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

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FREEZE FRAME
A look at the technology that shaped this industry.

Do you remember?
In December, 1989, Broadcast Engineering interviewed ATSC's (then chairman) Jim McKinney and Atlantic Bell's CEO, Ray Smith. What key technology did both men say was crucial to the future of television? And, which of today's widely popular technology was not mentioned as being an important development? Send your answer to brad_dick@intertec.com. Selected correct entries will receive a Broadcast Engineering T-shirt. Previous winners not eligible.

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Everyone's an expert

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

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

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

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

"You don't understand," said one. "With 96Khz sampling, air modules are affected differently than with 48kHz. The transmission of audio is simply different with 96kHz. The whole physics of audio transmission changes with 96kHz."

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

On Monday, I heard a guy say the difference between listening to 48kHz-sampled CDs and 96kHz-sampled audio was similar to the difference between a 78rpm record and surround sound. But the know-it-alls weren't limited to attendees. We're all familiar with the stories of how people can hear the differences in wire. Well, how about hearing the differences based on RLT? Never heard of RLT?

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

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

Next time you need an expert just attend the AES.

Brad Dick, editor
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[Image of modular digital video/audio interfaces with text overlay]
Dear Editor,
In this age of computers and advanced technology, why not allow online requests for the Broadcast Engineering magazine? This would save paper, postage, etc. and make it easier for the consumer to order.

Thanks!

FRANK DANIELS
ASSISTANT CHIEF ENGINEER
KRGV-TV
WESLACO, TX

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

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

BRAD DICK
EDITOR

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

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

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

DOUG SMITH
NASHVILLE, TN

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

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

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

MORGAN PARK

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

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

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

September T-shirt winners:
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Sinclair Broadcasting files FCC petition

BY LARRY BLOOMFIELD

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

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

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

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

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

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

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

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

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

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

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

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

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**CBO, CEMA urge must-carry rules for cable**

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

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

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

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

“Without digital must-carry rules for cable systems during the transition, a move that most cable operators oppose, the likelihood of reaching the 85
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The Harris ARX-H100 and ARX-H200 professional ATSC receivers let you monitor digital transmissions from any point in the air chain. These units can decode any of the 18 ATSC formats and signals from all VHF and UHF channels, and also support PSIP and Closed Captioning (CC). The ARX-H200 also provides equalizer tap information and signal-to-noise measurements, and features a TCP/IP remote control interface.

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

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

OTHER DTV SOLUTIONS

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

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

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

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

TRANSMISSION

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

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

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

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

Multichannel DTV Antennas
Check out Harris' family of antennas, including models for DTV that can handle up to five signals simultaneously. Antennas are available for low- to super-power applications with a variety of mounting options.
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DTV Training Solutions
We know that training is critical, so our Broadcast Technology Training Center in Quincy, Ill. is offering more DTV training classes than ever. And we've extended our SmartPak DTV RF Training Program offer, which allows stations to enroll in five courses for the price of three. SmartPak courses include: Intro to HDTV, TV Transmitter Systems and Installation, RF Transmission Fundamentals I and II and TV Transmitter Measurement Workshops. Coupons are valid for one year and can be mixed and matched among station personnel. Visit our Web site for detailed course descriptions and space availability at www.harris.com/customer-service/training schedule.
At Harris, we take our commitment to broadcasters very seriously. That's why we've invested in a new state-of-the-art headquarters that we believe will help us serve you even better. Centralizing our strategic Television, Radio and Systems business units with advanced digital engineering, Harris' recently completed Broadcast Communications Division's headquarters exists for one reason - to speed the development of the next level solutions you need to thrive in today's rapidly changing marketplace.

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

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

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

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

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

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

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

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

Sony co-founder Akio Morita dies

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

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

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

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


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

The CBO concludes

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

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November 1999 Broadcast Engineering 29
Kennard vows to reshape the FCC

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

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

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

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

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

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

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

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

WHAT AUTOMATION BACKUP?

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Start-up company offers delivery of video to PCs

Geocast Network Systems Inc., a start-up company, has developed a timely method to deliver digital video and high-quality audio to personal computers, stating that its cross-over architecture method combines “the bandwidth and immediacy of broadcast with the customization and control of the PC.” Geocast put together a package that makes timely deliverance of content to PC users. Joe Horowits, chief executive officer of Geocast, says that the Internet’s point-to-point architecture was never designed to deliver rich media content to a mass audience. The Internet industry has been trying to catch up to broadcasting by improving infrastructure, with lackluster results.

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

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

Hearst-Argyle Chairman Bob Marbu sees the Geocast crossover architecture as a whole new opportunity for their stations to serve their respective local communities. Marbu suggests that Hearst-Argyle can develop specific programming for the PC user that will help to recoup some of the heavy investment they’ve made in digital broadcasting.
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Hearst-Argyle owns 22 television stations and have another four under management. The group reaches nearly 18 percent of U.S. households, making it one of the two largest non-network-owned domestic television station groups, as well as one of the seven largest television groups overall as measured by audience delivered.

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

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

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

**NBC dabbles in convergence**

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

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

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

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

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

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**Stations prepare for satellite carriage**

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

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

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

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

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

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in the law for recreational vehicles which travel countrywide.”

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

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

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

DirecTV plans to provide customers in the next few months with set-top boxes which would decode the digital signals of their satellites and terrestrial ATSC and NTSC, with seamless integration of their channel navigation services and no A/B switch required. Echostar V was launched September 23 to add local programming to the Dish Network’s lineup of 500 channels.
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Circle (123) on Free Info Card
The FCC’s first auction of broadcast channels began Sept. 28, 1999, and concluded on Oct. 8, after 35 rounds of bidding. The following were the winning bids and bidders for full-service TV construction permits:

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

New channels for pending Channel 60-69 applicants

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

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

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

TV duopoly logjam expected

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

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

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

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<th>Min. bandwidth for HDTV</th>
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Do the math: the equation for figuring out the bandwidth you'll need to broadcast HDTV. No matter how you figure it, it adds up to ADC Superjacks.

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What is HD?

JERRY WHITAKER, BE CONFERENCE CONSULTANT

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

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

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

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

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

Now let’s count pixels. Digital standard definition has 720 pixels (Y) per line and 480 lines, and in the studio the active video occupies about 170Mb/s.

1080-line HD has 1920 pixels per line, and uses about 1Gb/s, or five times the data. 720 progressive has 1280 pixels per line, but because all the lines come in one frame the data rate is just under 900Mb/s. This is why the ATSC table shows 1080 and 720 as high definition — all that data represents image detail that will be perceived as high definition.

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

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

To me, high definition means composed and delivered in widescreen with many times more image information carried as faithfully as possible to a viewing device with the best resolution possible. However, I would be remiss if I didn’t say that compromises will probably be made in order to send other digital information along with the audio and video that can augment and enhance the viewing experience, and that
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DTV and HDTV are not just about great pictures anymore. I would also be remiss if I didn’t say that there will be a significant role for SD images integrated into HD programming. One can easily imagine upconverted news field footage combined with studio production to create an impressive and cost-effective final result.

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

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

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

The systems at American Production Services are 1080i and can handle all of the existing 1035i footage. Yes, 1035i was a standard. All of the post-production job in our new LA facility was a feature “film” called “Last Mountain” shot and posted with color correction on HDCAM to be taken to 35mm film. It looks great. Our first post-production job in our new LA facility was a feature “film” called “Last Mountain” shot and posted with color correction on HDCAM to be taken to 35mm for release. With all of the possibilities, the “1080” standards for post production are here to stay.

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

I was initially critical of ABC’s decision to start HDTV programming in 720p rather than 1080i. My observations at that time were that 720p lacked a superior picture, equipment availability was a real concern and, because 720p were unfounded. The pictures are very good, certainly far superior to NTSC, even when critically viewed on a 100-inch projection TV. I have not talked to anyone who has seen the pictures (professionals or consumers) who has not been astounded by their quality.

ABC has put considerable effort into the DTV graphics for “Monday Night Football,” and it shows. Progressive scanning means graphic elements are crisp and clean, which opens up new possibilities to designers. Overall, the efforts from ABC have been first rate. 720p produces a high-quality picture, capable of creating an “Oh, wow” reaction from anyone who sees it. Will it become the de facto standard? It’s far to early to tell, but it will give viewers a great picture, one that will hopefully drive consumers to purchase HDTV sets.

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

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

**Analog compression**

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

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

- The ability of the viewer to retain or in some way to remember the impression of an image after it has been withdrawn from view. When the light entering the eye is shut off, the impression of light persists for about 0.1 second. Consequently, 10 pictures per second can adequately convey the
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illusion of motion.
- The HVS requires a picture repetition rate in excess of 10 still pictures per second to reduce flicker. The critical flicker frequency is the minimum rate of interruption of the projected light that will not cause the motion picture to appear to flicker. The perception of flicker varies widely with viewing conditions and picture material. Comfortable viewing requires in excess of 24 pictures per second. For film projection, each picture is projected twice, resulting in a flicker rate of 48Hz.

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

Finally, analog television standards make effective use of several widely ignored compression concepts. The final aim is to reduce the transmitted channel bandwidth as follows:
- The total number of scanning lines per picture was adopted taking into consideration the number of vertical details (total number of scanning lines in this case) discernible at an empirically selected distance from the TV screen (6x the picture height). It was determined by experiments that the eye resolves about 572 vertical details under these conditions. North America adopted 525 lines (slightly below) and Europe adopted 625 lines (slightly above) the visibility limit. This choice limited picture resolution based on human vision characteristics.
- Interlaced scanning was adopted to reduce the transmitted bandwidth. Given the frame rate of 29.97Hz (nominally 30Hz or 25Hz in Europe) the video bandwidth is reduced to one half of what would be needed for a progressive scan. The resulting large-area critical flicker frequency is equal to the field-rate (59.94Hz or 50Hz). Consecutive field line-to-line differences are perceived as interline flicker, mostly unnoticeable by the eye and have required an 8.4MHz transmitted bandwidth plus an extra 200kHz for FM audio. A progressively scanned picture with an 8.4MHz video bandwidth would have required a 16.8MHz double sideband transmission channel.
- Color information is transmitted using a set of two bandwidth-limited (±600kHz) B-Y and R-Y signals, each modulating in amplitude an associated suppressed subcarrier of about 3.58 MHz. The reduced chrominance bandwidth reflects the eye's reduced sensitivity to colored picture details. The modulating process is suppressed carrier, double sideband amplitude modulation of two subcarriers in phase quadrature (we might refer to this process as SCDSBQ-PAM). The selected NTSC subcarrier frequency is 455/2 fH (fH=15734.25 Hz) allowing the chrominance information to be frequency division multiplexed (FDM) with the monochrome (luminance) information thus maintaining the baseband spectrum of 4.2MHz.

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

**Digital compression**

Conventional analog composite systems compress video information by restricting the bandwidth of the baseband luminance and chrominance signals. These restricted bandwidths reflect the eye's sensitivity to spatial and temporal picture details. Analog component video formats use similar baseband methods, but with slightly wider bandwidths for chrominance signals. The CCIR 601 4:2:2 video format specifies a luminance signal bandwidth of 5.75MHz and a chrominance signal bandwidth of 2.75MHz, slightly below the Nyquist frequencies corresponding to the related sampling frequencies but well above any
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analog composite signals such as NTSC, PAL or SECAM. After digitization the three component digital signals are time division multiplexed into a 27Mword/s (10bits/word) parallel bit stream and subsequently serialised. The serial bit-rate equals 270Mb/s. While this signal can be comfortably distributed inside a production facility, the high bit rate is unsuitable for transmission purposes or for moderate cost/size digital videotape recorders. Figure 2 summarises the 4:2:2 encoding process and outlines the component bandwidth limitations and the resulting 270Mb/s serial digital spectrum.

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

**Video signal redundancies**

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

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

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

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

**The human visual system**

Video signals are ultimately decoded and displayed for human observers. The human eye, in conjunction with the brain, constitutes a well-developed imaging system. It can operate under a wide range of light intensities, recognize colors and peripheral detail is higher than its sensitivity to chrominance detail.

- **Contrast sensitivity:** Variability of one image detail is reduced in the presence of another.

- **Noise frequency:** The HVS has a low sensitivity to high frequency noise.

Temporal redundancies:

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

- **High brightness levels increase the flicker perception**

- **Spatial frequency content:** Low spatial frequencies reduce the eye’s sensitivity to flicker.

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

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

Send questions and comments to: michael_robin@intertec.com
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Windows NT update

BY BRAD GILMER

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

What's in a name?

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

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

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

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

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

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

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

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

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

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

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

**Microsoft and television**

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

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

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

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

*Brad Gilmer is president of Gilmer and Associates, a management and technology consulting firm.*
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Potholes along the road to digital

BY STEVE EPSTEIN, TECHNICAL EDITOR

Dr. Digital,

I just read your August column about component video levels. It brought up a similar question that I have about converting from NTSC composite to CCIR 601.

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

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

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

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

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

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

By the way, on those Ikegami CCUs, you might check the chroma levels on the color-difference outputs. Because the Y channel has setup, the outputs might be configured for Betacam levels, which include increased chroma level. As always, comments and questions are encouraged, drop me a note at drdigital@compuserve.com.
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The RGB 109xi (VGA, 15-pin HD) part number is 60-289-01.
The RGB 112xi (Sun/SGI Workstations, 13W3) part number is 60-282-01.
Under-desk kit part number is 70-077-01.
Through-desk kit part number is 70-077-02.

For complete details, visit Extron's website at:
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http://www.extron.com/product/product.asp?id=rgb112xi

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Two identical control consoles were implemented for concurrent transmission of activities taking place in Connecticut's House of Representatives and Senate chambers.
In 1979, Brian Lamb, a young reporter, joined forces with three other journalists in a small office with a single phone line to bring democracy to television for the first time. Lamb and his network, known as C-SPAN, made it possible for people around the country to see political leaders run for office, argue issues, compromise in committee and cast votes.

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

**Design goals**

CT-N’s mission is to educate citizens about state government in much the same way as C-SPAN. The network chose to focus on coverage of all House and Senate sessions, as well as selected public hearings. Knowing they would be compared to that national model, the CT-N partners and staff were careful to ensure the high quality of network broadcasting. The equipment’s level of quality had to match that of the staff.
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The most important design goal was to create a broadcast facility that was prepared for the future.

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

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

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

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

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

The system currently consists of 10 Sony DXCD30W SL cameras and 10 Crestron CPC-CAMI network-connected, remotely controlled pan-tilt units with lens control. Three cameras were installed in the House of Representatives and four in the Senate. The remaining three cameras were mounted in a large hearing room in the legislative office building.

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

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

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

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

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

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

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

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

The network plans to meet its goals of going beyond broadcasting only the legislative branch. Year-round coverage of the executive branch, including state commissions and agencies, has begun. Broadcasting the state Supreme Court and hearings before the court will begin soon and three fixed robotic Sony DXCD30W SL cameras may be added to the courthouse in the future. CT-N sees unlimited potential for education. With such advanced technology, the facility is an ideal training ground for technical college students. As such, CT-N wants to tie operating the different facets of the network into the schools' curricula.

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

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

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

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

Equipment list

House of Representatives:
3 Sony DXCD30W SL digital processing widescreen 16-9, 4.3 switchable color cameras
3 Crestron CPC-CAMI network-connected remotely controlled pan-tilt units with lens control

Senate Chambers:
4 Sony DXCD30W SL digital processing widescreen 16-9, 4.3 switchable color cameras
4 Crestron CPC-CAMI network-connected remotely controlled pan-tilt units with lens control

Hearing Room 2C:
3 Sony DXCD30W SL digital processing widescreen 16-9, 4.3 switchable color cameras
3 Crestron CPC-CAMI network-connected remotely controlled pan-tilt units with lens control

Recording System:
3 Sony SW2000 75 Betacam SX digital recorder/player
1 Grass Valley PDR324D Profile digital recorder player MPEG-2 with 72GB of storage, 2 I/O channels, simultaneous recording and playback

Duplication:
3 Sony SDN75 Betacam SX digital docking recorder for use with DXC-D30W SL

Portable System:
1 Sony DVC-5 Betacam SX digital clocking recorder for use with DVC-D30W SL

Control:
2 Grass Valley Model 1200 component digital production switcher 4:2:2:4 digital video signal processing, 16 inputs, E-Mem system, fully compatible with 16-9 picture formats, with I/O modules
1 Grass Valley SMS-7000 32x32 I/O component digital routing switcher with redundant power supplies, control and interface for existing Horizon routing switcher, 4 XY control panels

1 Tektronix Sync and Transcoder System including genlock master sync, video delay distribution, source timing modules, video DAs, 270Mb monitor DAs, 270Mb to NTSC encoder 10 bit, 270Mb to NTSC encoder 8 bit, NTSC to 270Mb decoder
2 Pinnacle Write Deko broadcast character generators with data monitors
2 Crestron CPC-2000 dual joystick controls for pan-tilt and lens control with preset positions and touchscreen control
8 Nova ASD-25 analog composite to SDI transcoder with frame sync
6 Panasonic WV-M503 Triple five-inch monochrome monitors to view camera and tape sources
6 Sony PVM-14M2U 14" Trinitron monitors to view preview, line and character generator
1 Sony PVM-20M2U 19" Trinitron monitor to view CPTV feed and test
1 Sony BKM-101C SDI input module for PVM-20M2U
2 Tektronix 1740 Waveform monitor/vectorscope for analog test
1 Videotek VTM-203 digital/analog test system
1 Videotek SVGA-17RK rack mounted monitor for VTM-203
2 Mackie MS-1402-VLZ audio boards
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Lightning protection
BY DON MARKLEY

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

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

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

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

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

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

<table>
<thead>
<tr>
<th>Program</th>
<th>Total Streams served</th>
<th>Total visitors</th>
<th>On-air rating</th>
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<td>200,000</td>
<td>1.5 million</td>
<td>20.2</td>
</tr>
<tr>
<td>Clinton video</td>
<td>700,000</td>
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<td>4.1</td>
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<td>Ms. Universe Pageant</td>
<td>20,000</td>
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<td>CNN Operation Desert Fox</td>
<td>130,000</td>
<td>49.2 million</td>
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<tr>
<td>JFK Jr. Tragedy</td>
<td>2.4 million</td>
<td>n/a</td>
<td>1.4</td>
</tr>
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The HDK-790D Studio/Field and HDK-79D Portable Companion cameras take the guess work out of choosing production formats. It is now possible to deliver any of the leading HDTV formats directly from one camera system with no external converters. This is made practical by 2.2-million pixel 2/3" CCDs that provide selectable native-interlace and native-progressive read-out modes. Thus, the camera can be switched to provide 1080i, 720p and 480p.

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Outputs are provided for HDTV and SDTV in both digital and analog. NTSC signals can be independently switched to 16:9, 4:3 side-cus or 4:3 letterbox aspect ratios. Return video supports all these combinations as well, giving the operator a consistent HDTV display in the viewfinder.

Recent breakthroughs in advanced ASIC design provide a high quality digital solution for camera and CCU. Introduction of new solid-type electrolytic capacitors will improve component life dramatically. Ikegami has again taken the lead in developing the most versatile camera system to address the future needs of HDTV.
the energy into the ground that would reduce that voltage gradient. In other words, the high current involved, coupled with a high resistance path, caused high voltages to exist between points along the ground such as from one end of the transmitter building to the other. Those high voltages caused very high currents to flow in the equipment and wiring which might be in that building with attendant damages. The article made some recommendations as to how to reduce that effect.

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

A ground system that works

An excellent broadcast engineer of that era, Jack Moffet (now deceased), drew upon the points of that article and developed a ground system which he recommended to his clients. That method has been brazenly copied by this author and has been found to work very well for broadcast facilities. To start, at least four ground rods, each at least eight feet long, are driven around the base of the tower. They are connected together in a ring around the base and all of the rods are also connected to the tower with either copper strap or large (#4 or bigger) copper wire. Then at least eight radials of #4 or larger copper wire are buried out 50 feet from the tower where they are again connected to eight-foot ground rods. All connections are hard soldered or welded with the single exception being the connections to the tower, which can be bolted via large lugs. The same type of ground system is then installed at each guy point. All transmission lines on the tower must be well grounded to the tower at or near the base. This system is not intended to keep lightning from striking the tower. Instead, it is designed to reduce the harmful effects of the lightning strike by dissipating the energy harmlessly along a low resistance and reactance path spread over a large area. It works well, as has been proven by the author in multiple installations.

The other half of the problem is keeping the lightning from striking in the first place. Toward that goal, different systems, which claim to reduce or eliminate strikes, are on the market. These consist mainly of devices and circuits and run rampant with hand waving to some seemingly scientific explanations. Regardless of just how they may be claimed to work, the results in the field do appear to support a significant reduction in strikes. Using these devices seems to be a good idea.

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

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

Don Markley is president of Markley and Associates, Peoria, IL.
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Typically, two of these fields, interlaced together, compose one frame of video.

Frame Number: 1 2 3 4 5 6
Fields Played: OEO OE OEO OE OE OE

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

Frame Number: 1 2 3 4 5 6
Fields Played: OE OE OE OE OE OE

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

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

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

Where's the quality difference?

What's really interesting about DVD-Video is just how good its quality can be. Of course, DVD players can be plugged into any TV set as easily as a VCR, resulting in better video quality. More importantly, home theater enthusiasts can experience incredible results with widescreen, digital projection and high-definition TV sets and get similar audio improvements.

It's this potential, which is only today being exploited by the enthusiast crowd, that will ultimately replace VHS tape with DVD.

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

When the DVD-Video specification was created, its designers realized that most DVD titles would be mastered from film. Because film is recorded at a rate of 24fps, they decided that the DVD player itself would add the additional 6fps to match the 30fps display rate of TV, in order to save space on DVD discs. All DVD players manufactured for NTSC support this, using 3:2 pulldown. During 3:2 pulldown playback, the 6fps are added by duplicating one field of video for every other frame. This is illustrated below, where 'O' refers to the odd field, and 'E' refers to the even field. Typically, two of these fields, interlaced together, compose one frame of video.
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Ensuring the quality of transmitted digital video requires new tools such as program quality of service monitors and MPEG protocol monitors. Photo courtesy of Tektronix.
The Importance of DTV Testing
The transition to digital brings with it a variety of new testing procedures and equipment. Scopes for monitoring digital signals are taking their places alongside traditional analog equipment. Photo courtesy Leader Instruments.

By Kenneth Hunold

Television is joining the CD, DVD, and other consumer electronic entertainment media in the march to digital production, distribution, and transmission. For every consumer technology there is often a professional line of equipment developed to provide content for it. Digital television is no exception. Implied ads for DTV say that "It's digital, it must be good." Producers and users assume that digital will make things easier and better. After all, with digital, it either works
perfectly or doesn't work at all.

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

From spectrum analyzers to bitstream analysis

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

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

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

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

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

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

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

Interface checks

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

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

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

As LANs become an increasingly important part of broadcast facility infrastructure, network testing becomes a higher priority for broadcast engineers. Photo courtesy Wavetek Wandel Golterman.
output of another. Second on the list is improper bitstream synchronization. Digital audio signals need to be synchronized to a common reference, just as video signals have always been. Otherwise, the results can include pops, clicks, and mutes.

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

Don’t forget the analog side

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

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

Because of the amount of compression used to reduce the data rate of the digital video signal for broadcast, there is an issue of compensating for the time that the compression system takes to do its job. This is often referred to as latency. It takes time to determine what is going to be thrown away (or hidden.) A similar, picture, where the individual frames are sent in an order different than the display order. Frames are rearranged and processed in the decoder. Time stamping the audio and video elements helps, but they can still end up being out of sync. To correct this requires the tools to measure the audio-to-video-delay. Several vendors are beginning to offer solutions to this problem.
An idea that originally grew out of the desire to reduce the amount of equipment carried into the field is a product that is often called a rasterizer. Rasterizers were originally built to allow vector type displays (such as the aptly named vectorscope) to be seen on a conventional (raster scan) video monitor. This product class has evolved to include various front-end devices intended to be viewed on inexpensive, high-quality displays. The display of choice seems to be the computer VGA display, or any of its higher quality extensions (SVGA, XGA, etc.)

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

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

Cabling and beyond
An area where the RGB component video monitors masquerading as VGA monitors has caused problems is in the area of color component transcoding. Both the standard definition Rec. 601 sampling format and the scaled-up versions for 720- and 1080-line HDTV systems use sub-sampling of the color difference components to reduce the data rate of these uncompressed interface links (SMPTE 259 and SMPTE 292 for serial SD and HD transmission respectively.) For these color difference component systems to coexist with RGB displays, component transcoders are required. Also, any component system introduces the possibility of inter-component delay errors. These delays should be checked so that HDTV systems do not lose any of their superior resolution due to inter-channel delay problems.

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

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

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

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

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Monitoring in the digital environment

Non-technical staff members, graphic artists and editors, often spend the greatest amount of hands-on time with video content. Monitoring methods tailored to their varying levels of expertise can help to ensure that video standards are met. Photo courtesy Magni Systems.
Within the broadcast industry, two trends are placing unprecedented demands on video engineers and video monitoring equipment. First, the digital transition has increased the breadth of technical information that must be understood and managed. In addition to the traditional analog technologies, video engineers must also understand digital and HD technologies. Second, the convergence of video and computers is changing all phases of video and post production, including animation, multimedia content creation, nonlinear editing, computer-generated imaging and character generation.

As a result of the growth in PC-based video systems, broadcast facilities have many non-video users creating and editing video content. These users, who may have positions as video editors or graphic artists, are trained to create aesthetically pleasing work. However, they may not understand that their work must adhere to video standards. Engineers are often called upon to support these creative professionals and train them to use monitoring equipment, ensuring that standards are met.

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

Potential serial digital problems

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

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

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

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

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

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

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

Essential monitoring function and form

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

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

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**Monitoring video signals in a mixed format environment**

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

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

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The most useful qualitative representation of signal level is typically in the form of gauges or bar charts.

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

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

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

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

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

Component/composite monitoring

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

Exception reporting

Users performing operational monitoring typically need to monitor only a few parameters on a continuous basis. However, additional parameters must be reported on an exception basis. To use the automobile dashboard example again, many drivers only monitor speed and fuel level on a continuous basis. However, they want to be notified if temperature, oil pressure, or other exceptions occur. The SDI parameters needing continuous reporting are input signal strength, jitter and performed while operators are not present. In such cases, automated status reporting is required. Log files are the answer to this requirement, especially if users can select the individual parameters to be logged. Log files can be used to document system status on a scheduled basis. For example, complete status information can be appended to a log file every 30 minutes. Alternately, only error conditions may be stored in the log file. Status reporting can be a real help to the video engineer because it can be easily set up to monitor the quality of operations, such as tape duplication.

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

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Sources of magnetic field interference problems in a typical office structure. Because of an increased reliance on computer-based technologies, broadcast facilities are particularly susceptible to interference of this type. Illustration courtesy Field Management Services.
When reports of wavy or jittery images on monitors or an audible hum in an audio system are received, maintenance engineers scramble for an explanation and a solution. Grounding systems are meticulously checked and inspected, yet the monitor distortion remains or excessive audio hum persists. Broadcast engineers and technicians are generally knowledgeable about the equipment interference problems often associated with electronic grounding issues or external environmental sources (RF, microwave, radar systems, etc.). However, few engineers and technicians are aware of interference that may be caused from elevated low frequency magnetic field conditions.

**AC and DC magnetic fields**

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

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

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

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

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

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

Common magnetic field interference problems

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

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

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

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

Lastly, elevated levels of magnetic fields present in archive areas may affect the long-term storage of magnetic media including magnetic tape, floppy disks, etc. Typical specifications for magnetic storage media, including floppy disks and hard-disk drives, range from about 6000 to 10,000mG for
magnetic field levels in the frequency range of 0Hz (DC) to 700kHz (which includes the power-frequency of 60Hz). Below 6000mG data corruption on storage media is typically not observed as reported by hard-disk drive manufacturers.

**Dealing with EMI problems**

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

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

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

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

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

Jon W. Munderloh is vice president and senior technical consultant for Field Management Services, Los Angeles. He has more than 15 years experience in the broadcast industry.
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Today's broadcast facilities are under constant pressure to do more with limited resources. While individual staff members or departments may have their own scheduling systems, there is currently no way to coordinate scheduling information from across an entire network. Some stations try to coordinate by the paper and pencil method, commonly known as "the big book." This works well, but the scope is limited; only one person can access and update the book at one time. As anyone in broadcast knows, events can change several times a day, causing a nightmare in coordinating staff equipment and use.

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

### Customizing for a database

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

### Features and benefits

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

### Enterprise

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

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

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

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

Why MediaTwist UTP?
Belden MediaTwist is an UTP cable designed and constructed to support multiple applications, including audio, video, data, machine control and telephone. The reason is that its design and manufacturing processes result in a four-pair cable with extremely uniform dimensions and internal physical spacing, as well as structural stability.

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

Because of these enhanced performance characteristics, MediaTwist cable is currently being used in a wide variety of multimedia applications, including telephone, fax, modem, machine control, high-speed telephone and data links (e.g. 556, 135MHz serial digital equipment at the Underwriters Laboratories facility in Northbrook, IL. Not only did MediaTwist pass stringent tests intended for coaxial cable, but it also was awarded a Class A Certification for Digital Devices.

Previously, UTP cabling was primarily used for computer LANs. MediaTwist, however, expands UTP applications into areas once dominated by coax, shielded or fiber optic media.
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With the Q-G Twist, you have just two parts to assemble: a front-shell with a pre-filled insert, and a combination strain relief and handle. In fact, the two pieces are what makes the Q-G Twist so simple to build.

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If you would like a twist with your Q-G Twist, we also offer black finishes, gold plating, rugged die-cast handles, or just about any variation—just ask.

So if you're looking for a quick and easy, durable connector, just ask to do the twist—the Q-G Twist, that is. Call us and we'll be happy to partner with you.
In addition to video applications, Belden MediaTwist is used for KDTV-14's analog and digital video. MediaTwist cable can be punched down easily on this ADC panel, and with no ground wire, the problem of ground loops is eliminated.

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

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

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

The balun challenge

Once KDTV made the decision to employ MediaTwist, the project's main challenge was finding a way to match the signal format to the cable. Since most video signals are format-specific interfaces are changing — and the same transformation is poised for the future.

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

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

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

Stephen H. Lampen, Belden Wire & Cable Company; Robert Wrayt, KDTV-Channel 14; Marei Mearns, Brill Electronics; Jack Andreasen and Michael LaPorte, Energy Transformation Systems.
Our experience spans more than 65 years, and our engineering still makes it simple.

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

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

NTSC television is a composite video signal where color and luminance information is encoded into a single signal. This entire signal can be converted to a digital signal and recorded digitally onto videotape. The D-2 and D-3 formats are both composite videotape formats. When fitted with analog inputs and outputs, these recorders can be drop-in replacements for analog VTRs such as one-inch C-format and 3/4-inch U-matic recorders.

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

Oddly enough, these two types of digital recorders share a common serial digital signal interface. SMPTE 259M is a serial digital interface standard that operates at different data rates for different formats. The interface operates at 143Mb/s for composite digital signals, 270Mb/s for component digital format. This takes advantage of the superior multigeneration production performance, which is due to the elimination of the composite encode/decode process rather than just the digital recording process alone. This led to the development of the other families of digital VTRs, which are all component digital VTRs.

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

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

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

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

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

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

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

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

Kenneth Hunold is a broadcast applications engineer for Dolby Laboratories Inc. in New York.
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On the cover
With DTV, MPEG compression systems are finding their way into the entire broadcast change, from acquisition to the final links to the viewer, ATSC transmission. Photo courtesy IMMAD ECVS, Systems Integration

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

- Is an open, international standard;
- Provides excellent compression efficiency;
- Is flexible, with modes specifically designed for the professional environment; and,

- It offers the possibility of using a consistent standard throughout the production and broadcast chain.

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

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

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

A work in progress

Current technical work of the Forum is based around:

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

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

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

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

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

Successful first year

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

Dr. Nick Wells is with the BBC and also serves as Pro-MPEG Forum chairman.
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What does it mean to broadcasters?

By Gordon Castle

Interoperability for broadcasters is a must.

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

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

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

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

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

End users envision the use of compression as an enabling technology needed for the production system design of the future. In these future systems, all levels of media — from text to HDTV with ancillary data — will move easily and freely throughout the system without any user intervention. Audio and visual media will be extended to everyone, enabling users to...
Development of new production systems and the interoperability required of them is one of the top goals of the Pro-MPEG Forum. Photo courtesy Vibrir: Technologies.

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

A practical example of the Forum’s interaction is the requirement for users’ servers from different manufacturers to exchange compressed video with no quality loss. In past Forum sessions, users and manufacturers have worked together to define the detailed requirements, which has led to a demonstration of servers exchanging data in their native, compressed format. The lessons learned in creating these demonstrations with real-world user input will greatly accelerate the development of standards. Other global issues under discussion are requirements for predictable quality loss in the production system, partial file transfer, standards for indexing, efficient use of satellites and file formats standards for removable media. These new systems add capability and complexity to the production facility; every area is affected, although many have not been directly addressed in the past. To achieve a working equipment capability, the manufacturers must create new solutions. In many cases, this new technology requires broadcasters to create new workflow plans; therefore, they need to work with the manufacturers to establish new solution-driven paradigms.

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

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

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

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

Gordon Castle is vice president of research and development at CNN.
Choosing compression parameters
By David Brooks

MPEG's flexibility is key to diverse applications.

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

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

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

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

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

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

With these considerations in mind, the Forum is taking two steps to promote interoperability of MPEG and other compressed video equipment in professional TV applications. First, the Forum has written a code of practice that defines key interoperability ranges. For each of these interoperability ranges, the necessary compression parameters are specified to ensure proper interface functionality between equipment from different manufacturers. Second, a companion document will examine application-
specific requirements and recommend appropriate operating parameter choices. The combination of these interoperability specifications and application-specific parameter settings will facilitate design and application of flexible MPEG-based professional TV equipment.

**Interoperability ranges**

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

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

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

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

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

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

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

**A big step forward**

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

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

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

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

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

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

David Brooks is head of planning and coordination with Snell & Wilcox.
Moving MPEG as files, not as streams.

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

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

**MPEG in files**

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

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

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

### File interchange work in process

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

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

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

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

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

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Mark Ostlund is strategic business manager for Pinnacle Systems.
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Nonlinear editing system
Panasonic Postbox 2000: this nonlinear integrated production systems features 4:2:2 signal processing with optional SDI capability, built-in Zip and CD-ROM drives, three PCI slots for system expandability and Version 4 editing software; complete post-production edit suite offered as a user-friendly turnkey system; 800-528-8601; 323-436-3500; fax: 323-436-3660; www.panasonic.com/broadcast

Widescreen camcorder
Panasonic AJ-D810WA DVCPRO: features 63 minutes of record time, 10-bit digital signal processing, minimum illumination of 2 lux, consumes less than 24W of power and weighs under 6kg fully-operational; 800-528-8601; 323-436-3500; fax: 323-436-3660; www.panasonic.com/broadcast

Stand-alone playout package
Omnibus ECLIPSE: this playout package includes VTR control, router, simple mix-to-air and logo/bug control; includes a broadcast server option; 801-975-9799; fax: 801-975-0970; www.omnibussystems.com

Program QoS analyzer
Tektronix PQM300: this monitor gives providers of compressed digital video an approach for managing image quality and efficiently allocating bandwidth; allows users to identify quickly the most common visual impairments, including blockiness, frozen and repeated frames, loss of service and Gaussian noise; 800-426-2200; 503-627-7111; fax: 503-222-1542; www.tektronix.com

Multimedia degaussser
Verity Systems V94 Eraser: this degaussser provides effective erasure of any previously recorded tracks; up to 180 VHS cassettes can be erased in one hour; erases a variety of common video, audio and data magnetic media formats, as well as 4 and 8mm data, exabyte and travan material; 1-800-642-5151; 530-626-9363; fax: 530-626-9395; www.veritysystems.com

Vision switcher
Sony DFS-700P: this system comes with eight standard inputs as standard: four serial digital and four analogue components; with optional boards, the number of inputs is doubled to 16, any eight of which can be freely assigned to the control panel at any one time; includes a full range of outputs, including two SDI, two analog components, two analog composite and two Y/C; 1-800-686-SONY; fax: 201-930-4752; www.sony.com/professional

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

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Broadcast Engineering November 1999
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Accom APR Attache: this digital disk recorder features a choice of either 8-bit or 10-bit video recording resolutions, standard PreRead with Accom's Non-Destructive PreRead for concurrent play/record operation; has over 30 minutes of uncompressed digital video and audio storage; 650-328-3818; fax: 650-327-2511; www.accom.com
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PC-based stills store
AVS Graphics International StillBank: a low-cost, entry-level PC-based stills store operating on Windows 98 or NT platforms; produces full broadcast quality pictures (32-bit output) in bitmap format; image importation is possible from simple disks and CD-ROMs to network and Internet importation; 801-975-9799; fax: 801-975-0970; www.avsg.co.uk
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Digital to analog converter
Viewgraphics HDView: this digital to analog converter and HD signal generator automatically detects and converts a broad range of HD formats including all 1080 and 720 standards; accepts uncompressed 4:2:2 HD serial digital video and produces broadcast quality HD analog output; also provides an independent HD signal generator that can be used as a studio-grade HD master sync generator; 650-903-4900; fax: 650-969-6388; www.viewgraphics.com
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Miniature electric field probe
Holaday Industries HI-6005: this miniature electric field probe weighs only 80 grams and occupies a space less than 12 cm in diameter; optical coupling to a variety of readout options makes this new probe suited for a wide range of field monitoring applications; 877-HOLADAY; 612-934-4920; fax: 612-934-3604; www.holadayinc.com
Circle (383) on Free Info Card

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

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

Circle (387) on Free Info Card

**Broadcast monitor**

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

Circle (390) on Free Info Card

**Palm-size test instrument**

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

Circle (388) on Free Info Card

**Database management system**

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

Circle (392) on Free Info Card

**Network management system**

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

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

Circle (400) on Free Info Card

TASCAM MM series graphical interface

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

Circle (453) on Free Info Card

Video assist transmitter/receiver

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

Circle (454) on Free Info Card

Switch controller

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

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

Circle (500) on Free Info Card

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

Circle (394) on Free Info Card

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

Circle (395) on Free Info Card

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

Circle (396) on Free Info Card

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

Circle (397) on Free Info Card

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

Circle (398) on Free Info Card

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

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

Circle (456) on Free Info Card

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

Circle (458) on Free Info Card

seamless switcher w/6 HR-inputs
Analog Way Graphic Switcher: this switcher is a seamless switcher with six high-resolution inputs; it cuts, fades and mixes instantaneously between six high-resolution sources up to 1600x1280, with no synchronization dropouts; scales the inputs to a VGA, SVGA, XGA.2 output format and works with staging live events, conferences, exhibitions and conventions; 212-269-1902; fax: 212-269-1943; www.analogway.com

Circle (457) on Free Info Card

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

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Circ-e (168) on Free Info Card
Harris recently unveiled its new Broadcast Communications division's headquarters, located in Deerfield Township, northeast of Cincinnati.

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

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

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

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

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

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

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

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

Cornerstone Television selected Panasonic's DVCPro50 as its house tape format.

Screen Shot

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

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

Using Sony's HDCAM digital camcorder equipment, 19 camera crews will capture 216 participants as they compete for 12 days under extreme conditions in the world's toughest Expedition Race, the Discovery Channel Eco-Challenge, in Patagonia, Argentina. The Discovery Channel's camera crews will use Sony's HDCAM one-piece camcorders to shoot the multi-sport event on foot, from helicopters and boats fixed with Wescam, a gyro-stabilized camera, taking advantage of the format's high mobility and flexibility. Sony will also provide technical support.
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Circle (162) on Free Info Card
San Antonio’s Texas News Network (TXN) recently integrated Sony’s NewsBase news production system.

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

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

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

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

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

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

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

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


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

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

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

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

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

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

Manta Sound recently purchased five SADiE ARTEMIS Digital Audio Workstations.

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

People

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

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

Sigma Electronics appointed Barry Gardner as international sales manager.
Fiber Optics

Why You Need Fiber

Distributing SDI and HD-SDI signals via fiber optic cable provides several benefits over normal electrical distribution:

1. Signals can be received at far greater distances.
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Why You Need NVISION’s Fiber Products

In SDI and HD-SDI signals, pathological signal content (long strings of 1s or 0s) can cause a DC shift that results in bit errors at the receiver. If the pathologicals are not compensated for properly, the results will show up as sparkles in the picture.

1. NVISION has adopted unique circuitry designs that ensure pathological content is received correctly, without bit errors.
2. NVISION fiber optic products provide accurate point-to-point signal distribution at affordable cost
3. NVISION uses industry-standard HD and HD-SDI signal formats.
360 Systems recently appointed Brian James as western regional sales manager.

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

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

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

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

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Screen Shot
ABC's Sports Night revamps with Trinity system

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

BY KARE ANDERSON

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

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

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

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

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

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

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

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

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

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

Or the human condition:
“God pulled an all-nighter on the sixth day.”

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

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

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

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

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

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

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

For more ways to bring humor into your life, here are some fun resources: Speaker’s Library of Business Stories, Anecdotes, and Humor by Joe Griffith

Using Humor for a Change:101 Clever Ideas to ‘Lighten Up the Workload by Scott Friedman (303-671-7222)
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The text contains information about JVC's DSR-200A and DSR-30 camcorders. Here is a summary:

**DSR-200A 3-CCD Digital (DVCAM) Camcorder**
- Combining a compact and lightweight body with the superior picture quality of DSP (Digital Signal Processing) and the DVCAM format, the DSR-200A is the ideal acquisition tool for video production, broadcast, and widescreen production.
- It has a Super 3CCD 1/3" Exmor R sensor, a Carl Zeiss Lens, and an IEEE-1394 interface for direct digital output.
- It has a variety of features such as a Variable speed control, Gain and balance shutter, and a Custom Preset function.

**DSR-30 Digital Video Camcorder**
- The DSR-30 is a 3-chip digital VCC with compact chassis and a variety of convenient functions for recording, playback, and editing.
- It is capable of recording and playing back 3-chip digital video with a variety of features such as a built-in SMPTE time code generator and a compact body.
- It has a Super 3CCD 1/3" Exmor R sensor, a Carl Zeiss Lens, and an IEEE-1394 interface for direct digital output.

**Professional Specifications**
- The DSR-20 and DSR-30 are equipped with Control L interface, the DSR-20 also incorporates a Control S input allowing functions from a PC.
- Both camcorders have a Compact Control function that uses the Compact Control function to allow easy and accurate operation.
- They have a variable speed control from 1/60 to 1/196.7 of a second in 255 increments to produce smooth transitions.

**Features**
- The DSR-20 is capable of simultaneously recording 3-chip digital video and audio with 48kHz/16-bit recording.
- The DSR-30 is capable of recording 3-chip digital video and audio with 48kHz/16-bit recording.
- Both camcorders are equipped with a built-in SMPTE time code generator and a compact body.

**Additional Features**
- The DSR-20 has a built-in SMPTE time code generator and a compact body.
- The DSR-30 has a built-in SMPTE time code generator and a compact body.

**Conclusion**
- Both camcorders are ideal for professional use due to their superior picture quality, compact body, and convenient functions.
- They are equipped with a variety of features such as variable speed control, Gain and balance shutter, and a Custom Preset function.
- They are capable of recording and playing back 3-chip digital video with a variety of features such as a built-in SMPTE time code generator and a compact body.

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In addition, remaining battery capacity information is available by

DV2 System

- The smallest head of the Steadicam line
- Steadicam Touch and Go operation with automatic camera lock and safety level balancing protection
- Excellent test point calibration with the means of an LCD display on each battery and in the view - finder

DV4 System

- Swing balancing plant
- Four separate modules with automatic camera lock and safety level balancing protection
- Excellent test point calibration with the means of an LCD display on each battery and in the view - finder

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Specifications

- Four-Position Power/Chargers
- Specifications: 14.4 V. 50 WH (Watt Hours)

In addition, remaining battery capacity information is available by

DV2 System

- The smallest head of the Steadicam line
- Steadicam Touch and Go operation with automatic camera lock and safety level balancing protection
- Excellent test point calibration with the means of an LCD display on each battery and in the view - finder

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- Four-Position Power/Chargers
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While ENG camera technology evolves faster than ever, delivering ever higher quality pictures, it is becoming increasingly difficult for lens manufacturers to keep up with the pace. Fujinon has succeeded in manufacturing superior quality Lenses, making its EV (Electronic Viewfinder) optics stand out from the crowd.

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**PC-CODI Hardware:**
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- User definable intercharacter spacing (squeeze & expand).
- Character, Logo and PCX Image transparency.
- User definable tab stop settings.
- Stacked background of tapes and transparency.
- Software controlled video timing.

**PC-Scribe Software:**
- Number of fonts is virtually unlimited. Also supports most international characters.
- User-defined application formats are possible.
- Font style selection and the level of anti-alising applied is selectable.
- Additional applications, to register additional fonts, are part of the composition tools.
- Character format, sizes and fields can be too big.
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- Characters can be auto-timed with menus. Menu pages can be manually advanced or put into sequence along with page timing.

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**TARGA 1000/MCXpress Turnkey Systems:**

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**MCXpress Features:**
- User definable zoom, Pan, left zoom, right zoom.
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- Customizable tab stop settings.
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**TARGA 1000 Standard Zoom Lens**

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**5680C WAVEFORM MONITOR**

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**5680C WAVEFORM VECTORSCOPE**

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**5872A Combination Waveform/VectorScope**

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**5864A WAVEFORM Monitor**

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

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**SENIOR MAINTENANCE ENGINEER**

The Christian Broadcasting Network (CBN) is seeking two seasoned Maintenance Engineers to fill key positions in its Television Engineering Department. Headquartered in beautiful Virginia Beach, Virginia, this dynamic organization broadcasts in over 70 nations and is recognized internationally for its humanitarian and evangelistic efforts. This individual will provide maintenance support for electronic equipment used in various functions by CBN's Television Operations Group. The successful candidate will possess the following qualifications: experience as a Senior Maintenance Engineer for a television station; experience with NTSC, PAL, SECAM and broadcast/recording formats; and experience in television production, post production, studio and remote production. The ability to distinguish colors as related to monitor service, adjustment and operation is required. Strong communication skills are a must. CBN offers a competitive salary and excellent benefits package. If you meet the listed criteria and share our vision and purpose, call our 24-hour line (800) 888-7894 to request an application or visit our website at www.cbn.org to print out an application.
Assistance Chief Engineer - Wtoc-TV (CBS), Savannah, Georgia, is a Raycom Media station, is seeking a hands-on Assistant Chief with a significant transmitter, ENG and master control background. Five years of broadcast TV maintenance supervision, including transmitters, and IS experience is preferred. There will be work on some nights and weekends. Qualified applicants are encouraged to send cover letter and resume to: Ms. Stacey DeLoach, Business Manager, Wtoc-TV, P.O. Box 8086, Savannah, GA 31412. Raycom Media is an equal opportunity employer. Women and minorities are encouraged to apply. No phone calls, please.

Chyron Operator - Northfield Park, a progressive pari-mutuel facility featuring state-of-the-art equipment, located near Cleveland, Ohio, is currently seeking a Chyron operator for its nightly simulcast program. Must be familiar with MAXINE and INFINIT. Must possess ability to do NETWORK UTILITIES, TRANSFORM II and INTELLIGENT INTERFACE. Must have Photoshop and Animation experience. Must work well in a team and have ability to work weekends and holidays. Send resume to: John Powell, Director of TV Operations, Northfield Park, P.O. Box 374, 10705 Northfield Road, Northfield, OH 44067-0374. Equal Opportunity Employer.

Chief Engineer - F/T Chief Engineer wanted for leading Spanish-language "Univision" TV station in the San Francisco market. Responsible for directing daily broadcast operations. Oversees the acquisition, installation, maintenance and repair of all broadcast equipment as well as management and engineering staff. This "hands on" position requires thorough familiarity with broadcast equipment. Must be team-oriented, organized and capable of communicating effectively. The ideal candidate will have 5-10 years’ experience as a Chief working at a UHF station in a top ten market. Competitive salary and benefits. Fax resume to: 415.538.8053 EO/M/F.

FT Studio Technician - Formal schooling in Electronics Theory. 5 years experience in Broadcast TV business technician on Beta video tape machines and E.N.G. cameras. Knowledge of studio equipment repair. Should qualify for a state driver's license. Send resume to: KOB-TV, Job #15-99, 4 Broadcast Plaza, SW, Albuquerque, NM 87104. EOE/M/F.

Engineers

Turner Broadcasting System has career opportunities for experienced television engineers. These career positions demand an extensive background in equipment maintenance, digital video and audio, and knowledge of computer systems and networks. Please mail or fax your resume and cover letter to: Jim Brown, Assistant Vice President of Engineering Services Turner Broadcasting System, Inc. One CNN Center • P.O. Box 105366 Atlanta, GA 30348-5366 Fax: 404-827-1835 Phone: 404-827-1638 TBS is an equal opportunity employer.

Maintenance Engineer/SNG Operator: Fox 11 in Santa Barbara Ca. seeks applicants capable of assisting Chief Engineer in all aspects of buildup of master control and news operations. SNG experience a plus, duties include technical support of ENG/SNG operations. Send resume to Personnel/Engineering, KFAX Fox 11, 7000 Hollister, Goleta CA 93117. Fax 805-685-4998 EOE


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WETA

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Broadcast Engineers

STUDIO MAINTENANCE ENGINEER- Must be able to perform the following duties: install and maintain studio transmission equipment including video switchers, audio consoles, DVE, CG, SS cameras and robotics. Experience with automation systems and master control environment. Should possess a general computer/networking systems and master control environment. Must be able to work on a rotating shift schedule. Position Code SME

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

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

Candidates should have an engineering degree or equivalent technical training. SBE/FCC certification is a plus. If you want to be a part of the exciting transition to HDTV in the most exciting city in the world, please send your resume and cover letter to: Kurt Hanson, WABC-TV, 7 Lincoln Square, New York, NY 10023. No telephone calls or faxes please. We are an equal opportunity employer.

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CHIEF ENGINEER KEKI-Missoula, KCFW-Kalispell and KTVM-Butte/Bozeman in beautiful Western Montana. Headquartered in Missoula, this person will lead and coordinate a multiple facility engineering team. The ideal candidate will be proficient in microwaves, transmitters and will be able to lead our transition to digital. They will be able to train and work on DVC Pro, Sony U-matic, computers and servers. This person has the perfect balance between technical skills and people skills. A positive attitude and team oriented approach is a must. Excellent benefits package. 401k. EEO. Contact: KEKI TV, Attn: Keith Sommer, General Manager, 340 West Main Street, Missoula, MT 59806.

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Broadcast quality video ... again?

BY PAUL MCGOLDRICK

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

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

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

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

That is not to say that true high-quality (I cannot bring myself to use the dreaded terminology) video streaming will not be available on the Internet — but not on the Internet connection most have today. Internet2, which is a five-year project, will interconnect about 160 universities and bring the Internet back to the exclusive club that it was before the Web exploded onto the market. The University Corporation for Advanced Internet Development has spent $500 million on developing the 2.4Gb/s Abilene fiber backbone in partnership with Cisco Systems, Indiana University, Nortel and QWest Communications. Most of the universities are connected through 20Gb/s points of presence at strategic hubs around the country.

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

As is obvious to those of us in broadcasting, a 2.4Gb/s network is more than enough bandwidth for any video standardized to date. It was not unexpected that one of the first projects demonstrated over Internet2 was the carriage of DTV. The main proponents in the demonstration were the University of Washington’s ResearchTV project, Stanford University (Palo Alto, CA) and Sony. Different videotreams were transmitted, but the most significant — for broadcasters — was the extremely successful transmission of 20-minute segments of DTV and HDTV material at the magic speed of 270Mb/s. None of the participants seem to doubt that a commercial version of Internet2 could exist within five years. The project manager of the University of Washington’s ResearchTV project, David Richardson, has been quoted as saying, “The goal of the project is to use Internet2 as a real future delivery mechanism for the broadcast industry.” If there was ever a reason for terrestrial broadcasters to get nervous, here we have it. In five years the terrestrial services better be extremely well established in the public’s eye—or else Internet2 will be added to the existing satellite and cable threats.

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

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

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

Send questions and comments to: paul_mcgoldrick@intertec.com
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