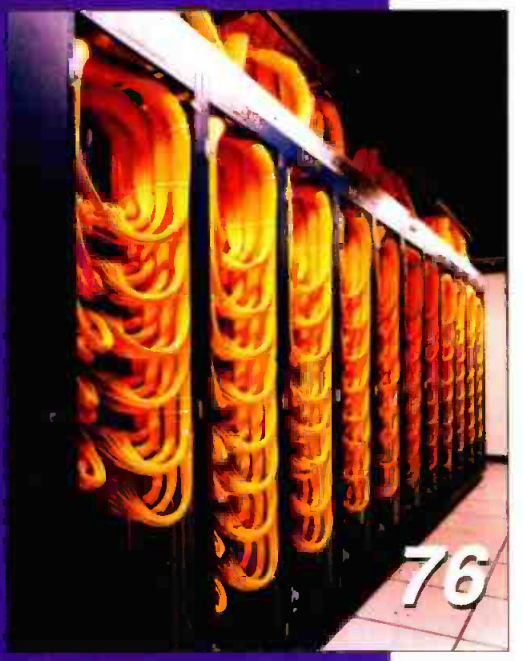

Features

Beyond the Headlines

Digital Handbook

(continued on page 8)

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ON THE COVER: *WFLA's new master control room is equipped with a Grass Valley Group M2100 master control switcher and Ikegami and Sony monitors. Photo courtesy of Grass Valley Group.*

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FREEZE FRAME

A look at the technology that shaped this industry.

We've come a long way

In the 25th anniversary issue of *Broadcast Engineering*, we reviewed some milestone technology from the broadcast industry. One of those technologies is shown here. Name the device shown and year it was first demonstrated. Correct entries received by June 30 will be eligible for one of the new *Broadcast Engineering* t-shirts. Send your entry to brad_dick@intertec.com.

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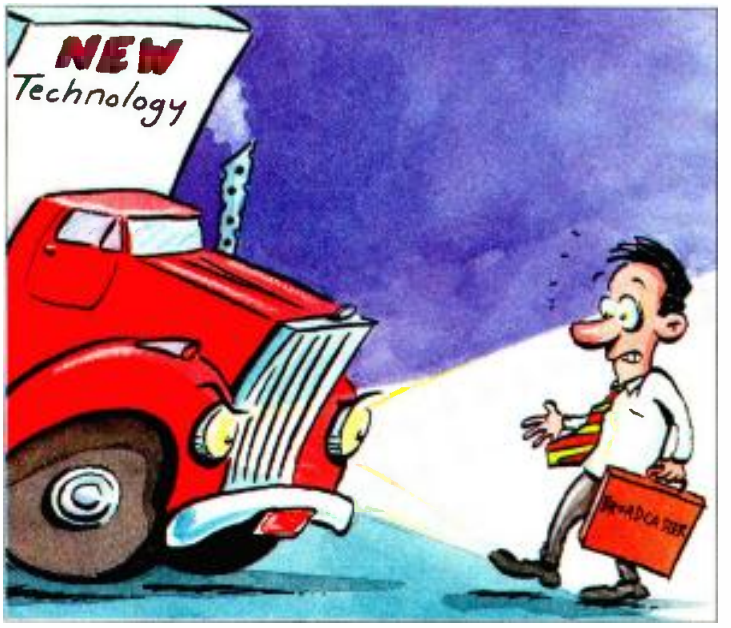
Editorial

Too scared to move

Are you a risk taker? Do you embrace new technology and new ideas? Or are you guilty of dragging your feet? Have you ever dismissed someone's suggestion to install or buy new equipment simply because it was unfamiliar?

It's interesting that engineers, who typically love new technology, are often roadblocks to a new technology's implementation. I've even heard broadcasters described as deer caught in the headlights of new technology, too scared to move.



I come from the "old school," where a person, at least a technical guy like me, could fix about everything he owned. I was brought up believing that there wasn't much I couldn't master, from two-cycle engines to four-barrel carburetors, from my first five-transistor radio to my first PC.

Back then, technology moved in years, not months. When making the shift from tubes to solid-state, I had a couple of years to adjust. As we moved from transistors to ICs, the learning curve got steeper. Once everyday technology moved from ICs to PCs, the educational pace shifted to warp speed. Engineers are now faced with implementing and managing technology that is not only new, but may be so far ahead of the curve that common standards for its use don't exist.

It's no wonder some are hesitant to adopt new ideas when there's no record of success, no worn path to offer comfort and no record to rely upon.

Because the rate of change is so rapidly accelerating, holding back, waiting for clearer direction or not taking chances are no longer options. While making the wrong choice is a risk, choosing not to decide is even more perilous.

I remember working under a much older and wiser chief named Les. He was a great guy, but to say he was "old fashioned" is an understatement. He once had to be forced by the GM to install new direct-drive turntables in the FM studio. He was convinced the new digital models wouldn't last a month. In fact, he was so sure that he went to great lengths to preserve the tried-and-true equipment. He carefully removed the old 16-inch Gates models, oiled the bearings to prevent rust, and then wrapped the turntable arms in pape and carefully stored the equipment. He just knew the station would return to this older, but more reliable, technology. Do you think the station ever went back to the old ways?

Our industry's future is with the new, not the old. As engineering managers, we shouldn't be frightened of new ideas, but excited by them. We should be grabbing every new idea and examining it with the zeal of a kid discovering a new bug or coin in the dirt.

So, next time someone claims broadcasters are like deer caught in the headlights, remind them that when it comes to delivering entertainment, we invented the business. This 60-year-old industry isn't going to let any upstart dotcom take anything from us.

Brad Dick

Brad Dick, editor

Send comments to:
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Reader Feedback

New age of editors

I liked the article and agreed with most of it, except the statements about the new editors of today not lacking depth and background. I have been in broadcasting for over a decade now, and I started out like a lot of editors and shooters today with a hundred pounds of gear strapped to my back. There was 10 times that sitting on the desk of the edit bay back at the station. A good friend taught me everything I know about shooting and editing, and I don't regret the days of sweating in 100 degree heat or the days of spending an extra hour in the edit bay because I assembled instead of inserted. I am happy to have had the background I have.

I don't think the editors of today are bad by any means. I just think they wouldn't be in any worse shape from a little wear and tear on the road. We are in a very metamorphic era where video and audio production is concerned.

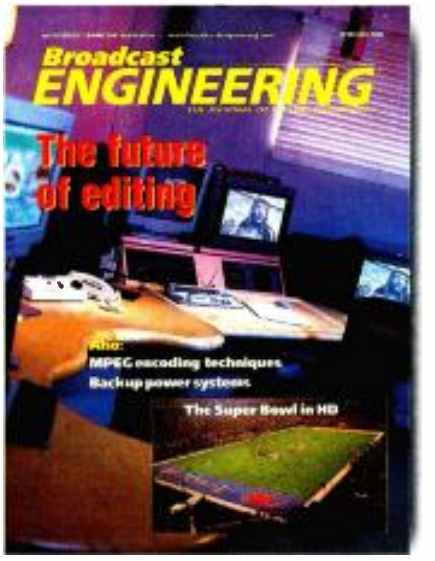
I don't know what will happen in the future, I just hope that as I become a fossil in the broadcast desert I won't be looked upon for my years of training as the follow-the-rules guy. Rules were made to be broken and bent. It doesn't hurt to be on the wild side every now and then. It's just wise to know when to do it.

Jeff McDaniel,
L.S.M. Studios
Corinth, MS

Mouse potatoes

I just finished your editorial "Mouse potatoes." It made me laugh out loud. Thanks to the Internet/chat rooms we also have new slang to draw from. The thing I hate the worst about my computer is when it tells me I am not authorized to do ... whatever. Give me a break!

Maybe things will change (I'm the eternal optimist). As studies are showing, our kids are getting smarter ... but markedly less healthy. The reason, I presume, is exactly what you pointed out, too much Internet surfing not enough real surfing. Perhaps society will catch



on and create a better balance.

At any rate, you are a breath of fresh air in this industry. Thanks.

Cathy Ross
Advertising Manager
AutoPatch

Broadcasters need a working PSIP

Dear Phil:

I read your article on PSIP in the February 2000 issue of *Broadcast Engineering*. I am the vice president of technology at Hauppauge Computer Works. We build TV add-in cards for personal computers. Our first low-cost ATSC digital receiver, called WinTV-D, was introduced last October for $299. This board will receive an ATSC HDTV broadcast in any of the 18 formats, and downscale it to 480 lines. The resulting signal is displayed in a window on your PC monitor and output as S Video or composite out the back of our card.

Hauppauge is working on additional members of this product family that will support full native resolution display.

We would welcome the opportunity to work with broadcasters and equipment manufacturers to make our receiver more robust. If you have any thoughts on how we can make our receivers more compliant or better behaved in the face of partial, damaged or incomplete PSIP tables please let us know.

I look forward to hearing how we all could work together to expedite the deployment of ATSC HDTV.

John B. Casey
Vice president of technology
Hauppauge Computer Works

Phil Titus responds:

I welcome John's request for a cooperative effort and applaud Hauppague for seeking new avenues to make their products more bulletproof and consumer friendly. Utah presents some unique geographical challenges to receiving any signal and is an excellent testing ground for some of the problems that face digital television today. I have spoken to my colleagues at DTV Utah about John's ideas and we are all excited about using our DTV facilities to help in testing any new products or upgrades they might have. The more we work together to solve these kinds of problems, the more we benefit. After all, the sooner John (or anyone else) has a product that consumers can live with, the sooner I start seeing a return on my DTV investment.

Freezeframe winners

The February Freezeframe displayed the cover from December 1985, which shows the use of a laser to create the grid for a new power tube. This process is also done today by precision sand blasting. The following *BE* readers submitted the correct answer and will receive the new *BE* T-shirt.

Chris Whittington
NBC News
Washington, D.C.

Gil Houston
CE, KNVN-TV
Chico, CA

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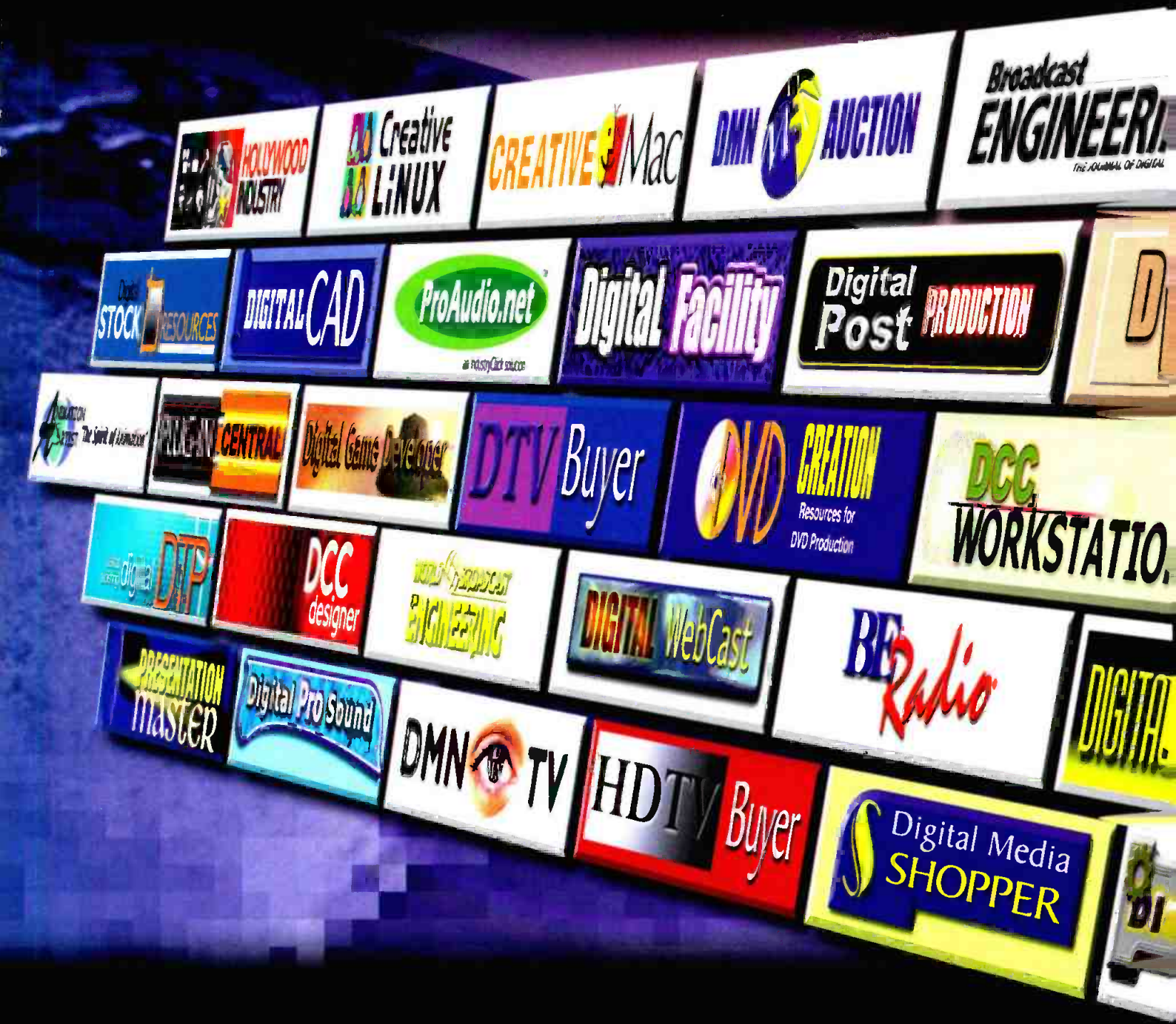

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News

NAB2000

BY LARRY BLOOMFIELD

NAB2000 was the biggest of the Association's conventions to date, touting turnout of over 113,000. Along with the latest solutions from the exhibitors, there appeared, at times, to be an undeclared "biggest booth" contest. The Sands had significantly more exhibits than last year with both floors brimming with exhibitors. Most of the new "dotcoms" vied for attention at the Sands, along with the other digital companies providing the answers to broadcasting's problems.

Streaming video made an appearance at a multitude of booths. Any number of exhibitors touted the quality of the 1Mb/s stream and suggested that the viewing audience would watch their favorite shows on computer monitors. Any television station could feed its programming over the Internet for anyone to see — a simple theory indeed, but much more difficult in practice. While the quality of streaming video leaves much to be desired, look for developments allowing better video quality. For example, in a joint venture, 3Com, TeraLogic Inc. and 2netFX.com have developed a technology for transmitting a 20Mb/s HD stream over a switched IP data network. This group claims to be the first to deliver HD streaming over IP networks using the same digital TV standard adopted by broadcasters and the standard Real-time Transport Protocol embraced in the Internet world.

Look for developments allowing better video quality.

Standouts

The emphasis this year was certainly on digital. Almost every one of the major manufacturers had something new to show. Many offered refinements to already established equipment lines.

There were some notable developments in antennas. TCI had a new broadband pylon antenna that performs much like a flat panel device but is capable of higher power.

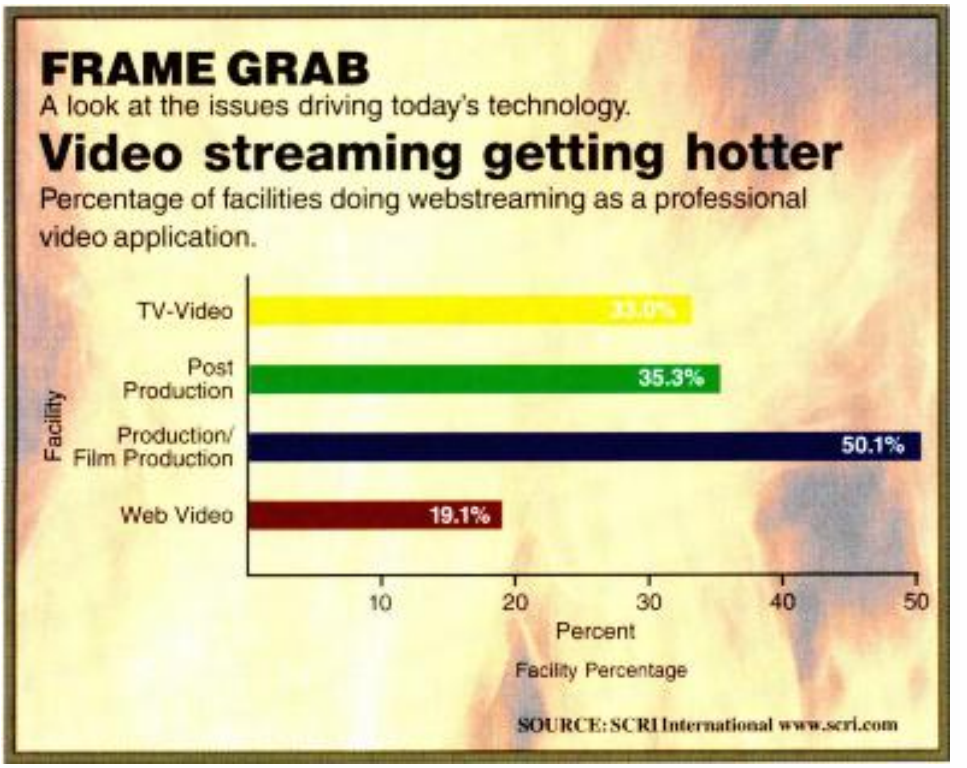
3DV offered its refinements to the art of keying. Instead of needing blue or green walls to key on, it has improved infrared technology to act like precise radar. It is capable of keying on any distance from the ring device on the lens of the camera. One of its demonstrations included the pitchman and an audience member interlocking hands while standing a few feet apart. A cartoon graphic was then keyed to come over their shoulder and down through the area between the connecting arms.

Ross Video has developed a digital video switcher frame that will accept Grass Valley Group 100/110 control panels. This updates these older, but familiar, switcher panels to include digital capabilities. Not only does this frame provide digital switching, but it also allows the GVG more capability.

Grass Valley Group made a splash simply by exhibiting its product line. This is the first time GVG has been at NAB in over 20 years as a stand-alone company.

Leitch had two impressive devices on display. One was its bidirectional, anything-in, anything-out frame synchronizer, which seamlessly interfaces both video and audio between digital and analog and prevents lip-sync problems. The other was the bidirectional capability of the I/Os on its servers.

Anyone who has been to NAB knows that the LVCC is a cavernous steel and concrete edifice. Indoor reception tests



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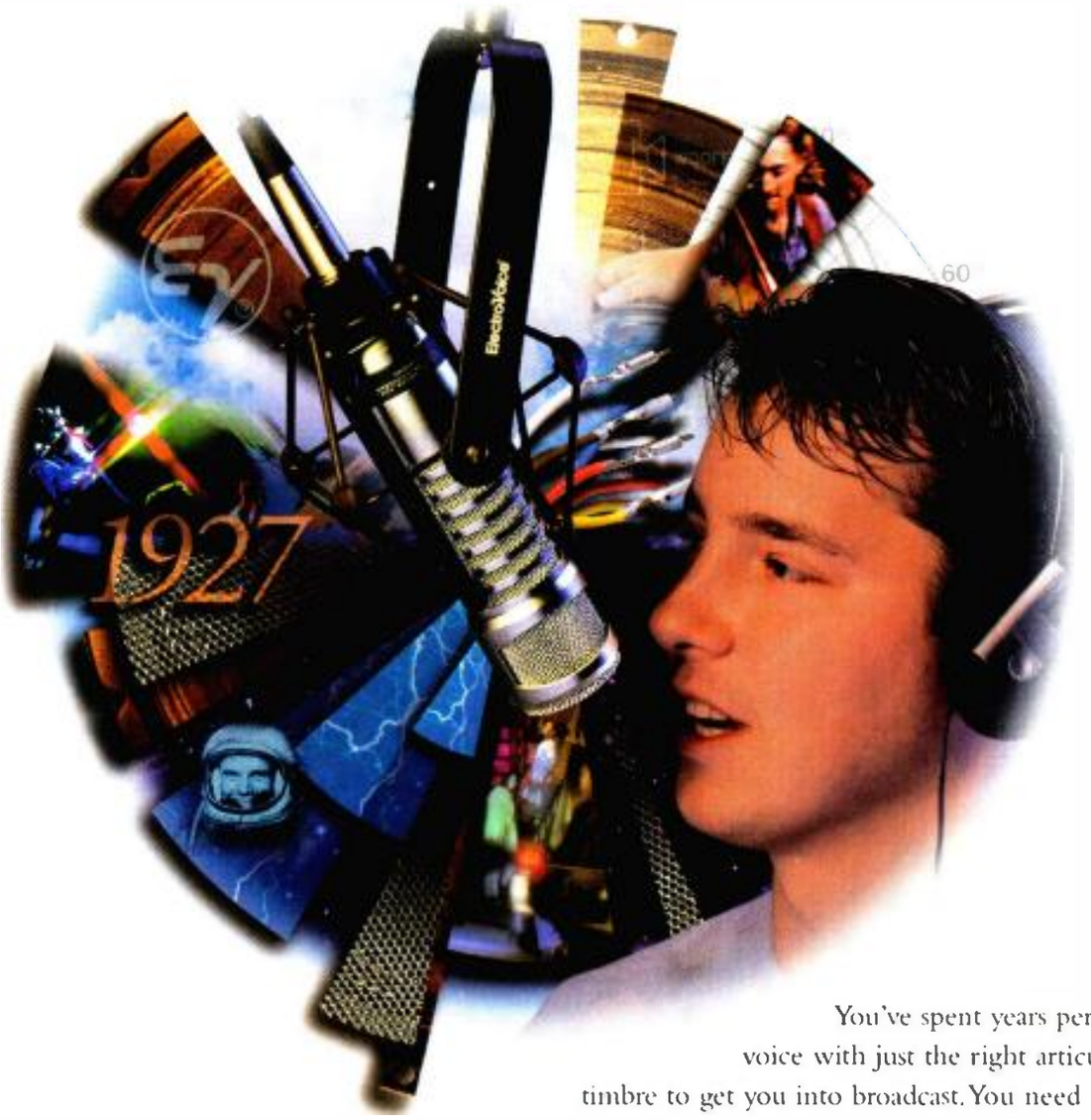

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allow COFDM modulation. Sinclair represented the owners of about 300 television stations. Mark Hyman, vice president of corporate relations said, "Only a year ago, many people thought we were the crazy aunt in the basement, but it is becoming more evident that we've been right all along."

Graves acknowledged Sinclair's technical objection to the problems with multipath issues. "The problems created by multipath signals are more complex than people imagined when the system was first designed," he said. Graves acknowledged it was not possible to re-create field conditions in the lab.

Sinclair has maintained that 8VSB is unacceptable for indoor and mobile reception. Despite the FCC's rejection of Sinclair's petition, the issue remains alive.

Recriminations continue

With all this backpedaling, could it be that some have had a technological epiphany? Other industry players have raised serious doubts about 8VSB's prospects as well. As the Sinclair petition was being denied, NBC was in the process of raising similar concerns over 8VSB.

The ranks of 8VSB supporters seem to be diminishing and that concerns many 8VSB proponents. "Sinclair should stop pointing fingers and start getting on the air with digital programs," said David Arland, government relations manager with Thomson Consumer Electronics.

Matt Miller of NxtWave says Sinclair's charges are based on "erroneous and outdated information." Miller said, "I agree it's difficult to envision solutions. That's the definition of a patent. Patents are supposed to be non-obvious to experts in the field." It should be noted NxtWave has two related patents under its belt and a half dozen more under review.

NBC conducted its own test of 8VSB reception in December and found problems with both indoor and outdoor operation. The network predicted it would be five years before 8VSB reception would be adequate to handle multipath issues.

According to NxtWave, its patches to 8VSB problems will reach the market in two years or less, significantly less than the span predicted by NBC.

Maximum Service Television (MSTV), despite a board of directors that nearly ignored its own technical findings, and the NAB have expressed concerns about the performance of 8VSB receivers. The NAB has avoided a fight between Sinclair's small station group allies and larger station groups backing 8VSB. The organization declined comment until the FCC ruled. In a politically expedient move, it has called for tougher receiver standards to be imposed on equipment makers.

The MSTV board went so far as to reverse its earlier position, disregarding the technical findings it had commissioned. The Board was troubled by the conclusions reached by a University of Massachusetts report done by Dennis Goeckel, whose comparison of 8VSB and COFDM performance was a component of a larger study presented to the group's board members. The study criticized the methods used by NxtWave and Motorola to improve 8VSB receivers' problems in dealing with dynamic multipath signals.

The FCC backpedals

When the FCC rejected Sinclair's petition back in February, it said that within 30 days it would "commence its biennial review of the DTV transition and, as a part of that proceeding, would encourage parties to comment on concerns regarding the 8VSB standard." Many insiders feel this is the FCC's attempt to say Sinclair was bringing too much political baggage to the table while trying to save face on the whole issue.

Further support for a review has been mounting steadily. A thorough Brazilian evaluation concluded that 8VSB was seriously deficient when compared to COFDM.

In early March, ATSC member Bob Utne said, "We are in an evolutionary mode of 8VSB with real solutions to potential problems available today. Zenith has developed a DTV receiver, which, according to Zenith, eliminates ghosting due to multipath."

Charlie Rhodes, from the ATTC, proposed a new antenna with crossed dipoles that has an inexpensive multiplier between them. The multiplier is controlled by some indication of minimum adaptive-equalizer tap energy coming from the set. Utne said the units are inexpensive, dynamically changing, optimized automatically for each receiver and allow a broad (90-degree) reception pattern. It also requires a minimum-tap-energy indicator from the DTV receiver.

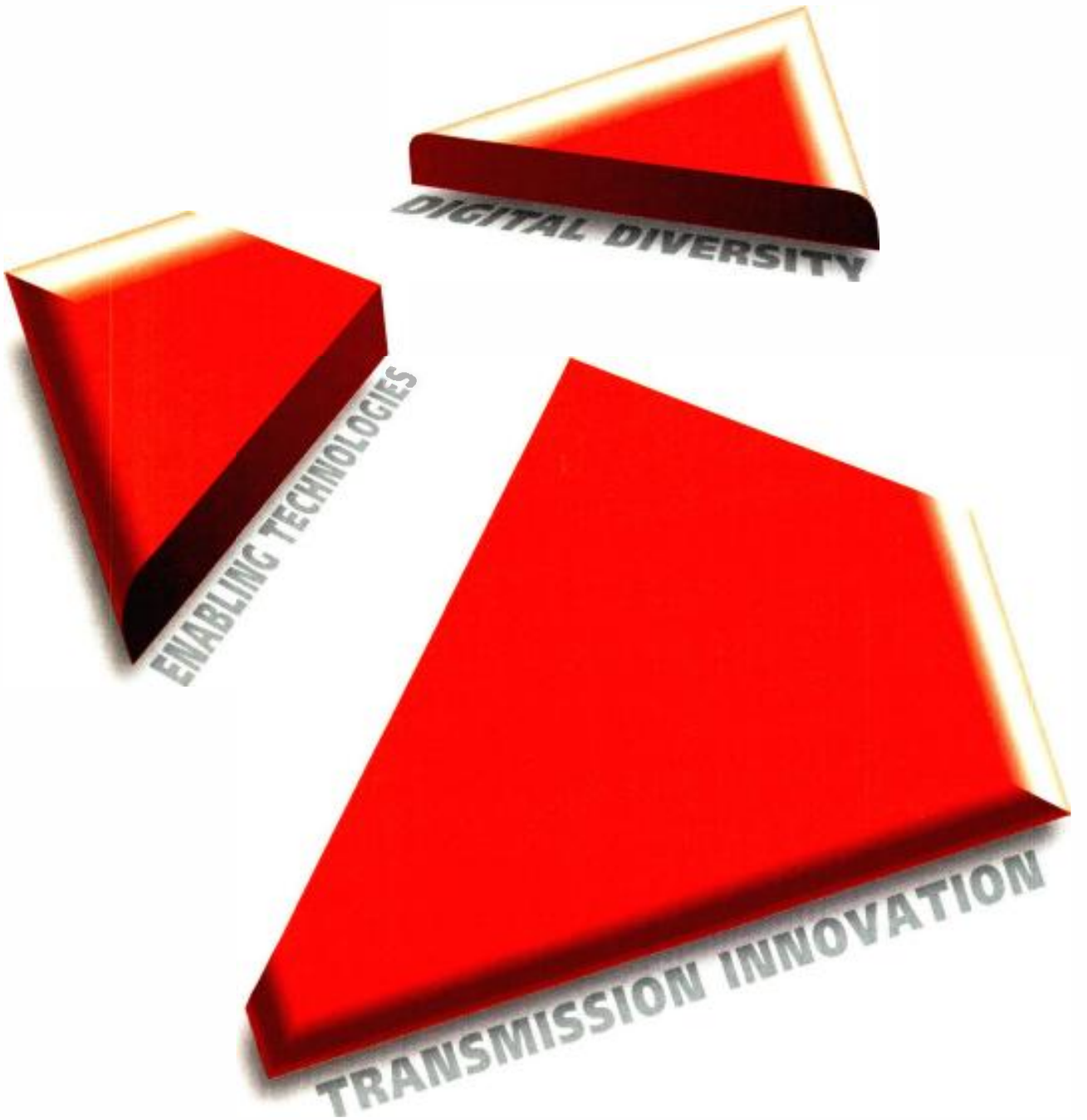
Utne concluded by saying, "Sinclair brings to light potential problems. We have real solutions readily available." However, within days Utne resigned. On March 8, he issued the following statement, "I have resigned from the ATSC after coming to the conclusion that vested interests preclude a meaningful examination of the deficiencies of 8VSB and have halted any attempt to add COFDM to the ATSC terrestrial-delivery standard." The ATSC would not comment on Utne's resignation.

NBC predicted it would be five years before 8VSB reception would be adequate to handle multipath issues.

Even survey results are being questioned. A TWICE Survey asked, "Should the Advanced Television Standard Committee amend the Digital Television standard to include both the 8VSB modulation scheme and the COFDM scheme that is being championed by Sinclair Broadcasting?" With a total of 331 respondents, over half, 51 percent, voted yes and the remaining 49 percent voted no. Not surprisingly, there are those who have questioned this survey and the possibility of the ballot box being stuffed.

Canada looks at DTV

The Canadian Research Center (CRC) conducted tests in Ottawa on the use of ATSC with set-top-receive antennas and confirmed the failings of 8VSB in portable reception. The tests were carried out on UHF channels 65 (NTSC, 740kW peak) and 67 (DTV 36kW average). The transmitters were fed into a common antenna. A commercial program source was broadcast on the NTSC channel.



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The Canadians used a 30-foot antenna with reception being verified on two DTV receivers. The consumer electronics industry avoided supplying receivers with the "super chips," so the tests were done with receivers that work within the 4dB/20 microsecond window for multipath and at expected S/N ratios. The receivers used were representative so that little change would be found in newer versions.

"The problems created by multipath signals are more complex than people imagined when the system was first designed," ATSC Chairman Robert Graves said.

The outdoor tests were in the clear. When the NTSC signal was a grade 4, the DTV worked with good margins. In outdoor sites where NTSC was a grade 2.5, the DTV signal proved to be unstable due to dynamic multipath. When the NTSC was grade 3.5, the DTV worked at an acceptable level. In downtown areas where multipath problems abound, the NTSC was a grade 2 to 2.5. The DTV signal failed completely under these circumstances.

The indoor tests were performed with two antennas. One was an active device with 30dB of amplifier gain. The other was a small log-periodic antenna with a front-to-back ratio of approximately 5-7.5dB. It was found that both had to be near a window with line-of-sight to the transmitter and precisely oriented or DTV reception was impossible. When the NTSC signal grade was 4 to 5, the DTV reception was good. When the NTSC signal dropped to a grade 3, however, the DTV signal was unstable. Below that, it failed completely. Most indoor antennas were reported to produce a grade 2.5 or 3 signal. There was, of course, the usual pointing requirement and DTV reception was found to be sensitive to this.

The Canadian tests proved clearly that 8VSB does not provide coverage (reception) equivalent to NTSC at the power levels used, and it is obvious that signal strength is not the cause. Of the 25 sites chosen in the first round of tests, most gave usable NTSC reception but only 50 percent provided usable 8VSB reception.

An alternative viewpoint

Recent developments have taken the Consumer Electronics Association (CEA) by surprise. According to CEA President Gary Shapiro, the "decision to launch [a] task force to study DTV technology is the result of 'business model change' by broadcasters." Shapiro downplayed the impact on the receiver business. "Broadcasters simply must decide what is their business model and what is the best standard to meet that need," he said. "They have switched from high definition to multiplexing and now to data."

Despite the apparent CEA push for 8VSB, a recent poll conducted primarily among electronics retailers, distributors and manufacturers found slightly more than half of those responding favored adding COFDM to U.S. DTV. ■

Mega-ownership

Under pressure from both the networks and group owners, the FCC is again looking at ownership, including restrictions against one company owning a broadcast station(s) and a daily newspaper(s) in the same market. It is also reprising the old Red and Blue network scenario, which forced NBC's break up and brought about the ban on one entity owning two networks.

Two items of note include the acquisition by Viacom of Chris-Craft's stake in UPN for $5 million and the acquisition by Chicago Tribune Newspaper Empire of the nearly as large Times-Mirror organization. These two business deals could have long-lasting repercussions in the broadcast industry.

Viacom, CBS and UPN

Viacom and CBS are in the process of developing a working relationship. When complete, the net result will be one company owning two broadcast television networks for the first time. Viacom says it would acquire full control of the UPN television network by buying out Chris-Craft Industries' 50 percent interest in UPN.

The major stumbling block to this latest acquisition of UPN by the owners of CBS is winning approval from the FCC, which has rules prohibiting the ownership of two networks. The executives at Viacom, CBS and UPN seem to think they can win some concession from the FCC that would allow the company to own both CBS and UPN.

Viacom believes it can win the necessary concessions from the FCC because of UPN's support for minority programming, and because Viacom's continued support for the network guarantees its survival.

Viacom's Sumner Redstone said he was hopeful about the prospects of closing the deal with CBS without having to divest UPN or spin off any of its syndicated shows. Redstone said, "If we keep it, it will succeed."

Tribune-Times Mirror

The (Chicago) Tribune Co. recently announced the buyout of the (Los Angeles) Times-Mirror Co. The FCC forbids cross-ownership of VHF stations and newspapers in the same market, and Tribune owns KTLA-5, the WB affiliate in Los Angeles. The Los Angeles Times is the city's only metropolitan daily newspaper.

If the FCC didn't have its prohibition, this move would put the L.A. Times back into the television business. Los Angeles' only daily major newspaper once owned KTLA's fierce competitor, KTTV, Channel 11 when it signed on the air back in 1949.

The L.A. Times is the third largest paper in the U.S., second only to the New York Times and USA Today. The Times-Mirror Co. owns papers in other major metro areas. This merger will result in the third largest "national" group owner.

The deal will create a coast-to-coast media empire encompassing the Los

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Angeles Times, Chicago Tribune, New York's Newsday, The Sun of Baltimore, 22 TV stations, Internet news sites, and magazines such as Popular Science, Golf and Field & Stream.

The New York Times and The Wall Street Journal also face cross ownership issues, as has the San Francisco Chronicle until recently, but they've been in place for the last 25 years or more. However, the Tribune's takeover of other newspaper chains is part of a major push to get the ban lifted in these times of consolidation.

This ban was first put in place by the "Wiley FCC" back in 1974, despite the fact that stations that are owned by newspapers have done more local news and public service than have standalone stations in the same markets. Support to keep the ban in place comes from politicians of both parties from the smaller states.

There is, of course, the possibility that the FCC may grant a waiver to permit this cross-ownership. A cross-ownership currently exists in New York City between WNYW and the New York Post.

The companies are asking for a two-year period to sort things out and come into compliance. For Viacom and CBS, ownership of two networks is not the only issue that faces this merger. It would appear this union would violate the "reaching more than 35 percent of the U.S. households" rule. That threshold could be cause for divestiture by the would-be alliance. "We will continue to fight very hard for relief from the caps because they just don't make any sense in the world in which we live today," Redstone said.

The group owners and the other networks have also been on the battlefield attempting to change the caps; but there is a strong lobby on the part of locally owned stations to stop any increase, fearing they would be handicapped in programming negotiations.

The FCC also is looking at the restriction on ownership of broadcast stations and newspapers in the same market but believes its rules still serve an important function in ensuring consumers have different informational outlets.

The FCC is waiting to see the impact of last year's action permitting one company to own more than one local TV station in the same market. The FCC has also eased the prohibition of ownership with respect to the ownership of both radio and TV stations in the same market. ■

The FCC vs. cable

Depending on whose figures you use, between 65 percent and 80 percent of American households are connected to some form of copper or fiber for television service. While consumers may own their cable set-top boxes, many may find their STBs will not work in another cable system because of incompatible standards.

The cable industry has given much verbal and now actual resistance to the carriage of local digital television stations. The FCC's Daily Digest lists reports of local television stations and cable companies wrangling over must-carry issues.

FCC Chairman William Kennard raised four points in January about the need for the cable industry to develop common standards. Despite the pronouncements of consensus, many crucial issues remain unresolved.

The cable industry has until July 1 to meet the FCC's deadline. With little progress being made, the FCC is initiating a resolution to the compatibility issues between cable television providers and DTV receivers, STBs and consumer equipment.

In a recently issued Notice of Proposed Rulemaking (NPR), the Commission asks for comments on two unresolved cable compatibility issues. The first issue is how to label DTV receivers with different features, including the proper designation for receivers providing two-way interactive capability; the second is licensing terms for copy protection technology.

The FCC will "reluctantly" apply its legal force to unresolved labeling and copy protection issues by initiating the rulemaking proceeding. Further delay on these issues could derail the transition to DTV, the FCC has stated.

The FCC will "reluctantly" apply its legal force by initiating the rulemaking proceeding.

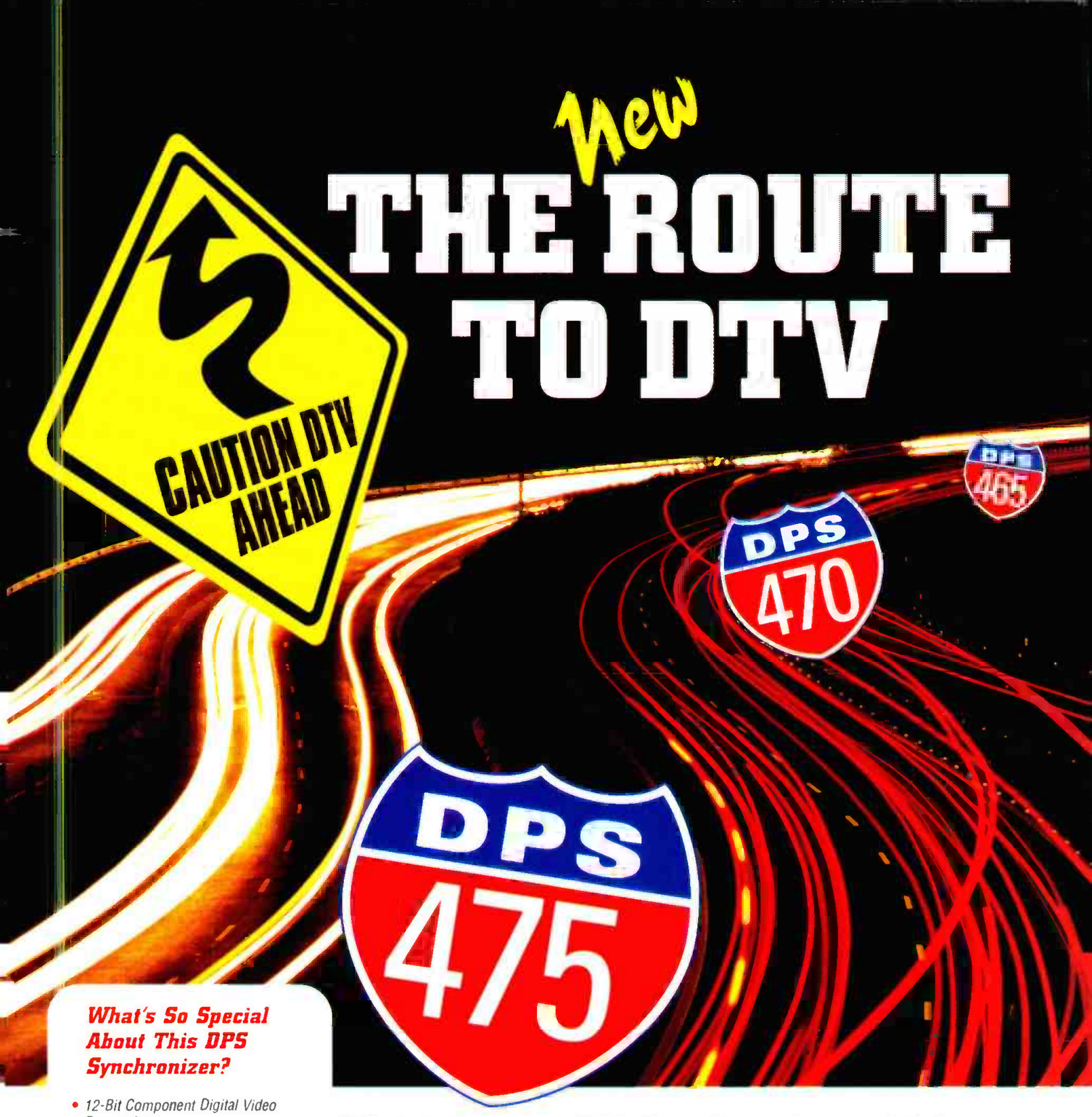
However, the Commission would allow the cable and consumer electronic industries to save face by reaching an agreement before it takes action.

On the set-labeling issue, the Commission wants to know how digital television receivers with different capabilities can operate within different digital cable television systems. There is a good chance that the modulation technologies adopted may not be the same. The FCC believes it is important to draw distinction between receivers that are equipped with circuitry for interactivity and those that are not. The FCC also wants to know if cable operators should be required to "offer supplemental equipment to subscribers to enable them to use special features of their digital TV receivers." The legacy issues of providing adapters for older NTSC set viewers who wish to connect to an all-digital cable system must be resolved as well.

On the copy protection issue, the Commission asked for comment on appropriate regulatory action, if any, with respect to copy protection technology licensing. The Commission said it was focusing on hardware and compatibility standards generally, and asked for comment on the hardware implications of copy protection. The Commission is also seeking input licensing terms of the technology that is part of the new services digital television brings with it.

Always mindful of those with disabilities, the Commission has asked for comments in these areas as well.

"I strongly support this Notice of Proposed Rulemaking," Kennard said, "addressing these issues that have to be resolved as part of the conversion to digital technology that is changing the television industry." ■



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FCC Update

"Class A" TV service established

BY HARRY MARTIN

The FCC has adopted rules making "Class A" status available to qualifying LPTV stations. Class A licensees will, in most respects, have "primary" status as television broadcasters. Such status will protect them from encroachment by both NTSC and DTV stations.

Class A licenses will be subject to the same license terms and renewal standards as full-power television licenses and will be accorded primary interference protection as long as they continue to meet eligibility requirements.

To be eligible, an LPTV station must broadcast a minimum of 18 hours per day, including an average of at least three hours per week of locally produced programming. Additionally, from the date it applies for a Class A license, the station must be in compliance with the Commission's operating rules for full-power television stations. Alternatively, LPTV stations may qualify for Class A status if the Commission determines that the "public interest, convenience and necessity" would be served thereby. The rules adopted provide for limited circumstances in which a station may qualify for Class A status under this criterion.

LPTV licensees intending to seek Class A designation were required to complete a certificate of eligibility and return it to the Commission by Jan. 28, 2000. The new rules preserve the service areas of LPTV licenses from the date the Commission received such an application of eligibility, as long as the Commission ultimately approves the certification.

Class A stations are required to protect existing analog stations and the facilities proposed in full-power analog applications that have completed all processing short of grant and for which the identify of the applicant is known. Class A stations must also protect the ability of DTV stations to replicate the service areas of their analog stations and to maximize their digital service areas within the constraints established by the statute.

Dateline

Independent stations in markets 1-30 and all other commercial stations must construct DTV facilities by May 1, 2002. (Affiliates of ABC, CBS, NBC and Fox in the top 30 markets should have completed construction by Nov. 1, 1999.) Noncommercial stations must complete DTV construction by May 1, 2003.

New DTV rules proposed

The FCC has initiated the first in a series of biennial rulemakings that will seek to fine tune DTV. The FCC has proposed requiring full replication of NTSC contours and "principal community" coverage of DTV stations' cities of license. In addition, it has proposed a process for early selection by DTV stations of post-transition "core" channels and a method for choosing among conflicting applications for modification of DTV and NTSC facilities.

- **Full replication.** In adopting the initial DTV table of allotments, the FCC attempted to assign DTV channels to existing NTSC television stations in a way that would replicate or match each station's existing NTSC Grade B contour. The FCC now is concerned about loss of coverage because some NTSC stations have proposed to locate their DTV facilities at a substantial distance from their NTSC facilities and communities of license.

The FCC asks for comment on whether to require replication and if so when, how to measure replication, and what the consequences should be for stations which do not replicate their NTSC contours.

- **Principal community coverage.** The FCC proposes a DTV station's community of license be served by a stronger signal than is required for the greater DTV service contour. It suggests basing DTV standards on field strength values that correspond to the current NTSC principal community signal requirements. The FCC has tentatively proposed DTV stations paired with NTSC stations meet the new requirement by May 1, 2004.
- **Post-transition channel election.** The FCC previously decided DTV service after the DTV transition should be limited to the "core" channels 2-51. It tentatively concludes that a process should be set up to ensure early election by DTV stations of the channel they will use after the transition, suggesting a deadline for election of May 1, 2004. This will allow time for stations converting to "core" channels to make construction plans. It asks whether it should select a final, long-term channel for each station. Another question is whether stations with an "out-of-core" DTV channel should be required to use their "in-core" NTSC channel. The FCC is also considering what restrictions to apply to channel election and use; for instance, whether to avoid other uses of channels 3 and 4 in order to benefit cable box users or to give first priority for relinquished channels to certain categories of DTV stations.
- **Choosing among conflicting applications.** The FCC also invites comment on whether to establish DTV application "cut-off" procedures and how to choose among applications to implement initial DTV allotments. It seeks input on how to prioritize between DTV area-expansion applications and NTSC applications and rulemaking petitions. ■

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

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

In praise of co-location

BY JIM SALADIN, SENIOR ASSOCIATE EDITOR

This salient figure was tossed out at an NAB press conference: There are likely to be more than 600 orders for new towers as the broadcast industry continues its DTV march. Last year the industry put up 15 tall (1000-foot and above) towers, a number that will increase to about two dozen this year. Assuming, conservatively, that only half of the necessary towers fall into the "tall" category, we're still looking at more than 12 years before all orders can be filled.

It's time to start looking at alternatives. Co-location, whether that means building a new community tower or leasing some space on an existing one, has consistently offered the best engineering and bottom-line solutions. This month we turn to two experts who know exactly what those solutions are: Don Doty from SpectraSite and Phil Titus from the DTV Utah project in Salt Lake City. What are the benefits of co-location? ■

VENDOR

Don Doty, SpectraSite

There are many advantages in having a single tower for each metropolitan area, including having all receiving antennas point to a specific geographic location. By having one tower there are fewer complications with flight paths and air navigation. In addition to the FCC, which encourages community tower sites, local communities usually prefer a single location so as not to have smaller towers located on various buildings or hilltops throughout the area disrupting their view.

There is usually less trouble and fewer complaints from neighbors if the single tower is remotely located away from residential and congested downtown areas.

A community tower is usually taller and can serve a larger geographical area. The tower also makes it easier for cable companies to obtain their signals from one location rather than a number of smaller sites.

A community tower will offer greater accessibility to parts and maintenance items common to all broadcasters, including coaxial cable, waveguide and transmitter parts.

How it works

SpectraSite generally owns the site, the tower and the building. You may purchase or lease the necessary broadcast equipment on your own, or lease it directly at favorable rates. The leases for equipment and/or space will be long-term agreements tailored to your individual requirements.

The company maintains an on-site manager whose responsibility is to direct the business activities of the company, deal with tenant problems and handle routine facility operations on a daily basis. The manager also processes inquiries regarding rentals and directs the services of sub-contractors. This manager is a facilitator and an arbitrator whose function is to resolve differences or tenant disputes in the most equitable manner possible.

An advisory committee composed of representatives from all of the tenant broadcasters generally sets a policy as to the broadcast operations and other operating functions of the complex. The final arbiter is the site manager who is the representative of the tower company.

SpectraSite maintains the tower, all common items and equipment. Local contractors do the electrical work. The fee for this work is budgeted in the operation costs of the complex and pro-rated to the tenants.

Individual stations are responsible for maintaining their own transmitters, rack equipment and antennas. It is required that all tenants keep their antennas in compliance with FAA standards.

As part of the basic lease agreement, tenants are authorized to have an STL/TSL dish and a news radio installation. If a tenant requires more than the basic STL installation, they may have additional installations at additional rental.

Arrangements with the local telephone company will be made for landline facilities and, if available, fiber optic networks for video.

SpectraSite Broadcast Group provides emergency power to the common areas of the facility and suggests that individual broadcasters build redundancy into their operations. We work with broadcasters to ensure sufficient infrastructure exists.

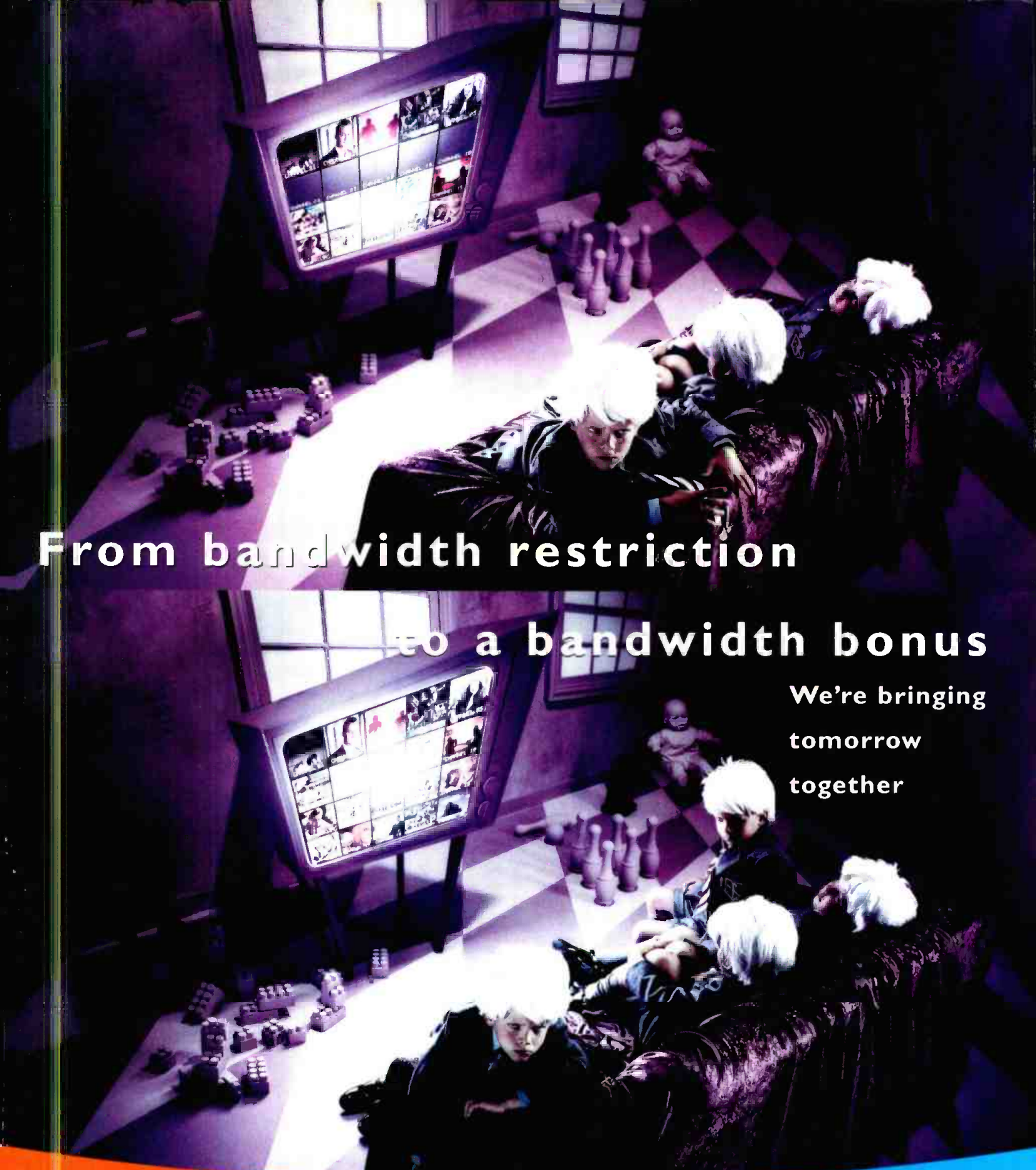
The tower complex is available to tenants on a 24-hour basis. The keying system is such as to have access to the main entrance, the station module and to all common areas at any time.

The options and expertise from each individual local broadcaster are important to SpectraSite. Remember, this is your tower for your broadcast activities. We need your input in order to make the tower operate at maximum efficiency and convenience.

We do not profess that the team assembled to launch this project has all of the answers. We have drawn upon the experience of many in order to provide you with a tower complex that will rival any similar installation anywhere in the world. There may be unique problems or situations in, say, South Dakota, but that is why your continuing contributions to the project are so important.

Don Doty is vice president, Tower Services, for SpectraSite Broadcast Group, Atlanta, GA.

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



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When the eight Utah community broadcasters met to form DTV Utah, two primary concerns brought us all to the table. One was the need to conserve individual station resources in the construction of transmission facilities. The other was the need to make it as easy as possible for our viewers to get a good quality DTV picture. It was quite clear to us from the beginning that if our viewers couldn't get a reliable signal, or had to use antenna rotors every time they changed channels, they weren't going to watch.

EXPERT

Phil Titus, KUED/ KULC

As we progressed into the design phase of the project, we discovered some major benefits for our viewers:

• Custom antenna design: One of the biggest DTV signal killers in early tests was the presence of multipath signals. To use the phrase coined by one of our members, our broadcast area is "geographically challenged." Large granite mountains bracket most of our viewers. This creates a huge amount of signal being fed into the backside of their antennas. Using a single custom antenna design, we were able to reduce the amount of signal pointed directly at the mountains nearby while increasing our signal power to communities farther out in different directions at the same time.

• Single point of transmission: DTV signal studies suggested that viewers would need a high gain antenna, perhaps with an antenna-mounted preamp, to receive a consistently viewable signal. Such an antenna, however, has a narrow beam width. Viewers accustomed to instant website access from their desks will not be happy if they have to get up to turn an antenna rotor every time they want to switch channels. A single transmission site for all DTV stations eliminated the problem. Viewers will not have to change their viewing habits. They will be able to continue to switch channels as usual, getting consistent signal quality from all stations.

• Single antenna: The process of combining RF signals into a single antenna reduces the potential for interference, especially at the fringe signal areas.

• Single tower: Sharing the same tower saved both time and resources for each station. In a time of increased environmental awareness, the opportunity to eliminate (in our case) seven other towers is a welcome idea. Low community visibility seems to be the cry from the masses. What better way to accomplish a federal mandate, benefit the community and still keep the "eyesores" to a minimum. A single tower was the answer.

The decision to form a community site was one of those decisions that just feels right. So many of the factors that made financial sense to [redacted] also made sense for our viewers.

Phil Titus is the director of engineering for KUED and KULC in Salt Lake City.

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AES/EBU digital audio signals

BY MICHAEL ROBIN

Processing, recording and distributing audio in a digital format has some well-recognized advantages. Among these are:

- Superior signal-to-noise ratio (SNR);
- Low total harmonic distortion (THD); and,
- Constant audio quality when operating in the digital domain.

The digital audio concepts were developed in the late 1940s by a team of scientists working for Bell Telephone. The two basic parameters of quality determination are the sampling frequency and the number of bits per sample.

Sampling and quantization

The sampling concept, developed by Claude Shannon in 1948 and better known as the (Harry) Nyquist theorem, states the following:

"If a signal contains no frequencies higher than F_{max}, the sampling frequency F_s must be at least $2F_{max}$."

This sampling rule must be followed to avoid aliasing. Aliasing is the generation of unwanted beat frequencies. The amplitude of the audio signal is periodically sampled, resulting in variable amplitude (amplitude modulated) pulses. The mechanism of sampling is better known as pulse code modulation (PCM). Shannon's concern was the digital transmission of telephone conversations. The voice audio signal bandwidth can be limited to a range of 300Hz to 3400Hz, so Shannon was sampling voice signals at a frequency of 8kHz, a concept still valid today. CDs use a sampling rate of 44.1kHz and studio audio technology uses a 48kHz sampling rate.

The PCM pulses are digitally represented by assigning a binary digital value to each amplitude modulated pulse. The accuracy with which the pulse amplitude is digitally represented depends on the number of bits per sample, or word length. The higher the word length, the higher the number of discrete digital levels representing the original analog pulse amplitude, hence the lower the total harmonic distortion (THD). The number of digital signal levels is equal to 2^n, where n is the number of bits per sample. For example, Shannon selected n=8 for telephone applications, resulting in 2^8=256 discrete signal levels that can represent the original analog signal. Unlike analog systems, the THD is highest at low signal amplitudes and decreases as the input analog signal level increases, until saturation occurs and the system breaks down.

In addition to its effect on the harmonic distortion, the word length also has an effect on a typical digital signal distortion known as quantizing error (Qe). The Qe manifests itself as random noise in the presence of a signal, hence the term quantizing noise (Qn). The Qn results from a peculiar random level variation between two consecutive pulse amplitude representations. Unlike analog random noise, Qn occurs only in the presence of a signal. In the absence of a signal, the system is shut off and there is no digital noise. In a digital audio system, the signal-to-noise ratio (SNR), referenced to the highest digital signal amplitude known as 0dB Full Scale (0dBFS), is approximately given by: SNR(dB) = 6n. Hence in a digital telephone system SNR = 6x8 = 48dB. A CD with 16 bits per sample can achieve an impressive figure of 6x16 = 96dB. Studio audio technology uses 20 bits per sample with an incredible SNR of 120dB.

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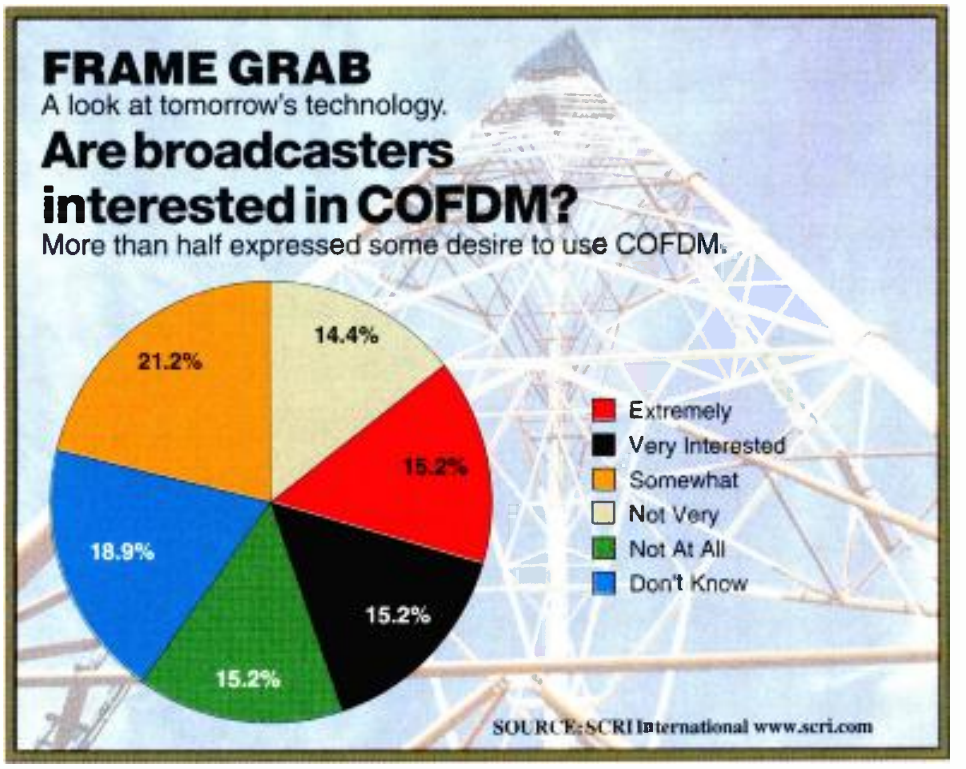

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afforded by digital audio requires that the signal remain in the digital domain in all subsequent processing and distribution, including delivery to the home listener. In a studio environment, this requires that the various elements such as digital audio tape recorder and digital mixing console be digitally interconnected.

Digital interconnection

Early digital audio interconnections used the bit-parallel concept. In a bit-parallel 20-bit system, the two analog audio signals are band limited to less than half the sampling frequency (20kHz) and subsequently sampled at 48kHz. The amplitude-modulated pulses are then digitally represented with a 20-bit accuracy resulting in 2^{20}= 1,048,576 digital signal levels. The output of the A/D converters consists of 20 pairs of wires, one pair for each bit. An additional pair of wires carries the bit clock to identify the start of each bit. The parallel data rate for each channel is equal to 48kb/s. While impractical, this type of interconnection can be used between two digital audio tape recorders. Early on, this was the way they were interconnected. Using this type of interconnection in a large studio with multiple digital signal sources and destinations and, perhaps, a routing switcher is unthinkable.

A solution to the bit-parallel problem is the use of bit-serial interconnection. With bit-serial, the instantaneous binary values (0 or 1) of each of the bits at the output of the A/D converters are read out sequentially, beginning with the least significant bit (LSB) and ending with the most significant bit (MSB). The values are then transmitted on a single cable to the destination. The essential bit-serial data rate (EBR) of each channel is given by the formula: EBR (kb/s) = n (bits per sample) x F_s (kHz) = 20 x 48,000 = 960kb/s.

The Audio Engineering Society (AES) together with the European Broadcasting Union (EBU) developed a digital audio transmission standard known as the AES/EBU standard (also called AES-1992, ANSI S.40-1992 or IEC-958). The transmission medium is wire, which offers wide bandwidth capability and allows for the bit-serial transmission of the digital audio data. The interface is primarily designed to carry monophonic or stereophonic signals in a studio environment at a 48kHz sampling frequency and a resolution of 20 or 24 bits per sample.

The bit-parallel data words are serialized by sending the least significant bits (LSB) first. Word clock data is added to the bitstream to identify the start of each sample in the decoding process.

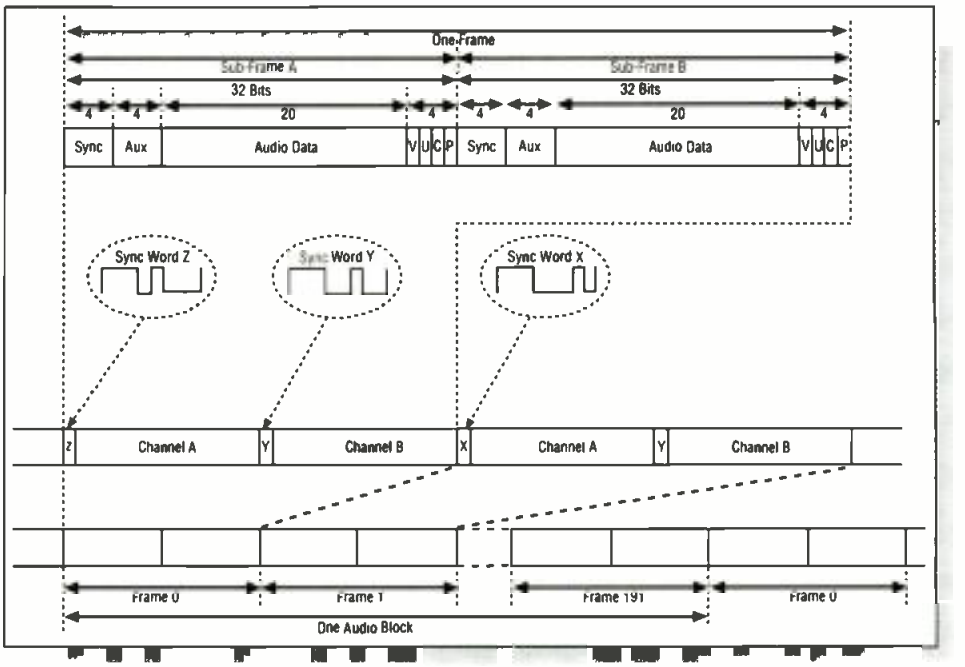

Figure 1. The structure of the AES/EBU digital audio signal consists of a block of 192 audio frames. Each frame consists of two 32-bit subframes.

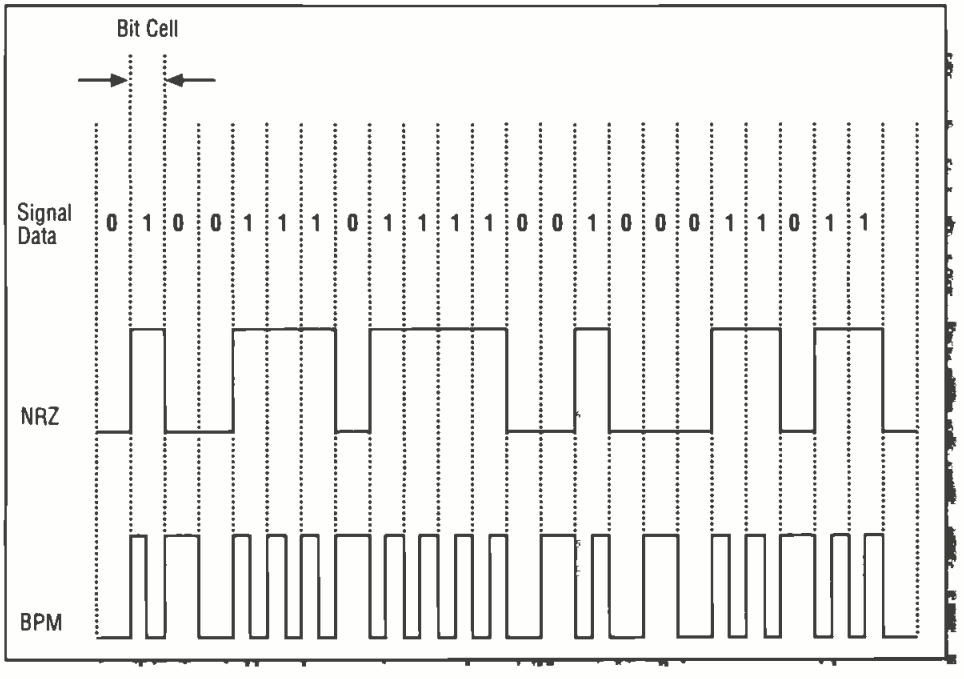

Figure 2. Comparison of the encoding format for non-return-to-zero (NRZ) and biphase mark (BPM). With NRZ, ones are high, and zeros are low, whereas with BPM, ones are marked with a transition on the center of the bit cell.

AES/EBU interface protocol

The AES/EBU signal format has the structure shown in Figure 1. The signal is transmitted as a succession of audio blocks. Each block is made up of 192 frames numbered 0 to 191. Each frame is made up of two subframes — A (left channel) and B (right channel). Each of the subframes is divided into 32 time slots numbered 0 to 31. Subframes combine sample data from one audio source or channel, auxiliary data, sync data and associated data. At a 48kHz sampling rate, the total data rate at the output of the P/S is 32 x 2 x 48000 = 3.072Mb/s.

Time slots 0-3 carry one of the sync words denoted as X, Y or Z.

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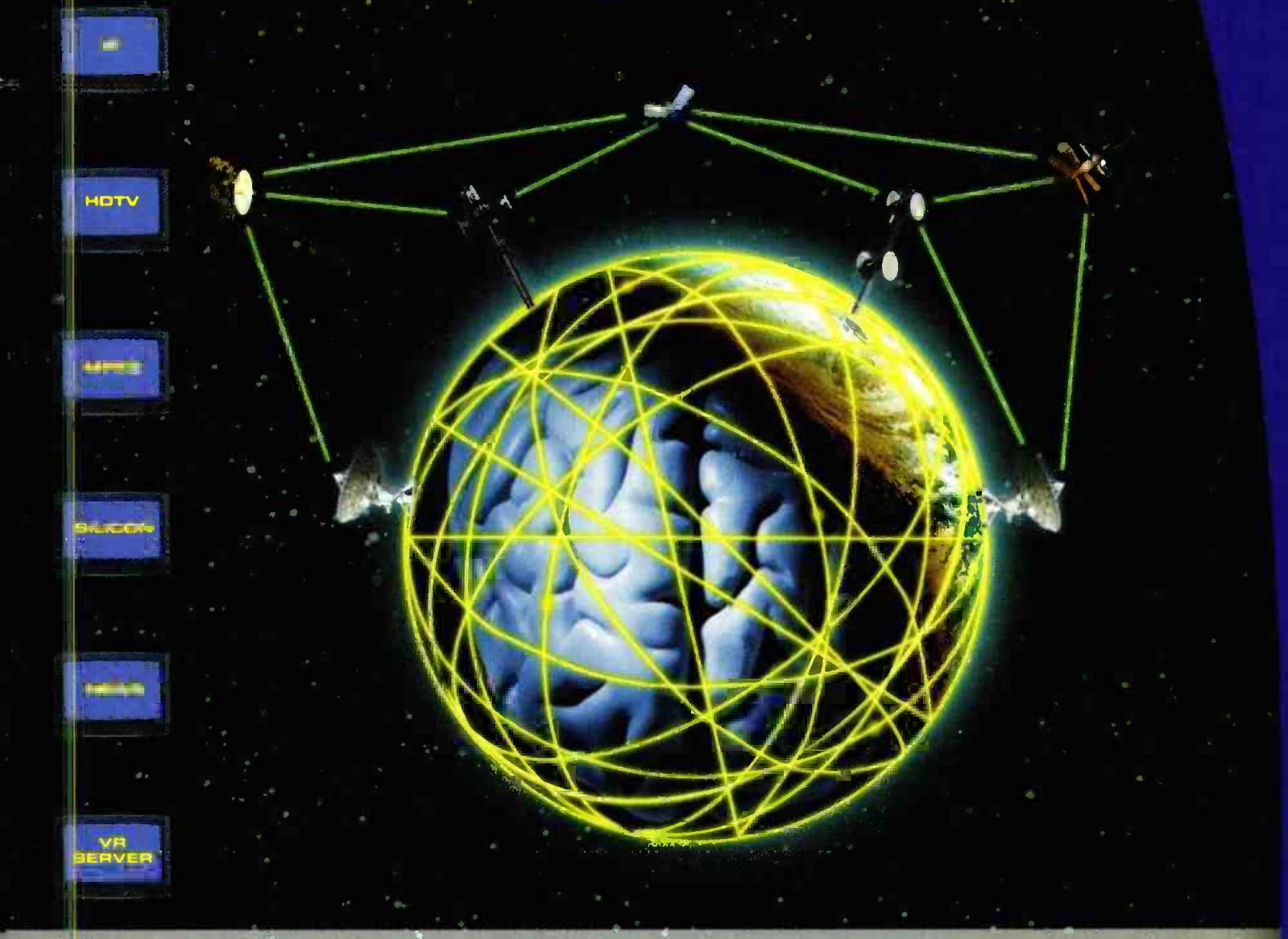

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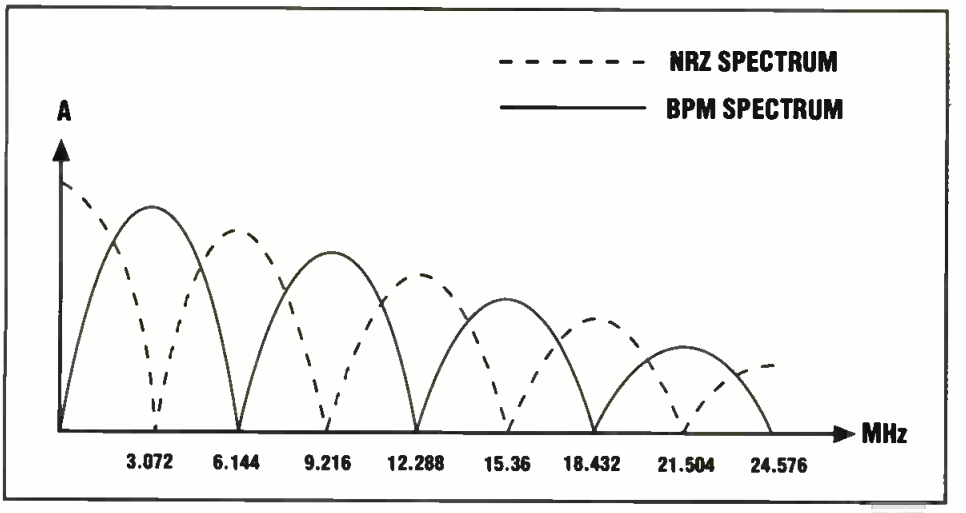

Figure 3. The dotted line illustrates the NRZ spectrum, and the BPM spectrum is shown by the solid line.

• Sync word Z: Bit sequence indicating the start of the first frame of an audio block.

• Sync word Y: Bit sequence indicating the start of every B subframe.

• Sync word X: Bit sequence indicating the start of all remaining frames.

Time slots 4-7 carry auxiliary information such as a low-quality auxiliary audio channel for producer talkback or studio-to-studio communication. Alternately they can be used to augment the audio word length to 24 bits.

Time slots 8-27 carry 20 bits of audio information starting with the LSB and ending with the MSB. If the source provides fewer than 20 bits the unused LSBs will be set to a logical 0.

Time slots 28-31 carry associated bits as follows:

• Validity bit (V): The V bit is set to zero if the audio sample word data is correct and suitable for D/A conversion. Otherwise, the receiving equipment is instructed to mute the output during the presence of defective samples. Not all manufacturers have implemented this capability and some equipment may not generate or verify the sample word validity.

• User bit (U): The U bit in each subframe is sent to a memory array. The AES18-1992 recommended practice specifies the format of the user data channel of the interface.

• Channel status bit (C): The C bit carries, in a fixed format, information associated with each audio channel. That information is decodable by any interface user. Examples of information to be carried are the length of audio sample words, pre-emphasis, sampling frequency and timecodes.

• Parity bit (P): A parity bit is provided to permit the detection of an odd number of errors resulting from malfunctions in the interface. The P bit is always set to indicate an even parity.

The bit-serial datastream uses non-return-to-zero (NRZ) coding. This means that a low voltage indicates binary zero (0) and a high voltage indicates binary one (1). Consequently, long strings of zeros and ones have no transitions and result in difficult signal decoding in the receiver. The AES/EBU standard uses a channel encoding method called *biphase mark* (BPM). This type of encoding introduces transitions in the middle of each one-bit interval. Figure 2 shows the formation of the BPM signal from an NRZ signal.

After BPM encoding, the datastream rate is doubled to about 6.144Mb/s. Figure 3 shows the spectrum of the NRZ and BPM signals. The sync words are not BPM encoded. Their structure minimizes the DC component on the transmission line and facilitates clock recovery and subframe identification as they are unique in the datastream.

The interface is designed to carry mono- or stereo signals at a 48kHz sampling frequency with a resolution of 20 or 24 bits per sample.

Interface characteristics

The original AES3-1985 standard defined the distribution of AES/EBU signals through a twisted-pair shielded audio cable. It specified a transmitter source impedance of 110Ω and a receiver input impedance of 250Ω. It also stipulated that up to four receivers could be connected in parallel across the audio cable. Difficulties with reflections and standing waves resulted, as the performance of the distribution link was unpredictable. It depended on the wide variety of installation conditions encountered in practice. This unpredictability was compounded by the loose specification of the output signal amplitude (2V to 7Vp-p), which puts additional stress on the receiver. The standard was revised and reissued as AES3-1992. This second version specifies a receiver input impedance of 110Ω and warns against the use of more than one receiver across the feeding cable. The AES3id-1996 standard defines the unbalanced 75Ω impedance interface. This version recognizes the need to narrowly specify impedance tolerances in terms of return loss and transmitter output signal levels (1Vp-p). If properly implemented, this results in more predictable performance as it is based on well-known SDTV video signal distribution concepts. However, many digital audio devices are fitted with XLR connectors. Use of unbalanced distribution (coax) requires conversion to BNC connectors through the use of 110– to 75Ω balun transformers and signal amplitude normalizers. ■

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

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ATM networks for video

BY BRAD GILMER

ATM has a number of characteristics that make it desirable for use in broadcasting. But like most things in life, it is better suited for some applications than others. The sweet spot for ATM is in wide area networks (WANs), connecting facilities over long distances. That is not to say that you cannot use ATM inside the studio, but other technologies may be more appropriate.

The main advantages of ATM for long-distance use are its speed, availability, and provisions for specifying quality of service (QoS). One of the biggest challenges of sending video over ATM is jitter. If jitter is not sufficiently controlled, it may severely affect the end result — video delivered at the far end of the connection.

What to look for

If you have ATM connectivity, it is likely that you will want to use it in two distinctive modes: streaming and file transfer. Streaming video involves sending out a continuous flow of isochronous (uninterrupted) video. The second mode, file transfer, involves sending a video file, perhaps a news story, from one location to the other. It is important to note that not all ATM networks support both streaming and file transfer.

Generally, you will pay more for streaming than for file transfer, as streaming requires a higher QoS. Early computer-related video efforts such as teleconferencing and video on CD-ROM made it painfully clear that video hates to wait. Interruptions in the stream are easy to detect and can be disturbing to the viewer. It takes a high QoS to deliver uninterrupted video across an ATM network, and you will pay dearly for that service.

Specifying QoS for a video link is critical. QoS is specified with four things; bandwidth (rate), loss, delay and jitter. Each of these parameters will have a direct effect on how video will look at the end of the link. They may also affect the cost of the link because a very high QoS may require better components, larger buffers, etc.

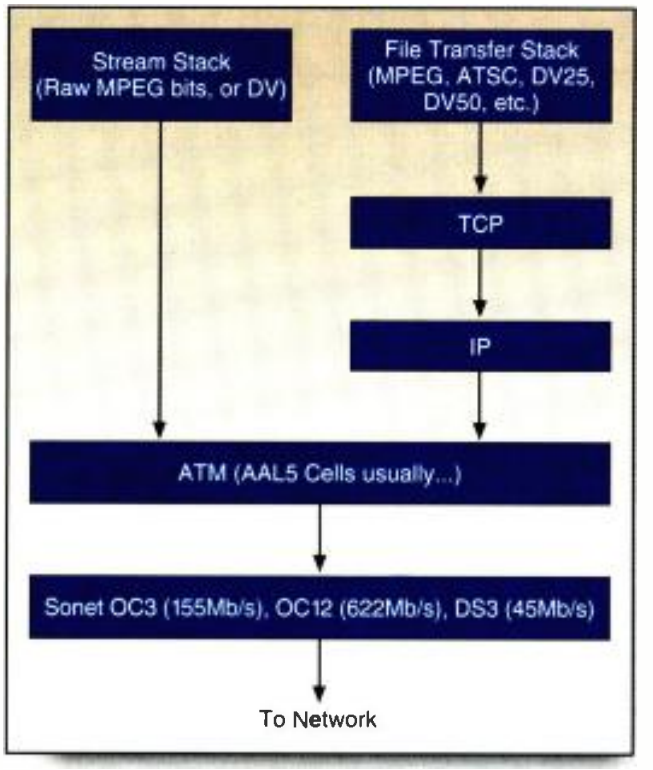

Figure 1. Both file transfer and stream protocol stacks can be mapped into an ATM stream. The ATM stream can then be sent easily over telco network transports.

What about file transfer? Because many file transfer protocols allow for automatic resending of cells that were incorrectly received, you might think that QoS is not an issue when using file transfer mode. This is not the case; QoS is still a concern.

Two of the four QoS parameters are still important. Rate is key because it determines how long it will take to transfer the file. (Ask for unspecified rate if you have plenty of time – the rate may vary 10:1, but it is the least costly rate because the network provider does not guarantee a particular rate). Because the transmission rate will vary during the transfer, you do not know when the file will get there, but if you have ample time, it will not make any difference.

The other factor to consider is delay. Delay is a consideration because the mechanisms that work in file transfer (TCP, the common reliability guarantee layer in a file transfer) work best if the delay is short. The problem is in the behavior of windowed protocols. Windowed protocols such as TCP assume a packet is bad if they do not get an acknowledgement within 64kB. If your delay is long and you have a high-bandwidth pipe, you can have more than 64kB of data out there before you get an acknowledgement that a packet was received. Imagine if the delay was a second. If you are sending something out at 64kb/s, a relatively slow rate, you won't get far before the connection times out and you resend the packets, blowing up the operation. If you have a long delay, transport protocols that are supposed to guarantee delivery might cause more problems than they cure.

With regard to streaming, all four QoS parameters are important. Delay is important in any situation with live talent interaction. Jitter is important because your receive buffer has to be able to deal with it. Otherwise, the jitter can become so great that the link begins to drop entire frames. Rate and loss are important because every bit lost has to be concealed on the receiving end because there is no way to resend it.

ATM is a different animal

One significant difference between ATM and other transport technologies is that ATM networks are not video frame-based. ATM has no concept of what it is carrying. There are no provisions for synchronizing the

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transport layer with video frames. This can cause significant problems if you do not understand the concept. Broadcasters are used to systems that are intimately aware of the video they are carrying. As a result, it is a simple matter to switch between sources on a frame boundary or vertical interval. Because ATM has no concept of frame boundaries, a switch can occur at any time. It is likely that such a switch will cause a disruption in synchronization at the receiver.

Another difference between ATM and typical broadcast transport technologies is that it takes a finite time to establish a connection between two points. Some say that the setup times for ATM are so long that switching video with ATM is not possible. The fact is that most ATM switches can do a setup in about three milliseconds, an insignificant amount of time. It does take longer to set up a connection between New York and San Francisco, but most people will not require frame-accurate switching in a WAN environment like this. In a complex path, setup time may be significantly longer than a vertical interval, causing a loss of video during the switch.

Some also criticize ATM by saying that it is unreliable. They claim it drops cells, causing a disruption in the received signal. This comes up frequently, but is not true if the rate QoS parameter is specified correctly. There are four ways to describe rate in ATM – constant bit rate (CBR), variable bit rate (VBR), unspecified bit rate (UBR), and available bit rate (ABR). The only one that guarantees you a lossless connection is CBR. CBR guarantees the switch will set aside a certain amount of bandwidth for you. In a number of tests using different manufacturers' equipment, switches in CBR mode did not lose a single cell, even up to 100 percent capacity.

While we are addressing myths about ATM, another one that is frequently mentioned is that ATM scrambles the order of cells during transmission. It turns out that this is also not true. This misconception may come from confusion about ATM protocols compared to protocols that are typically used on the Web. Web topology and routing often causes packets to arrive at the receiver out of order. The TCP/IP stack can handle this, and will put the packets back in the correct order. ATM uses different protocols. These protocols and the way routing and connections are handled guarantees that packets always will arrive in the order in which they are sent. That does not mean that ATM cells could not become corrupted — they are two different issues. ATM is frequently employed in the WAN environment. The more it becomes WAN connected, the more chance there is that something could go wrong. But if you specify the connection correctly, this should not be a problem.

If you have an ATM infrastructure, you are automatically one step away from connecting to the outside world.

One big difference between ATM and the video transport technologies that are in common use today is that ATM is self-routing. When an ATM switch sees a cell destination, it knows how to route it there. Video routers do not do that. You must have an external control to set up every connection; you cannot route by address. With ATM, the biggest advantage is that you are building a network. Video routers are not networks. They are just space division switches. Video routers do not grant the advantages of networking. ATM switches connect to the outside world. If you have an ATM infrastructure, you are automatically one step away from connecting to the outside world without having to use any other boxes.

In addition to specifying the quality of a connection so that it is good enough to carry video, QoS opens up another intriguing possibility. Imagine a video link between two distant points where you could put stamps on video such that you could specify that something be sent casually as "third class" or "first class" when the need is urgent. This would not work for streaming video, of course, because streaming implies that the stream moves at the network's optimum speed. If you want a delay, you are into store-and-forward applications, which are entirely different. File transfer grants the choice of delivery rates. As a sender, you specify what you want. If you specify CBR, you know the file will get there within a millisecond. If you go with UBR, it might get there tomorrow.

Problems and pitfalls

The biggest problem with ATM is that it is expensive, generally falling into the class of unaffordable. There are two kinds of networks. One is where you own the network (the fiber) and put ATM over it – between buildings or cities for example. In this case, ATM may be quite economical. However, if you pay a vendor for your connections – the second kind of network – it cost millions of dollars for a point-to-point connection across the U.S. Few can afford such a luxury. Additionally, there may be other technologies, such as SDI over satellite, that may be more economical.

ATM makes sense in some applications: SohoNet in London and HollyNet in Hollywood. Both use ATM to share content. You do not need to call up someone to make a switch – even when you are routing between different vendors. Instead, you just send the video with a destination address, and ATM does the rest.

While ATM may be costly, it is about the only way to stream high-bandwidth video over public networks. It is difficult to get anything greater than 45Mb/s that is not ATM. And, you can get ATM at OC-3 (155Mb/s), or OC-12 (622Mb/s), with higher bandwidth connections also available in some areas.

Another strong point in favor of ATM is that it can carry a variety of protocols. You can put IP on top of it, or if you want to transfer video, you can map MPEG or other formats onto it (See Figure 1). ATM can do both file transfer and streaming. Not many links can act that way.

ATM connections

How does ATM make a connection

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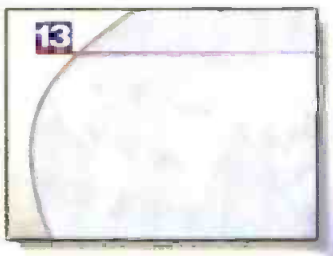

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from one place to another? Each port on the switch has a particular address that is used to set up a connection. There are two methods used to make a connection. The first is switched virtual circuit (SVC) and the second is a permanent virtual circuit (PVC).

With SVCs, you provide an endpoint address (like a telephone number) which is used to route the message through the network. Once a connection is made, the cells are mapped internally. In each cell, there is a header and an address. That address is then linked to that connection. From then on, all packets with that address go through that connection.

PVCs are more like video routers. You tell the switch to make a permanent connection, connecting this input to this output. The process is much the same as strapping wires from inputs to outputs. You are simply telling the switch to route this cell number to that output port. The process must be repeated for each switch along the way to build the path. It is a manual way of setting up a circuit.

SVCs are sophisticated, and most vendors in the WAN world do not support them. They only support PVCs because PVCs are simple to establish when you are dealing with equipment from different vendors.

ATM has characteristics that make it a good tool for moving video, but it also has some limitations. The place for ATM is most likely at the edge of a network, not in the center of the studio. Any number of transport technologies are likely to exist inside facilities, but there will also be a point for a connection to the outside world. ATM will be the high-bandwidth choice for this application. If you want to move things at 10Mb/s, don't use ATM. However, at 45Mb/s or greater, ATM starts to look like a realistic choice, especially for file transfer.

Inside the studio, Fiber Channel and Gigabit Ethernet using standard IP routing are winners. Both are easier to work with than ATM. But Gigabit Ethernet and Fibre Channel do not work between cities. That is the natural place for ATM. There is a compelling story for ATM outside the studio.

Specifying an ATM link is different from specifying a typical video connection. You will need to specify QoS, hours, service, support, reliability, back-up schemes, and so on. Once you have specified these things in writing, send it to Inter-Exchange Carriers (IXCs) such as AT&T, MCI, Sprint or any of the RBOCs. You must go out to bid on this. You cannot do it over the phone.

When you get the responses back, expect to spend considerable time working with the vendors to get to the point where you can do an apples-to-apples comparison. Vendors will deliver their responses to you using differing units, pricing strategies, etc. It will take some effort to get to where you can compare them effectively. Make the vendors work to present their responses in a way that you can understand. ■

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

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Ask Dr. Digital

Frozen operators

BY STEVE EPSTEIN, TECHNICAL EDITOR

What is the proper temperature for the equipment room and control rooms at a TV station? I am asking because an engineer across town keeps his facility at 62 degrees (F) because "it is better for the equipment." Meanwhile the operators freeze. Here, the various shifts fight over where the thermostat should be set. Any insight?

Matt Saplin
Technical Director
WRGB-TV

Brrrr!! That's cold! Does he have an excess of cold air, or is he running an air conditioner (or should I say refrigerator) to achieve this? If so, he could easily be spending more on electricity than he is saving on repairs. Regarding your question, there is no set value that I am aware of, but a good guideline for videotape storage is 50 percent relative humidity at a temperature that is comfortable for the operators. There is no reason this cannot be applied to equipment and control rooms.

With that said, there are some things that should be considered. First, a constant temperature is better than constantly fluctuating temperatures. Second, the real concern here is not really the room temperature, but the internal temperature of the equipment. The thermostat is a long way from the equipment racks. Although there is some relationship, there are numerous pieces of plastic, aluminum and steel that separate the two.

Let's look at what influences equipment temperature. Obviously, it will heat up while in use. Each equipment manufacturer should have accommodated for the heat produced internally by the components. Normally, this is done by providing heat sinks, ventilation, fans or a combination of these that move heat from inside the box to outside. I have a love/hate relationship with fans. Certainly, they can do a wonderful job of moving large quantities of air, but the problem is that air typically contains dust and other particles that coat internal components. That dust coating reduces cooling efficiency. Accumulation can be reduced with filters, but they require cleaning. A clogged filter can cause more damage than no filter at all. In addition, large numbers of fans can get noisy.

The thermostat is a long way from the equipment racks.

Once the heat is moved outside the equipment, the previous problem is re-created on a larger scale. In this new case, the component is a piece of rack-mounted equipment and the rack is the box we need to move the heat out of. Despite the larger scale, the rules still apply. Sufficient cooling must be provided by the assembler — in this case, you. Loading too much equipment into a rack can increase the heat load significantly. Leaving at least 1RU between equipment can help keep the heat load down and reduce the amount of heat directly coupled from one device to another.

If you've been paying attention, you probably realize the problem now exists on an even larger scale. This time, the racks are the toasty components and the room is the box we need to get the heat out of. Determining proper room temperature is a matter of working backward. Determine the comfort range for that board-mounted microprocessor, and set the room temperature to keep it there. Good heat dissipation through the equipment, the racks and then into the room will provide a closer cause-and-effect relationship between the equipment temperature and the room temperature. Bear in mind that the metal in the racks can sink a considerable amount of heat. Because of this, reducing the room temperature one or two degrees might not result in noticeably cooler equipment for several hours, depending on where you take your reading.

Having several temperature monitoring points is a good way to get a complete picture of what is happening in your equipment and control rooms. One location to be sure you monitor is the rack metal itself. Find a point near the center of the rack assembly and away from fans. Mount a digital thermometer there and check it from time to time. Finally, leave yourself a little headroom. Find a temperature setting that is reasonably comfortable for you and the equipment and then reduce it one or two degrees—just in case. The metal in the racks will change temperature slowly, whereas the air temperature throughout the room will change much quicker. Placing a few temperature alarms around will help you to spot trouble. That way when the system begins to fail, you can get it repaired and back on line before the control room temperature reaches dangerous levels.

Questions, comments or suggestions? Drop me a note at *drdigital@compuserve.com*. ■

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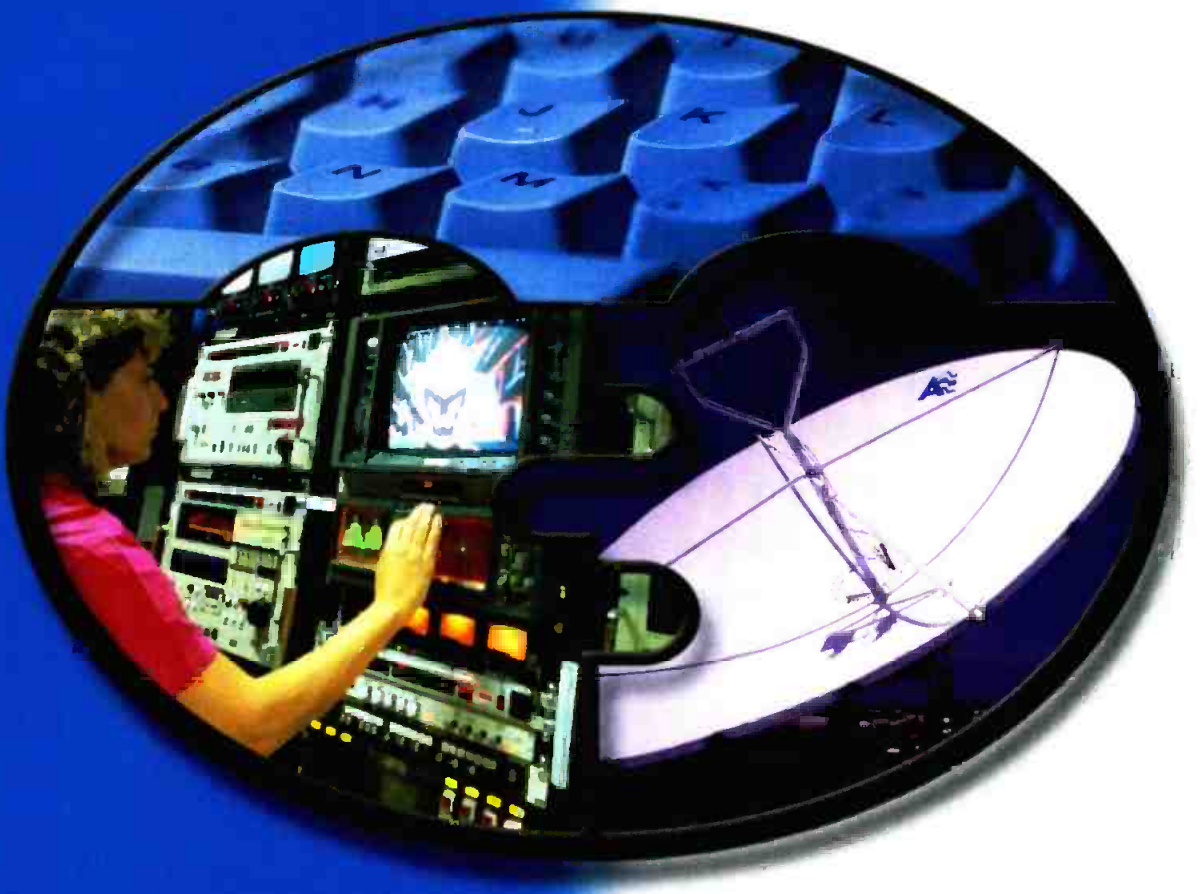

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SYSTEMS DESIGN SHOWCASE

WFLA-TV

By Faith Bohnke

Along with many of its fellow broadcasters, NBC affiliate WFLA-TV in Tampa Bay, FL, confronted common issues surrounding the transition to digital, including relocation of facilities, signal conversion and the appropriate time to make the move to digital. For WFLA-TV, the solution came from its parent company, Media General.

Working with architect Rees Associates Inc., Media General decided to relocate the television station and the online company Tampa Bay Online (TBO), next door to the existing Tampa Tribune facility. Rees designed a campus enclave for the three media operations along the Hillsborough River and adjacent to the central business district. Tampa Bay is the first market where commonly owned newspaper and television operations share a common facility and resources while maintaining editorial independence and integrity. In doing so, Media General has combined the depth and resources of a newspaper, the visual impact and immediacy of television and the interactive character of the Internet. More importantly, it created a unique "research and development" laboratory, and employees are encouraged to develop new multimedia products.

In equipping WFLA's new digital facility, the station chose Panasonic's DVCPRO format for acquisition. Its news studio uses Vinten robotics, Ikegami cameras and Canon lenses.

WFLA

Building a digital infrastructure

Media General chose Rees Associates for its experience in designing television stations. In addition to Rees, construction manager DPR Construction Inc. was chosen for its proven ability to manage projects with complicated issues, such as those presented by this project. Rees and DPR had previously collaborated on three broadcasting facilities. Professional Communications Systems Inc. (PCS) worked with Media General to determine its digital needs in the Tampa market. Each participant was able to translate its experience into cost savings and project value for the client by making flexibility the driving force behind the design and development of the News Center.

While many stations convert an analog signal to digital, WFLA will originate a digital signal that will then serve its analog transmitter. The new five-story, 121,500 square foot building is a fully digital broadcast facility.

Rees, DPR and PCS began the design work by examining the way the station functioned. The challenge was to determine how all three media outlets could benefit from the use of shared personnel, newsgathering resources, data transmission and archives. The new facility would also need to accommodate future growth.

The solution, in part, materialized in the design of a shared communications desk that combines the functions of the traditional TV assignment desk with the newspaper's photo assignment and research desk. At this hub, a multimedia editor identifies stories and projects that lend themselves to a multimedia approach and serves as a liaison between the three media. A recently developed intranet allows the three entities to share newsgathering resources from the live feeds of a TV truck on the scene of a breaking story to the closely-followed particulars of a criminal trial in the local courthouse via a newspaper reporter's laptop modem. Weather satellites, NBC and the Associated Press Newswire feed all three media.

Editing at WFLA is done in the station's linear suite, which employs a Grass Valley Group switcher and DVE.

Equipping a fully digital facility

Working within budget constraints and allowing flexibility for the future, PCS began the difficult process of assessing the WFLA's needs and matching them with state-of-the-art equipment or custom building equipment from components.

At the same time, they considered existing equipment. Working closely with Media General, PCS determined what could be used, what could not, what could be updated or integrated from the old facility. This included the relocation of a significant amount of the existing graphic systems, digital editing systems, and vast computer network and control systems from the old facility, to be integrated into the new design and new equipment. Reviewing each activity hub with Media General, PCS configured equipment and racks to be ergonomically functional and conducive to the eye line of the staff.

In the master control and rack room, a new centralized concept was envisioned. Here it would employ a largely tapeless environment with multiple video and information streams occurring simultaneously and allowing access by multiple users simultaneously. Management of multiple channels of information was a capability must. This was achieved through an environment much like the multitasking world of Windows on a PC. Many traditional functions are monitored and controlled through a system of common interfaces and displays provided by Crystal Systems. Overall system control is complemented by Florical Automation's AirBoss and ShowTimer platforms. The main servers are Pinnacle MediaStream and Pluto AirSpace and HD servers.

In the newsroom, the ability to manage the content from its acquisition through its delivery was the driving goal. WFLA chose Panasonic's DVCPRO for field acquisition, NewStar by AvStar for content management and editing of video, and Grass Valley Profiles for server platforms. In all, 22 field crews will be capable of shooting on DVCPRO with eight portable DVCPRO editors in eight live trucks feeding 24 server channels and 12 EditStar nonlinear editing stations. This is in addition to the multiple

A recently developed intranet allows the three entities to share newsgathering resources.

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For graphics, the existing Pinnacle equipment along with Quantel Paintboxes and Chyron iNFiNiT! were reconfigured as "digital capable" in order to share and move the graphics through a common network.

WFLA is the largest of Media General Broadcast Division's 26 television stations. In light of the costs of syndication, WFLA's new digital capabilities opened up an array of multiprogramming options, and the flexibility of the new studios maximizes opportunities to produce a variety of less-costly programming to its sister stations. In the production studios, they will be able to offer the largest and most fully equipped digital stages in the market. The commercial production unit, West Bank Productions, currently produces several live and taped programs for commercial clients. The new facility will provide the ability to expand these services.

WFLA's new digital capabilities open up an array of multiple programming options.

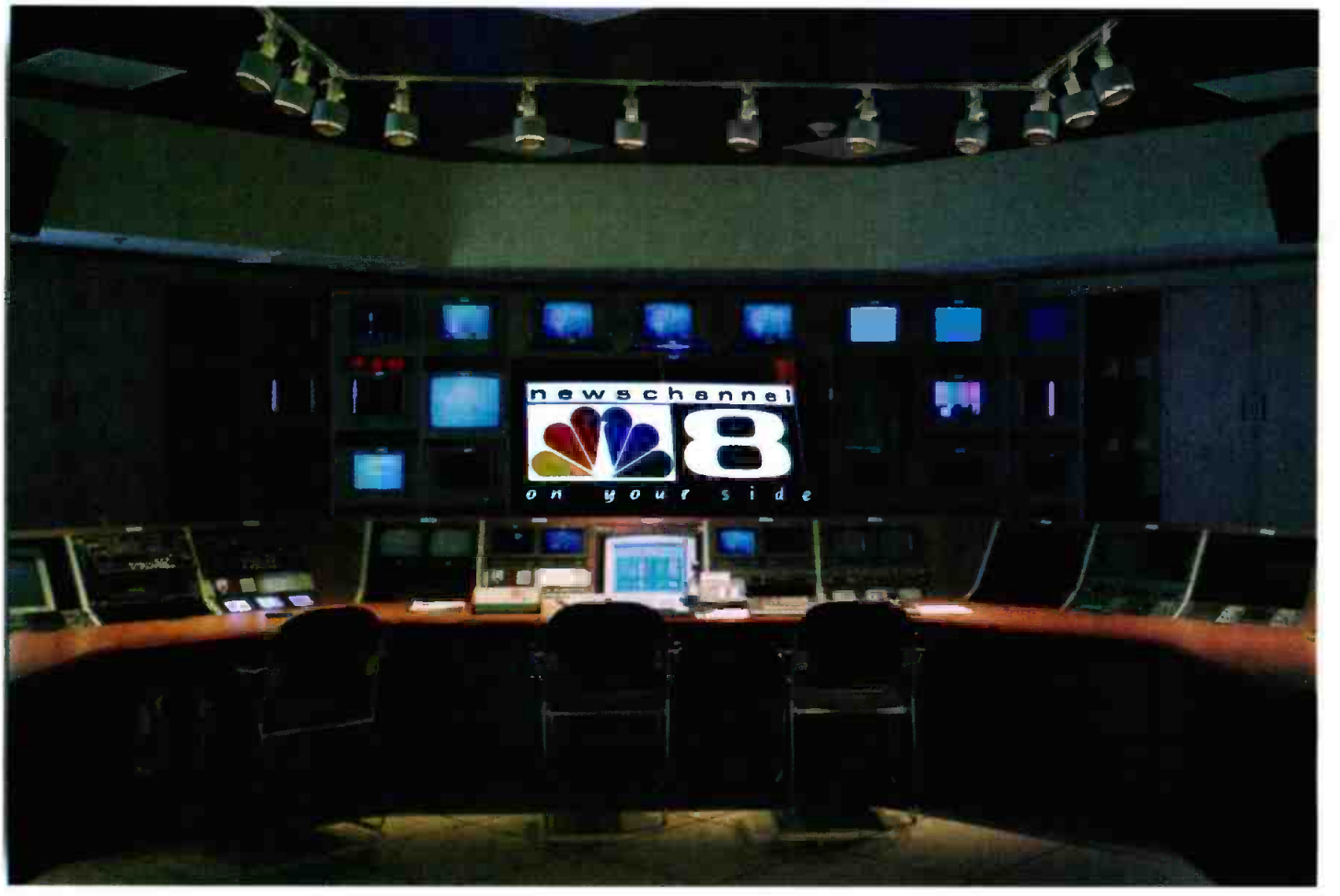
Interior design

Rees created a flexible, open facility that can be easily reconfigured with changing times and technology. Technical cores and rack rooms were located next to storage spaces and other functional areas that could potentially be relocated. Where possible, walls were removed not only to maintain flexibility but also to create a feeling of interconnection among the varied personnel and operations.

Rather than the traditional steel columns and drywall cover to create hidden space for critical cabling needs, Rees designed each of its 30 concrete structural columns with a six-inch conduit within the core and access at both the floor and ceiling of each story. This vertical engineering scheme connects with the traditional horizontal cable troughs at each floor creating a 3D grid of cabling interconnectivity throughout the building. Not only can WFLA change the working spaces as needed, they can connect into the signal power grid every 30 feet horizontally and produce "product" content from any location within the building.

Preparing for the storm

While the facility's first floor houses the broadcasting studios, the floor contains only "nonessentials" in the event of a flooding from a passing



WFLA's master control room features a large console that allows a variety of systems to be controlled from a single point.

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Evaluating video servers

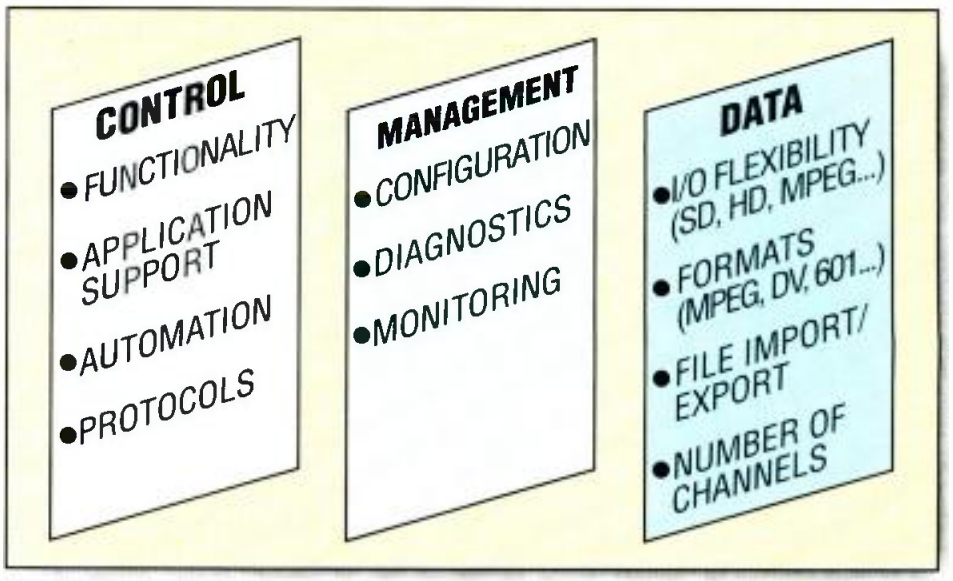


Figure 1. The three-plane model is used to describe the data, control and management planes of a device. In this model, each plane offers a specific functionality.

The three planes

In the telecom, information technology (IT) and Internet equipment worlds, devices are often designed using the three-plane model, which describes the data, control and management aspects of a device. Each plane offers specific functionality as shown in Figure 1. Until recently, most broadcast equipment was not designed using this model. This is changing due to industry awareness.

There are operational advantages to keeping the three planes separate. Each plane is composed of layers — physical, data-structures, protocol/framing and application. An SDI (SMPTE 259M) interface on a server may be considered a data plane component. It has physical, framing and format layers. The control plane is mainly proprietary command sets (Sony protocol, Louth protocol, etc) over RS-422 links. This, too, is changing as SMPTE is standardizing various dialects for machine control. In addition, machine control over standard LANs is becoming a reality. For example, many broadcast servers may be controlled over RS-422 or LAN connections. Some servers offer only simple control for recording/playing, while others offer increased functionality, including keying, output wipes, trimming and low-resolution proxy viewing.

Of the three planes, the management plane is the least mature within the broadcast industry. In most cases, this plane is completely absent from broadcast-related devices. Its purpose is to provide a portal to configure and monitor all aspects of a device's operations. The IT industry has taken the lead in this area. Broadcast equipment suppliers are just starting to include Simple Network Management Protocol (SNMP) and Management Information Base (MIB) support in their products. SNMP and MIBs form the basis of the management plane.

When assessing a product, inquire about the specifics of each plane. As the broadcast and professional video industry moves forward, these planes will become fully standardized. At this point, the data plane is the most mature, followed by the control and management planes.

Before leaving the topic of planes, it's worth mentioning the need for file exchange interoperability. Most servers compress the incoming audio and video and store the content as either MPEG or DV files. Many scenarios require that files be transferred between servers over LANs and WANs. For this to work smoothly, the file types and associated metadata must be standardized. When evaluating a server, verify whether the exchange format is a recognized standard.

The four architectures

There are several manufacturers of video servers. Each claims an advantage to its architecture. Are servers really that different or are there some common themes by which all servers may be categorized? There are four fundamental architectures by which all audio/video servers may be classified, and these four have one theme.

Class 1: Figure 2 shows the simplest of all the classes. This is the computer-like class. It looks and acts like a computer, but with specialized I/O, response time and storage requirements. Typically, the central connecting bus and CPU horsepower limits performance in this class. Some systems use a distributed bus/switch structure to move beyond a single bus's performance. Some systems use multiway processors to improve throughput. One can build a very large server of this nature, but the issues of cost, scalabil-

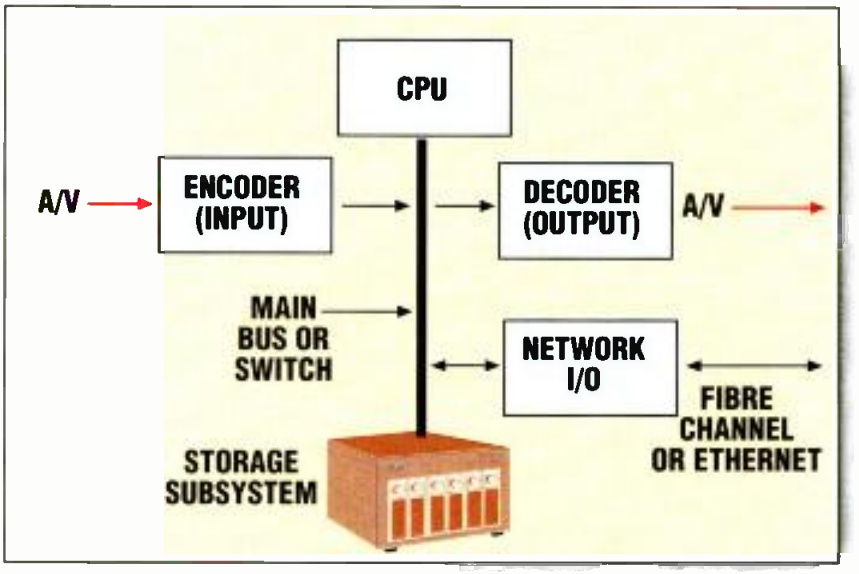


Figure 2. The fundamental architecture of a Class 1 server is similar to a computer, but with specialized I/O, response time and storage requirements.

ity and reliability come into play. In general, servers of this class usually support less than 15 high-bandwidth (20Mb/s) video channels.

In a traditional computer, most internal data traffic passes through the CPU. If the I/O cards are designed correctly, most storage- related data transfers could bypass the CPU by moving directly from/to storage and I/O ports, increasing bus performance by up to two times.

Many servers of this class use replicated components to achieve reliability. By doubling up on power supplies, fans, controllers and storage drives, these systems achieve a high availability status. However, even the most redundant systems can fail.

Class 2: Figure 3 shows a fundamental Class 2 system. This is a cluster of Class 1 servers. Usually, the cluster is formed using a Fibre Channel loop or switch fabric. There are several advantages to this class. For one, each node is an independent server. Independence improves the fault tolerance of the entire cluster. A/V content may be encoded into any server and migrated to another under automation control. Most automation vendors can load balance content across this class of server. Load balancing is a mature technology and is used each day in broadcast facilities worldwide. This server class is ideal for:

- Multichannel, satellite feed recording;
- NVOD server farm;
- On-air and satellite playout of short- and long-form material; and
- A truly bulletproof, fault-tolerant system.

One application space not ideal for this architecture is that of collaborative editing (news, sports, etc.). Such an application requires that all content be available to many editors simultaneously. (Class 3 is ideal in this situation.)

For applications that require from a few to hundreds of audio/video channels, Class 2 shines, it scales beautifully and can be made to be fault tolerant. By way of example, DirecTV's Los Angeles Broadcast Center uses a Class 2 server with more than 175 audio/video channels configured in a fault-tolerant architecture.

Class 3: Figure 4 shows server Class 3. This is fundamentally a storage-switched architecture. Each I/O node connects to a common storage pool using a switched network. Notice the dotted box in the figure; the contents should look familiar. They describe a Class 1 architecture. One of the hallmarks of this configuration is the notion of a distributed file system. In contrast to the Class 2 design where each node on the ring is an independent server, each node in a Class 3 system is a dependent node. The nodes are dependent especially regarding the file system. Consider when a node imports or encodes a new video file. All other nodes must be immediately aware of the new file's presence without the assistance of automation. Depending on file access permissions, any node can access any stored content. Such access is a strength of Class 3. It is most applicable when many users need access to the storage pool simultaneously.

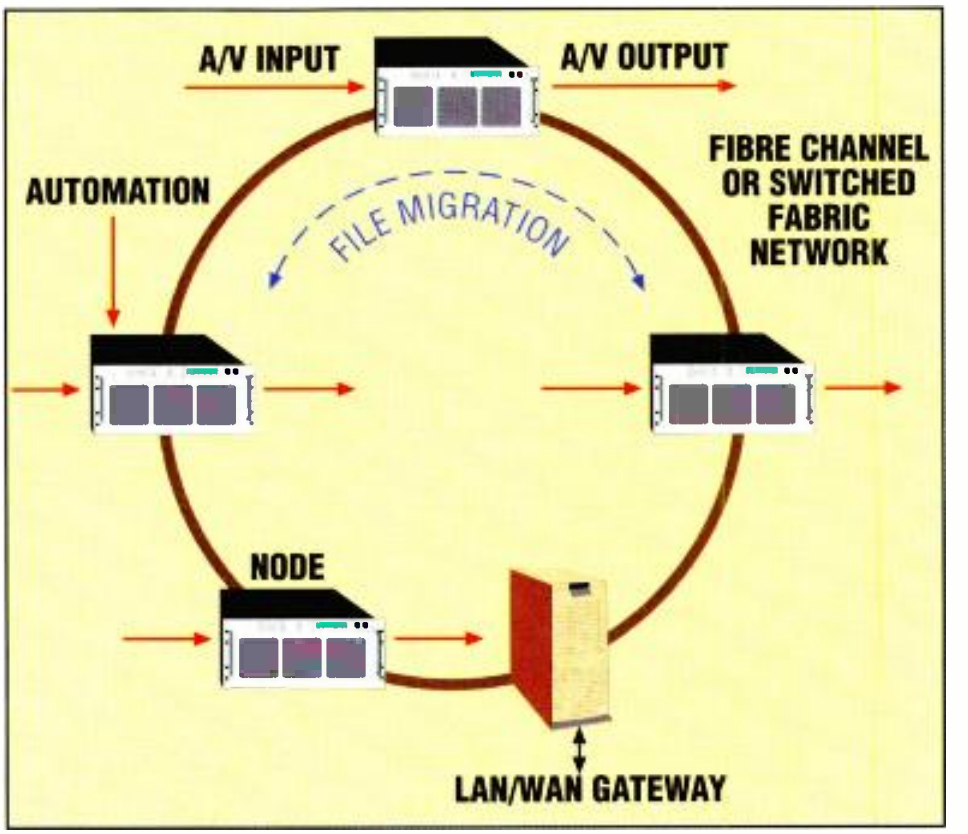


Figure 3. A Class 2 server is made up of a cluster of Class 1 servers. This cluster is constructed using a Fibre Channel loop or switch fabric and is composed of independent servers.

As our industry embraces the Internet as a new distribution medium, it will rely on Video Service Providers.

Storage switching may be accomplished by a variety of methods. The most common are:

- Fibre Channel loop switching;
- Fibre Channel switch fabric;
- Ethernet switch; and,
- Direct point-to-point access (each node has direct access to any storage node).

For correct load balancing, all the content is usually striped across all the discs. To a large extent, the performance of this architecture depends on the nature of the switch. By evenly distributing all stored files, the available access bandwidth is increased, thereby supporting more nodes. Even then, without disc access regulation rules, it is possible for data queuing problems to arise. Striping creates another form of dependence. If the storage subsystem ever fails in a catastrophic way, then all nodes lose access to all data and the entire server is dead. There are strategies to reduce the effect of disc failure, but they increase the solution's complexity.

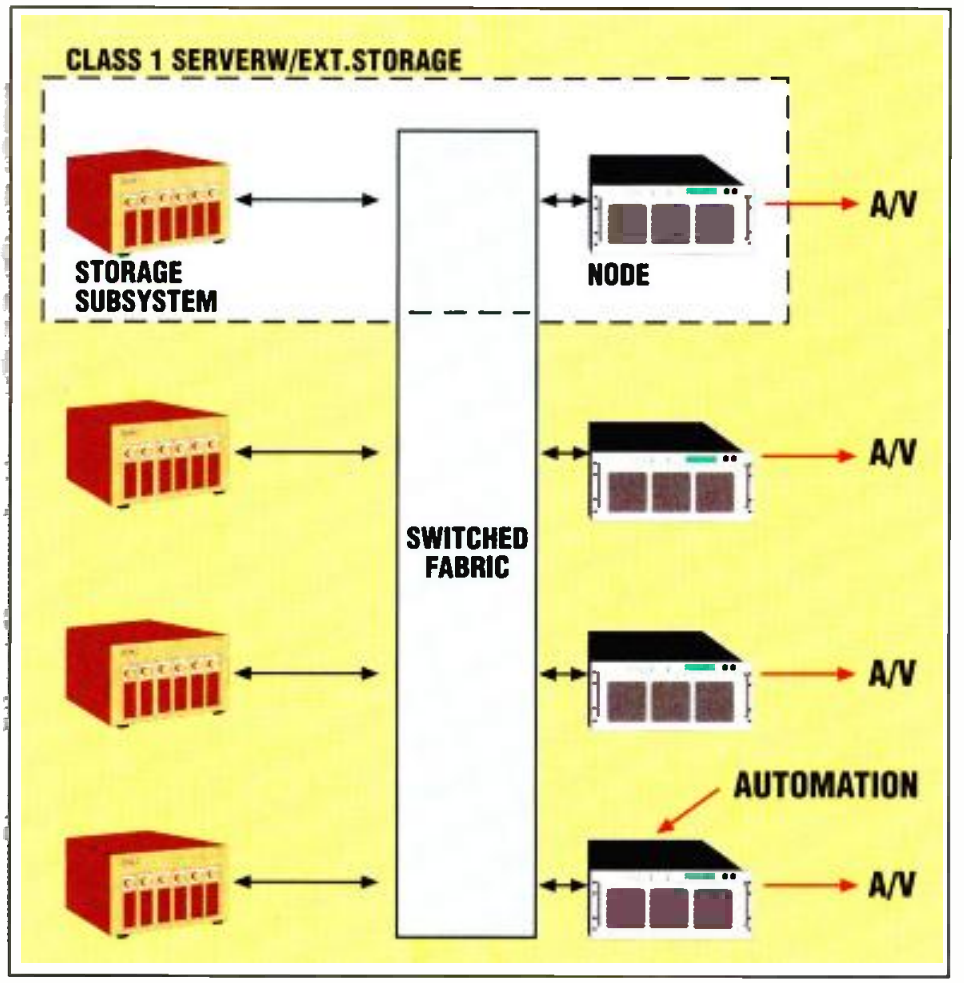


Figure 4. Class 3 is fundamentally a storage-switched architecture. Each I/O node connects to a common storage pool using a switched network. The dotted-line shows what is typically viewed as a Class 1 architecture. Because the servers are separate from storage, the interconnection can become complex as the system grows.

Building big, reliable Class 3 systems is no small task. More nodes usually require more common storage and more access bandwidth. There are other exotic variations on this theme, but practical systems (less than 40 channels) will adhere to the principles outlined here.

Class 4: Figure 5 shows a Class 4 server. This class finds application in Internet video streaming. Most broadcasters won't have one of these in their facility. However, as our industry embraces the Internet as a new distribution medium, it will rely on video service providers. They will use this class to serve an unlimited number of simultaneous streams.

A cluster of Class 1 servers compose this class. Internet viewers are directed to a selected server node by a so-called Level 4 router. A Level 3 router routes at the IP level. A Level 4 router routes at the application level (TCP for this discussion). Level 4 routers use various strategies to load balance user requests. It should be noted that a physical router is not the only way to load balance the nodes. Another popular strategy is to use features of a Domain Name Server (DNS) in assigning IP addresses for the destination node servers. Regardless of the method used, the intention of load balancing is to populate each server node with the same number of users, on average. The nature of IP, and of the Internet in general, allows for this class to be physically distributed over a wide geographic area. It is not uncommon to have the nodes in different locations, indeed even in different countries.

One problem with this method of streaming video is that in the worst case, every node must have identical stored content. Is this practical? Web video files (usually Microsoft, Real Networks or QuickTime formats) are small in size and duplication of content is not a major burden. Several companies offer application software to automatically load balance each node's stored content.

When evaluating a server, verify whether the exchange format is a recognized standard.

Storage subsystems

The storage subsystem is another component of the server. In general terms, there are three types of disk storage systems. One is the lonely, single disk drive. As of February 2000, 72GB drives are becoming available and 144GB units are due in 2001. A good figure to remember relates to 10Mb/s encoded (say, with MPEG-2 compression) audio/video content. It requires 4.5GB/Hr to store 10Mb/s content. So a 72GB drive can, excluding various overhead factors, store 16 hours of compressed video/audio.

A step above the single disk, is a JBOD (just a bunch of disks) array. This is usually an array of eight to 10 discs on a common Fibre Channel loop, typically mounted in a frame with dual power supplies. This method yields a linear increase in storage (160 hours with ten 72GB discs) and a nearly linear increase in R/W disk bandwidth. Additionally, content is striped across all the disks in the array. Striping increases the available array bandwidth to approximately N (number of disks in array) times the bandwidth of an individual disk.

A JBOD array is in jeopardy of losing its stored content if one or more disks fail. RAID (redundant array of independent, or inexpensive, disks) comes to the rescue. There are many types of RAID and there is a high confusion factor associated with it. RAID level 0 is data striping. RAID 0 distributes the file as chunks across several disks. RAID level 1 is mirroring, where the contents of one drive are duplicated on a second. RAID levels 2-5 use parity data to recreate missing data. Most storage subsystems that claim fault tolerant disks use some form of RAID.

Scalability

After deciding that a small server is

needed for your facility, it might be that a 2x4 (two input channels and four output channels) is ideal. What if, in six months, the server needs to be upgraded to a 2x8. Can it be upgraded?

Let's start with small servers. For a small number of I/O ports, the Class 1 server is the most practical. When purchasing a Class 1 server, ensure that it can become a node in a Class 2 system. This way, indefinite expansion is possible. Class 2 scales into the hundreds of ports by adding small nodes to the ring or switching fabric. For reliability, the ring/fabric may be of a fault tolerant nature.

Class 3 scales by adding nodes and separate storage. The SAN switch, throughput and reliability will limit the number of nodes in practice. Expanding this class' storage may require a complete re-striping of all content across all storage arrays. Scaling complexity increases considerably beyond about 40 channels. Finally, Class 4 can scale to support terabytes of storage and millions of viewers.

Reliability

Many factors affect the reliability of a server system. The following aspects are key:

- Server and automation software robustness;
- Software complexity, maturity;
- Storage protection strategy;
- Redundant components (fans, power supplies, codecs, etc);
- Redundant nodes that can be used in all classes; and
- N+N (true mirror) or N+1 strategies.

In practice, software fails more often than hardware. A world-class server is a complex device. It may include more than 50 years of effort in specialized software. Software reliability can be rated by looking for basics like the track record of the server, complexity of the design and the maturity of the solution, including automation control. When in doubt regarding a manufacturer's claims, decide based on these fundamentals.

A JBOD array is in jeopardy of losing its stored content if one or more disks fail.

Hardware does fail. In this area, there are really only two methods to achieve true fault tolerance. A Class 1 server cannot, in practice, be truly fault tolerant. There are designs that approach the ideal, but they are expensive and do not scale to a small number of I/Os. We need to look to Classes 2, 3 and 4 to achieve true high availability.

The two methods that work in practice are a true mirror (N+N) and the N+1 approach. In both instances, N is the number of live active nodes in a cluster. A mirror is a node replication design. With a mirror approach using four nodes, imagine two nodes as active (N=2) and two in standby. The standby nodes have identical stored content to the active nodes. If an active node fails for any reason, a standby node is called to resume its work schedule. Many automation vendors support this approach. Replication by 2X is costly, but it buys peace of mind because of its simplicity and performance guarantee.

A more efficient way is to add only one (hence the N+1 naming) standby server node. Let's assume that one active node fails. If the standby node has copies of the stored content of the other three, it can take over the workload of any faulty active node. Storage must be duplicated, but this is not as onerous as you might think. For example, a four-server system in an N+1 scheme adds only 10 percent to 15 percent to the total system cost due to the extra storage on the spare node. The cost of storage compared to the cost of the other system components is falling rapidly. This is a reliable configuration with virtually zero chance of a total system failure.

For a Class 3 system, the N+1 approach also works well. However, remember that this type of architecture has dependent nodes compared to the independent nodes in a Class 2. The storage subsystem and switch need bulletproof reliability as well.

Despite the cost effectiveness of the N+1 approach, many facility designers still choose to use a true mirror (N+N) for either Class 2 or 3 systems. Why? It has a simple architecture and automation control during node failure is very mature. ■

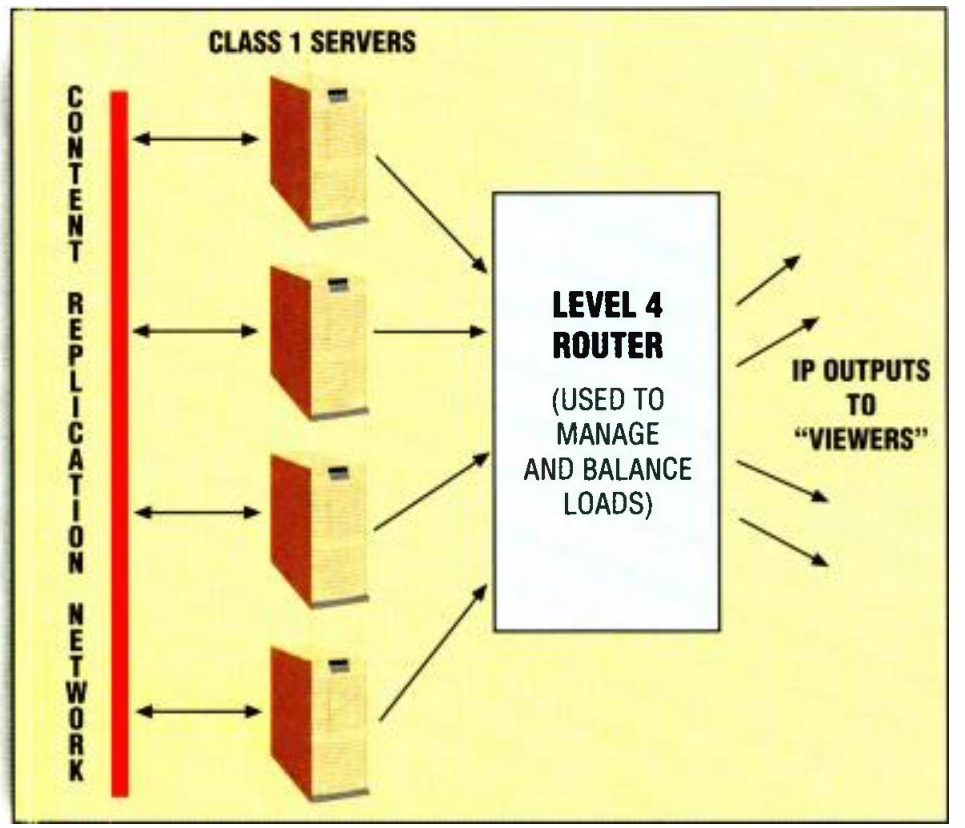


Figure 5. Class 4 architecture is applied to Internet streaming applications. The Level 4 router switches at the application level and can use various strategies to balance the load on the servers. The Class 1 servers can be distributed in separate locations due to the nature of the Internet.

Al Kovalick is chief technology officer, broadcast products for Pinnacle Systems, Mountain View, CA.

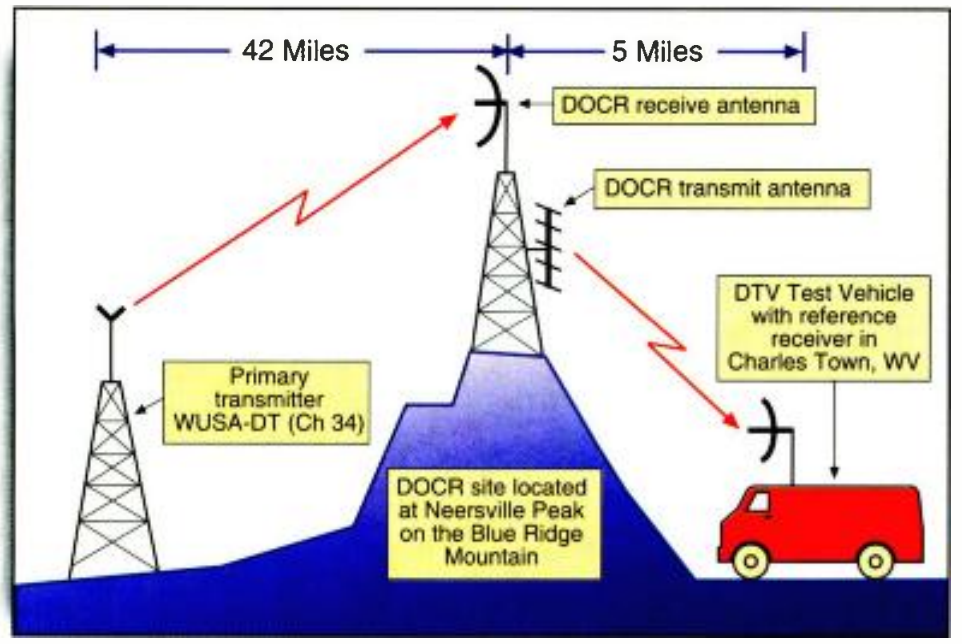


Figure 1. The ATTC digital on-channel repeater demonstration system consists of the primary transmitter (WUSA-DT) located in Washington, D.C., the DOCR site located at Neersville Peak, and the DTV test vehicle with a reference receiver located in Charles Town, WV. Blue Ridge Mountain blocks Charles Town from directly receiving a strong primary signal. The DOCR receives and retransmits the DTV signal on the same channel (34) as the primary signal.

For some broadcasters, particularly those in mountainous regions, adequate signal coverage requires the use of translators. There are currently over 5000 translators in the United States, a large percentage of which are located in western states. In places like Utah, as much as 75 percent of the TV households receive broadcast TV via this method. Unfortunately, the large number of frequency translator channels in the U.S. has not been considered in allocation of DTV channels.

The Advanced Television Technology Center (ATTC), having played a major role in testing DTV systems, understands the capability of the ATSC DTV standard to solve these problems not only for the U.S., but also worldwide. The ATSC standard, using the 8VSB modulation technique, provides sufficient performance margin to allow for the practical implementation of a repeater system that utilizes a single DTV channel – thus, the *digital on-channel repeater* (DOCR). 8VSB receivers have been shown to tolerate echoes as large as -3dB relative to the primary signal. Therefore, 8VSB permits the implementation of an on-channel repeater, even though echoes may be introduced by operating on a single channel.

The ATTC has successfully completed a full-scale field demonstration of the DOCR. The DOCR has the potential to aid broadcasters toward full replication of their coverage area. The broadcaster can also extend the coverage area without having to impact the DTV allocation table. The DOCR allows for the rebroadcast of a DTV signal, without frequency shifting, into an area previously unable to receive a signal directly from the primary transmitter. The DOCR can replace the traditional frequency translator to overcome terrain obstructions and to extend coverage into areas with weak coverage.

DOCR demonstration

The ATTC implemented a successful demonstration of the DOCR in the Washington, D.C. area. The demonstration system, shown in Figure 1, consisted of a primary transmitter, the repeater and a truck-mounted DTV reference receiver. The primary transmitter on UHF channel 34 (590-596MHz) was initially provided by WETA-DT, a PBS station operating with an experimental license, and later by WUSA-DT, a Gannett Broadcasting station. WUSA-DT transmits its DTV signal at an ERP of 636kW using an omnidirectional antenna. The final field tests were conducted using WUSA-DT. The repeater was located at Neersville Peak on the Blue Ridge Mountain near Harpers Ferry, WV, approximately 42 miles from the primary transmitter. The target area was the community of Charles Town, WV, which was effectively blocked from receiving WUSA-DT by Blue Ridge Mountain.

DOCR antenna design

The design of the DOCR antenna system is critical. The amount of feedback from the DOCR transmit

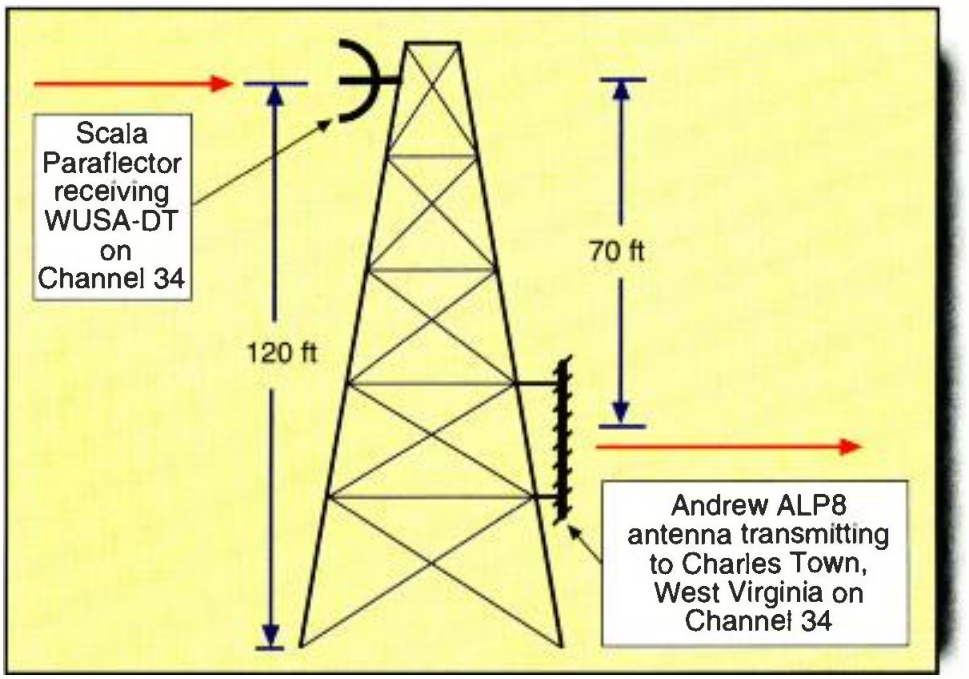


Figure 2. The ATTC DOCR antenna system utilized a Scala Paraflector antenna for receiving the primary signal from WUSA-DT on channel 34 and the Andrew ALP8L1-HSNR antenna to retransmit the DTV signal on the same channel. The antennas were placed on adjacent legs of the tower with as much separation as possible to maximize the isolation. The system was able to achieve an isolation of 120dB.

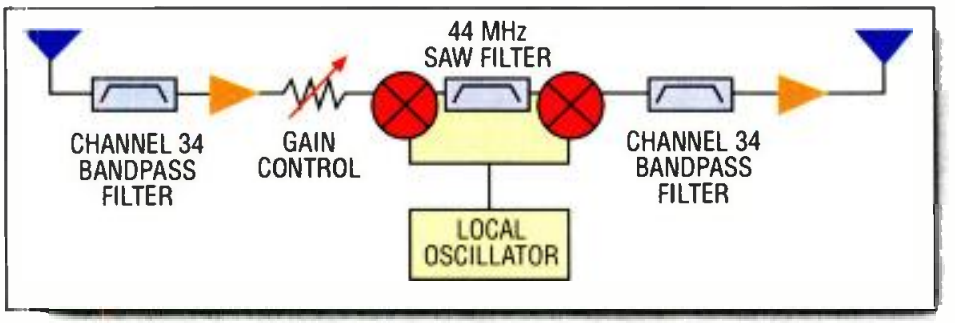


Figure 3. The ATTC DOCR electronics downconverted the primary DTV signal from WUSA-DT on channel 34 to an intermediate frequency, filtered the out-of-band signals and upconverted the signal back to channel 34 before retransmitting. The design easily achieved a transmit ERP of 1.2kW and provided significantly improved DTV coverage in the service area.

antenna coupled into the DOCR receive antenna directly limits the total power transmitted at the repeater. In addition, the feedback ultimately limits the performance of the DTV receiver. The antenna types and placements were chosen such that the coupling, and therefore the feedback, was minimized. Both DOCR receive and transmit antennas were chosen with high front-to-back ratios. Because the antennas were placed at different heights on the tower, antennas with narrow beam-widths in the vertical direction were selected to minimize coupling. The DOCR receive antenna was a narrow-beam antenna in both planes because it was aimed directly at the primary transmitter. The Scala PR-TV Paraflector was used for the receive antenna. The Andrew ALP8L1-HSNR was used for the transmit antenna. Figure 2 shows the antenna placements on the Neersville tower. The measured isolation at the antennas using a network analyzer was 120dB. With this isolation and the signal strength received from WUSA-DT, a repeater transmit ERP of 1.2kW with over 20dB of margin was easily obtained for the demonstration system.

DOCR electronics design

ATTC designed and implemented the electronics for rebroadcasting a DTV signal on a single channel (see Figure 3). The technique converts the received signal on channel 34 down to an intermediate frequency (44MHz), filters the signal using a SAW filter, then upconverts the signal to the original broadcast channel 34. The retransmitted signal is a copy of the primary signal with the addition of post-echoes caused by feedback through the antenna system. In addition to the post-echoes generated in the DOCR, a pre-echo can occur as a result of a direct, but weak, primary signal reaching the reference receiver in the test vehicle. Because the DOCR delays the repeated signal, the timing of the pre-echo is dependent upon the delay of the SAW filter used in the DOCR. Figure 4 shows the tap weights from the adaptive equalizer in the reference receiver, highlighting the various echoes that appear. The ATTC DOCR demonstration used a SAW filter with a four-microsecond delay requiring the DTV receiver to be capable of handling these pre-echoes. All second- and third-generation consumer DTV receivers have this capability.

Field test results

ATTC completed a series of field measurements to investigate the performance of the DOCR. The test vehicle and procedures conform to those used in previous ATSC field tests. A total of 51 sites were selected for testing. The field tests were divided into four categories: grid, cluster, arc and radial. Figure 5 illustrates the geographical area surrounding Charles Town and the various DOCR test sites.

The objective of the grid test was to determine whether the repeater improved reception in areas where the primary signal was weak. The twenty grid sites were arranged in a 4x5 matrix on two-mile centers placed within the Charles Town area. The grid was located along the main beam of the DOCR transmit antenna with the first row located four miles from the repeater and the farthest row 10 miles from the repeater. The grid was a relatively large rural area with rolling terrain. At each site, the field strength of the WUSA-DT primary transmitter was measured with the repeater off. The field strength repeated signal was measured while WUSA-DT was transmitting. Each site was examined for absolute and relative field strengths.

In general, the signal strength improved by nearly 20dB with the repeater. In addition, the site margin improved by 16dB. Site margin is defined as the excess signal strength above 41dBμV/m (the field strength

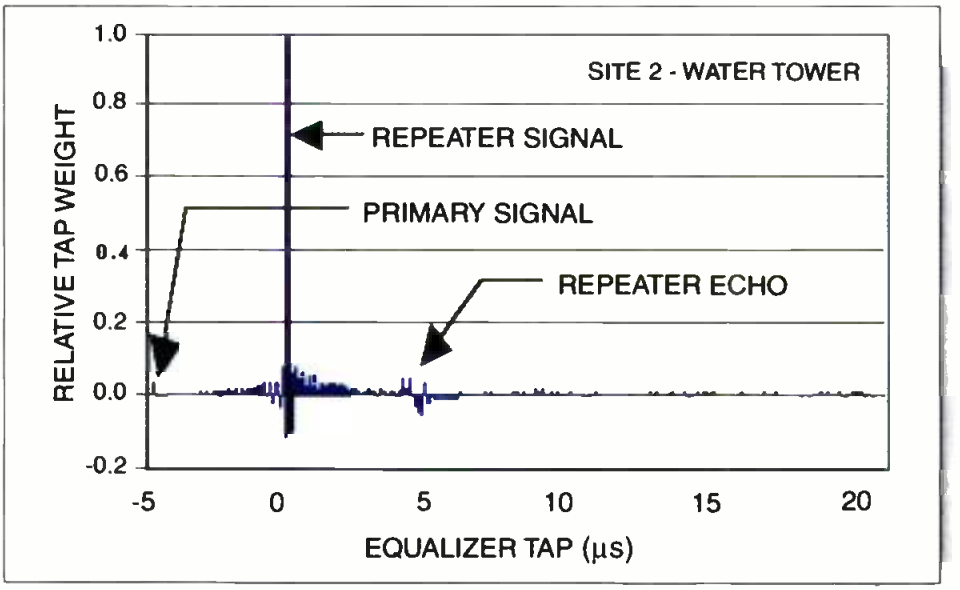


Figure 4. Equalizer tap weights from an 8VSB receiver illustrates the various echoes introduced by the digital on-channel repeater (DOCR). The primary signal will introduce a leading echo while feedback in the DOCR antenna system causes a lagging echo. Both echoes can be successfully handled by the equalizer in the DTV receiver.

at the edge of coverage). Further details of the field tests and test results are available.

Without the DOCR the success rate for reception of the primary signal was 75 percent (15 out of 20 sites). With the DOCR, the success rate increased to 95 percent (19 out of 20 sites). A 4μs leading echo that the reference receiver could not correct was the cause of the failed site.

The objective of the cluster test was to measure the performance of the repeater in an urban area. Twelve sites were selected in the center of Charles Town. The cluster included the effects of closely spaced buildings. The primary signal suffered from much higher attenuation in addition to more multipath in the urban environment. Several sites had adequate field strength, but failed due to multipath. The repeater significantly increased signal strength at every site. The increase in received signal strength with the DOCR was sufficient to override the impaired primary signal. In the cluster, only seven out of 12 successfully received the primary signal. With the DOCR, 100 percent of the sites in the cluster were successful.

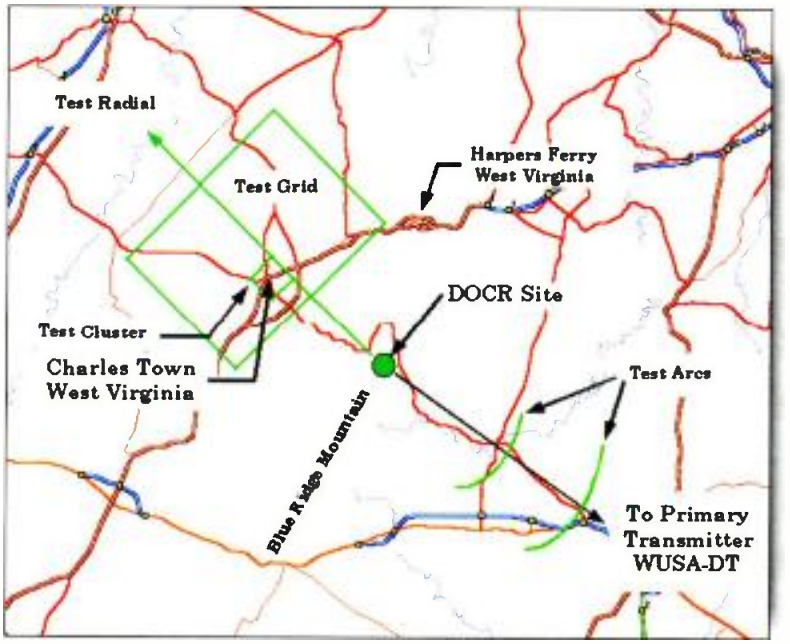


Figure 5. The digital on-channel repeater was successfully demonstrated on Blue Ridge Mountain near Charles Town. Various test sites were used to evaluate the system performance.

The ATTC DOCR receive antenna had a direct line-of-sight view of the primary station 42 miles away. The antenna was mounted on a rotor to investigate the effects of antenna orientation and coupling in the DOCR antenna system.

The objective of the arc test was to ensure the DOCR did not radiate appreciable energy into areas that were already capable of DTV reception from the primary signal. Two arcs were measured six and 10 miles behind the repeater (between the DOCR site and the primary transmitter site). At each site on the arc, a measurement of the primary signal was performed with the DTV test vehicle antenna pointed at WUSA-DT. The DOCR was then turned on and the signal from the DOCR signal was measured with the test vehicle antenna pointed at the DOCR. The signal strength at all sites for WUSA-DT was acceptable and had a receive margin in excess of 10dB. The field strength from the DOCR was not measurable, indicating excellent front-to-back isolation of the DOCR antenna system.

The objective of the radial test was to compare the performance of the demonstration DOCR, which did not have error correction capability, with a repeater that provided error correction at the transport stream level. Details of the test results are available. A DOCR design that provides error correction is especially useful in multiple-hop systems where it is necessary to improve the overall DTV signal.

Findings

The digital on-channel repeater provides the broadcaster with an important tool to improve and extend coverage. Because the DOCR utilizes a single channel, it is the most spectrum-efficient approach for the transition of translators to digital television. ATTC has demonstrated that the DOCR is an effective means to extend reliable coverage into areas of marginal DTV service due to signals being blocked by the terrain. The demonstration also confirmed that the DOCR is able to improve coverage into areas of low signal strength or strong multipath. These improvements are achieved by increasing the received signal strength well above the primary signal to ensure reliable DTV reception.

The ATTC is now working with Oregon Public Broadcasting and others to apply the DOCR to provide coverage in areas that currently rely heavily upon translators. Strongly consider DOCR technology for the full replication of the NTSC coverage area. ■

Charles Einolf is the deputy executive director for the Advanced Television Technology Center, Alexandria, VA.

On-channel boosters to fill DTV coverage gaps

By Sam Zborowski

The rollout of DTV service brings new concerns for signal coverage to broadcasters. Significant populations of viewers reside in "propagationally challenged" areas that are substantially terrain-shielded from primary transmitter locations. Many of these coverage gaps occur well within the predicted (noise-limited contour) coverage region of the associated DTV station. This problem is particularly acute for stations with UHF DTV channel assignments. With the cliff effect of the DTV system, many receive locations which now experience a weak, noisy NTSC signal may find the DTV signal level below the receiver input threshold, producing unreliable service or no service at all. Where channels are not available for translators, the use of on-channel signal boosters may prove to be helpful in filling specific gaps in coverage.

On-channel boosters have been employed in cases where the population to be served is substantially terrain shielded from the originating transmitter. Boosters can also be used to fill smaller coverage gaps where they could result in interference to the reception of the originating station at some locations. With careful analysis of terrain/propagation, demographics, antenna patterns and receiver capabilities, on-channel boosters can be successfully deployed to fill significant coverage gaps in the primary DTV service area.

The use of very low-power boosters by individuals to overcome terrain obstructions is known from the earliest years of television broadcast service. The use of signal boosters in multichannel, multipoint distribution service (MMDS) at 2.5GHz is relatively common to solve similar terrain obstruction problems. Both analog and digital MMDS systems employ boosters.

FCC rules govern the use of NTSC translators, such as at this site near Monroe, UT, to boost coverage in mountainous areas. While on-channel boosters could improve DTV services in such areas, the FCC has not established regulations for DTV translators. Photo courtesy of Kent Parsons.

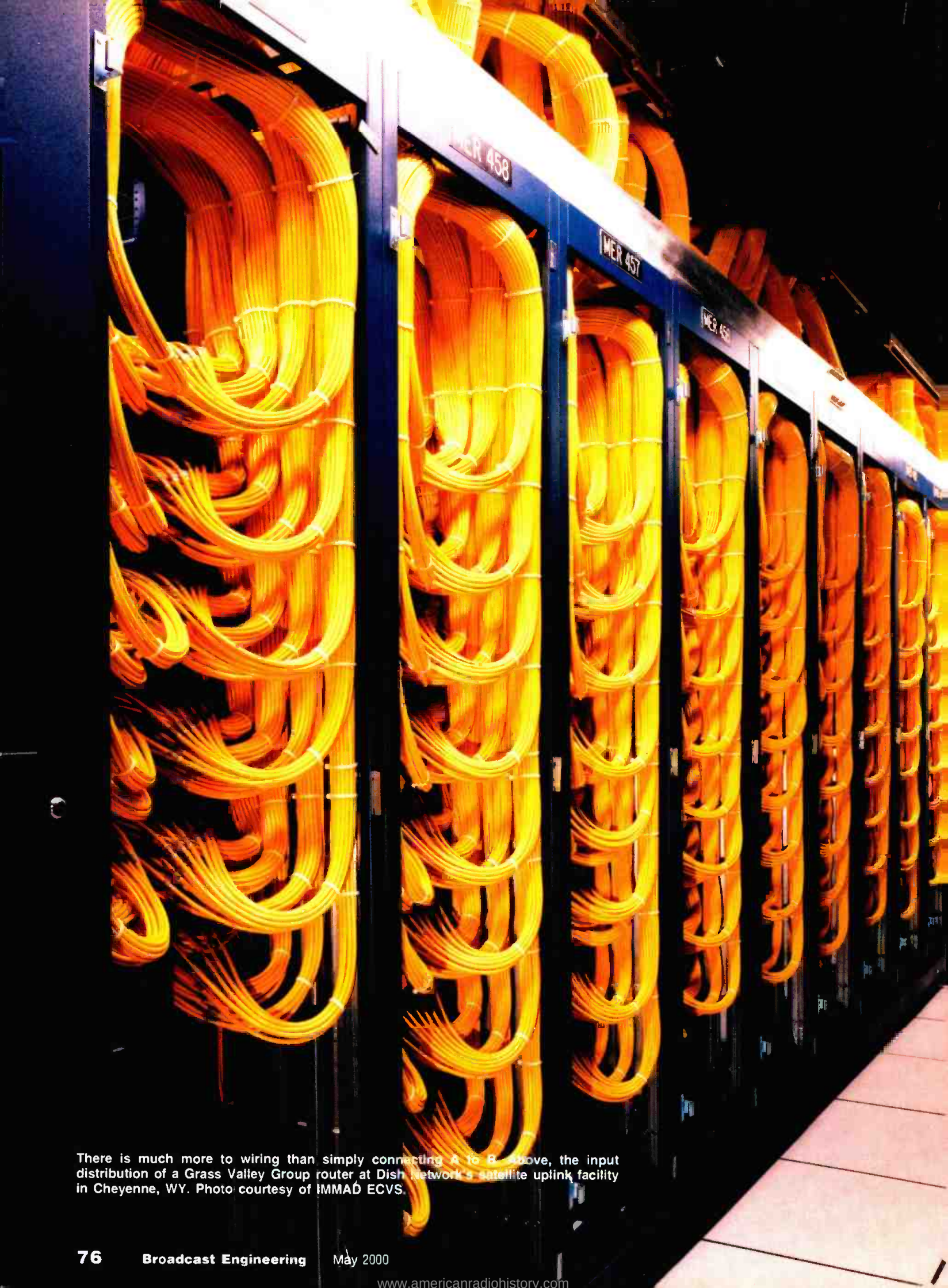
Booster regulations

As of this writing, the FCC has no rules in place to authorize the licensing and standard operation of DTV boosters. Translators and boosters for analog TV service are covered under Part 74 along with LPTV service. Similarly, as of this writing no regulations are in place to authorize standard operation of DTV service with translators or in LPTV. Discussions with various FCC staff members indicate the need for a comprehensive study of Part 74 services relevant to DTV and digital services in general. Such a study, together with the related petition for rulemaking, comment periods, likely reconsideration and further comment periods, optimistically will take several years to arrive at adopted rules for these digital services. There are substantial areas that lie well within the defined service areas of many DTV broadcast stations, yet they are essentially terrain-shielded from adequate DTV coverage. The problem is especially acute in mountainous areas. A possible fast-track approach to relieving this problem would be for the FCC to authorize DTV booster deployments by each Part 73 licensee within its DTV station service area. The Part 73 booster rules can and should be separate from the Part 74 rules. Each Part 74 operation would introduce a new service area for each new station that merits a comprehensive interference study. A comprehensive interference analysis is performed as part of the existing process for each Part 73 DTV station to obtain its main station license. It is a much simpler process to add low-power boosters within an existing DTV service area in such a way as to provide improved coverage while adding little additional field strength at the noise-limited contour. For example, a showing could be required to predict less than 1dB increase at the noise-limited contour due to addition of all planned boosters. This type of deployment can bring coverage benefit with little risk of harmful interference to adjoining service areas. The FCC has been conducting a biennial review of the new DTV service. The biennial review process may provide a convenient vehicle to incorporate suitable Part 73 DTV booster rules.

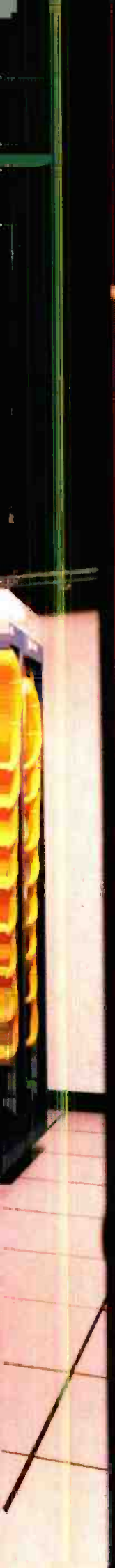
Antenna isolation

A critical requirement for on-channel booster applications is to achieve sufficient isolation between receive and transmit antennas. The required isolation is proportionately greater with greater system gain. Booster system gain requirements grow with the need to cover a larger area (higher output power) and weaker input signal level (booster located farther from the originating station). The MMDS case is generally easier to implement than the UHF TV broadcast case due to availability of antennas with narrower beamwidth and better sidelobe performance in a modest physical size. MMDS systems can also take advantage of cross-polarization from booster input to output to improve antenna isolation. This is possible because the system operator provides the receive equipment with the appropriately polarized antenna for each receive site. In the broadcast TV case the consumer provides the receive antenna, which is generally assumed to be horizontally polarized. This assumption suggests that the broadcast TV booster should be H-POL input and output. ■

Sam Zborowski is chief technical officer at ADC Telecommunications' broadcast division, McMurray, Pa.



There is much more to wiring than simply connecting A to B. Above, the input distribution of a Grass Valley Group router at Dish Network's satellite uplink facility in Cheyenne, WY. Photo courtesy of IMMAD ECVS.



Wiring & Connectors

By Dale Reed

HDTV is bringing significant changes to the video broadcast market, not the least of which involves the coax used for interconnection. Numerous signal issues have arisen regarding the higher data rates of these new technologies. Despite a number of possible standards, both interlaced and progressive, some iteration of 1080 remains an industry goal, meaning that even greater bandwidth issues could be on the horizon.

The coax used in television stations, production facilities, mixing/editing suites, CATV headends and other video systems will need a major upgrade to support the bandwidth requirements of HDTV. This article examines the challenges that exist in rewiring a facility, reviews the RF effects involved and offers some recommendations.

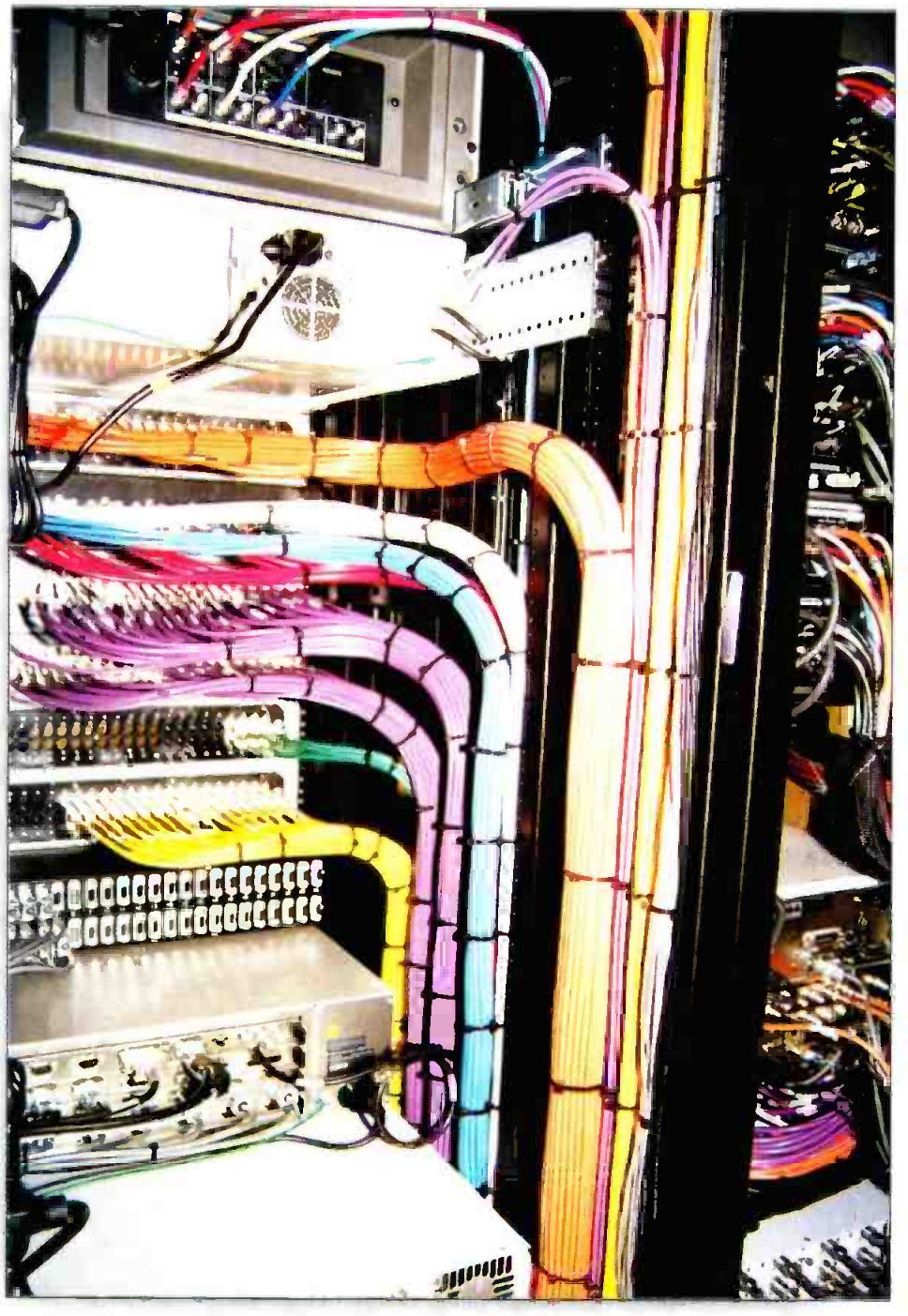
Wiring & Connectors

It's about bandwidth

Standard-definition video signals do not require the bandwidth necessary for high-definition signals. Bandwidth is a measure of capacity that describes low-to-high frequencies used to transport signals. Requirements therein vary widely and are based on application. For example, the bandwidth of an analog telephone signal is around 3kHz, whereas the bandwidth of an audio CD is about 20kHz. The difference is the main reason why CD audio sounds so much better than a voice over telephone.

As a practical matter, higher bandwidth means higher frequencies. This is where the fun starts. The science of electronics must be adjusted when frequencies approach the RF zone and above. The laws of physics warp when transmitting signal down a wire. As the frequency gets higher, wavelength diminishes and the energy transmission migrates from electrical to electromagnetic in nature.

RF typically refers to frequencies from 500kHz to 100GHz. In some circles, RF has come to stand for the electrical signals sent at high frequency over a controlled impedance line. For example, HDTV signals sent over coax cable essentially transform that cable into transmission line. At these higher frequencies, RF effects like return loss (or VSWR), skin effect and insertion loss can make a big difference.



Today's high-bandwidth facilities require cabling and connectors designed for the task, as well as practices to lessen the RF effects associated with the routing of such signals. Photo courtesy of Professional Communications Systems.

Return Loss: When signals travel down a wire, a portion of the signal is reflected back toward the source at every discontinuity. The reflected signal returns down the line and meets the existing inbound or incident wave, creating distortions in the waveform and its intensity. As a result, energy is lost. Because the loss is due to reflections, simply turning up the power level can worsen the problem.

Discontinuities, those things that might cause reflections, include abrupt changes in direction (a 90-degree corner in a signal trace), geometry (small conductor to a large connector) or in impedance (a 75Ω cable into a 50Ω connector). At sub-RF frequencies, these reflections are minor, but as the frequency increases reflections can seriously alter the original signal. If the reflection is 180 degrees out of phase and equal in amplitude to the original signal, the two can cancel each other completely.

One of the most common errors committed by broadcast equipment suppliers is using 50Ω jacks on their equipment and specifying them for connection to a 75Ω connector and cable assembly. Table 1 shows the degradation in line performance when a 75Ω transmission line is mated to a 50Ω component, or vice versa. At low frequencies you can see there is no real penalty, but at higher frequencies the increase in return loss is significant.

Skin Effect: In low-frequency designs, the conductor's size is directly related to the amount of tolerable temperature rise allowed in the system. All conductors become resistors and create heat at some power level. For low-frequency designs, this is a known and attributable loss value for energy. But this is not the case with high-frequency signal management. As frequency rises, energy moves to the outside surface, or *skin*, of the conductor (see Table 2). The

thickness of the skin region varies with frequency — the higher the frequency, the thinner the skin region. For RF transmission, about 98 percent of the total energy in the signal exists in the region three times the thickness of the skin.

Insertion Loss or Attenuation: Attenuation is an alternate name for throughput loss — the total amount by which power received is less than power transmitted after a device has been inserted. This applies to the entire connector/cable system. In any signal path, energy is used up in conductor losses (transformed to heat), dielectric losses, reflection and radiation. The signal is thus attenuated or reduced in energy level. Loss is measured in dB, usually expressed in dB per 100 feet. Distance plays a major role in loss values.

For longer transmission lines, properties of attenuation are crucial. Most coax cable, for example, is rated based on attenuation per unit of length. Because the signal is not in the connector for long relative to the time it spends moving through the cable, attenuation is of less importance for connectors.

In some cases, it is desirable to produce a full attenuation of an incoming signal. This is called a *load* and is typically a termination resistor that absorbs the incoming signal and eliminates reflection back to the source.

These RF effects can work in concert to degrade your signal. And with digital signals in general, even a single dB of degradation matters. Signal degradation is not at all gradual. You either have enough signal to get a perfect picture or you get no signal at all, hence the term *cliff effect*.

SMPTE 292

SMPTE 292 is still an emerging document and has to contend with the uncertainties in standards that currently exist. The specification states the wire line will be 75Ω and capable of supporting better than -15dB of return loss. This level is a compromise in performance and that specification will most likely be tightened considerably, perhaps to -20dB. SMPTE 292 also specifies the digital signal will utilize the third harmonic and must be capable of handling a data rate of 1.5Mb/s.

Digital technology involves a series of ones and zeros that represent samplings of the real or analog situation. Because it is only necessary to determine that a given signal is not a zero, one of the tricks to increasing processing speeds is to square up the wave form so it transitions rapidly from one state to the other. One of the properties of wave propagation is that the odd harmonic of a wave can be used to square the wave (see Figure 1). The reference to a third harmonic is simply a description of the extent of squaring specified. The impact of this on the required bandwidth is that now the harmonic needs to be discernable, making the bandwidth of interest just over 2GHz.

The digital technology that allows transmission is far more forgiving of extraneous noise on the cable. Because we are only trying to select between a one and zero, and can be almost certain when we have one of these, it becomes easier to discard the other spurious noise.

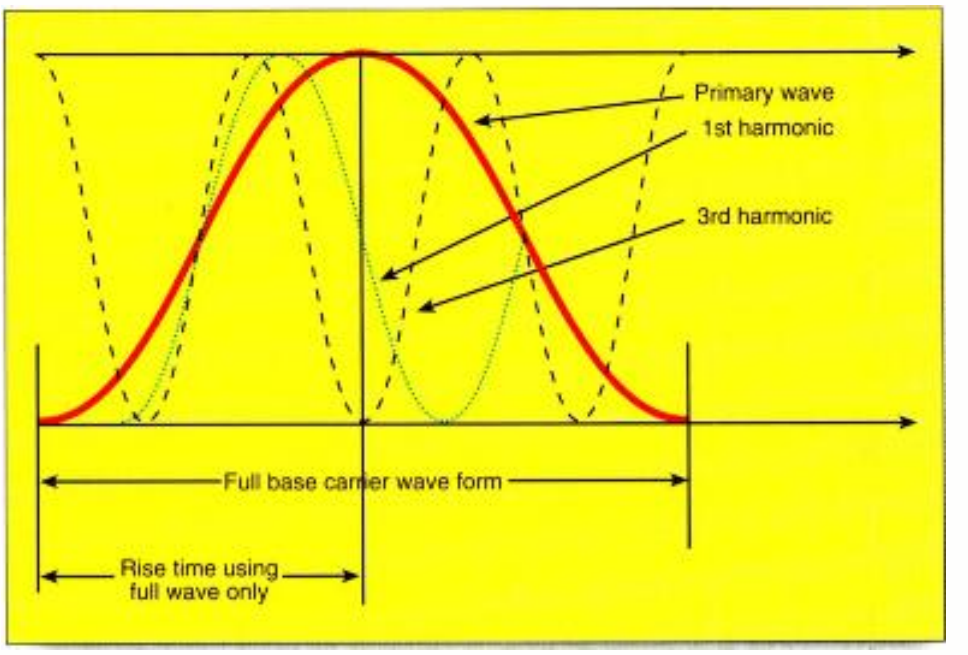


Figure 1. Using harmonics to square a sine wave results in faster signal rise time.

For RF transmission, about 98 percent of the total energy in the signal exists in the region three times the thickness of the skin.

Transmission paths

The key components of an in-station transmission line are the patch jacks, cable and connectors (including the equipment jacks, distribution panel jacks and cable terminating plugs). The coax cable used in transporting

Mating Impedances	1 to 20MHz	20 to 300MHz	0.3 to 2GHz
75/50	>-30dB	-24dB	-7dB
75/~75	>-30dB	-25dB	-12dB
75/75	>-30dB	-25dB	-21dB

Table 1. Degradation of RF performance due to impedance mismatch with rising frequency. The first column shows the two impedances. The following columns show the resultant return loss at various frequencies.

One skin depth (in inches)	Frequency
0.315000	60Hz
0.027000	10kHz
0.000790	10MHz
0.000028	10GHz

Table 2. The thickness of the skin region varies with frequency. Shown are skin region thicknesses for several frequencies.

Wiring & Connectors

the HD digital signal from place to place within a facility is quite good. However, in most cases it still needs to be replaced because it was designed for lower frequency and higher insertion loss conditions. The major cable manufacturers have not stopped innovating to achieve better insertion loss performance. Use of low-loss dielectric materials and lower dielectric constant materials is growing. Typical values on some new cable types today are 9dB loss per 100 feet of length at 1GHz. (Note that the key technical issue for cable selection is insertion loss over distance.) Further, the tradeoffs of overall cable diameter, cable weight and cost are being addressed.

In most stations, digital video patch jacks are used to insert new signal content into a signal stream that is already in place. For that reason, patch jacks are specified as normal through, meaning that the back end or BNC jack side is wired to pass the energy through the jack and onward if nothing is in the front panel or patch side. The interior of the jack itself is a tough engineering assignment, because the switching function must coexist with multiple signal paths, all of which need shielding and dielectric controls for optimum signal processing.

Another key element of the transmission line is the BNC connector itself. Many low-end BNC connectors are not capable beyond 1GHz. Test results on leading BNC connectors supplied to the U.S. broadcast market over the last decade reveal they can significantly degrade the signal at the upper end of the HD bandwidth. Fortunately, improved products have entered this market. The technology exists to permit BNC connectors that perform through 2.5GHz with better than -30dB of return loss.

Attenuation losses are, to a large extent, cumulative. Many engineering assignments start out with a loss budget that can be spent on excellent hardware (cable, connectors, patch products) or distance. The more dB of loss you can provide as headroom for your signal, the less stress you place on the system for signal discrimination and the more fault-tolerant your installed transmission line will be.

> The technology exists to permit BNC connectors that perform through 2.5GHz with better than -30dB of return loss.

Suggestions

The bandwidth levels in common usage in today's facility are not such that signal management has been at issue. Accordingly, it hasn't been necessary to fully address the engineering problems outlined above. With the advent of HDTV, this will change. Fortunately, these problems are well known to microwave engineers and there are existing solutions. Consider the following steps to reduce your risk.

- Staff your engineering group with RF-savvy engineers.
- Purchase components that conform to performance specifications like SMPTE 292 and support efforts to improve this evolving specification.
- For manufacturers, incorporate known solutions in design – i.e. as frequency goes up, the need to appropriately control the electromagnetic fields goes up. This is done through precision control over the dielectric constant of the insulating material, proximity (distance) to ground through the dielectric material, and the geometric precision of the product features. Good design tools for modeling RF effects are readily available for achieving designs that consider signal degradation due to RF effects.
- Use suppliers who have a demonstrated track record in RF design. Quiz them on the issues discussed herein; see if they know what your problems are before they offer products that solve them.

Finally, embrace the change and have fun. HDTV is the single biggest event to hit our industry since color and you are in the middle of it. ■

Make sure that your BNC connectors are up to the task of routing your signal. Many low-end BNC connectors are not capable beyond 1GHz. Photo courtesy of Commscope.

Characteristic	SDTV	HDTV
Bandwidth	up to 45MHz	up to 2.5GHz
Primary conductor usage	full cross section	surface only or skin
Dielectric	voltage barrier	propagation velocity, tight tolerance, low loss
Impedance matching	modest importance	must be matched, critically important to minimize reflection
Connector	insertion loss resistance (heat)	reflection (VSWR), potential signal canceling
Losses	conductors (heat)	dielectric (radiation)

Table 3. Differences between SDTV and HDTV relative to signal transmission.

Dale Reed is the vice president of marketing for Trompeter Electronics, Westlake Village, CA.

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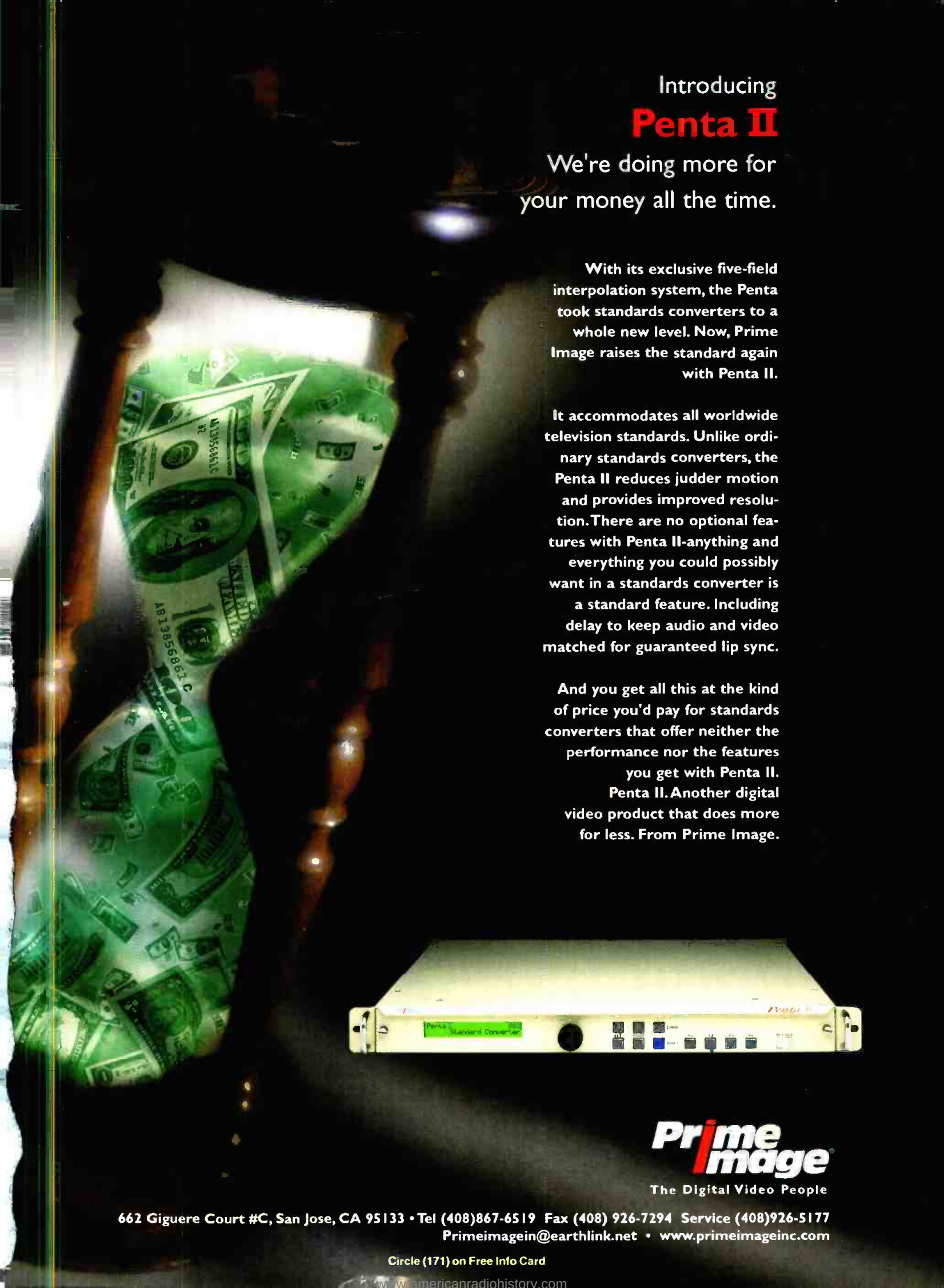
HD Production: HD storage servers

By Chris Romine

Now that HD is being widely embraced by the broadcast, production and post-production industries, HD server technology is being examined more closely. In many cases, the early adopters of HD took what they could get. Their primary objective was to get *something* going to compete for the limited opportunities offered by their clients. Fortunately, several manufacturers demonstrated a strong commitment to customer relationships with these courageous pioneers and products were made available.

More and more facilities are turning to uncompressed storage for their HD content. Shown here is the main edit suite at American Production Services' Seattle facility. Photo courtesy Concept: Benson and Rice.



Today, as more cost-conscious players enter the market, the demand for value and flexibility has taken priority over availability. At NAB 2000, there were several demonstrations of HD storage solutions for the budget-driven user. While many of these new products use compression to reduce cost, a surprising number of manufacturers now offer uncompressed solutions. So, with compressed storage so widely available, why spend the extra money on an uncompressed HD video server? What are the advantages of uncompressed storage? Where is it used?

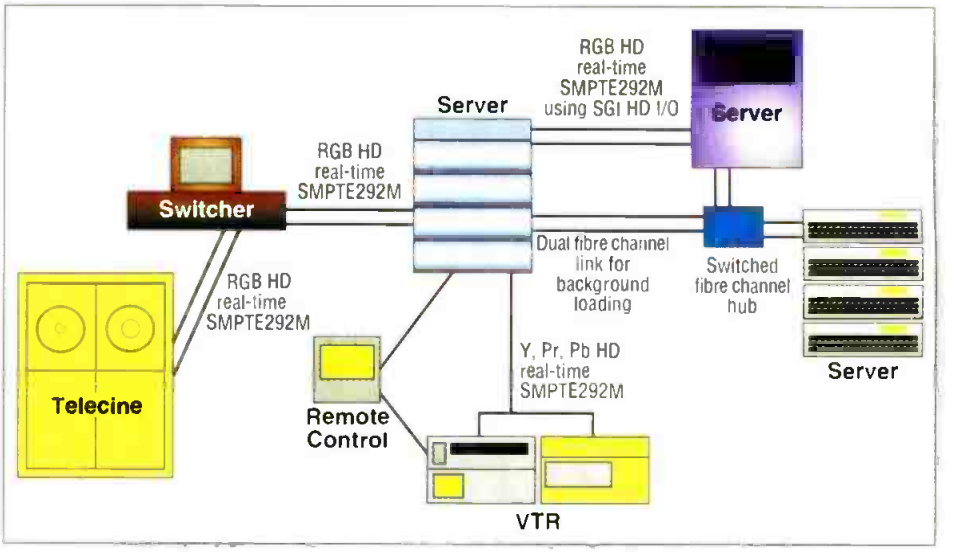


Figure 1. Using networked digital systems, digital image information can be acquired, manipulated and stored in a variety of formats (compressed or uncompressed) on either tape or disk.

What is an uncompressed HD storage server?

For purposes of this discussion a true uncompressed video disk recorder or storage server records the full bandwidth HD signal at 1.5Gb/s without modifying the material in any way. Normally, the four to 16 tracks of accompanying digital audio are also recorded without compression. Fields and/or frames are individually accessible without the need for the supplementary information or boundary constraints normally associated with compression algorithms and computer file formats. Unlike compressed solutions, uncompressed HD storage devices normally comprise multiple disk drives in a RAID 0 or RAID 3 configuration striped with image data by a common controller. Manufacturers differentiate their products by the value added to this basic storage. Features such as support for multiple HD and SD formats, fast computer interfaces, synchronized audio, frame-accurate edit capability and full bandwidth RGB (4:4:4 or 22:22:22) performance are available.

Many manufacturers tout HD I/O capability using the 1080i, 720p and 1080/24p nomenclature for their vid-

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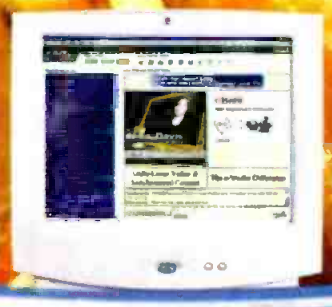

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eo storage devices without highlighting the actual internal recording format. Panasonic's HD D5 format utilizing a separate HD processor for encoding and decoding video signals popularized a class of disk-based recorders based on their technology. These recorders rely on the HD processor's mild compression (approximately 5:1) to reduce data rates from 1.5Gb/s to 360Mb/s. Similarly, Sony's HDCAM encoder/decoder board set reduces the bit rate from 1.5Gb/s to 270 Mb/s. These lower data rates allow some standard-definition SMPTE 259M disk recorders to record and play back 292M HD material when connected to the appropriate processor or codec.

The pros and cons of uncompressed storage

While the disadvantages of uncompressed HD storage are few, they are significant to the decision-making process. Increased initial cost is the most obvious of the perceived showstoppers. The word "perceived" is used here because the technology of compression is still evolving, suggesting that today's encoders and decoders will become obsolete long before the useful life of today's uncompressed solutions. The packaging of uncompressed storage also requires more rack space and the increased number of hard disk drives require additional power. The failure rates of hard disks have been reduced to the point that reliability is not a major issue, but it does remain a factor. Some compressed devices store images in a format native to an application, eliminating the need to convert or reformat image files, sometimes a time-consuming process.

Increased initial cost is the most obvious of the perceived showstoppers.

The advantages of uncompressed video storage are many. As compression of HD digital video becomes more pervasive, multiple compression algorithms are applied in the workflow between content creation and transmission or distribution. In that environment, the quality of the source material becomes more critical. Artifacts due to encoding and handling of the material can increase both post-production and distribution costs. Uncompressed images are more suitable for facility servers that require film transfer and grading, paint and effects work in the graphics department and online edit and compositing prior to print or distribution. At this time, no efficient method exists for computer access to compressed HD D5 or HDCAM material. The quality resulting from the multiple encode/decode passes necessary for computer access to 1080i, 1080p or 720p formats using these compressed VTRs or their disk recorder counterparts has proven unacceptable in some applications. Finally, uncompressed storage is more likely to be independent of computer platforms

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and other evolving technologies that can render equipment obsolete before a facility can amortize its costs. This factor can partially neutralize the initial cost disadvantage of uncompressed storage.

Data vs. video

A recent development in uncompressed image storage and transfer is worth noting. The notion has been that image quality could only be maintained if the images were transferred and stored in an RGB data format. Moving high-resolution images in data form around a facility has been slow and expensive. An argument for compressed images has been transfer speed. A proposal currently before SMPTE, and supported by manufacturers such as Cintel, Philips, Discreet Logic, da Vinci, ITK and Sierra Design Labs, specifies using dual 1.5Gb/s HD links to transport full bandwidth RGB images at up to 125 percent of real time using 1080/24p material. Look for further developments in this technology.

An argument for compressed images has been transfer speed.

Typical workflow models for HD servers

Figure 1 shows a simplified workflow model using an uncompressed HD storage server. In this example, film-based material is transferred from a telecine, film scanner or VTR in full resolution at 30 frames per second into the server. This can be either directly or through a color correction system. The server has the ability to then transfer high-resolution images to a workstation as data using either dual-link HD I/O in real time or a high-speed computer connection such as Fibre Channel in background. Images can be stored on attached RAID systems to free up the video server for projects or backed up to tape as archive or offline storage between project phases. The workstation processes selected images for paint, compositing, editing and/or restoration. In more efficient installations, the server has built-in VTR edit capability and the ability to play out multiple formats without reloading the material,

New Products & Reviews

Applied Technology

Aphex Thermionics: Model 1100 mic preamp

BY MARVIN CAESAR

A mic preamp combining new design philosophies allows broadcasters to safely run at higher gains without noise and overload distortion.

The value of a wide dynamic range

Consider dynamic range as a window. The top is the maximum peak level and the bottom is the noise floor. These are physical limits existing in both analog and digital. Ideally, the window should be wide enough to accommodate the highest input level without any overload distortion, while adding as little noise as possible to the signal.

Wide dynamic range for a microphone preamplifier is particularly important, as the level of the input into the microphone can vary greatly. In order to accommodate these variations, the gain in the preamplifier is set so there is no overload distortion on the highest peaks. The difference between that nominal gain setting and the maximum peak level is headroom. Setting the gain too low in the preamplifier, however, will require gain in a later stage. Any increase in this gain will also boost the noise from the preamplifier. Obviously, the lower the noise floor in the preamplifier, the lower the noise on the final output.

If the output of the preamplifier is digitized at too low a level, the conversion will have low resolution. One bit represents 6dB of dynamic range in the digital domain. Once the signal is converted, there is no way to increase the resolution.

Level variations from live acoustic sources such as voices or instruments can be quite high, so it is imperative that a great amount of headroom be set in the conventional preamplifier. This reduces the chance of overload due to an unexpected increase in input level. However, this means that the nominal output level will be low and will have to be boosted in a following gain stage. This creates noise buildup, since any gain taken on the signal after the preamplifier increases the noise from the preamplifier by the amount of gain in the second stage. For example, if the noise of the preamplifier is –60dBu and the noise of the following stage is –60dBu with 10dB of gain, the noise at the output of the second stage will be –47dB. When two equal noncorrelated noise sources are summed, the noise is increased by 3dB. As you can see, noise builds up very quickly if the dynamic range of each gain stage is not maximized. That is why it is essential to choose the equipment with the widest possible dynamic range. The most important gain stage is the first — the microphone preamplifier.

Aphex Thermionics Model 1100 Discrete Class A microphone tube preamplifier.

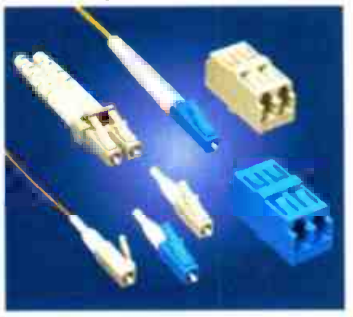
An important specification for any microphone preamplifier is the equivalent input noise (EIN). The noise is measured with the input shorted and at a specific gain and that figure is added to the gain to obtain the EIN. The dynamic range of a preamplifier at a specific gain setting is computed by adding the noise and the maximum output level.

Designing the 1100

One of the primary design goals of the Model 1100 was to have as wide a dynamic range as possible. Several key inventions combined with a no-compromise selection of components create a microphone preamplifier with unprecedented performance. The EIN with 65dB of gain is an incredible –135dBu. That means the Model 1100 adds less than 1dB of noise to the natural self noise of a 150Ω microphone. The worst case dynamic range is 97dB to 101dB. But low noise is only part of the story.

• 20dB extra headroom. The Model 1100 has two inventions that provide up to 20dB of extra input headroom so that it is virtually impossible to overload the preamplifier and a third that maximizes available headroom in the digital domain. The first, the MicLim, comprises a custom-designed optical attenuator directly on the microphone input line, which smoothly limits the microphone output signal prior to the preamplification by up to 20dB. The peak limit detector is located after the preamplifier input stage and feeds a control current back to the attenuator so that the input signal remains below clipping. MicLim has no effect whatsoever on the input sig-

LC Fiber Optic Connector Products



Methode Fiber Optic products manufactures a complete line of LC connectivity products for voice, video and data applications. The LC brochure details product specification and performance standards of this small form factor solution. Singlemode and multi-mode connectors, adapters, simplex and duplex patchcords, and cabling hardware are now available.

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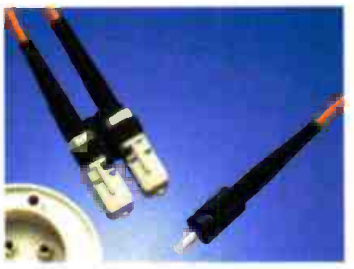

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Quantum QX™ Backplane System

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MP™ Connectors

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SC Fibre Channel Loopback

Methode offers several loopback products to test a variety of optical network and basic transceiver operations. Fibre Channel System (FCS) compatible loopback connectors are available with several attenuation levels.

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nal until the preamplifier's output approaches clipping. The second is a tunable low frequency cancellation filter (LoCaf) meshed into the nodal intersections of the first and second amplifying stages in a servo configuration. Finally, a patented drift-stabilized A/D converter eliminates the DC in the analog domain without a high pass filter. This allows the input to be at the true maximum level, without requiring extra headroom in the converter to allow for the DC.

• **Full-featured AES/EBU digital audio output.** AES/EBU XLR output is standard, with clock synchronization options and digital audio signal controls on the front panel. Digital and analog outputs may be used independently and respond equally to input gain, low-cut filter and all front-end conditioning effects.

• **Precision three-turn output level attenuator.** In order to match the analog output of the Model 1100 to the user's system level, the output gain is adjustable from 0dB (max gain) to –14dB.

• **48-volt phantom power circuit.** Very slow rise and fall of the phantom voltage is used to eliminate turn-on and turn-off thumps.

• **Series-shunt, optical soft mute attenuator.** The second-stage output signal passes through a specialized series-shunt optocoupler circuit to provide a soft mute without introducing distortion or noise.

• **Front panel peak headroom meter and function controls.** Each channel contains a 20-segment LED headroom meter calibrated in decibels below clipping, where 0dB is the analog clipping point. The headroom meter also indicates the digital audio level accurately.

• **Rear panel mute jack.** The mute function may be activated by the front panel control or by a remote switch plugged into the mute jack.

• **Internal linear low-noise power supply.** Though it was a heavier and more expensive option, we designed the Model 1100 with a high-quality, fully regulated, linear power supply to maintain the highest audio performance.

Sound quality by design

While specifications and functions are important, the most important characteristic of a piece of audio gear, particularly a microphone preamplifier, is how it sounds. The sound of the Model 1100 is clean, clear, present, open and solid. This sound is achieved through the use of proprietary designs, careful engineering and the highest quality components as described below.

• **Ultra low-noise, transformerless, discrete Class A, bipolar PNP, variable gain differential input stage.** No outer feedback is used, eliminating the possibility of any dynamic interaction with the microphone's self-impedance. The input impedance remains passive, providing an optimal load for any microphone. The solid state, Class A, PNP bipolar design achieves high common mode rejection with extremely low noise, wide bandwidth and low distortion at all gain settings. The gain is adjustable in 4dB precision steps from 21dB to 65dB.

• **Tube, discrete Class A differential second stage.** The Aphex-patented "Reflected Plate Amplifier" tube circuit is configured as a single-triode differential opamp to further enhance the preamplifier's common mode rejection. This imparts the tube's sonic warmth and character while retaining relatively long and stable operating life.

• **Tube, discrete Class A output stage.** A "Reflected Plate Amplifier" tube circuit is configured as a low distortion triode buffer having a very low output impedance and high output current drive and a maximum output level of +27dBu. Matched-impedance balancing assures peak performance whether driving balanced or unbalanced lines. A rear panel switch is assigned to insert a 12dB low impedance pad into the output line for systems based on IHF (semi-pro) operating levels. Rear panel XLR and quarter-inch phone jacks are both provided for balanced output.

Every circuit and component that went into the Model 1100 was studied and scrutinized for optimum performance. The result of the innovations and careful engineering is a uniquely excellent preamplifier. ■

For more information on the Model 1100 microphone preamplifier from Aphex, circle (278) on the Free Info Card.

Marvin Caesar is president of Aphex Systems.

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Applied Technology

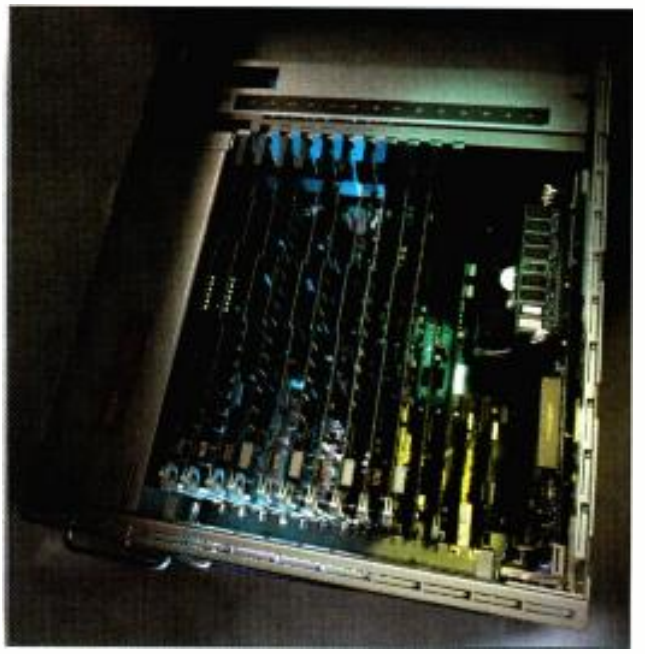
Grass Valley Group's Profile XP Media Platform

BY MIKE CRONK

The rapid expansion of bandwidth availability, networking technology, processing speed and storage capacity is creating an unprecedented number of new opportunities for producing and distributing content. To fully leverage these opportunities — to even keep pace with them — engineers must chart a capital equipment plan that simultaneously accommodates a transition from analog to digital and the ability to broadcast in high definition and over multiple DTV channels. It must also build an infrastructure that enables central casting, interactive television, data services and the Internet. These carefully laid plans must be flexible and highly scalable, as these new digital distribution mechanisms are still evolving.

Several questions arise during the development of a sound plan for a digital business model. How many formats should I produce in? What are the implications, if any, to my existing production work flows in the station? How do I efficiently tailor content for each medium? What formats should I archive? Perhaps the most compelling question is "What is the lowest-risk approach to rapid financial growth in a period of extremely rapid technological change?" The practical answer is a capital equipment strategy that essentially costs no more than the standard-definition equipment of today, works within the existing plant infrastructure and can address the needs for these new services.

The Grass Valley Group has a digital media platform that addresses these concerns and will support a sound capital equipment strategy: the Profile XP Media Platform. At its inception, the Profile XP Media Platform had to meet four objectives. It had to handle all formats from high definition to Web video, MPEG to DVCPRO, AES to Dolby, and NTSC to Internet protocol (IP). Its software architecture had to be flexible enough to accommodate the applications currently developed for the platform, in addition to providing for any future applications. It had to provide strong links to powerful asset management systems and have a strong archive solution. Today, it is the focus on these design goals that makes the Profile XP Media Platform more than just a video server and enables it to provide answers to the challenges today's broadcast engineers are facing. It is this focus that truly defines the Profile XP as the media platform for digital broadcasting.

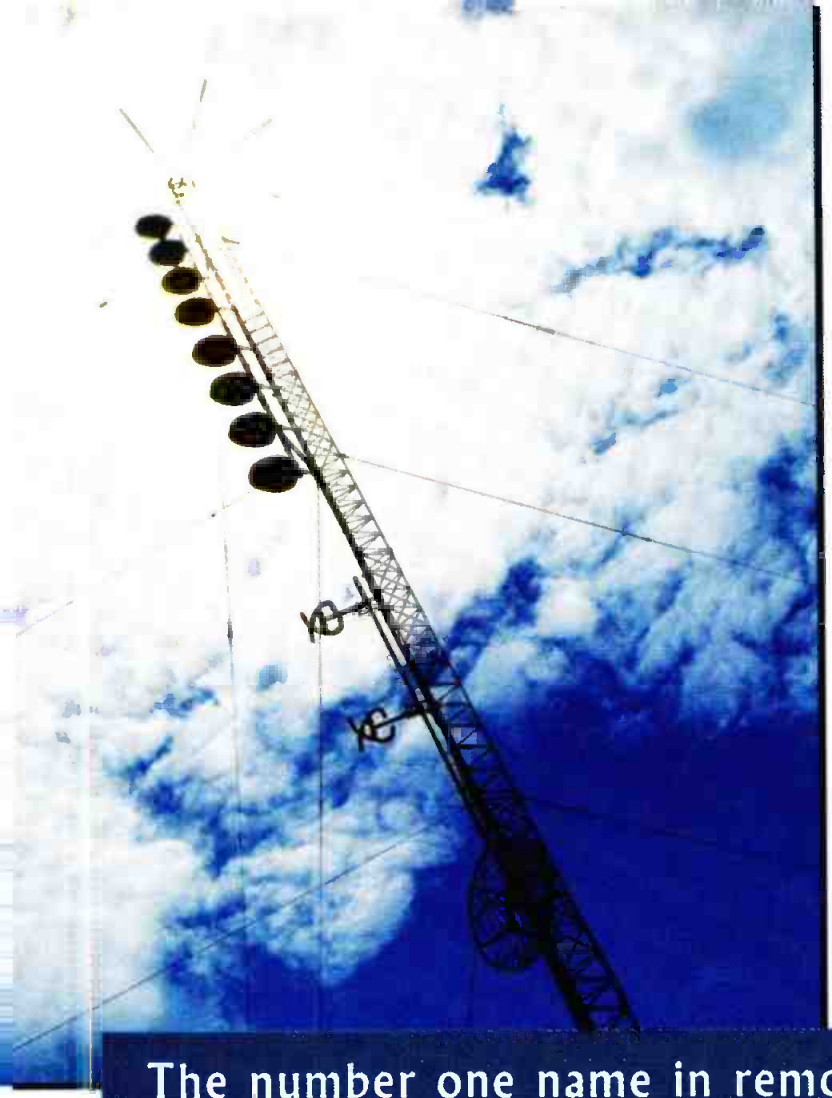


Grass Valley Group's Profile XP Media Platform's modular card design.

The first characteristic of a media platform is the ability to support multiple formats, both in terms of compression and I/O. This requires an architecture that has sufficient bandwidth for all potential formats and consists of standard, supportable components such as 64-bit PCI and Fibre Channel disk drives. The architecture must also be modular so that it will support future additions.

At NAB 2000, with this foundation in place, the Profile XP Media Platform demonstrated its support of standard-definition MPEG 4:2:2 MP@ML and high-definition MPEG@HL. The Profile XP also has the technology to support MPEG-1 low-resolution proxies and the ability to generate streaming video in RealNetworks and Microsoft formats. These features are all included on the same platform. In the future, the Profile XP Media Platform will support DVCPRO. It supports both uncompressed and compressed audio (Dolby E) and will support ancillary data.

I/O format flexibility is also essential. Ideally, a media platform should be able to exchange media with other devices in any I/O format available to the broadcaster; the Profile XP Media Platform does. These I/O formats include traditional digital video such as SMPTE 259M, SMPTE 292M high-definition video, serial digital transport interface (SDTI), MPEG Transport Streams on asynchronous serial interface (ASI), and



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IP over both Ethernet and Fibre Channel. This flexibility in format support is the first step toward achieving a true media platform.

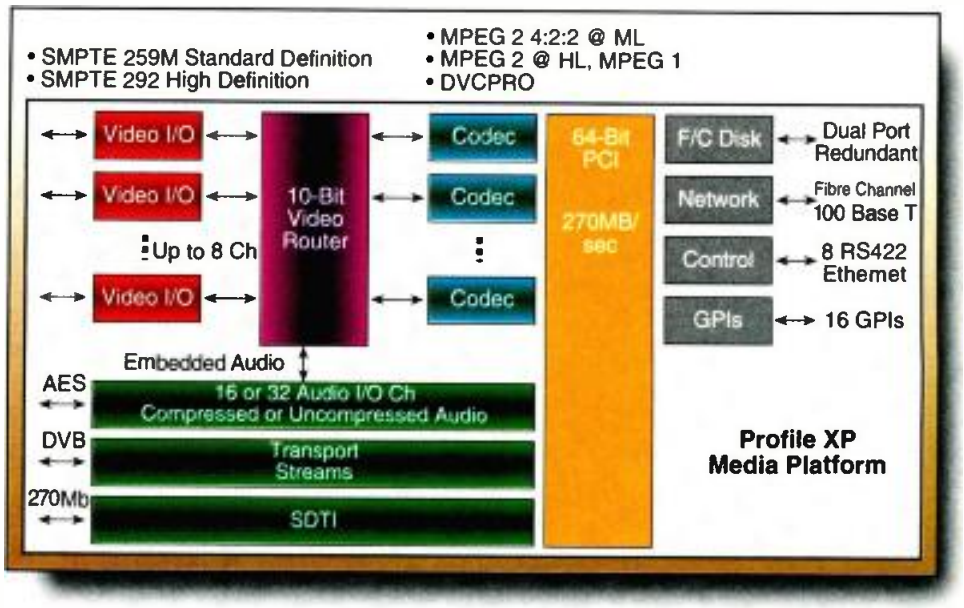
However, without the ability to flexibly control and manipulate and reliably play back these different formats, the format flexibility mentioned above would be of little use. In examining this requirement, the Grass Valley Group was convinced that simple RS-422 protocols, or their derivatives encapsulated over Ethernet, alone would not meet the demands of a media platform. Instead, a robust software architecture featuring Microsoft's Windows-based application programming interface (API) was needed. This software architecture is now known as the Grass Valley SoftwareBus.

The SoftwareBus is layered architecture that gives Profile application developers access to the lowest-level commands for complete flexibility, but also provides higher levels of API abstraction with software engines, which slash development time. SNMP support for remote monitoring is integrated into the SoftwareBus, as are advanced asset management links via the company's ContentShare platform for media management. The SoftwareBus harnesses the power of Profile XP Media Platform and provides far more flexibility than video servers that rely only on RS-422 protocols and their encapsulations over Ethernet. Most importantly, the SoftwareBus architecture of the Profile platform has been embraced by more than 50 developers worldwide.

As new applications proliferate, the ability to flexibly handle video, audio and data recorded on a server must be accompanied by efficient media creation and management, including the ability to locate and access other media and metadata -- be they graphics, scripts, log files or news rundowns. Not only must this metadata be accessed, but the relationships between the data must be represented and preserved as media is modified and moved.

It is one thing to be able to convert high-resolution video into an Internet video format for the Web, but how does one access the news script and associated graphics to build the actual Web page? The goal should be to provide a system that puts data at the user's fingertips. The ContentShare platform meets this goal by providing a framework for the location, access and tracking of metadata across a distributed array of equipment and applications. Designed using common Internet standards such as extensible mark-up language (XML), extensible style language (XSL) and JAVA, it can be easily incorporated into any application. It is supported today by more than 16 companies, and it is incorporated into the Profile XP Media Platform.

One other defining characteristic of a media platform is its ability to support not only online media, but also a sound digital archive strategy. A media platform should interface to a variety of data tape libraries and support a variety of data tape formats to meet customer needs. Archive material should be accessible from multiple devices via the network using standard protocols over TCP/IP. An archiving solution should have strong backup and fail-over support as the archive holds a facility's most precious assets: its media. An archive solution should be implemented with proper services from the vendor to analyze bandwidth requirements, fail-over strategies and network topologies. Without this, one does not have a comprehensive digital media strategy. The Profile XP Media Platform links very well with the Profile Network Archive in support of a comprehensive digital media strategy.



A true media platform supports multiple formats from high-definition encoding down to internet formats. As a user's needs change or new standards are adopted, the Profile XP can be easily reconfigured with new capability. Codecs can be easily changed, additional audio channels added and compressed data I/O can be added with either SDTI or MPEG Transport Streams (MTS).

To be a compelling video server for today's standard-definition broadcast environment, the Profile XP Media Platform needs to meet stringent reliability, performance and quality requirements. It needs technologies such as dual-loop Fibre Channel disk storage, dual power supplies, NetCentral SNMP remote monitoring capability, quick access to all hardware components, audio scrub, high-speed networking and future shared storage capability. However, it is the Profile XP Media Platform's support of all necessary formats, its strong SoftwareBus architecture, its links to asset management via the ContentShare platform, and its support of a flexible and robust archive solution — that make the Profile XP more than just a video server. It is a media platform.

As you look for a platform to provide a capital plan that can meet the broadcast requirements of today and tomorrow, the Profile XP Media Platform is an excellent choice. ■

For more information on Grass Valley Group's Profile XP Media Platform, circle (276) on the Free Info Card.

Mike Cronk is vice president of marketing for Grass Valley Group.

[No smoke. No mirroring.]

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Applied Technology

Digital interoperability in post production

BY STEVE WISE

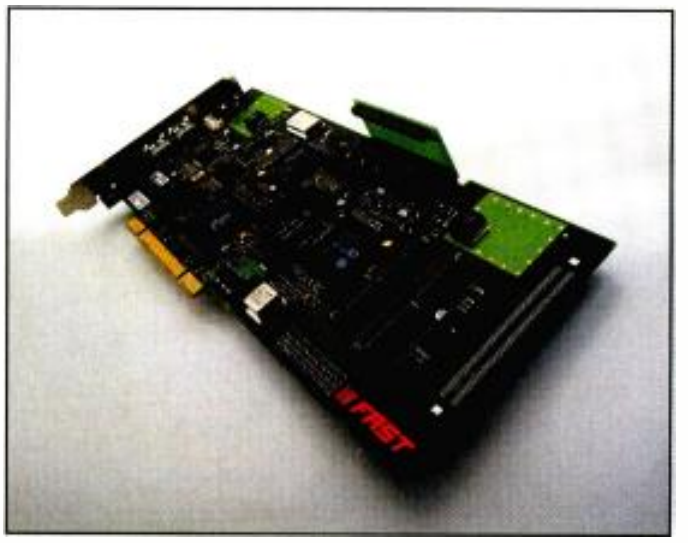
Contrary to conventional wisdom surrounding the impact of the silicon chip on the post-production industry, some may find it heartening to find that progress has been relatively sedate. Nevertheless, progress is being made and much of it concerns digital content compression and, by extension, digital interoperability.

If the 1990s' agenda can be summarized, even in general terms, then the eclipse of all things analog has been foremost in most manufacturers' minds. A plethora of competing formats and a new digital status quo not dissimilar from the old analog regime cropped up. Ironically, this illustrates rather well the fundamental premise of digital technology – essentially sampling the real, analog world.

However, it quickly became apparent that the so-called "format war" was not going to be won overnight. Now, at the beginning of a new millennium, we can detect an air of comparative maturity and reconciliation that enables us to form a much clearer view of how things are likely to pan out.

Certainly, it's safe to say that MPEG-2 is a done deal. At NAB98, the Pro-MPEG forum was inaugurated, uniting the computer industry, in the shape of IBM and Hewlett-Packard, with established MPEG proponents Sony, the BBC and of course, FAST Multimedia. The forum decided MPEG-2 was the way forward, stating "the basic prerequisite for post production and editing is frame accuracy and MPEG-2 (4:2:2 Profile at Main Level I-frame editing) provides this and much more, including variable digital compression with no quality degradation."

Moreover, MPEG-2 is a standard – unlike its antecedent, Motion JPEG, which has outlived its usefulness in unifying analog formats. It also affords the benefit of interoperability, not only across rival manufacturers' equipment, but across the entire production process, from acquisition through post production to distribution. Nowhere is this better illustrated than with DVD.



Fast Multimedia's silverDV. The DV option allows silver. users to input DV footage directly from DV cameras.

DVD is also based on MPEG-2 and is a serious competitor – in fact the only competitor – to the dominant analog VHS distribution format. Competitively priced and aggressively marketed to the consumer, it offers the promise of consumer digital conversion within years, not decades.

Closely allied with MPEG-2 – in compression technology at least – is DV and its professional derivatives DVCAM, DVCPRO, D-9, etc. The tumbling cost of hard disk storage and its burgeoning capacity makes it increasingly feasible to simply not bother to use compression at all in high-end compositing and multilayering work.

We can already see the emergence of a new digital order that is quite different from the previous stratified hierarchy. It promises a flexibility — through interoperability — that provides new opportunities, both commercial and creative.

Some time ago – NAB97 to be precise – FAST Multimedia first unveiled blue., a "next-generation" nonlinear editor marketed as "Native Digital Editing" with the promise of "Every In, Any Out." Slick marketing aside, it's the mark of a good idea that is, if anything, even more relevant.

Yet you still can't buy it.

Why? Well, in hindsight, perhaps FAST was getting a bit ahead of itself. Fulfilling the blue. promise necessitates the native exchange of a variety of digital formats, most of which comprise compressed data. The prevalent serial digital interface – SDI or SMPTE 259M – accommodates only uncompressed data. SMPTE has since recognized this in the form of Serial Digital Transfer Interface (SDTI or SMPTE 305M), a connection standard that is in the process of final definition.

So FAST had a choice: dilute the message or wait until the standard is defined in full. The modified concept of "Various In, Numerous Out" would perhaps appeal to a cynical British sense of humor but, in all probability, would not be a great selling proposition in the United States. It was not a choice.

From the outset, it was always

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Field Report

Vibrint NewsEdit: The right product for 7NBC in Boston

BY STEVE HARRINGTON

As a news organization, Boston-based 7NBC News, WHDH-TV, has two goals: 1) to go live as often as possible, and 2) to turn video around quickly and accurately before anyone else. We believed in the fall of 1999 that we could gain a competitive advantage by replacing our tape-based, cuts-only bays with the right nonlinear solution. We were already using a popular high-end nonlinear system for feature pieces and special projects, but that system wasn't what we wanted for breaking news.

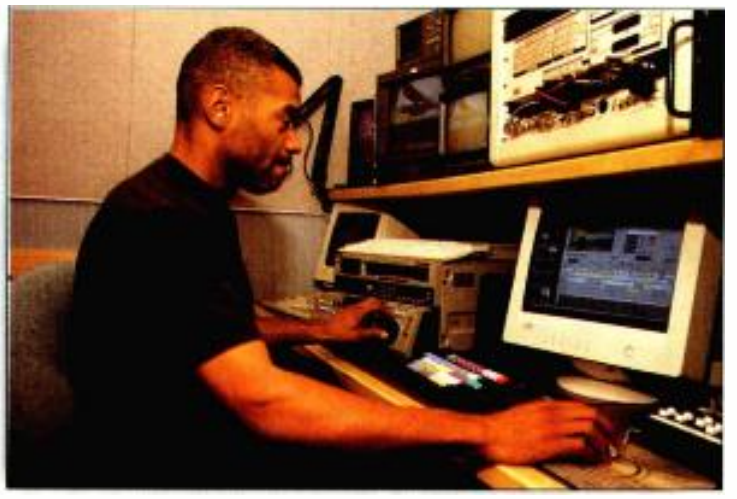
In choosing a nonlinear solution for hard news editing, the following criteria were most important:

- **Speed and ease of use.** We wanted a nonlinear system that we wouldn't be afraid to use five minutes before going to air.
- **Ease of training.** We don't have the luxury of sending editors off for weeks of training.
- **Integration with existing systems.** We have to be able to move stories quickly from scripting, to editing, to air.

As part of the decision-making process, we conducted in-house testing of editing solutions from a number of manufacturers. We chose Vibrint's NewsEdit because it offered most of the features we wanted right out of the box. It also appeared to offer the speed and simplicity needed to get breaking news to air quickly. We have been pleased with how well it has met each of our requirements.

Speed and ease of use

For hard news, we wanted a system that offers all of the advantages of nonlinear systems, but won't bog us down in editing and digitizing. Bells and whistles slow you down. NewsEdit lets you work quickly and efficiently — just as fast as tape — because it's geared for editing directly from tape to timeline. On average, we spend less than 30 minutes on each package we put together. If you have to digitize a complete 30-minute tape before you start editing, you've wasted all of your time on the most mundane task.



The utility of the NewsEdit system is largely due to the similarity of its tools to those used in tape-based editing, allowing those without nonlinear editing skills to transition easily to its use.

NewsEdit makes it easier to correct the inevitable mistakes. If two shots are in the wrong order, you simply swap them around in the timeline. If a shot runs too long, you can use the trim tool to tighten it up. If you make a bad edit on tape, you have to start from scratch, usually making a dub and losing a generation in the process. NewsEdit eliminates that time-consuming process.

NewsEdit gives you just the right amount of functionality for hard news editing. It doesn't include numerous pages of effects, but it does offer wipes and dissolves. That's all you really need for hard news. Also, even though the effects have to be rendered, it's quick. Our editors have found the toolbar easy to navigate and the audio features, including cross fades, easy to learn and manipulate.

Training

As we installed NewsEdit, we had just completed an acquisition format conversion to Sony Betacam SX and began a move into a new facility. We were also covering some pretty big news stories, including JFK Jr.'s crash, the Ryder Cup and the crash of Flight 990. Despite all this activity, the implementation of NewsEdit went well.

We began by installing NewsEdit in two edit bays. Vibrint provided training for the editors assigned to those rooms, and the editors then took the lead on training the rest of the staff. The flexibility of this approach was important because we didn't have to send every one of our editors off-site for special classes.

NewsEdit is easy to learn, even for editors who have no prior nonlinear experience, because it is so similar to tape editing. It offers L-cuts, insert edits and three-point edits, just like tape systems. It uses the same terms and techniques, so traditional tape editors don't have to learn a whole new way of editing.

Integration

One of the most important aspects of my job is to manage the station's assets. With NewsEdit, I can take advantage of our existing systems by

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integrating it with our Avstar Newsroom Computing System and Grass Valley Group Profile video server. Integration of NewsEdit and Avstar via 100BaseT allows the editors to view rundowns and scripts on their news editing system. This makes it easier to view the information and eliminates an additional workstation from the edit bay. Vibrint's NewsEdit also automatically enters the slug name from the Avstar system as the name assigned to the story being edited, thus assuring that the edited sequence won't have a different name from the script or rundown. With Profile integration, we will eliminate the chaos of trying to find video at the last minute. Completed packages can be transferred faster than real time from NewsEdit to the Profile. They are available for playback from Profile's hard drive even while they are still being transferred. NewsEdit and Profile are connected via IP over Fibre Channel, allowing simultaneous transfers from multiple NewsEdit bays even while Profile is playing to air.

We will also evaluate Vibrint's FeedClip feed recording application, which will allow us to record feeds directly to a hard drive and quickly move video either to a NewsEdit or directly to the Profile.

Choosing the right product

When looking at nonlinear systems, it's important to choose the right product for the right station at the right time. If you're looking for a system loaded with options, you probably don't want NewsEdit. If you're looking for something that is fast enough for hard news, NewsEdit is good to go when you take it out of the box.

NewsEdit is good to go when you take it out of the box.

As of the writing of this report, there are a few additions we would like to see for NewsEdit — for example, a mosaic effect for investigative stories and a slate generator to provide a video ID for each story. There are also a few housekeeping details to work out, specifically in the area of file naming conventions, data management and archiving. But we know that Vibrint is addressing these issues, and solutions will probably be implemented by the time this report appears in print.

A final word on the importance of standards: MPEG and NT are the two most significant technological advances in recent years. We wouldn't be using NewsEdit today if it was not based on both of these standards. ■

For more information on Vibrint's NewsEdit, circle (277) on the Free Info Card.

Steve Harrington is director of news operations for WHDH-TV in Boston. Additional Contributors: Bill Holbrook, Stephen Spence, Bill Barrier.

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Format conversion for DTV

BY JOHN LUFF

There was a time when conversions between formats fit into a neat 3x3 matrix. Since the advent of color television, the world has relied on essentially three standards, with some minor variants:

- NTSC (525-line interlace with a 3.58MHz color subcarrier and 30f/s) — Add a 625-line NTSC variant to fill the options;
- PAL (625-line interlace with a 4.43MHz color subcarrier and 25f/s) — Add a 525-line variant and a couple of bandwidth options to fill the options; and,
- SECAM (625-line interlace with line sequential color and FM subcarriers at 25f/s) — Add two variants for color synchronization method to fill the options.

The variants to each of these complicated the mix but increased the mix to only eight or nine practical combinations. One could make the case that component 525 and 625 could be added, but little conversion was done starting with three wire (RGB or YPrPb). The total number of basic conversions from line standards, with output subcarrier and bandwidth optional, equals only six basic input formats and six basic output formats — a total of 30 meaningful conversions.

Leap forward to the standards in use today. There are now more than 40 conversions in line scan formats. Doing the simple math yields at least 1560 conversions. If a designer a few years ago had a complicated task designing a standards converter for NTSC, PAL and SECAM, imagine the task now. The puny size of the infamous ATSC Table 3 is just not a meaningful problem in comparison.

Consider all the conversions that must be part of the math. For the best possible conversion, you need to be aware of the origin sampling. You need to set up for either progressive to interlace, progressive to progressive, interlace to progressive or interlace to interlace. Count those as four main sets.

The simple number of pixels horizontally and vertically must also be considered. The following numbers of horizontal pixels are commonly found in the luminance channel: 640, 704, 720, 960, 1280, 1440 and 1920. The two chrominance channels could have the same, one-half, or one-quarter as much data.

	525 NTSC	625 NTSC	625 PAL	525 PAL	625 SECAM H	625 SECAM V
525 NTSC	NV	X	X	X	X	X
625 NTSC	X	NV	X	X	X	X
625 PAL	X	X	NV	X	X	X
525 PAL	X	X	X	NV	X	X
625 SECAM H	X	X	X	X	NV	X
625 SECAM V	X	X	X	X	X	NV

NV = Not Valid X = Valid

Figure 1. Conversions required between the three main television standards worldwide.

Vertically, the picture could be sampled 480, 483, 576, 720, 1035 or 1080 times. Adding the possible conversions from computer line scan standards, which is very much a real world concern, further complicates the matter.

How do color space conversions figure into the mix? The reference primaries and color equations for NTSC, PAL and HDTV are not the same. Conversions from computer formats — which are often not "video aware," and therefore may not have nonlinear gammalike conventional video imaging — are also problematic. Published accounts suggest that a minimum of six distinct operations need to be done to convert color space, some of which can be combined.

So far, we have only defined the scope of the problem for a single frame. What about the temporal rates? In common use (or planned use in the near term) we find the base rates of 24-, 25-, 30-, 50- and 60f/s. We also have the legacy problem of running our frame rate 1/1.001 slower to make the color subcarrier work for NTSC. That makes the additional rates of 23.98, 24.98, 29.97 and 59.94 necessary (I know of no one who anticipates using 49.95 in the real world). Again, look out for computer scan rates. They will be all over the map, including significant content at rates above 60Hz. With adequate hand waving, we come up with a staggering number of conversion possibilities. A number of these would be eliminated as nonsense conversions by many observers, but an equipment designer needs to think about the total set and pick the range of signals that can be practically handled in the device.

Exactly how does one convert 30f/s to 29.97f/s? One suggestion is to simply drop one frame per thousand (one every 33 seconds and 10 frames). Unfortunately, this approach is not exactly invisible, especially if the program material has motion in it. The alternative is to do motion compensation between frames to imperceptibly eliminate the information content necessary to run the captured image at a new rate. While

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temporally compensated conversion is nothing new, the 3D filtering necessary is not trivial. Going the other way, back to 30 from 29.97, presents the same problems, as does any temporal conversion.

What the designer has on his plate is actually a small supercomputer that has to load perhaps several thousand sets of microcode into an image processor. Now consider the pixel clock rate necessary to make a conversion. For a 1080i/29.97 image the pixel count per second is 62,145,792. In common 4:2:2 sampling, each luminance sample comes with another sample (1/2 sample for Pr, and 1/2 for Pb, or double the sample rate) — a total of 124,291,584 samples to be processed per second. Converting each pixel requires the scaling engine to make a number of calculations and other operations such as color space conversion. Filtering must be done to keep the output within the filter mask for the output standard. Your garden-variety PC will not suffice.

Thus, the designer succumbs to pressure from marketing and comes up with a design but tells marketing that it will have to live with a couple of input options, a couple of output options, aspect ratio conversion, color space conversion, a few GPIs and remote controls. This is the genesis of the first generation of converters, and the reason why those that claimed to do a zillion conversion possibilities generally did not do them very well. Systems optimized for one possible conversion could not adapt to all possible options. If you wonder why a format converter costs tens of thousands of dollars per rack unit, think about the task at hand.

For the best possible conversion, you need to be aware of the origin sampling.

However, several manufacturers have recently come up with clever machines that handle many options for I/O and frame rates. The above entry-level math should impress upon you just how technically remarkable these machines are and the cleverness of the designers who have begun to attack the "generic" problem of image transformations.

The good news is that the most critical conversions have been reduced to silicon and are embedded in things like VTRs and cameras (HD to SD for reuse of images, monitoring on less expensive monitors, and conversions between 1080i and 720p). These intermediate steps will not solve the systemic need, but they do make it much easier to choose between "all format converters" and less expensive special purpose converters for less demanding needs. ■

John Luff is president of Synergistic Technologies Inc. in Canonsburg PA.

HD conversion equipment manufacturers

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Altinex Inc	714-990-2300	800-ALTINEX	714-990-3303	www.altinex.com	441
Analog Way	212-269-1902		212-269-1943	www.analogway.com	442
Astro Systems	818-244-1806		818-244-1878	www.astro-systems.com	443
Band Pro Film & Video	818-841-9655	888-BANDPRO	818-841-7649	www.bandpro.com	444
Chyron Corp	516-845-2000		516-845-3867	www.chyron.com	445
Comprehensive Video Group		800-526-0242	201-814-0510	www.compvideo.com	446
Digital Vision Inc	310-914-5200	888-914-5200	310-914-0011	www.digitalvision.se	447
Divicom	408-490-6560	877-348-4266	408-490-6999	www.divi.com	448
Evertz Microsystems Ltd	905-335-3700		905-335-3573	www.evertz.com	449
Extron Electronics	714-491-1500	800-633-9876	714-491-1517	www.extron.com	450
Faroudja Laboratories Inc	408-735-1492		408-735-1571	www.faroudja.com	451
Focus Enhancements	978-988-5888	800-538-8865	978-988-7555	www.FOCUSinfo.com	452
Folsom Research	916-859-2500	888-414-SCAN	916-859-2515	www.folsom.com	453
For-A Corporation of America	352-371-1505		352-378-5320	www.for-a.co.jp	454
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Ikegami Electronics	201-368-9171		201-569-1626	www.ikegami.com	458
JVC	973-315-5000	800-JVC-5825	973-315-5030	www.jvc.com/pro	459
Key Digital Systems	212-595-6721		212-595-3334		460
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Panasonic	323-436-3500	800-528-8601	323-436-3660	www.panasonic.com/broadcast	466
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Screen Service Italia	+39 03 03730773		+39 03 0322001	www.screen.it	470
Snell & Wilcox	+44 1730 821 188		+44 1730 821 199	www.snellwilcox.com	471
Sony Electronics	800-686-SONY		201-930-4752	www.sony.com/professional	472
TeraNex	407-517-1086		407-517-1101	www.teranex.com	473
Thomson Broadcast	201-569-1650	800-882-1824	201-569-1511	www.thomsonbroad.com	474
Visual Matrix	818-843-4831		818-843-6544	www.visual-matrix.com	475
YEM America	310-544-9343		310-544-9363	www.yem.com	476
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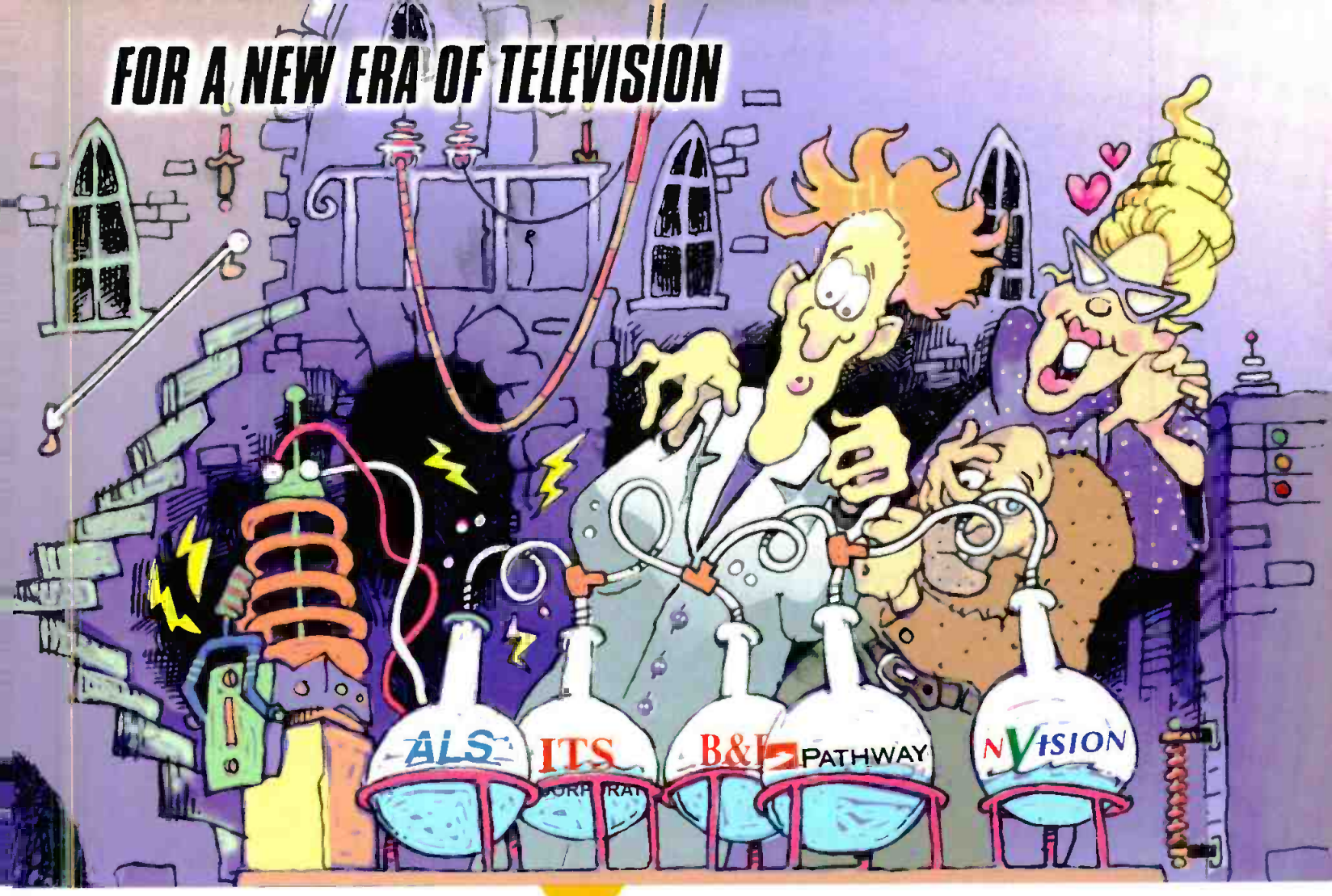

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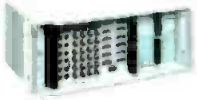

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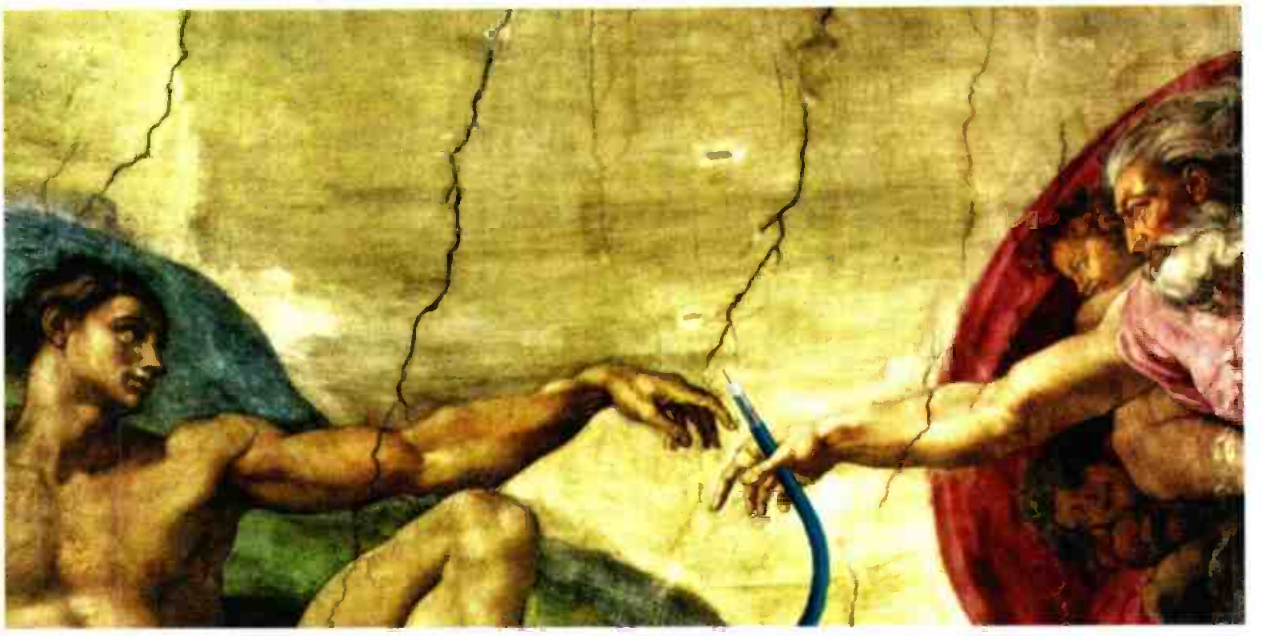

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Digital Processing Systems/DPS dpsVelocity-2D: new configuration of dpsVelocity, a nonlinear editing system combining DPS' compressed/uncompressed video hardware and its advanced NLE software; options include 3-D processing and I/O support for DV, SDI and digital audio; also features compressed and uncompressed video editing on a single timeline, digital card I/O support of BNC and XLR AES/EBU output, and full three- and four-point edit control of clips and timeline events; 606-371-5533; fax: 606-371-3729; www.dps.com

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Production and post-production mobile

HD Vision HDV-5: a self-contained mobile for high-definition video imaging, allowing users to affordably shoot local events; the unit is available with four Sony HDC-700 cameras with Canon 65x1 lenses and four Sony HDC-750 portable cameras with Canon 18x1 lenses; other equipment available in the 53-foot unit includes four Sony HDW-500 digital VTRs, a Snell & Wilcox HD-1024 digital switcher, a Matrix intercom and a Clarity HD graphics system by Pixel-Power; 972-432-9630; fax: 972-869-2516; www.hdvision.com

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Updated software for POSTBOX 2000

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Internet news service platform

Leitch News-In-A-Box: allows newscasters to create a turnkey Internet-ready newsroom; the system can be used for acquisition of both low- and high-resolution video and audio, as well as low-resolution browse; Leitch's NEWSFlash editor allows integrated online editing and Callisto Media Systems' Voyager server and Solaris operating environment form the system's video server backbone; 800-231-9673; 757-548-2300; fax: 757-548-4088; www.leitch.com

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Multivideo processor

Extron MVP 104: allows user to display up to four NTSC or PAL video signals simultaneously on a single screen; each video window may be independently scaled, positioned or overlapped so the user may display different window configurations such as picture in picture or quad splitting; provides 44 factory/ user presets for convenient one-touch selection of different windowing configurations; 800-633-9876; 714-491-1500; fax: 714-491-1517; www.extron.com

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Television news solution

Harris NewSource: this module supports both MOS and Betacart protocols; it combines the Louth automation system with a newsroom computer to allow broadcasters to control news servers, VTRs and cart machines from one system; changes made in the program rundown are instantly transferred from the newsroom computers to the automation system, which then reorders the playlists for all devices it controls; 800-622-0022; 513-459-3400; fax: 513-459-3890; www.harris.com

Circle (355) on Free Info Card

75Ω BNC connector

Bomar SHADOW: is a true 75Ω BNC connector, engineered for use with commonly used coaxial cables; the connectors provide superior VSWR, impedance and return loss at 3GHz; 973-347-4040; fax: 973-347-2111; www.bomarinterconnect.com

Circle (357) on Free Info Card

Time-lapse recorder

Hitachi SR-800: uses a removable DVD-RAM drive as its recording medium with a JPEG compression system; the unit has recording capacity of 2.6GB and a maximum recording time of 1500 hours; allows users to determine any combination of compression ratio, pixel count and recording time; other features include one-shot and repeat recording, as well as pre-alarm recording for scenes shot before the alarm signal starts; record modes can also be remotely controlled via an RS-232C or RS-485 port; 516-921-7200; fax: 516-496-3718; www.hdal.com

Circle (358) on Free Info Card

Widescreen LCD monitor

SGI 1600SW: this LCD monitor features a SuperWide screen capable of displaying two pages side by side; has three times the brightness and five times the contrast of CRTs; it is the first photo-realistic monitor, with 110dpi and 1600x1024 resolution; the interface is all-digital; 650-960-1980; fax: 650-933-0819; www.sgi.com/go/broadband

Circle (359) on Free Info Card

Zoom lens

Canon Digi Super 86xs: incorporates Canon's new optical stabilization technology to eliminate vibrations at a frequency of up to 10Hz; the new lens system is 19 percent longer than Canon's Digi Super 70 lens system, with a maximum focal length of 1600 mm with a 2X extender; 800-321-4388; 201-816-2900; fax: 201-816-2909; www.usa.canon.com

Circle (360) on Free Info Card

Asset management system

Avica Vecta AMS: is an NT-based system providing backup and archiving to standard SCSI devices, C2-level security and multiple-criteria database searches; also offers seamless integration with Vecta DTV Stillstore; users can view stored images from remote clients through an Internet browser and utilize centralized reference storage and archival of still and graphic images; 800-706-0077; 818-846-0589; fax: 818-846-0175; www.avicatech.com

Circle (361) on Free Info Card

Broadband and production/broadcast video servers

SGI Media Server: two new versions of SGI Media Server, one designed for broadband and the other for production and broadcast; both feature the Origin server in an integrated solution; the broadband version utilizes Kasenna MediaBase media streaming software to deliver content over the Internet, enterprise and virtual private networks to multiple client platforms; this version can also deliver 100,000 high-quality MPEG streams daily; the production and broadcast version supports DVCPRO news format and is available in four-channel and eight-channel configurations; it manages video as data, distributing it over existing LAN/WAN infrastructures; 650-960-1980; fax: 650-933-0819; www.sgi.com/go/broadband

Circle (362) on Free Info Card

HD interface card

Computer Modules HD-SDI Master: is a full-size SMPTE-compliant PCI card with interface applications ranging from video editing workstations and video wall to HD presentation; the card automatically adapts to 1035:60I/59.94I, 1080:60I/59.94I/50I, 1080:30P/29.97P/25P/24P/23.976P and 720:60P/59.94P; also has 256MB of memory to prevent dropped frames and a built-in relocking function with genlock; the latter allows it to be a repeater for long distance runs; 408-496-1881; fax: 408-496-1886; www.compumodules.com

Circle (363) on Free Info Card

Waiver-analysis tool

Decisionmark Corporation WaiverTV: satellite subscribers who feel they cannot receive an adequate signal from their provider can request a waiver allowing them to receive a satellite-delivered feed from broadcasters; according to Congress' Satellite Home Viewer Improvement Act satellite carriers can forward these requests to broadcasters, who must act on a request within 30 days of receipt or the request will be considered granted; satellite companies can use Decisionmark's electronic waiver system to forward these subscriber waiver requests to broadcasters, who can then access the requests using WaiverTV; 800-365-7629; 319-365-5597; fax: 319-365-5694; www.decisionmark.com

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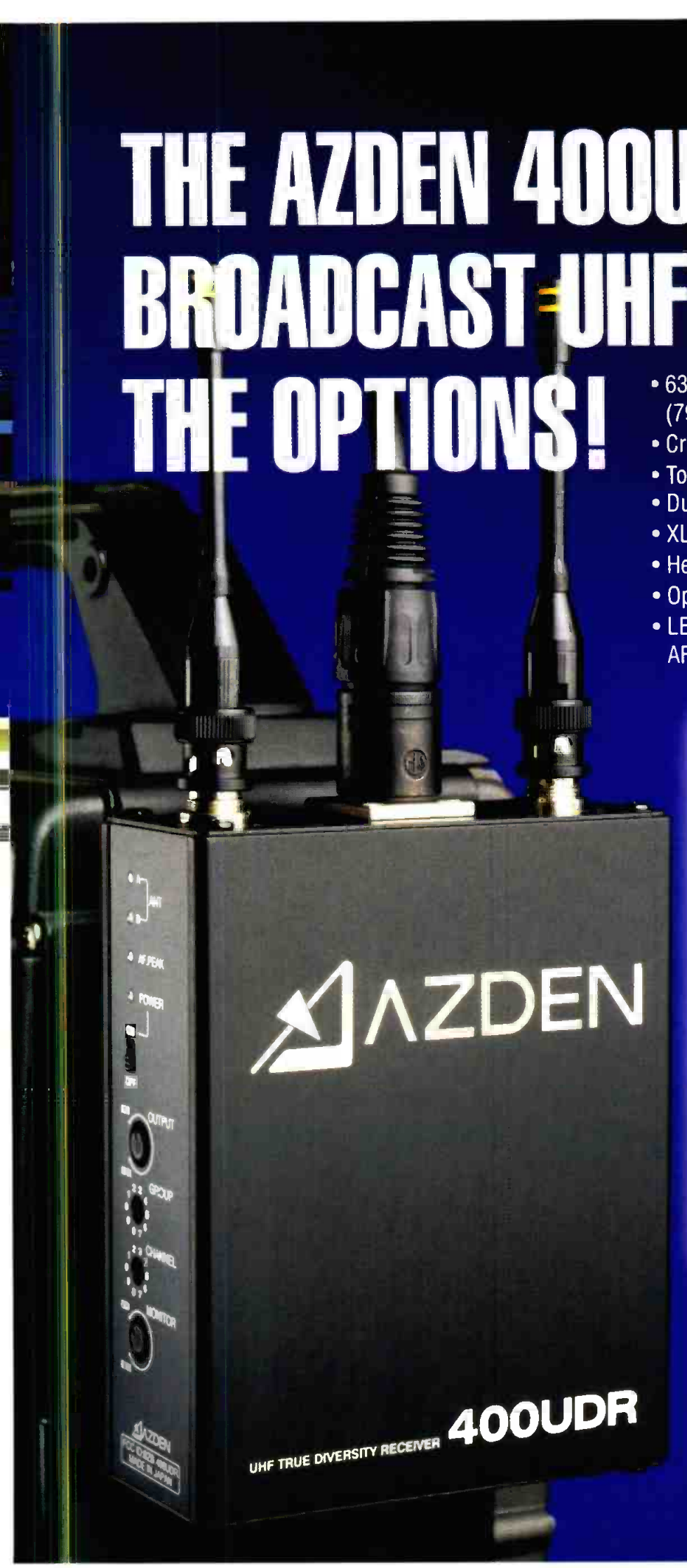

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www.rocketnetwork.com

Rocket Network, Inc. is the first and only company to provide Internet Recording Studios where audio professionals can meet online to collaborate and produce original audio from anywhere in the world. The Company'srevolutionary network provides a cost-effective and convenient complement to traditional studios by reducing production expenses and increasing creative options for professional-quality audio in TV, film, radio, music and Websites.

www.folsom.com

Folsom Research: Folsom Research offers a complete line of scan converters, video format converters, scalers, and other image processing products. Our easy-to-navigate website features detailed product specifications, including downloadable files and articles. The site is continuously updated and is always full of new information. To get more information visit www.folsom.com or call toll free at 888-414-7226. Come see us at NAB 2000, Booth #M8532.

www.pinnaclesys.com

Pinnacle Systems: Pinnacle Systems' broadcast products give professionals the cutting edge tools needed to create dazzling productions faster and more affordably than ever before. These innovative digital video manipulation tools perform a variety of on-air, production, and post-production functions such as the addition of special effects, image management, capture, storage, and play-out, as well as graphics and title creation.

8VSB translator

Ktech Telecom Inc VSB-REMOD-200: receives an 8VSB signal on-air or via cable, demodulates to baseband data, and corrects multipath errors by Forward error correction and equalization techniques; the translator then remodulates the baseband data into a new 8VSB signal; 818-361-2248; fax: 818-270-2010; www.ktechtelecom.com

Circle (369) on Free Info Card

HD effects system

Accom Abekas HDveous: this high-definition effects system is available as an upgrade to DVeous system and features an identical control surface and interface; it also offers identical features for easy transition from standard definition to high definition; features include RGB/YUV color correction, target frame store and SurfaceFX with dual light sources; can be configured as a single twin or a dual twin channel system; 650-328-3818; fax: 650-327-2511; www.accom.com

Circle (370) on Free Info Card

Digital video and audio editing system

Sonic Foundry Vegas Video: a multitrack digital video and audio editing system that provides tools such as compositors, filters and transitions with real-time editing and rendering; saves to all popular media formats; 608-256-3133; fax: 608-256-7300; www.sonicfoundry.com

Circle (371) on Free Info Card

12-bit digitizer

Fortel DTV ADC-331: digitizes an analog component input (RGB, Betacam or SMPTE component format) with 12-bit precision and generates three SDI outputs; it operates with either 525 or 625 line inputs; EDH insertion is provided on the SDI output; it also provides a component analog input channel when used with the INTEGRITY serial digital router; 800-530-5542; 404-885-9555; fax: 404-885-1501; www.forteldtv.com

Circle (372) on Free Info Card

Virtual set with NT technology

Orad CyberSet NT: CyberSet NT incorporates NT technology from Accom; is designed to deliver a low-cost system that allows free camara movement and live virtual set rendering; is configured as a plug-in to 3D Studio MAX; features live video I/O, depth key and texture processing tools for a photo-realistic look; 212-931-6723; fax: 212-931-6730; www.orad-ny.com

Circle (373) on Free Info Card

2x2 video/audio changeover switch

A.F. Associates COS-1A: the changeover switch monitors incoming feeds such as satellite, fiber or microwave, and switches from a malfunctioning feed to an operational one; a coax control network interface allows up to 256 units to be connected to single or multiple monitoring/control panels for automatic or remote switching; features operational cards including

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a video detection card; 201-767-1200; fax: 201-784-8637; www.afassoc.com

Circle (375) on Free Info Card

HD virtual set

Radamec HD Scenario: new HD version of Radamec's Virtual Scenario System provides easy upgrade for current users of the system; incorporates real-time HD or upconverted video for photo-realistic backgrounds; also features a high-definition chromakeyer; 877-RADAMEC; 732-246-0906; fax: 732-448-1184; www.radamec.com

Circle (376) on Free Info Card

Serial digital character generator

Inscriber LIVE!Logo: new NT-based serial digital character generator from Inscriber offers users tools for scheduling and display of station branding, tagging and advertisements; using the system, broadcasters can work with complex multiple element screens incorporating logos, clocks, timers, text strings and audio clips; 800-363-3400; 519-570-9111; fax: 519-570-9140; www.inscriber.com

Circle (377) on Free Info Card

Interactive TV software applications

NDS Limited Value@TV: this suite of interactive TV software applications enables broadcasters to offer interactive programming; the suite's iADs advertising application allows for targeted advertising to viewers via a smart card in their set-top box; other applications include SportsActive for interactive sports viewing and a system for TV commerce that will allow users to order products in real time; TV commerce transactions are secured by NDS' OpenVideoGuard conditional access solution; +44 20 8476 8000; fax: +44 20 8476 8100; www.nds.com

Circle (378) on Free Info Card

High-resolution switcher

Folsom Research Screen Pro 8: offers transition effects including cut, dissolve and wipes; clean, crisp video scaling is provided by two internal scaling engines; 888-414-SCAN; 916-859-2500; fax: 916-859-2515; www.folsom.com

Circle (379) on Free Info Card

MPEG-2 encoder with DVB interface

Exatel Visual Systems DVN-2000: professional quality, stand-alone encoder accepts signals including composite, S-video and SDI in PAL and NTSC formats; offers MPEG-2 encoding at a variable bit rate of 256Kb/s-24Mb/s with a DVB interface; provides two balanced analog audio inputs, as well as AES/EBU digital channels; an RS232 serial interface enables remote control applications; 781-221-7400; fax: 781-221-7407

Circle (381) on Free Info Card

Video on demand system

Lysis VOD solution: allows for the management of on-demand digital TV services through catalog management, asset management, and rights and reporting management systems; users of the systems can manage catalog items from acquisition to online publication and distribute encoded assets; the solution also enables the handling of intellectual property and provides service performance analysis and reports on content providers; Lysis' VOD solution is integrated to the Lysis Content Management platform; +41 21 341 97 00; fax: +41 21 341 97 97; www.lysis.com

Circle (382) on Free Info Card

Digital cinema pre-processor

Miranda Technology DT-4101: features an MPEG artifact reduction system, noise-reduction technology, detail enhancement and multiformat conversion; it allows users to enhance video before scaling or upconversion for display in large screen or digital projectors; 514-333-1772; fax: 514-333-9828; www.miranda.com

Circle (383) on Free Info Card

Cell analysis software

Tektronix Cell Analyzer: new cell analysis software from Tektronix serves as an add-on package for the Tektronix K1205 Signalling Protocol Analyzer; combines functions of Actix' Abis Analyzer with those of the K1205; allows users to monitor the radio performance of a base station and solve radio frequency problems; can be used to perform dropped call analysis and monitor cell statistics; 800-426-2200; 503-627-7111; fax: 503-222-1542; www.tektronix.com

Circle (385) on Free Info Card

Universal power sensor

Anritsu Microwave Measurement MA2481A: designed for use with ML2400A series power meters; operates at 10MHz to 6GHz and allows measurements to be made on wide bandwidth signals including W-CDMA, multitone and HDTV; offers true RMS detection, low power sensitivity and wide dynamic range; 800-ANRITSU; www.global.anritsu.com

Circle (386) on Free Info Card

TV facility automation

Columbine JDS LinkServer: links information between CJDS-DAL automation systems and CJDS traffic systems, creating a unified station database; results in near real-time information exchange between the traffic schedule and the on-air schedule; 303-237-4000; fax: 303-237-0085; www.cjds.com

Circle (387) on Free Info Card

Video access demultiplexer

Artel Video Systems Cross Stream 155D: MPEG video switching platform providing access to ATM and IP networks; platform is scalable, re-configurable, and capable of accepting feeds from satellite receivers, encoders and transcoders; combines a network edge device and an MPEG switch; allows for jitter-free local video connections; offers DVB-ASI and DVB-SPI interfaces for MPEG/ATM environments, as well as an OC-3 network interface and a 10/100BaseT Ethernet port; 800-225-0228; 508-303-8200; fax: 508-303-8197; www.artel.com

Circle (388) on Free Info Card

Video processor

Sarnoff Acadia I: chip offering complex real-time video processing at 80 GOPS; functions include stabilizing shaky video, performing full stereo 3D scene analysis, and detecting and tracking moving targets; designed for use in PCs, TVs and set-top boxes, also available as a PCI board for Windows-based computers; 609-734-3178; fax: 609-734-2040; www.sarnoff.com

Circle (389) on Free Info Card

Receive/transmit antenna

Andrew NewsFlash SNG antenna: Ku-band, 1.2-meter vehicle mountable, receive/transmit satellite antenna for use in newsgathering; operates in receive band of 10.95GHz to 12.75GHz and transmit band of 13.75GHz to 14.5GHz; 800-DIAL-4-RF; 708-349-3300; fax: 708-349-5444; www.andrew.com

Circle (390) on Free Info Card

Software module

mSoft Inc Pro/Spotter — Film Version: updates the TV version of Pro/Spotter for the ServerSound media retrieval system; new scene and reel levels were added to original functions including an intuitive audition and spotting process; 818-716-7081; fax: 818-716-0547; www.msoftinc.com

Circle (391) on Free Info Card

PCI-based MPEG-2 decoder

Vela Cineview Pro XL: new addition to the CineView family of MPEG-2 decoders; provides 4:2:2 profile MPEG-2 playback at 50Mb/s; it combines this video decoding feature with dual stereo audio decoding of Musicam and Dolby digital, which allows multichannel audio playback; also allows simultaneous play of MPEG-2 video on VGA and NTSC or PAL monitors; supports SDI and analog composite outputs; 727-507-5300; fax: 727-507-5311; www.vela.com

Circle (392) on Free Info Card

Router control system

Leitch PageBuilder: provides hot-linking of photos, drawings and other images for easy routing of audio and video signals; graphic interface allows touchscreen and computer routing for audio and video selections; 800-231-9673; 757-548-2300; fax: 757-548-4088; www.leitch.com

Circle (393) on Free Info Card

Uncompressed HDTV board

DVS Digital Video HDStationPRO: DVS has added support for 2K high-resolution output to its HDTV board, in addition to support for HD and post-production standards such as 1035i/1080i, 720p and 1080p24/30; the board includes analog HD monitoring output with overlay as well as real-time digital color space converter to support YUV/4:2:2 and RGB/4:4:4 data storage modules; RS-422 ports interface for VTR master control and VTR emulation purposes and Sony RS-422 nine-pin protocol; slow motion, 3:2 pulldown and 24/25 conversion are supported as well; 818-241-8680; fax: 818-241-8684; www.digitalvideosystems.com

Circle (394) on Free Info Card

Video servers

Compaq AlphaServer DS20E/ES40: have been enhanced with 21264A "EV67" processors; dual data-rate secondary cache has been increased from 4MB to 8MB; total memory has been doubled for faster processing and data retrieval; 800-345-1518; fax: 218-514-8797

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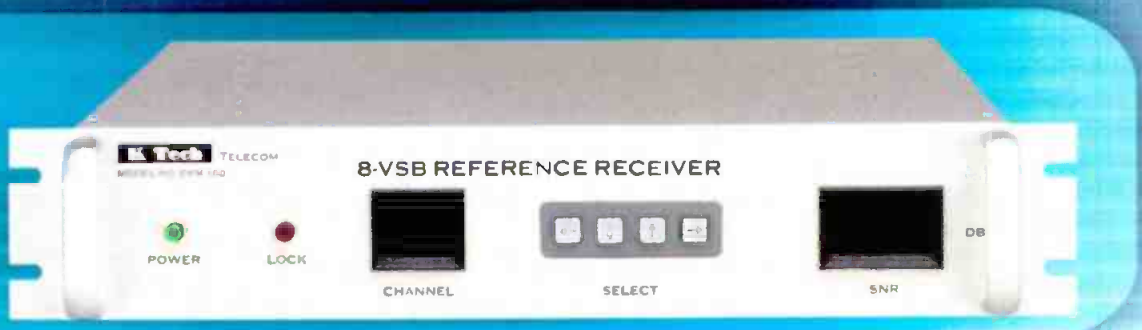

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Circle (160) on Free Info Card

Coax adapter

Telemetrics 55B-CA-PT: single cable connection which attaches directly to robotic pan/tilt mechanisms, eliminating the need for multiple cables; provides video, audio and control signals; may be used with a TM-9255 coax base station to power and control a camera along with a pan/tilt mechanism; 800-424-9626; 201-848-9818; fax: 201-848-9819; www.telemetricsinc.com

Circle (397) on Free Info Card

Convertible digital camera

Panasonic AW-E800 16:9/4:3 convertible camera: 2/3-inch, 520,000-pixel, three-CCD DSP color camera offers true native 16:9/4:3 aspect ratio; "open-slot" architecture allows use of plug-and-shoot feature cards to allow users to select the functions they need; other features include 850 lines of horizontal resolution, 63dB signal-to-noise ratio, SMPTE color bars and a seven-setting, high-speed shutter; also available are six optional feature cards providing users options such as component video output and the ability to use a five-inch viewfinder; 800-528-8601; 323-436-3500; fax: 323-436-3660; www.panasonic.com/broadcast

Circle (398) on Free Info Card

HDTV upconverters

YEM HUC-1000/HUC-2000: part of YEM's series of HDTV upconverters; offer real-time conversion of component digital signals into digital HDTV signals; the user can select 1035i, 1080i or 720p formats at 59.94Hz and 60Hz; the HUC-1000 is the upgrade for YEM's HSC-1125D1A and provides improved resolution through new architecture and image processing technology; the HUC-2000 fills the blanking area with text or graphics using either an external device connected through a 601 input or an internally-generated signal; other features of the HUC-2000 include five modes for easy picture sizing and positioning, a SMPTE 274M color matrix, and standard D1-SDI input connectors; 310-544-9343; fax: 310-544-9363; www.yem.com

Circle (399) on Free Info Card

Production switcher/routing switcher interface

PESA Switching Systems Tiger 144x144: an interface between the Tiger routing switcher and Ross Video's Synergy production switcher eliminates the need for a router control panel in the production control room; Synergy displays router mnemonics for all router sources from the Tiger's internal mnemonic tables; router sources can then be saved and recalled by Synergy to facilitate router source selection during live production; 800-328-1008; 516-845-5020; fax: 516-845-5023; www.pesa.com

Circle (400) on Free Info Card

Multiple downstream keyer

Avtek Systems TrikKey Multiple Downstream Keyer: this keyer allows three separate Downstream key sources to be keyed over a background in one compact chassis; it has its own A/B vision mixer which can be used with the Keyers for a composite transition; in addition, it features 12-bit internal processing, an 8/10-bit I/O and a full preview facility; 800-423-0913; 978-422-3466; fax: 978-422-5258

Circle (401) on Free Info Card

HDSDI standard converter

Astro Systems SC-7033: an HDTV SDI standards converter for bidirectional conversion among 1080i, 720p and 1035i; frame synchronization between 59.94Hz and 60Hz is also supported along with serial digital I/F; 818-244-1806; fax: 818-244-1878; www.astro-systems.com

Circle (402) on Free Info Card

Custom news truck

Frontline NT-7A: seven-rack Ku-band video uplink SNG built on a Sterling chassis; features an Andrew 2.4 meter antenna, custom dual path analog and digital RF system; 727-573-0400; fax: 727-571-3295; www.frontlinecomm.com

Circle (403) on Free Info Card

Top-mount antenna

SWR Clarion TD Series: a high-power, top-mount antenna; favorable for omnidirectional applications, delivering an excellent signal and premium performance; available with custom or standard azimuth patterns; 800-762-7743; 814-472-5436; fax: 814-472-5552; www.swr-rf.com

Circle (404) on Free Info Card

Stadium lens

Band Pro Film & Video Abakus HD Stadium 3.5mm f1.8 lens: in a B4 mount; 210-degree diagonal angle of view and controlled distortion make it ideal for opening shots at stadium sporting events; 888-BANDPRO; 818-841-9655; fax: 818-841-7649; www.bandpro.com

Circle (405) on Free Info Card

Interactive TV creation environment

Canal + Technologies Studio +: integrated development environment for the creation of interactive TV applications based on the Java programming language; +33-1-71715715; fax: +33-1-71715578; www.canalplus-technologies.com

Circle (406) on Free Info Card

Media asset management system

Imagine Products ImageMine V 2.0: newest version offers upgrades of ImageLibrary, ImageLog, ImageBrowse and ImageTrack; integrated modules coordinate activities related to media archive, including logging and cataloging, searching, browsing, and tracking functions; 317-843-0706; fax: 317-843-0807; www.imagineproducts.com

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Animation plug-in

Cambridge Animation Systems Inkworks: a Maya plug-in that give 3D animation a cartoon cel look in keeping with the flat painted and colored outline style of a traditional cartoon, 3D animation can be exported in Animo compatible format either as 3D models or as 2D pre-painted Animo levels; +44 1223 578 100; fax: +44 1223 578 101; www.cam-ani.co.uk

Circle (408) on Free Info Card

Video distribution amps

Netcom PatchAmp: a combination of five 24-position patchpanels and 24 1x5 distribution amplifiers internally within a 14RU frame for digital video and AES applications; features 75Ω impedance HD frame, low power consumption and hot-swappable, redundant power supply; 201-837-8424; fax: 201-837-8384

Circle (409) on Free Info Card

Video card for Windows

Viewgraphics VideoPump D1: a real-time, uncompressed serial digital video with embedded audio I/O solution for Windows; video I/O is performed to and from standard files within the standard operating system; 650-903-4900; fax: 650-969-6388; www.viewgraphics.com

Circle (410) on Free Info Card

Graphic board

Compix Media HD-TV Graphic Board: an HDTV graphic overlay board designed to incorporate VideoCG character generator features; 310-320-8937; fax: 310-320-8938; www.compixmedia.com

Circle (411) on Free Info Card

Character generator

Compix Media VideoCG Character Generator: a broadcast-quality PC-solution character generator; newly integrated hardware features digital overlaying with eight-bit Alpha Channel solution, 32-bit software with digital I/O and preview/program output; 310-320-8937; fax: 310-320-8938; www.compixmedia.com

Circle (412) on Free Info Card

Network infrastructure

DataDirect Networks SAN DataDirector: an intelligent network infrastructure device that incorporates key components of current SANs into a single integrated, reliable, plug-and-play appliance making it easier to build a SAN; offers high-bandwidth access to shared data needs in broadband applications; 800-322-4744; 818-700-7600; fax: 818-700-7601; www.datadirectnet.com

Circle (413) on Free Info Card

AES/EBU audio distributor

RDL (Radio Design Labs) RU-AED4: designed for installation requiring high-quality distribution of a digital AES/EBU signal; single AES/EBU input is decoded, reclocked and retransmitted to four individually buffered transformer isolated AES/EBU outputs; 800-281-2683; 805-684-5415; fax: 805-684-9316; www.rdlnet.com

Circle (414) on Free Info Card

Lens accessories

Century Precision Optics Digital Series for Cannon GL1: high-quality lens accessories include .55x Fixed Angle Adapter, .65x Lightweight wide angle converter and 16:9 widescreen adapter for higher res images; 800-228-1254; 818-766-3715; fax: 818-505-9865; www.centuryoptics.com

Circle (415) on Free Info Card

Camera cases

Calzone Case Company Escort, Ultima and Proline: Escort line provides maximum protection, exceeds ATA specs; features heavy gauge aluminum trim and recessed handles and latches; Ultima Series offers lightweight flight case protection; features aluminum extrusion, metal corners and polytolene laminate; Proline Series uses double-angle construction as Escort Series; 800-243-5152; 203-367-5766; fax: 203-336-4406;

Circle (418) on Free Info Card

HMI lights

K5600 Joker-Bug 800: comparable to a 3200/4000W quartz fixture but with a power draw of 12.5 amps; offers flexible optical configurations by achieving spot to flood ratios of 55:1 with beam angles from 45 to five degrees; 800-662-5756; 818-762-5756; fax: 818-762-6629; www.k5600.com

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HMI lighting system

K5600 Joker Bug 400: comparable to a 1500/2000W quartz fixture but with a power draw of 5.5 amps; offers flexible optical configurations for location lighting by achieving spot to flood ratios of 80:1 with beam angles from as narrow as five degrees to as wide as 55 degrees; 800-662-5756; 818-762-5756; fax: 818-762-6629; www.k5600.com

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VHF digital and analog transmitters

Technosystem VHF Band I and III SS Analog and Digital TV transmitters: these transmitters are compliant with ITU DVB-T and ATSC DTV standards; they are available in single and multifrequency networks versions; feature serial and parallel inputs, automatic bit-rate adaptation, and front panel and remote control in digital broadcasting; for increased reliability, they have one power supply for each power amplifier and full protection of each power amplifier and power supply; offer stability of performance under temperature and power variation; +39 06 225871; fax: +39 06 2282355; www.technosystem.it

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Audio meter panels

B&B Systems/Convergence Corp MP-4 Audio Meter Panels: four independent VU or PPM meters; feature four XLR connectors; offer four independent input circuits and precision buffered, balanced, active bridging amplifiers; come in any combination of VU or PPM meters; 818-551-5858; fax: 818-247-3487

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Rolling cargo case

Lightware RC1042: uses new materials to make an ENG kit ideal for an Arri 650/30 setup with accessories; 800-211-9001; 503-641-7873; fax: 503-643-9756; www.lightware.com

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Video compression systems

Faraday Technology ADC-100R: for digitizing high-quality analog video; can be used where a 10- or 12-bit output is required; incorporates the latest in analog filter design technology, A/D conversion and digital filtering in one module; +44 1782 661 501; fax: +44 1782 630 101; www.faradaytech.co.uk

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Signal splitters

Faraday Technology SDI Video and AES, ASI signal splitters: provides easy and low cost solution to the problem of providing two SDI and AES feeds from one source; for short runs of cable it can replace digital distribution amplifiers; +44 1782 661 501; fax: +44 1782 630 101; www.faradaytech.co.uk

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HMI/MSR fixtures

Lowel Light Mfg DP Daylight System: these HMI/MSR fixtures incorporate the design features and accessory system from DP Light; in addition, they include a flicker-free triple output lightweight ballast that can be used to power a 200-, 400- or 575-watt fixture with input voltages between 90 and 260v; they feature quick setup and extraordinary focusing range; 718-921-0600; fax: 718-921-0303; www.lowel.com

Circle (424) on Free Info Card

Pigtail connector

Nemal Electronics FO-100PT: a HDTV pigtail with a SMPTE standard connector on one end and an 18" tail terminated in two FC connectors and one multipin connector; allows for ease of installation and maintenance by quickly adapting the hybrid; 800-522-2253; 305-899-0900; fax: 305-895-8178; www.nemal.com

Circle (425) on Free Info Card

AES/EBU audio converter

RDL (Radio Design Labs) RU-AEC1: designed for installations that need high-quality analog audio from an AES/EBU digital audio source; input is 110Ω terminated; audio outputs are available on XLR connectors and on the full-size barrier block; 800-281-2683; 805-684-5415; fax: 805-684-9316; www.rdlnet.com

Circle (427) on Free Info Card

Lens converters/accessories

Century Precision Optics Telephoto Cine to B-4 Lens Mount adapter: allows Century- or Universal-mounted telephoto lenses to be used by Sony HD cameras; 800-228-1254; 818-766-3715; fax: 818-505-9865; www.centuryoptics.com

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ENG camera bag

Petrol Camera Cage: lightweight EFP/ENG camera bag featuring generous padding over a rugged internal skeleton; comes in three sizes — for larger DV camcorders, for standard-size EFP cameras and for HD rigs; 972 3 6731891; fax: 972 3 6731894; www.petrolbags.com

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EFP camera bag

Petrol Power Bag: includes rugged internal skeleton and an internal battery so camera can be demonstrated at airport security without removing it from its case; fits most EFP cameras and meets carry-on regulations; 972 3 6731891; fax: 972 3 6731894; www.petrolbags.com

Circle (430) on Free Info Card

Soft side video case

Lightware XL1, XLS: utilizes an offset curved zipper; provides photographer with opportunities for easy travel and packing of camera and accessories; 800-211-9001; 503-641-7873; fax: 503-643-9756; www.lightware.com

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Weather data system

Weather Central A.D.O.N.I.S MicroCast: this system provides station-controlled, market-specific, high-resolution forecasts; it features advanced visualization of future weather imagery and includes 60-hour forecast duration and output at 15-minute timesteps; 608-274-5789; fax: 808-278-2748; WXC.com

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Electronics reference books

CJ Publishing Electronics tutorial books: *The Transistor Handbook* and *The Diode Handbook* are the latest additions to this series of technical books written for the engineer and technician in the electronics or electrical industries; both books contain practical theory and circuit-level applications; 913-764-3577; fax: 913-764-8909

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Modular frame systems

Lighthouse Digital Systems Modular II: available modules include SDV to Fiber, Fiber to SDV, AES to Fiber, Fiber to AES, AJA 10-bit NTSC to Fiber, Fiber to AJA 10-bit NTSC, Analog Audio to AES Fiber and AES Fiber to Analog Audio; one RU frame holds four modules, two RU frames hold 16 modules — 14 modules with redundant P/S; 800-323-8287; fax: 530-272-8289; www.lighthousedigital.com

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Pinnacle Rocket for FXDeko: a software option that allows users to enhance titles and create sophisticated business graphics using both 2D and 3D elements including slabs, line charts, bar graphs and clocks; graphics can be manipulated in real time in 3D space and streamed in real time directly to air by interfacing with live data streams; uses template-basedapproach to configure graphics for playback; 650-526-1600; fax: 650-526-1601; www.pinnaclesys.com

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Option for nonlinear editor

Fast Multimedia FAST601 In-Time: this multiprocessor board requires the FAST-Studio XL software option, which delivers multiprocessor control; offers parallel processing capacity to accelerate all editing effects; 800-249-FAST; 425-354-2002; fax: 425-354-2005; www.fastmultimedia.com

Circle (367) on Free Info Card

Software enhancements for Audicy

Orban Audicy 3.0: this software update for the Audicy digital audio workstation supports five new types of digital effects, including Chorus and Flanging effects, dual-mono Digital Delay and a "Stereo Toolkit," which acts as a center channel "vocal eliminator" for some stereo music; the new software also offers users a mono-to-stereo synthesizer and the ability to create up to 20 custom presets for each class of effects; users can also bundle all elements in a full-multitrack production into a single file; 510-351-3500; fax: 510-351-0500; www.orban.com

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Encoder

Scientific-Atlanta PowerVU Plus Originator: now shipping from Scientific-Atlanta, the encoder incorporates the technology of the PowerVU system; allows users to originate digitally compressed programming with one box; operators interface through an integral video-source monitor; 770-903-6057; fax: 770-903-6464; www.sciatl.com

Circle (374) on Free Info Card

Datastorage systems

Lacie Limited 6GB & 18GB Pocket-Drive hard drives: these compact hard drives: these compact hard drives offer both Universal Serial Bus (USB) and FireWire (IEEE 1394) support; they allow content developers and audio/video professionals to expand storage on USB-equipped computers and FireWire systems such as PowerBooks; users also have the option of quickly sharing drive contents with others; the hard drives can serve as full backup for internal drives; 503-844-4500; fax: 503-844-4508; www.lacie.com

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Business Wire

Business highlights from broadcast and production

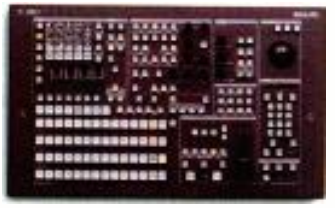
BY LAURA COLLINS, EDITORIAL ASSISTANT

RT-SET recently acquired Evans & Sutherland's Digital Video Division and Mindset, its line of 3D PC-based, open platform virtual studio solutions. RT-SET will also acquire Mindset's intellectual property, development team, customer base and distribution network.

The CNN News Group is using 30 dual-channel VR300 video servers from Leitch for its transition to server-based video playback. Two of its networks are currently using the system, with additional networks to be brought online later.

Also, four of Leitch's NEWSFlash nonlinear editing systems and other VR Technology desktop workstation solutions were purchased by ABC. The equipment will provide a 22-channel solution for ABC's West Coast NewsOne Affiliates News Service operations.

In other news, Sheridan College has purchased Leitch's 14-channel newsroom server with two integrated NEWSFlash editors. The server will be used as part of Sheridan College's new postgraduate program in Journalism-New Media.



Philips will provide 16 DD35 and up to 40 DD10 production switchers for the 2000 Summer Olympic Games. The switchers will be deployed at several major venues and provide coverage of main events.

Columbine JDS Systems renamed its new automation division CJDS DAL after its acquisition of DAL (formerly Drake Automation). In the reorganization, all automation products of the former Drake Automation and CJDS MCAS were moved into the new division. Promotions made in the course of the reorganization include: Barry Goldsmith to chief executive officer, Joseph French to vice president of CJDS DAL and John Wadle to director of software engineering of CJDS DAL.

Joseph French

NBC-owned-and-operated station WTVJ-TV chose Panasonic's DVCPRO Smart Cart automated record/playback system for their news and commercial archiving. The system will be implemented fully when the station moves to a new digital plant in the spring.

The Smart Carts hold DVCPRO 25Mb/s and 50Mb/s tapes, which will be used to maintain news and commercial archives respectively. Both carts will also be programmed to serve as backups for playing to air.

Panasonic also delivered digital cinematography equipment including four AJ-PD900WA 2/3" camcorders and four AJ-PD950 studio VTRs to Plus 8 Video in Hollywood. Plus 8 Video also purchased 12 AJ-D95DC DVCPRO50 desktop VTRs.

Los Angeles-based Grotto Studios has also purchased Panasonic equipment. The studio installed two DA7 digital mixers and linked them together to provide a 48-track fully automated digital and analog recording environment.

ScreenShot

Fujinon lens used in "Strangers with Candy"

Harlan Bosjamin, a director of photography with Comedy Central, used Fujinon's 10x5.2 high-definition lens to shoot the series "Strangers with Candy." The lens was used because of the modern look that it would create for the show: an appearance somewhere between video and film. The wideness of the lens also allowed interior shooting to be done more easily.

The Comedy Central series, shot in New Jersey and the outskirts of New York City, is the first sitcom to shoot episodes entirely in high definition.

SSL Axiom-MT captures symphony debut

Sheffield Remote Recordings used Solid State Logic's Axiom-MT digital console for the debut performance of composer Michael Kamen's symphony "The New Moon in the Old Moon's Arms" at the Kennedy Center in Washington, D.C.

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Ubi Soft recently installed **Solid State Logic**'s Axiom-MT digital multitrack console as a central element of its new multimedia studio complex. Ubi Soft decided to create the studio in order to improve the audio capacity for their video games and interactive software applications.

Peak Broadcast Systems' Everest Virtual Set and 3D graphics software is being used for the creation of promos and bumpers for a weekly program by Turner Sports. The virtual set was also used for Turner's NBA half-time show — to enhance game scores and integrate emersive graphics such as sponsors' logos.

CBS-owned KUTV-TV in Salt Lake City recently installed EPNS, the **Associated Press**' Electronic News Production System, to aid in production of its weekly on-air news programming.

Sinclair Broadcast Group recently awarded **Synergistic Technologies** a multimillion dollar contract to design and install digital systems for Sinclair's television stations. The systems will be installed in stations in Columbus, Ashville and Tampa and will double the number of component digital stations Sinclair operates.

Euphonix's System 5 digital audio mixing system and digital R-1 hard disk multitrack recorders are being used in Emerald Entertainment Group's studio, the Mix Room.

Utah Scientific, formerly Utah Comteck Video, recently acquired the UTAH-Series routing switcher product line from **Artel Video Systems**, along with the rights to the Utah Scientific name. Utah Scientific founders Lyle O. Keys and Earl Gray will serve in the reformation as honorary chairman and chief executive officer respectively. Carmelo Catalano will serve as chairman of the board.

Acrodyne Industries reached a license agreement with Sinclair Broadcast Group giving Acrodyne the exclusive rights to manufacture and sell the QUANTUM IOT analog and digital transmitters designed internally by Sinclair.

NEP and World Wrestling Federation Entertainment are working together to design a remote broadcast truck for use in the production of WWFE's live pay-per-view and TV broadcasts. The new remote truck, the SuperShooter 21, is scheduled for completion this fall.

The SuperShooter 21 will house a Kalypso Switcher from **Grass Valley Group**, making it one of only three NEP units in the country with the switcher. The remote truck also includes a "double expando" feature, which allows a portion of the truck's outer shell to be extended to provide more video production space.

Los Angeles-based 5.1 Entertainment Group recently installed a DPC-II digital production console from **Soundtracs**. The installation is part of 5.1 Entertainment Group's plan to offer consumers true 5.1, 24-bit/96kHz music in a DVD-A format.

Laser Pacific, a Hollywood-based post-production facility, purchased a **Tandberg Television** E5820 HD ATSC encoder as part of a system allowing production teams to view high-definition dailies. The system utilizes Tandberg's encoder in conjunction with a high-definition VTR, a SMPTE 310 converter and a 8VSB modulator to produce a Panasonic digital VHS tape.

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ScreenShot

Panasonic records Little Women for "Great Performances" series

Panasonic's HDTV truck was used recently by the Houston Grand Opera to record Mark Adamo's opera "Little Women." The truck recorded three performances of Adamo's adaptation of Louisa May Alcott's novel to be broadcast on 13/WNET New York's "Great Performances" series. The series will be seen on public broadcasting stations throughout the country in the next television season.

Equipment used in the production truck includes the AQ-7200P 720p studio cameras and AQ-720P hand-held cameras, AJ-HD2700 1080i/720p D-5 HD VTRs, and AJ-UFC1800 Universal Format Converters.

Profile video platform supports 72nd Academy Awards

The Grass Valley Group Profile digital video platform was used to provide digital recording, editing and playback for the 72nd Academy Awards in March. Overall, 20 platforms were used in the production. Thirteen provided source material to rear-screen projectors onstage. Six more provided playback of segment clips, Oscar-winning films and pre-produced graphic material. Finally, a stand-alone platform was utilized to record live camera feeds during the "star arrivals" segment.

The Profile platform has also been used for the American Comedy Awards, the Golden Globe Awards and the Grammy Awards this year.

Clients can then view the day's work in HD rather than standard definition, as has been the usual practice.

Chicago-based post house Optimus recently added a DVH2010 High Definition Adaptive Grain and Noise Reduction system from **Digital Vision** to the Digital Vision standard-definition systems already installed in its facility. The arrangement allows colorists to switch between formats without moving from room to room within the facility.

Chips Davis Designs, named one of the world's best Sound Design firms by *Mix Magazine*, supervised the redesign and construction of ***one/eleven***'s new Studio One. The new studio includes a Dolby Digital 5.1 surround sound system, as well as Genelec monitoring and a Ramsa digital automated mixing console.

Panasonic, prime contractor for the producers of the 2000 Summer Olympic Games, has selected **Videotek** to provide test and measurement equipment for the Games.

NBC has ordered a 56-channel Alpha 100 digital audio console from **Calrec** for studio 3A in its headquarters in Rockefeller Center. The order is part of a wider agreement between NBC and Calrec to cooperate in the development of digital audio production consoles for live broadcast operations.

Fletcher Chicago purchased the first **Canon** Digi Super 86xs, offering their customers the longest field zoom lens available. The 86xs allows shooting to be done in HD or NTSC and incorporates a new image stabilization system to eliminate vibrations at a frequency of up to 10Hz.

TTC and **Wavetek Wandel Golmann** recently merged to create a new, as yet unnamed, company. The new company will offer expanded products

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and services, with a presence in over 80 countries. Corporate headquarters for the company will be in Germantown, MD. The company will have more than $800 million in revenue and more than 4000 employees.

K-mart recently purchased five Z-3000W camera systems from Hitachi for its world headquarters in Troy, MI. The camera systems will be used to update K-mart's broadcasting video network.

NBC will use storage and editorial finishing systems from Avid to handle nonlinear post-production for the 2000 Summer Olympics Games and the 2002 Winter Olympic Games in Salt Lake City. NBC purchased 12 of Avid's Symphony editorial finishing systems, with a supporting Unity MediaNet system.

AMS Neve was recently honored with a Scientific and Engineering Award by the Academy of Motion Picture Arts and Science. AMS Neve received the award for the design of its DFC Digital Film Console for motion picture sound mixing. The console allows for multiposition mixing capabilities and stem routing predub inputs. It has been installed in over 40 facilities worldwide and has produced sound for movies including *Toy Story 2*, *StarWars: The Phantom Menace*, and *The Matrix*.

ABC affiliate WNCF-TV chose Devlin Design Group to assist in the development of their new facility for virtual newscasting.

TANDBERG Television was chosen by FOX Sports Net to provide encoding and decoding, ATM interfacing, and a control system for FOX Video Network. The national asynchronous transfer mode (ATM)-based content contribution and distribution network will allow regional production facilities to exchange regional sports content.

LAUNCH purchased a three-camera Larus Post system from RT-SET. The system will be used to render content for simultaneous broadcast over the internet and traditional television channels. Using the system's real-time post feature, LAUNCH can tape programs around the talents' schedules and recomposite the scenes later.

CBS stations WCBS/New York and KCBS/Los Angeles will use Panasonic's DVCPRO News Automation System for news production and storage. Six DNA systems will be located at KCBS and nine systems will be installed at WCBS. The systems will allow three-channel playback to air.

In a ceremony at Itelco's booth at NAB2000, the Order of the Iron Test Pattern awarded some of the veterans of the television industry for their unique accomplishments. John Battison — a former editor of *Broadcast Engineering*, founder of SBE and a current writer for *BERadio* — was awarded the Crusty Engineer Award. He received the award for being the oldest engineer still earning a living in the industry and for having done so for the longest time (55 years).

John Battison

Joseph Barath, a television engineer with the Johnson Space Center Television Systems, received the Iron Desk Award for holding the same position while being employed by five different organizations. The Rusty Doc Award went to Dr. Byron St. Clair for his work with low-power transmitters. Chuck Pharis, senior video engineer with ABC, received the Rust Collector Award for his personal collection of 70 ancient broadcast cameras.

Panasonic recently launched their new Value-Days web site, www.panasonic.com/valuedays. The site allows users to purchase Panason-

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ic pro video equipment at up to 50 percent off suggested list prices.

Harmonic aquired **DiviCom** business C-Cube Microsystems to provide delivery systems for cable, satellite, telco and wireless networks.

360 Systems' TCR8 is being used in the *Tonight Show* for recording duties including layering and mixing sound effects. 360 Systems' Instant Replay is then used to cue the effects on-air. Live musical performances on the show are also recorded using the TCR8.

GlobeCast selected **Philips** seven-channel MPEG-2/DVB compression and multiplexing system with a CleverCastPCT Data Broadcasting/IP Hub for its uplink in Miami. Use of Philips' system will allow GlobeCast to expand its satellite-based information delivery service.

Yahoo! is using **Avstar's** Newsroom Computer System (NRCS) to assist in the launch of Yahoo! Finance Vision. The new service from Yahoo! will allow users to receive financial news and stock quotes by live video.

Thomson-CSF has acquired **Siemens'** power grid tube activities. Manufacturing will be transferred from Siemens' Berlin facility to TTE's technical facilities in eastern France, pending the approval of national authorities.

Capitol Broadcasting's datacasting unit, **DTV Plus**, and **WaveXpress** formed a strategic partnership to develop an infrastructure for broadcast E-commerce.


Dick Crippa

PEOPLE

Snell & Wilcox announced the appointment of **Dick Crippa** as president of Snell & Wilcox, in Santa Clara, CA.

Richard Fiore, Sr. -- founder, president and CEO of Comark Communications -- died on April 29 at age 71.

Jorgen Bredesen, was appointed as the new president and chief executive officer of Tandberg Television.

New York Media Group appointed **Steve Clark** as vice president, audio engineering.


Robert Mueller

Robert Mueller was recently appointed as executive vice president for JVC Professional Products Company.

Bland McCartha was named vice president of business development for Archion. ■

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PHOTO - VIDEO - PRO AUDIO

FUJINON ENG LENSES

While ENG camera technology evolves faster and faster, delivering ever higher performance in ever smaller bodies, it has been increasingly difficult for lens manufacturers to improve quality while keeping size and weight to a minimum until recently. With Aspheric Technology (A-2) Fujinon has succeeded in manufacturing superior quality lenses that are both smaller and lighter than lenses of conventional spherical design. From the widest angle to the highest telephoto, Fujinon's broadcast hand-held style lenses offer unparalleled features and performance. In fact, they are so advanced and so optically superb they will reshape your thinking about how well a lens can perform.

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

A15X8EVM Standard Zoom Lens

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

A20X8EVM Standard /Telephoto Zoom Lens

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

CHYRON PC-CODI & PC Scribe

Text and Graphics Generator and Video Titling Software

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

PC-CODI Hardware:

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

PC-Scribe Software:

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

PC-CODI and PC-Scribe Bundle 2995.00

TRUEVISION/Avid

Professional Video Production Workstation

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

TARGA 1000 Features:

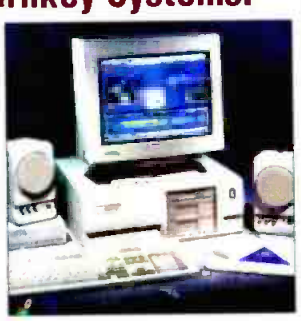
The TARGA 1000 delivers high processing speed for video and audio effects, titling and compositing. Capture, edit and playback full-motion, full-resolution 60 fields per second digital video with fully synchronized CD-quality audio.

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

MCXpress Features:

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

TARGA 1000/MCXpress Turnkey Systems:



- 300-watt, 6-Bay full tower ATX chassis
- Pentium ATX motherboard with 512K cache
- Pentium III- 450 MHz Processor
- Matrox Millenium II AGP 4MB WRAM display card
- 128MB 10ns 168-Pin (DIMM) S-DRAM
- IBM 10GB IDE System Drive
- Seagate Barracuda External 9.1GB SCSI-3 ultra-wide capture drive
- Adaptec AHA-2940U2W Ultra Wide SCSI-3 controller card
- Teac CD-532e 32X EIDE internal CD-ROM drive • 3.5" floppy drive
- Altec-Lansing ACS-48 3-piece deluxe speaker system
- Viewsonic G771 17" (1280 x 1024) monitor (0.27mm dot pitch)
- Microsoft MS Mouse • Focus 2001A keyboard
- Avid MCXpress for Windows NT • Windows NT 4.0 operating system
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KNOX VIDEO

RS4x4/8x8/16x16/16x8/12x2
Video/Audio Matrix Routing Switchers

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

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

LEADER

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

5860C WAVEFORM MONITOR

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

5850C VECTORSCOPE

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

5100 4-Channel Component / Composite WAVEFORM

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

5100D Digital Waveform/Vectorscope

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

5870 Waveform/Vectorscope w/SCH and Line Select

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

5872A Combination Waveform/Vectorscope

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

5864A Waveform Monitor

A two-input waveform monitor that offers full monitoring facilities for cameras, VCRs and video transmission links. The 5864A offers front panel selection of A or B inputs, the choice of 2H or 2V display with sweep magnification, and flat frequency response or the insertion of an IRE filter. In addition, a switchable gain boost of X-1 magnifies setup to 30 IRE units, and a dashed graticule line at 30 units on screen facilitates easy setting of master pedestal. Intensity and focus are fixed and automatic for optimum display. Supplied with an instruction manual and DC power cable.

5854 Vectorscope

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

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

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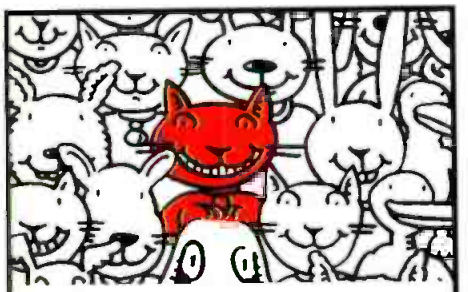

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Classifieds Help Wanted

FRONTLINE Communications Corporation

Due to growth, Frontline Communications has positions for **Broadcast Systems Engineers** and **Systems Integrators** with experience designing and or installing and testing Audio, Video, Satellite Uplink and Microwave Systems used in Television Broadcast Vehicles. Send or FAX resume to the attention of Personnel at Frontline Communications, 12725 Automobile Blvd., Clearwater, FL 33762; FAX: 727-573-1135. Frontline offers competitive salary, health and dental insurance, 401K, vacation and holidays, EOE. Drug Free Work Place.

ASSISTANT TO THE COORDINATOR OF MEDIA/TECHNICAL SUPPORT: Leading Connecticut State University seeking highly motivated studio professional. Experienced in maintaining and calibrating University TV Studio, Satellite System, Cable Channel and editing facilities. Systems include Grass Valley 200, Panasonic S-VHS, DVC Pro and Media 100 Non-Linear. Repair and trouble-shooting of all Media equipment required. Administrative staff position, degree or experience, SBE certification a plus. Salary negotiable, full benefits including tuition waiver for self and dependents. Interested candidates should send resume and three references to: Jack Boyko, Coordinator of Media Services Eastern Connecticut State University 83 Windham Street Willimantic, CT 06226-2295 ECSU is an AA/EEO employer, women, members of protected classes and people with disabilities are encouraged to apply.

Broadcast ENGINEERING
THE JOURNAL OF DIGITAL TELEVISION

MAINTENANCE ENGINEER: Immediate opening for an experienced broadcast Engineer. Must have a minimum of 2 years experience in broadcast maintenance, including systems troubleshooting and repair of studio video and audio equipment to the component level. Computer and networking experience a plus. FCC General Class License or SBE Certification is desired. Excellent wage/benefit program. Respond with resume to Personnel Administrator- 139, WTOL-TV, P.O. Box 1111, Toledo, Ohio 43699- 1111. No phone calls, EOE.

Help Wanted

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

Classifieds Help Wanted

ASSISTANT CHIEF ENGINEER GW TELEVISION: The George Washington University, a private institution located in the heart of Washington, D.C., is seeking an Assistant Chief Engineer to supervise the technical operation & maintenance of GW Television (GWTV). The successful candidate will coordinate and direct the day to day technical operation and maintenance of the television and multimedia production facilities. GWTV is looking for a hands-on engineer/supervisor to provide expertise, experience, and direction to GW Television's Engineering and Operations staff. Knowledge and experience with analog and digital television systems is essential. Remote operations experience is a definite plus. GW Television encompasses three multi-camera production studios, EFT equipment and staff, digital audio/video/data compression systems, ITFS broadcast channels, multipoint ISDN Teleconference facilities, fiber optic and satellite communication systems, and a 750MHz campus-wide cable system. GWTV is also in the planning and design stages of a move into a new all digital facility. The selected individual will play a key role in making this new facility a reality. The individual selected will work with a group of dedicated professionals using state-of-the-art equipment in the rapidly developing field of communications and distance learning. The Assistant Chief Engineer reports directly to the Chief Engineer of GWTV and is a key member of the management staff. GW offers an industry-competitive salary (mid to high 50k's), a generous benefits package including exceptional education opportunities, and an opportunity to participate in shaping the future of technology learning. To apply reference requisition #R7760 and mail or fax a resume with cover letter and three professional references to E. Dancil, Human Resource Services, 2033 K Street, N.W., Suite 220, Washington, D.C. 20052. (202) 994-9609 fax. E-mail edancil@gwu.edu. Please see our web page at www.gwu.edu/~hrs and if possible submit a completed application and applicant data form with your resume. GW is an equal opportunity employer.

ASSISTANT CHIEF ENGINEER MIN. 4 YEARS IN TELEVISION BROADCASTING AS A MAINTENANCE ENGINEER. MUST HAVE A WORKING KNOWLEDGE OF VIDEO BROADCAST EQUIPMENT, TRANSMITTING EQUIPMENT, FCC RULES AND REGULATIONS. ABILITY TO TROUBLESHOOT EQUIPMENT PROBLEMS DOWN TO A COMPONENT LEVEL. FCC GENERAL CLASS RADIOTELEPHONE LICENSE AND OR SBE CERTIFICATION. SEND RESUME AND SALARY HISTORY TO: CHIEF ENGINEER, KFWD-TV, 3000 W. STORY RD., IRVING, TX 75038. KFWD IS AN EEOE.

KSHB-TV, the NBC affiliate in Kansas City, is looking for a seasoned SNG operator/broadcast engineer to join our staff. Qualified candidate should have at least 2 years of college or technical school training majoring in electronics and 3 years experience as both a broadcast engineer and SNG truck operator. Must be available to work flexible shifts and travel as job requires. Valid CDL and FCC license required. Resumes may be addressed to: HR Administrator, KSHB-TV, 4720 Oak Street, Kansas City, MO 64112; or you may e-mail to Stoner@kshb.com. EOE

ENGINEERING MAINTENANCE TECHNICIAN: KPLR-TV WB11 in St. Louis MO has an immediate opening for an Engineering Maintenance Tech. Duties include Maintenance of all broadcast and related equipment including DVC Pro and Betacam VCRs, GVG & Utah switchers, ENG/EFP equipment, etc. Microwave & VHF transmitter experience is a plus. 3-5 years broadcast equipment maintenance required. Come help us move to a new Digital facility. Please reply with resume to: Dept. 116F, KPLR-TV, 4935 Lindell Blvd., St. Louis, MO 63108. EEO EMPLOYER M/F/V/H.

Classifieds Help Wanted

Engineering

FOX CHANNELS GROUP

FOX Channels Group, a major producer of sports entertainment products, is currently seeking an experienced Director of Engineering.

DIRECTOR OF ENGINEERING

Individual will direct and oversee engineering assignments within a wide range of technical disciplines to design, develop, maintain, and integrate electronic subsystems and components, software systems, signal distribution subsystems, and other components required in the operation of the company's Los Angeles Technical Operations facility; will perform, at various professional levels, in one or more technical disciplines including software engineering, hardware engineering, systems architecture, systems engineering, systems integration, and testing; direct the Engineering staff involved in the installation maintenance, testing, and repair of all broadcast equipment and systems. Will also establish and maintain standards for Technical quality within the facility; coordinate with all clients, Net engineering, and Houston Operations concerning all engineering needs and requirements; prepare and maintain department operational budget including forecasting and maintenance of operational budgets, and Capital budgets; prioritize, plan, and direct all facility engineering projects. Individual will also plan and direct all technology needs as developed by Operations and oversee project development; plan and develop new technology for use in broadcast systems to meet ever-changing needs; work with General Manager and staff to develop Capital plans utilizing future technology.

Requires Bachelor's Degree in Electrical Engineering (BSEE) or the equivalent from a four-year college or technical school, or 4+ years' experience and/or training or the equivalent combination of education and experience; in-depth knowledge of engineering principles, design and development techniques and specialization in one or more of the following technical disciplines: software engineering, hardware engineering, systems architecture, systems engineering, systems integration, and test engineering; developed analytical and research skills and the ability to coordinate technical projects with other engineering organizations and outside vendors; the ability to work with engineering as well as non-engineering people with ease, especially in highly charged production environments. Candidate must also have a solid background in Budget preparation, especially relating to operating budgets, forecasts, and the preparation of Capital budgets.

We offer competitive salaries and excellent benefits. For immediate consideration, please submit your resume and salary history to: **Fox Channels Group, Human Resources Dept., Code: JK/DE, 1440 S. Sepulveda Blvd., Ste. 353, Los Angeles, CA 90025**; fax to: **(310) 444-8490**. NO PHONE CALLS, PLEASE. We are an Equal Opportunity Employer.

FOX CHANNELS GROUP™

NBC 25 Director, Engineering, & Information: Successful candidate must be well versed with news operation and support and all broadcast engineering practices. Hands-on experience with studio operations & UHF transmitters required. Knowledge of computer systems and digital technologies desired. MCSE or equiv experience a plus. Should be "quick thinker" who completes tasks timely and within budget. **Manager, Transmitter & Studio:** Candidate must have a minimum of 5 yrs hands-on experience with broadcast news & studio operations & UHF transmitters. Trouble shooting capability with working knowledge of equipment installation and maintenance to the component level a must. NBC25 is a small market NBC Affiliate. We offer a comprehensive benefit package, including 401(k) and section 125 plans. Send resume and cover letter to NBC25, Dept Z, 13 East Washington Street Hagerstown 21740. Drug Screen Required. EOE.

MAINTENANCE ENGINEER: Bay News 9, Time Warner's digital, state of the art, 24-hour cable news operation in Tampa Bay, has an opening for a full time maintenance engineer. The qualified candidate will possess an AS degree or equivalent technical training in equipment maintenance and repair. Requirements include at least three years experience in the Installation and maintenance of analog and digital television systems. Should also have a strong background in ENG/DSNG trucks, microwave systems, satellite systems, fiber networks, studio automation and computer networking. Must be able to operate Independently or as a team member to complete projects on time and under pressure. Work on the cutting edge of television news presentation technology. Send resume to Steve Weitekamp, Director of Operations, Bay News 9, 7901 66th Street North, Pinellas Park, FL 33781. Email: sweiteka@baynews9.com. EOE.

ASSISTANT CHIEF ENGINEER (Full-time Regular) JOB DESCRIPTION: WJBK/Fox 2 is seeking an enthusiastic individual to oversee the day-to-day operations of the Engineering Department. The position will serve as the first point of contact for all News technical related operations. In addition, the position will have direct responsibility for the technical maintenance of news broadcast equipment and the assignment of the maintenance staff. The position will also assist the Vice President of Engineering with OSHA and FCC compliance requirements. REQUIREMENTS: Must have a bachelor's degree or equivalent experience in a related field, plus 3-5 years experience in engineering management. Must have demonstrated success in a large-scale, fast-pace news engineering operation. Hands on experience with Microsoft Office Systems, Novell networking and Internet technical skills are highly preferred. For consideration, please forward resume and cover letter to Tim Redmond, Vice President of Engineering c/o, the Human Resources Department, WJBK-TV 16550 West 9 Mile Road, Southfield, MI 48075. EOE/M/F/D/V.

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EOM

Watched lips show slips

BY PAUL MCGOLDRICK

The commercial success of DVD has been one of the most interesting product launches since electronics began. In exactly three years of machine production, there have been an estimated 6 million players shipped. There are now nearly 6000 DVD titles available. During 2000 there are expected to be 200 million DVDs shipped with a total revenue of $8 billion. Additionally, an amazing 10 percent penetration of DVD players in U.S. households is expected this year.

That phenomenal performance continues to be unstoppable. Virtually every video being released in VHS is now also being released in DVD, and there seems to be little or no consumer resistance to the price of DVD titles.

A lot of the credit for this growth must be given to the manufacturers of the players; they were never overly expensive, even for the so-called reference models. Decent players are now available for between $250 and $300 if the Dolby Digital decoder is not on board. Thank goodness the standard avoided the subsequent wars that have been waging around both digital audio and DTV implementation itself. Throw a smorgasbord of abbreviations at the general public and confusion is completely natural. Even within the industry, few of us can completely differentiate between DVD, DVD-A, DVD-A/V, DVD-RAM, DVD-RW, DVD+RW, DVD-V and, of course, CD, CD-R and CD-RW without going to a reference source for some information.

But even a good standard, one that brings studio-quality video and audio to the consumer, needs to be knocked when something is not right — and I think there is a major problem brewing.

The nature of digital video — with the large amount of processing involved compared to the audio channel, particularly in the compression/decompression cycles — means that there is always going to be an issue with lip sync. This is annoying on the two DBS feeds when the most highly compressed channels have lip sync errors approaching a full second. On channels with material such as cartoons, it really doesn't much matter. But on any channel with real video or film, it is troublesome. When combined with the motion artifacts of these higher compressions, the channel becomes unwatchable. Even for non-technical types, lip sync errors are annoying.

Even a good standard ... needs to be knocked when something is not right ...

As channel compression rates reduce — which seems to be the case with most sports and the premium channels — lip sync problems all but disappear, so presumably the decoders are optimized for that use. There should, of course, be little problem in devising a decoder that varies the audio delay as the compression ratio changes: All the information is there in the video path. The technology for providing a variable audio delay is not exactly difficult or expensive.

But whereas an audience might be willing to put up with some lip sync problems on a low cost service, it is unlikely to bear the same problems on an expensive product. That is what some DVD titles face. I have seen titles where the lip sync is wrong throughout the complete production. I have seen titles where it goes wrong after a while or within particular segments of the production. This is inexcusable. Here we have a consistent compression that is fully correctable for the consumers' decoders during authoring. If there is a difference between decoders from different manufacturers of more than a frame, then we have a standards problem. But I don't believe there is such a problem; when you see a lip sync error on DVD it seems to be at least eight frames.

Some saw the laser disc and S-VHS as technologies that were too early for themselves or badly handled. The S-VHS machine gave great pictures but the industry wanted a ridiculous price and invented a special tape mechanism so that ordinary VHS tape could not be used. The format would have been the standard if the machines had been priced at a par with VHS and all video releases had been S-VHS. It is interesting to see S-VHS making a comeback as prices have dropped and the public has become more familiar with S-video.

Laser disc produced great pictures and audio and was an amazing product for an analog technology. But how many people do you know with an LD player? A few, and they're probably heavy techies. The laser disc was a good product at the wrong time. The DVD is a good product at the right time; but the public will not tolerate poor presentations of that product. ■

Paul McGoldrick is a freelance industry consultant based on the West Coast.

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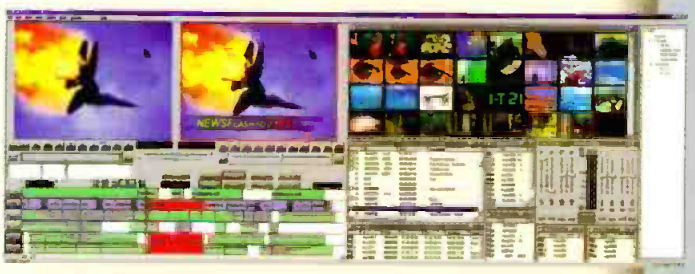

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