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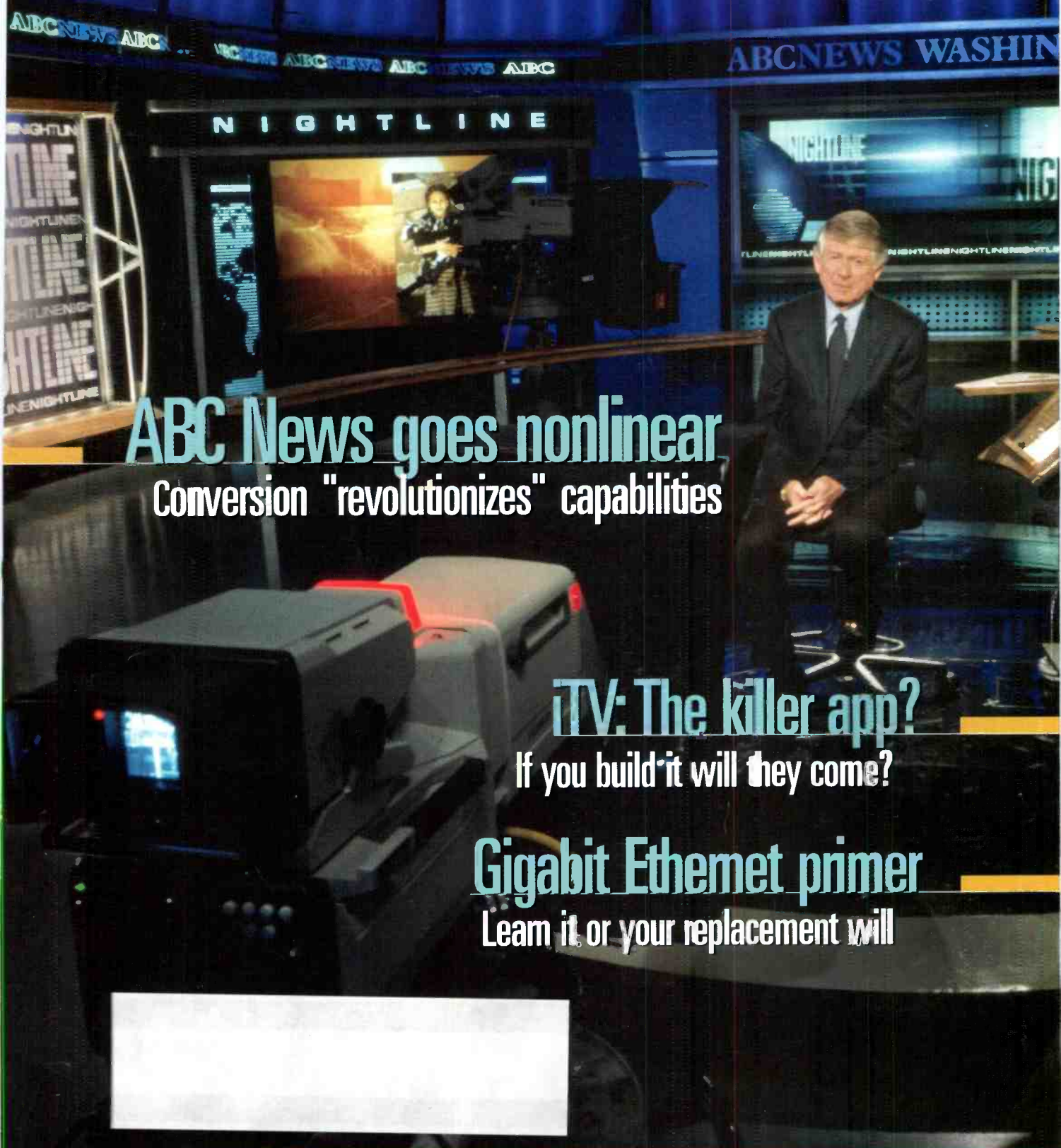

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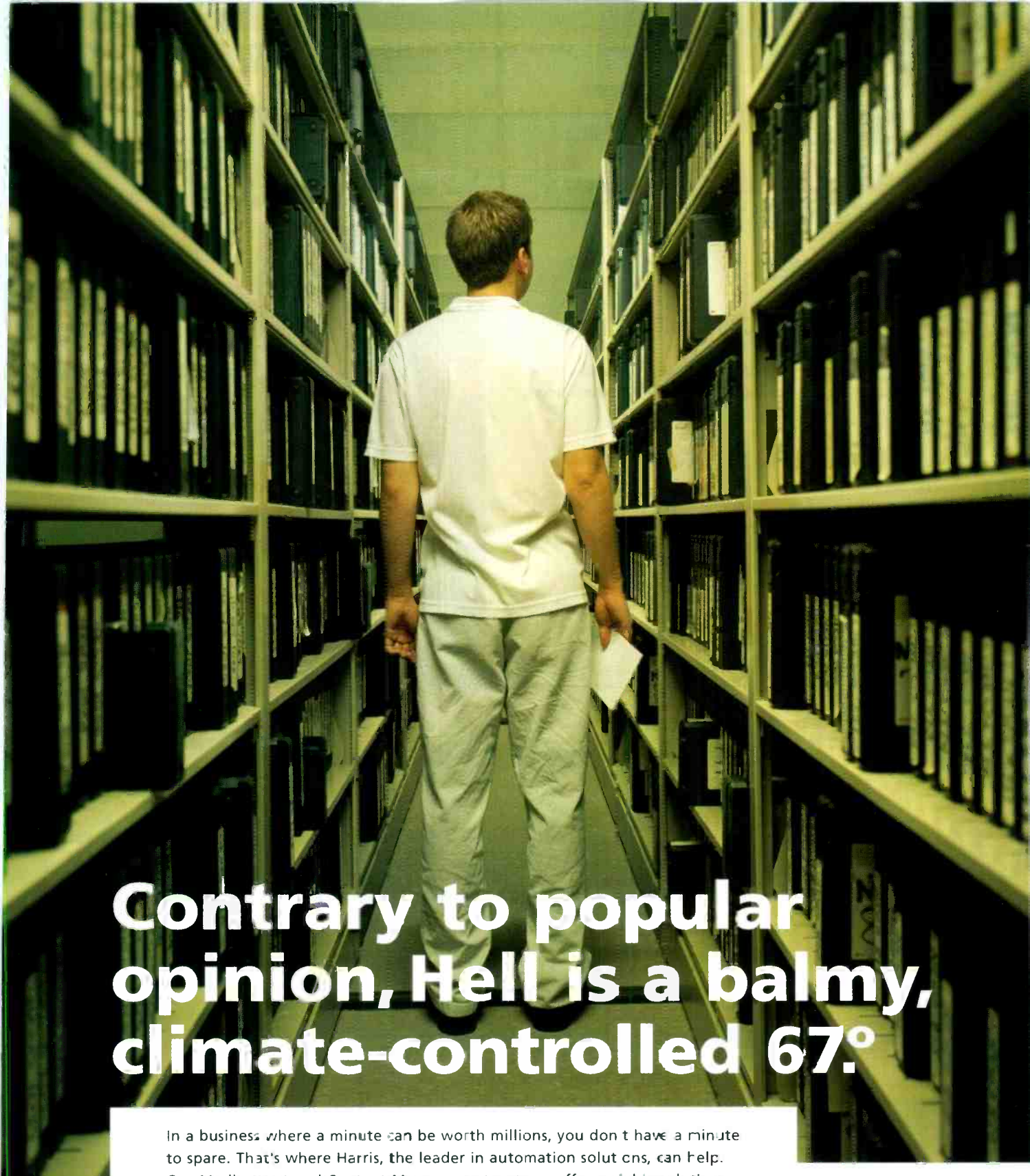

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ON THE COVER: Ted Koppel on the ABC Nightline set. The network recently added an Avid-based NLE system to the program's newsroom. Photo by Andy Washnik. Photo courtesy Avid.

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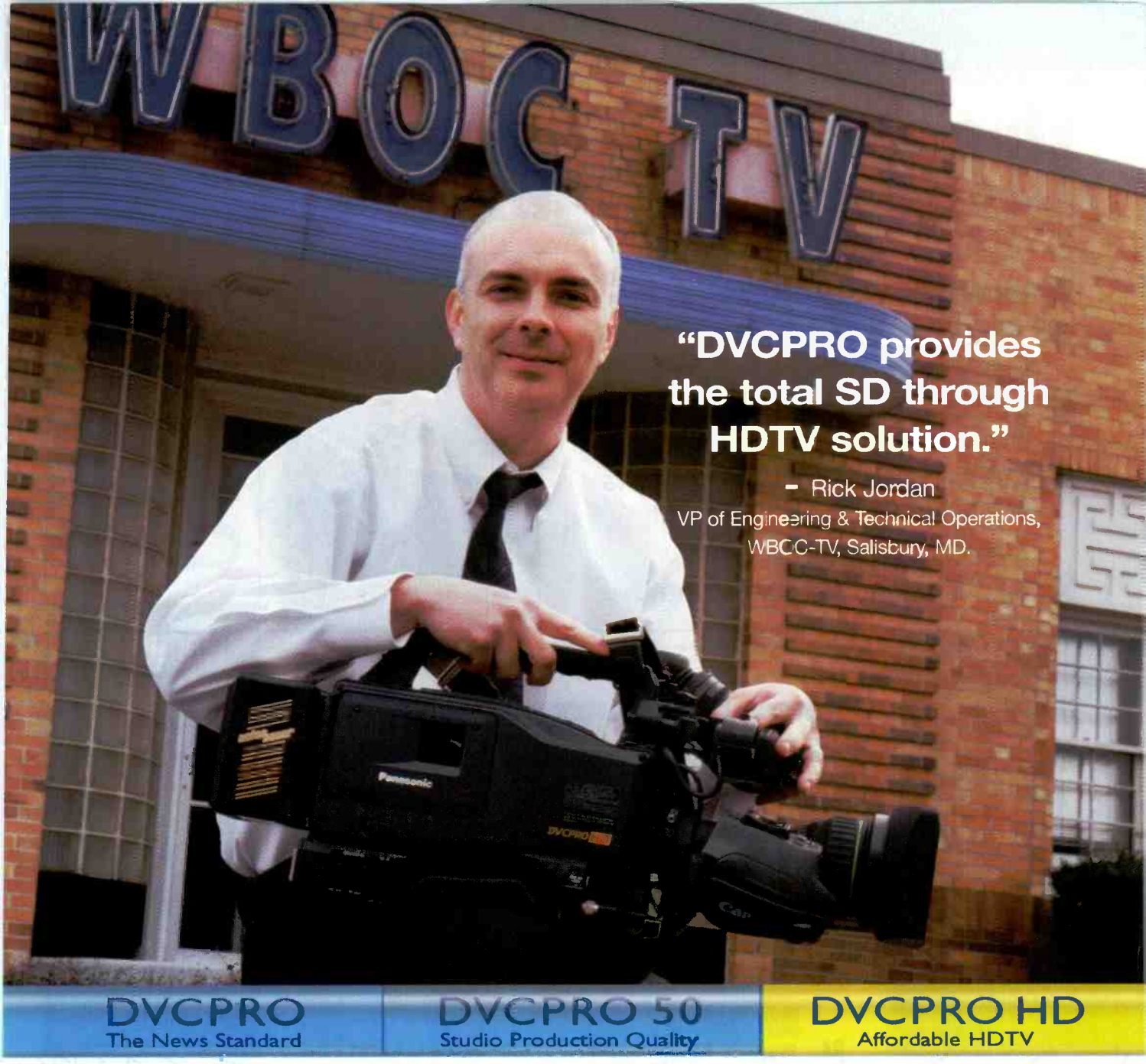

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Name this VTR

In what year was color television first demonstrated? The system employed three-spiral scanning disks for both the transmitter and receiver. Bonus if you can provide the lines of horizontal resolution the system was capable of. Correct entries will be eligible for a drawing of the new *Broadcast Engineering* T-shirts. Enter by e-mail. Title your entry "Freezeframe-February" in the subject field and send it to: bdick@primediabusiness.com. Correct answers received by March 17, 2001, are eligible to win.

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I want my DTV (station)

Another survey reinforces what we've been saying — that consumers are finally opening their pocketbooks to buy DTV. Last September, the NAB arranged for a telephone survey of 1000 Americans and found that 43 percent of the respondents said they were either "extremely," "very" or "somewhat likely" to buy a new digital television set in the next few years.

The survey further supported the building interest in DTV by showing that 55 percent of the respondents were "familiar" with DTV. Survey organizers claimed that this high percentage of familiarity with DTV was unexpected, given the relatively young age of the technology.

So what do consumers perceive as the main benefit of DTV? Not surprisingly, it's picture quality. Almost two-thirds said that the primary advantage of digital television was "better picture quality." Improved audio quality was the second most mentioned benefit. To us former radio guys, that's not surprising. DTV audio is an amazing improvement over the old 3-inch speaker days, when audio was just the "noise" that TV stations sent with the picture.

Further evidence of burgeoning DTV interest was seen at the CES show in January. Final factory-to-dealer sales of DTV sets totaled 1,459,731 units in 2001. Total sales for the year, representing more than $2.6 billion, surpassed CEA's initial 2001 forecast of 1.1 million units by November and sales continued to soar in December. I helped support those numbers with my own DTV purchase that month.

What surprised me most was the number of "integrated sets" sold. Of the 1.46 million units sold, almost 100,000 were integrated sets. This represents a whopping 1455 percent increase in integrated set sales over last year. An additional 196,564 stand-alone STBs were sold in 2001, representing a 434 percent increase over 2000.

According to CEA, the total number of DTV products sold since establishing that product category in 1998 is almost 2.5 million units. Based on these numbers, CEA estimates that 16 percent of the DTV sets in use are now capable of reproducing an ATSC digital signal.

CEA projects that another 2.1 million DTV products will be sold in 2002, 4 million in 2003, 5.4 million in 2004, 8 million in 2005 and 10.5 million in 2006. If these estimates are exceeded like we saw last year, TV stations had better get DTV signals on the air now. Otherwise, consumers are going to be keeping general managers and their engineering staffs up at night explaining why viewers' favorite TV shows aren't HD, or at least digital.

I only wish the four major network affiliates in my city (CBS, ABC, NBC and FOX) had the guts to support the technology. While I've paid my HDTV *entry fee* with my purchase, I couldn't even watch the Super Bowl in "imitation HD," or what FOX calls 480p. Shame on every one of them!

Brad Dick

editorial director

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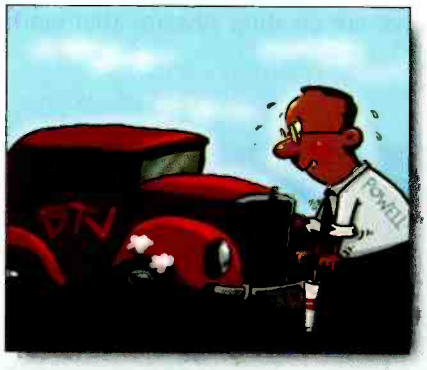

Low-power DTV

The idea of operating at much lower power to just get on the air will have significant long-term negative effect on the viability of DTV in general. Your first observation that a few kilowatts at 20 miles may be difficult to receive is, of course, true. However, the Table of Allotments made certain assumptions about power and interference ratios that under a generalized reduced power scenario will fall apart. The classic example is the adjacent DTV channel assignments that assumed the DTV signal would be at a high power level close to the level of the NTSC signal. If the DTV signal level is reduced by 10db or more, the adjacent channel high-power signal can destroy the receiver's ability to even recognize that a DTV signal is present. We witnessed this very reflect when running COFDM vs. 8VSB testing in Baltimore and Washington, DC.

Rather than giving DTV a boost I am afraid that Chairman Powell may have set the process back for many, many years, if not forever. Perhaps you are correct, it is time to get serious about cable carriage of DTV.

There is now clearly no other real option as long as the ATSC system remains unimproved.

Nat Ostroff
Vice President-New Technology
Sinclair Broadcast Group

The FOX sleight of hand

Once again, FOX network is showing their complete ineptitude in getting anything high-def on the air. When I heard that FOX would be doing the Super Bowl this year, I had a sinking feeling in my stomach because I know this is the only network that has completely ignored HD, managing to not have a single hour of HD programming. Here is an opportunity to showcase what HD can do and FOX can only muster a feeble 480p. On their Web site they bragged about FOX Widescreen and how this production was going to be so much better than the (CBS) digital broadcasts of years past. A 1080i upconversion of 480p cameras is hardly better. From the FOX Web site: "Previous digital Super Bowl telecasts have only shown the game itself, with the signal originating from a separate production unit. The result was that the digital viewer experienced only a fraction of the production values enjoyed by the traditional analog viewer." 1080i can't do slo-mo and since all the HD viewers would rather see that than good quality video, let's use all 480p cameras! Some logic.

A 1080i upconversion of 480p cameras for the Super Bowl is hardly better than native 1080i.

I think I speak for all HD viewers when I say I would rather see a simple four-camera native 1080i production than a fancy NTSC upconversion from some old analog truck. Everyone who spent thousands on HD equipment this past year (myself included) is going to be furious when they turn on their local FOX DTV affiliate and see that once again, FOX has taken the cheap route to making their programming. Thanks to FOX for putting another roadblock up for HDTV.

When does the game go back to CBS/ABC/NBC? They at least show a commitment to doing the right thing. What kind of engineer actually thinks HD viewers won't notice the Super Bowl is in 480p? I hope all the HD viewers complain to FOX and maybe that will prevent them from being so cheap, and then trying to pass it off as an improvement.

Bob Zajko, CBT
Liberty Uplink

The "last word" on birds

In all the responses to the lemmingbird story, no one seems to have hit on what I consider the bigger issue: Protecting towers from birds.

I recently engineered a station where both towers were being destroyed by copious quantities of bird guano. If it is left unchecked for a few more years there is a good possibility that one or both towers could be felled by these feathered bipeds. A major highway runs between the towers, so if one came down in the wrong direction... Oh, the humanity! These towers have red lights, but they've invariably failed to prevent hundreds of winged squatters from perching anywhere they wish. Working beneath these towers is a real treat also, as you can well imagine. A raincoat and hat in the dead of summer is not my first choice of wardrobe.

In some factions of our society today, critters have far more rights than humans, but in my view some serious seagull genocide wouldn't be a bad thing.

John Collinson
Modulation Limited

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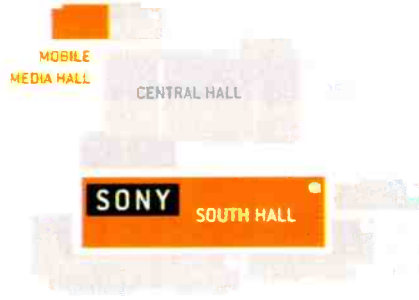

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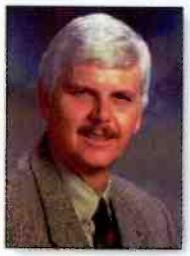
Digital set-top boxes



BY CRAIG BIRKMAIER

The 1999 movie, *Pirates of Silicon Valley*, tracks the exploits of Steve Jobs and Bill Gates, calling them pioneers of an industry that transformed the world.

In this story, the pioneer is Steve Pearlman. He faced rejection when he tried to get Apple to develop a digital set-top box that would bring digital entertainment and the Web to the TV. (This was before Jobs returned and reversed Apple's declining fortunes.) Pearlman left Apple and founded WebTV.

In 1997, Microsoft acquired WebTV as part of their strategy to make Windows the hub of the networked digital home. The acquisition was announced at NAB, along with the formation of the ill-fated DTV Team. Microsoft, Intel and Compaq planned to deploy tens of millions of computers capable of receiving DTV broadcasts.

The DTV Team soon learned that the real battle for control of the transition to digital is being fought between the cable industry and the consumer electronics industry, which has partnered with DBS services around the world to compete in the lucrative multichannel television business.

The primary objective in this battle is control of the digital set-top box — the gateway to hundreds of millions of existing TV receivers deployed worldwide.

Five years later, it is highly revealing to look at the number of U.S. homes captured by the various combatants in the DTV wars.

WebTV has less than 1 million subscribers. It offered too little too soon. Microsoft has incorporated the WebTV technology in its Microsoft TV initiatives, including the UltimateTV platform offered by DirecTV.

According to a recent FCC report, as of June 2001 Dish Networks and DirecTV had about 16 million subscribers; the growth rate is about 15 percent. According to the National Cable & Telecommunications Association, as of November 2001 there were 13.7 million digital cable subscribers; approximately 100,000 customers per month are upgrading to digital cable.

Meanwhile, according to the Consumer Electronics Association, as of December 2001 approximately 300,000 homes now have integrated DTV receivers or set-top boxes capable of receiving DTV broadcasts. The report does not mention that virtually all of these are HD-capable DBS receivers that also include an ATSC receiver.

Consumers are interacting with the TV via video game consoles, DVD movie players, electronic program guides and PVRs.

Thus far, surfing the web via the TV has not appealed to the masses. But consumers are interacting with the TV via video game consoles, DVD movie players, the electronic program guides (EPG) that are common to multichannel digital TV services, and PVRs. And interactive TV features are beginning to take off in some areas of Europe.

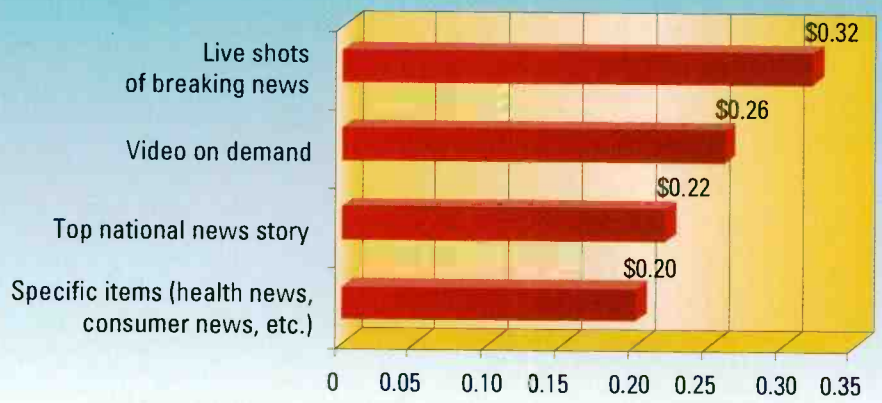
Meanwhile, a variety of digital media devices are starting to proliferate via consumer electronics retailers, including digital still cameras, DV camcorders and MP3 audio players. The PC is becoming the hub for manipulating and personalizing digital media content. It often doubles as a stereo, a DVD movie player or even a TV (with an NTSC TV tuner card).

But the promise of millions of PC-DTV receivers never materialized.

FRAME GRAB A look at the issues driving today's technology

Live, local news is tops

How news departments want to spend each dollar of their news budget



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Microsoft failed to convince PC manufacturers to include the stuff needed to turn a PC into a DTV.

Key technologies

Two technologies are helping to blur the distinction between a TV and PC:

- Cheap mass storage (hard disks and recordable optical media)
- Wireless networking

Hard disks are now big enough, fast enough and cheap enough to turn the promise of the PVR into a practical reality. Consumers — especially those who subscribe to digital cable or DBS — are beginning to understand the natural synergy between the PVR and the EPG. Local caching will soon provide a variety of information services on demand, via the TV or any other digital media appliance in the home. News, weather, sports and local directory services can be updated continuously.

The most important benefit to broadcasters is the bandwidth multiplier effect of local caching. Broadcasters could deliver pay-per-view movies to local cache during off-hours, and these movies could then be purchased and consumed on demand.

But broadcasters are sitting on the sidelines while the cable, DBS and consumer electronics industries are deploying millions of set-top boxes.

The other technology blurring the lines between the PC and digital TV set-top box is wireless networking. Several technologies are vying to become the wireless networking standards for the home. IEEE-802.11 is the early leader. Bluetooth, a standard championed by Intel, is beginning to see significant deployments, especially for low complexity hand-held devices like cell phones. Also known as WiFi, the current 802.11-1997 standard supports TCP/IP networking at 11 Mbits/s. The 802.11-a and -b standards will push the data rates up to between 20 Mbits/s and 50 Mbits/s.

One hot new product at this year's CES show was the Moxi Media Center. The product aims to become a home's centralized audio/video entertainment center with built-in DTV or satellite receiver, digital music jukebox storing hundreds of CDs, internal PVR with 60 hours of storage, DVD player and cable/DSL modem.

Apple pioneered the WiFi technology with its Airport base stations and cards — every Mac now ships with a built-in antenna and slot for an Airport card.

Support for WiFi is growing rapidly in the PC world as well. Microsoft has provided native support for the standard in Windows XP, and WiFi was prominent in the plans of many consumer electronics companies exhibiting their latest gadgets at CES.

The digital networked home

Bill Gates, Steve Jobs and Steve Pearlman all took to the public stage on Jan. 7, 2002, to update their strategic plans to become the hub of your digital home.

Steve Jobs used the annual MacWorld

Web links

Eighth annual FCC report on competition in video markets:
www.fcc.gov/csb/
National Cable & Telecommunications Association statistics:
www.ncta.com/industry_overview/indStat.cfm?indOverviewID=2
Final 2001 DTV sales figures from CEA:
www.ce.org/Newsroom/Newsroom_recent_news.asp
Moxi Digital – The Moxi Media Center:
www.moxi.com/home.htm

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show in San Francisco to introduce the successor to its trendsetting iMac all-in-one computers. The new iMac has a 15-inch flat panel display that floats above a hemispherical base on a stainless steel arm. Apple is positioning the new iMac as "the center of your digital lifestyle," a digital hub that provides the tools to deal with the proliferation of digital devices seen at CES.

Jobs also announced the completion of the suite of digital hub applications that ship with the iMac, which allow users to manage CDs and MP3s or digital photography, plug in DV camcorders and edit video, or post images to a Web site. The iMac also comes with a DVD-R drive and an application for producing DVDs that can be played on any DVD player.

Jobs still believes that the path to controlling digital media in the home is via the computer, not the TV. But all the hooks are in place to deliver content to

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Viewing HD

BY MAX UTSLER

The manufacturers' optimism over HDTV in 2001 has given way to the realities of 2002. According to Ed Wolff, general manager of Panasonic's Display Group, "nothing significant is going to happen in 2002." That pretty much sums up the projections of most of the major TV manufacturers at the annual Consumer Electronics Show held in early January. But don't take that to mean "nothing is happening" in the digital marketplace.

Viewers write on a two-way plasma display.

HD-capable sets with 16:9 screens are fast becoming the rear projection standard-bearers. Several manufacturers, such as Sanyo and Panasonic, will no longer make analog rear projection units. Last year Philips offered two HD-ready models. This year they will offer five.

In 2001 the industry sold two million projection TVs, one million of them HD, and research indicates sales of 2.3 million in 2002 with 1.7 million of them HD and 80 percent 16:9 according to Scott Ramirez, vice president of marketing for Toshiba. However, that's 2.3 million compared to the more than 18 million analog units likely to be sold. Major analog TV set makers such as Sanyo, Panasonic and Philips report no timetable for the elimination of analog units, at least for direct view.

For the moment, HD content is confined to CBS prime-time, a slowly increasing number of shows on ABC, a handful of shows on NBC and major events such as the Super Bowl, the Olympics and the Academy Awards. Wolff pointed out HDTV sales are strong in markets where the local stations broadcast in HD, but said DVD players are really what has spurred the HD-ready, 16:9 growth.

If the number of displays is any indication, the 2002 CES signified a growing move of the TV industry towards LCD and plasma displays. Direct view and rear projection TVs were much less prominent than wall-hung flat screens.

While plasma is unlikely to become the home standard, the Stanford Research Forecast predicts that by 2005 more plasma units will be in homes than in business.

Mark Holt, vice president of sales for Sanyo's Presentation Product Group, sees a future where LCD panels will rule the small-screen market; CRTs will handle 19-30 inch screens; plasma will be in the 32-64 inch range; and projection will drive the 64 inch-plus market.

Dr. Max Utsler is an associate professor of journalism at the University of Kansas.

Strike one, you're out.

A single bolt of lightning can throw you off the air for hours — even days.

Even if your grounding exceeds minimum requirements, you could be in for some major league problems. One New England TV station lost $140,000 in equipment costs, plus untold amounts in revenue, from lightning damage. A midwestern FM station was tossed off the air for several weeks, costing them thousands of dollars. And lightning doesn't affect just commercial stations. Virtually every transmission tower — whether for police and fire stations, 911 call centers or telecommunications — is at risk.

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other devices connected to the home network.

Bill Gates delivered a CES keynote in which he revealed two new Microsoft technologies designed to bring Windows into the family room. Mira is a rather obvious application of wireless networking. A touch screen flat panel display connects to its host PC using WiFi. You can take the display anywhere in the home, continuing to work with the PC, and use it to control other devices connected to the home network. Gates also demonstrated Freestyle, a graphical user interface optimized for the TV. The demo featured a digital music application that one could navigate via the TV to select songs for playout through the TV.

Steve Pearlman used CES to introduce his new company – Moxi Digital — and announced technology partnerships with EchoStar Communications Corp., Macromedia, RealNetworks and NDS Group.

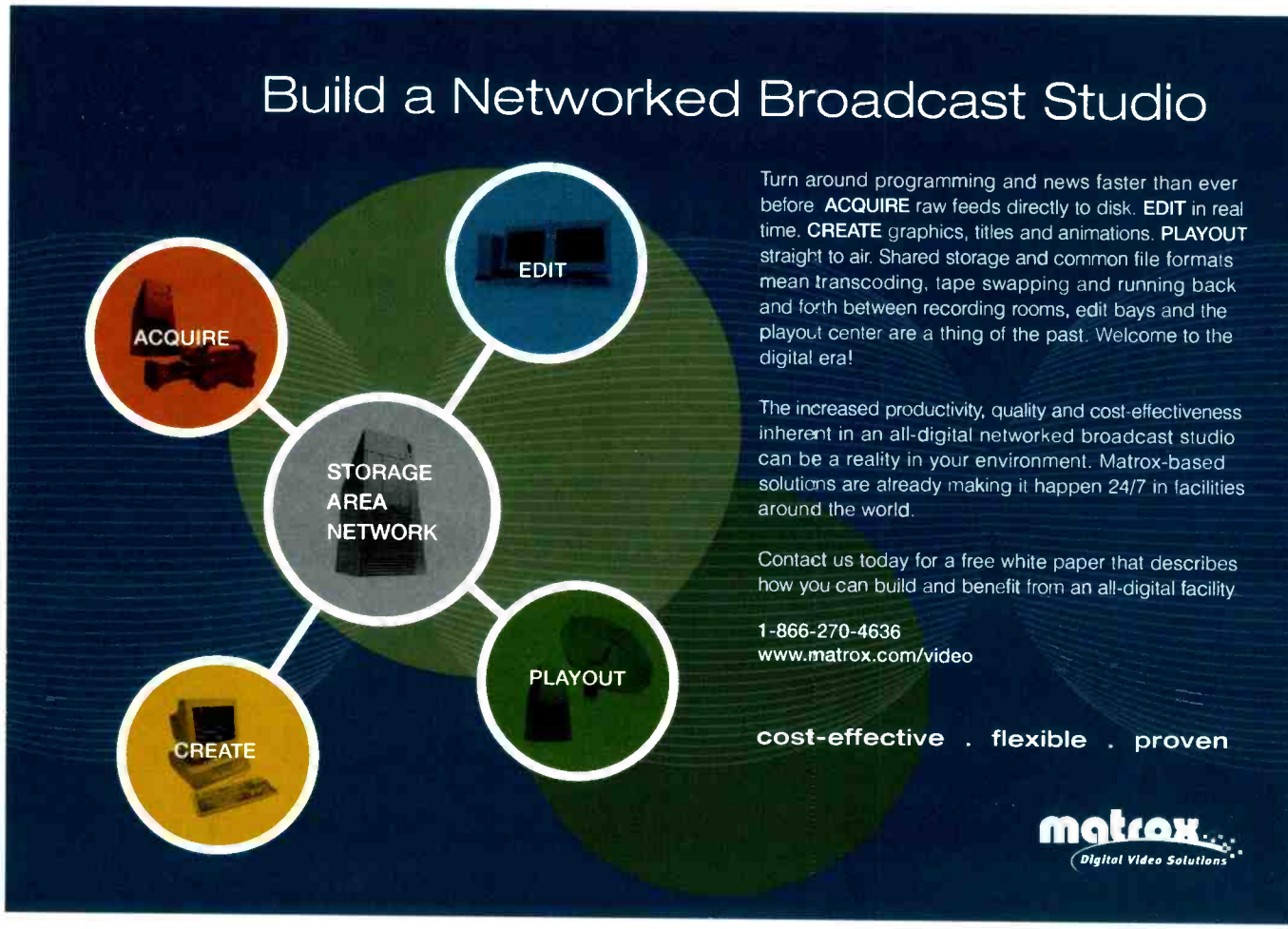
Moxi's main product will be the software that integrates the functionality of the Moxi Media Center and wireless pods that allow media to be shared with up to four TV sets in the home. The company will license the platform to companies like Echostar, who will build and deploy the set-top boxes and pods to subscribers.

The Moxi platform is based on a Linux OS kernel; Macromedia Flash will be used to develop the graphic user interface for the Media Center and remote pods. NDS is providing conditional access technology. In addition to support for MPEG-2 video decoding, the platform will also support Real Networks video coding technology, and theoretically, other software video codecs in the future. Wired and WiFi wireless networks can be used to share media with the remote pods.

Configurations will vary based on the requirements of each company that licenses the platform. Some features include a multi-tuner cable or satellite receiver with IEEE-1394 support and the ability to record over 60 hours of video, a built-in CD/DVD player and digital music jukebox and a cable/DSL modem and Internet gateway for access to the Web from any computer in the home, with a built-in firewall for security.

The relationship with Echostar, which recently announced plans to acquire DirecTV, is particularly noteworthy. As part of the plans to consolidate operations, Dish Networks and DirecTV have indicated that they plan to replace millions of set-top boxes, as the systems currently are incompatible with one another. BE

Craig Birkmaier is a technology consultant at Pcube Labs, and hosts and moderates the Open DTV Forum.



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New allocation scheme set for channels 52-59

BY HARRY C. MARTIN

In December, the Commission adopted new allocation and service rules for the spectrum now occupied by TV channels 52-59 (the lower 700 MHz band). In its Report and Order, the Commission reallocated the entire 48 MHz to fixed and mobile services, although it retained the existing broadcast allocation for incumbent broadcast services during the DTV transition, and for theoretically possible new broadcast services. Congress is forcing the Commission to auction off that particular spectrum by Sept. 30, 2002, for use in the fixed and mobile services.

Despite those impending auctions, the Commission recognizes that the transition to DTV is not scheduled to end until at least the end of 2006, and that date may well slip in a number of markets. Obviously, this time differential creates a need to accommodate existing broadcasters in the spectrum.

Accordingly, the Report and Order established technical criteria designed to protect incumbent TV operations in the band through the DTV transition period. Further, the Commission did not adopt any band-clearing rules for channels 52 through 59. The Commission recognizes that the 52-59 band has approximately twice as many incumbents operating as the upper 700 MHz band (channels 60-69), a consideration which made band clearing in the lower 700 MHz band far more problematic. Any voluntary band-clearing arrangements will be reviewed on a case-by-case basis to determine whether they would serve the public interest.

LPTV and TV translator stations will be allowed to operate in the channel 52-59 band on a secondary basis even after the DTV transition.

While ongoing full-service television operation will be protected only through the DTV transition, LPTV and TV translator stations will be allowed to operate in the channel 52-59 band on a secondary basis (as is the case now), even after the DTV transition. This provision may be of limited use, however, depending upon the outcome of the spectrum auctions and the types of services that are initiated in the band. Since LPTV and TV translators will remain secondary services, they will be required to change channels or cease operations should they cause interference to whatever new services are established in the band. Nonetheless, depending upon how the roll out of new services takes place, the provision may provide some benefit to LPTV and TV translator stations by allowing them to remain on their current channels until the DTV transition is over. At that point, presumably more channels will be available for use as displacement channels, as TV stations are required to return one of their paired channels at the end of transition.

The Commission dismissed all pending petitions for rulemaking for new NTSC allotments in the channel 52-59 band. For pending applications for construction permits, a 45-day window will be opened to allow applicants to modify their applications to specify either analog or digital service within the core spectrum (channels 2-51) or digital service only in channels 52-58. No new service will be allowed on Channel 59.

As for the future uses of the lower 700 MHz band, the Commission has divided the spectrum into three 12 MHz blocks, with each block consisting of a pair of 6 MHz segments, and two 6 MHz blocks of contiguous, unpaired spectrum. The Commission will license two of the three 12 MHz blocks and the two 6 MHz blocks on a regional basis using six Economic Area Groupings. The remaining 12 MHz block of paired spectrum will be licensed using Metropolitan Statistical Areas (MSA) and Rural Statistical Areas (RSA).

All operations in the lower 700 MHz band will be regulated under the framework of the Commission's Part 27 technical, licensing and operational rules. The Part 27 power levels have been amended, however, to permit 50 kW effective radiated power transmissions in the lower 700 MHz band, subject to specific requirements for notification and non-interference. BE

Dateline

No biennial ownership reports are due in 2002. Quarterly problems and programs lists for the first quarter of 2002 must be placed in stations' public files by April 10.

March 1 is the deadline to file FCC Forms 337 seeking extensions of the May 1, 2002, DTV construction deadline for commercial TV stations.

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

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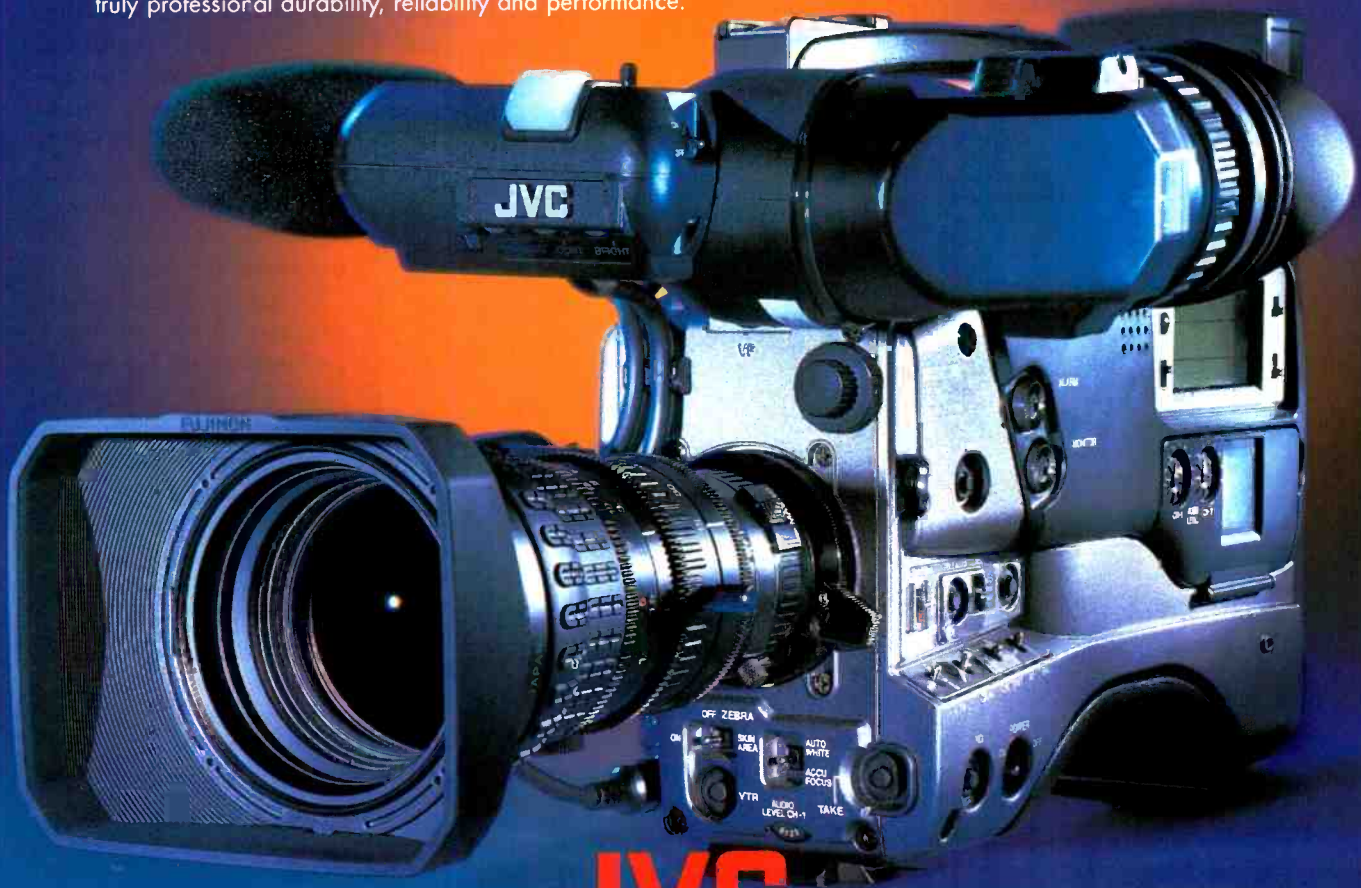

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Improving video quality

BY MARTIN J. STEIN AND MARK SCHAFFER

As new broadcast services battle for the same amount of fixed transponder bandwidth, improving quality at low bit rates has developed into a fertile area for technological advances – and has become a primary concern for service providers. Lowering the bit rate of video services makes space available for new, advanced services. Finding ways to do so without sacrificing video quality is the new "holy grail" for compression scientists. There are now a number of techniques that pre-processing and compression software can apply directly to each individual program to achieve the best quality within the available bandwidth. These content-based techniques analyze various aspects of the content's creation to efficiently apply compression to different scenes.

Finding ways to lower the bit rate without sacrificing video quality is the new "holy grail" for compression scientists.

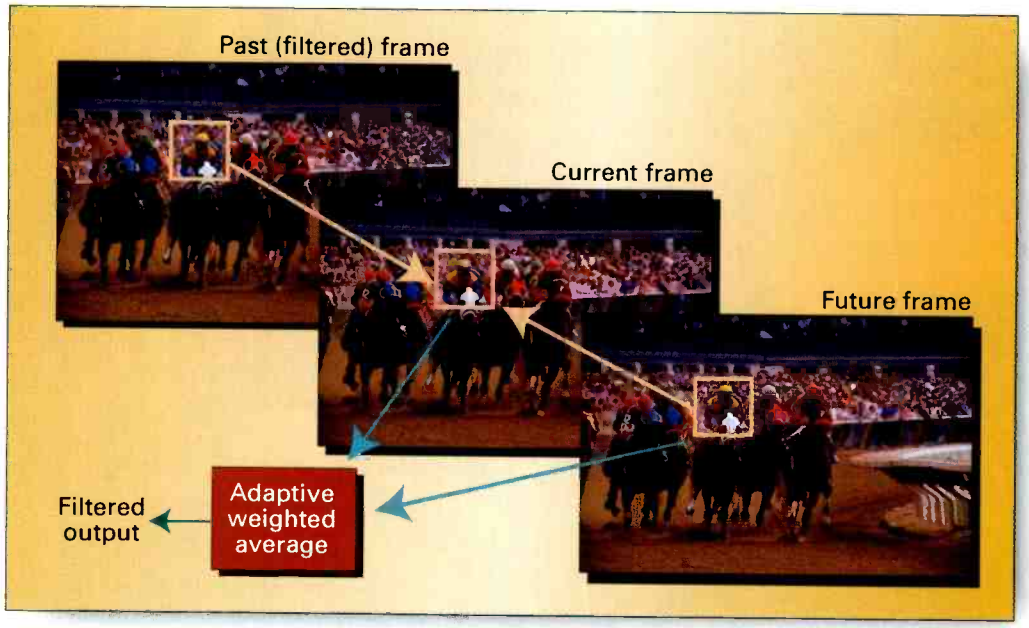

Figure 1. Bi-directional motion compensated temporal filtering removes random and impulse noise between adjacent frames.

Pre-processing techniques

The following pre-processing steps can be applied sequentially to condition the video and optimize compression.

Film mode. To translate first-generation film material into video, the telecine process converts the 24 film frames into 48 fields, then duplicates 12 of the fields to come up to the required 60 video fields per second. The film-mode process, often referred to as "3:2 pull-down reversal" or "inverse telecine," automatically detects and eliminates any duplicate fields. This method can yield up to 20 percent compression efficiency when compared to video-originated material, and is one of the most widely applied pre-processing techniques today. Detecting "bad edits" that may have been created during the post-production process reveals where the 3:2 sequence has been interrupted. This allows the pre-processing activity to drop out of film mode when necessary and re-enter it when a consistent 3:2 sequence is again detected.

Scene-change detection. Carefully allocating the available bit rate to either picture detail or motion improves the quality of MPEG-2 compression. A scene change in a program results in drastic content change between adjacent frames, mimicking the effect of significant motion. As a result, the compression engines reduce the bit rate assigned to picture detail, which reduces the instantaneous picture quality and often consumes more of the available bandwidth than needed.

The scene-change-detection process eliminates these problems by storing several video frames in memory to compare to adjacent frames. The process can then detect a scene change in time to gracefully close one MPEG-2 group of pictures and build an anchor frame for the next sequence. This process allows the software to allocate more bits to the new anchor frame, preserving the quality of the next picture sequence.

Fade and flash detection. Similar to scene changes, fades and flashes can also be detected and processed to avoid unnecessary artifacts. Fades and flashes change all luminance values over a number of

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frames, mimicking the effect of significant motion. By using a multi-frame memory, the software can examine picture sequences to detect fades or flashes and allocate more of the available bit rate to picture quality.

Noise reduction through filtering. Filtering processes, either temporal (between frames) or spatial (within a frame), can reduce noise that the encoder might mistake for extensive picture detail or motion. Noise removal significantly improves compression efficiency, allowing the encoder to focus on the meaningful portions of the content.

Motion-compensated temporal filtering is a sophisticated process for removing source video noise between adjacent frames in moving pictures. (See Figure 1.) By tracing the motion of each pixel between frames, the process appropriately filters according to the related motion vector. This process removes random and impulse noise in moving objects, preserving the detail of the object and further improving compression efficiency.

Adaptive spatial filtering removes source video noise between adjacent pixels (picture elements) within a frame. This process works on a pixel-by-pixel basis to remove random and impulse noise within the video frame, appropriately filtering according to the values of its surrounding pixels within the frame and carefully preserving the edges of any perceived object. Typically, the service provider can adjust the strength of this filter to match the desired encoding quality, balancing picture sharpness with perceived digital artifacts.

Compression techniques

After pre-processing and noise reduction, the video source material is ready to move through the compression process. Compression techniques such as motion estimation, statistical multiplexing and dual-pass compression produce the final MPEG-2 stream.

Motion estimation. Motion estimation is the most critical and computer-intensive step in the video compression process. Up to 80 percent of the redundancy in moving pictures is a result of the temporal correlation between the current picture frame and elements of past or future encoded frames. The accuracy of the motion-estimation process affects both the final picture quality and the efficiency of the compression process. Any improvement made to this process is of great value. The motion-estimation technique most often used works by varying the "search range" and the search strategy. (The search range is the number of pixels surrounding the target pixel, which the software analyzes to determine the exact motion path of the target pixel.)

Allocating the available bit rate to either picture detail or motion improves the quality of MPEG-2 compression.

Statistical multiplexing. Statistical multiplexing is based on the principle of a fair distribution of quality across all the video streams within an MPEG-2 multiplex. An examination of the statistics of full-motion video reveals that it spends most of its time in less complex scenes that respond well to digital compression techniques, and only briefly experiences scene changes or other forms of rapid movement. This provides an incentive for pooling the available bandwidth and treating multiple programs as a group. Statistical multiplexing can dynamically allocate the group's bandwidth where it is needed most, improving the quality of those pictures that are experiencing rapid movement or contain significant picture detail.

In a statistical multiplex, each service operates at a variable bit rate. Individual services make demands on the group's bandwidth based on the complexity of the video. The encoder's multiplexer receives these bandwidth requests from each member of the group and determines the maximum picture quality that the available group bandwidth can sustain. It then allocates a bit rate to each service to achieve that level of quality. The dynamic allocation of variable bit rates ensures that bandwidth is not wasted on less complex scenes, allowing for higher quality complex scenes. Statistical multiplexing enhances the quality of the entire multiplex and enables service providers to achieve higher levels of multichannel service.

Dual-pass encoding. Repeating the process via dual-pass encoding further improves statistical multiplexing. During the first pass, the encoding system determines the precise bandwidth requirements of each stream, rather than just the instantaneous demands of a frame from each program. It then uses that information to accurately allocate the bandwidth on the second pass.

Combining all of the above mentioned compression techniques in a tight feedback loop further enhances the encoding process. For instance, if a single program is consuming an inordinate amount of bandwidth, the statistical multiplexer can instantaneously modify the filtering values for that stream – or a number of other less critical streams – to optimize the performance of the entire multiplex.

Only a year or two ago, it appeared that there was little opportunity to squeeze more bits out of the multichannel compression process. In that short period of time, however, scientists and engineers have made major advances in compression efficiency to meet the increasing demands on transponder usage and the competitive requirements of service providers. Now, a new generation of cost-effective, high-speed media processors allows the real-time execution of an increasing array of compression and pre-processing techniques – and marks yet another conquest in compression scientists' continuing pursuit of their grail. BE

Martin J. Stein is senior marketing director and Mark Schaffer is senior product manager of Motorola Broadband Communications Sector, Satellite & Broadcast Network Systems Division in San Diego.

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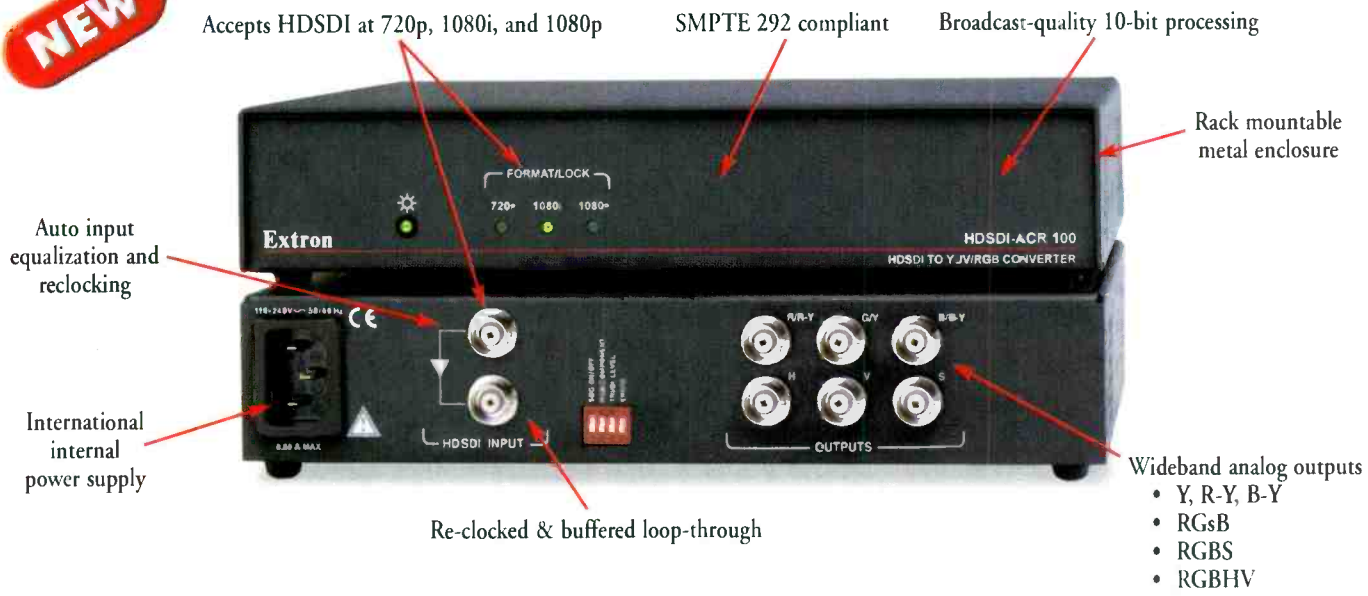

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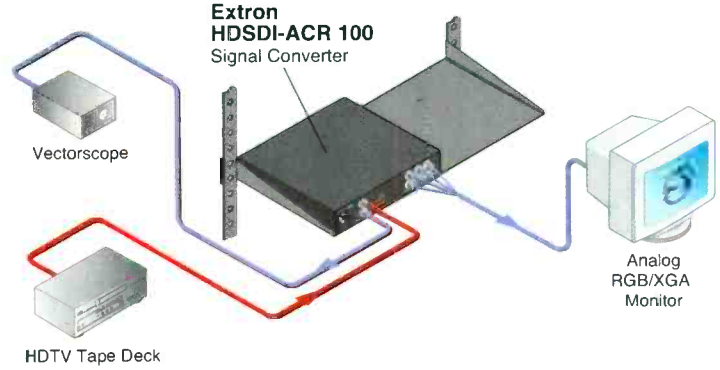

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Understanding
composite digital video

BY MICHAEL ROBIN

Over many years, video equipment manufacturers have responded to the trend toward digital video by producing a large number of application-specific digital black boxes. These products were developed to fulfill specific production needs. They were operating at incompatible sample rates, number of bits per sample and quantizing range, and so they are often incompatible with each other. The one thing they do have in common is a link with their analog ancestry: analog composite I/O interconnect ports that make them compatible with all-analog composite production studios.

The continuing trend towards an all-digital studio resulted in the need for digital video equipment industry standards. What resulted was the development of two sets of composite digital standards for studio equipment: the $4f_{SC}$ NTSC standard and the $4f_{SC}$ PAL standard.

These standards specify that the analog composite video signal must be sampled at a rate of four times the color subcarrier frequency ($4f_{SC}$). The number of bits per sample plays an important role in determining the signal quality and the economics of videotape recording, so the standards allow a choice of eight or 10 bits per sample.

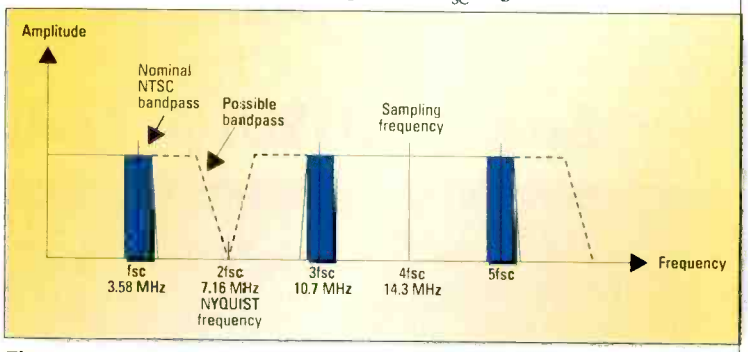

Figure 1. Spectrum of the $4f_{SC}$ sampled NTSC

In North America, the initial interest in $4f_{SC}$ composite digital videotape recorders (VTRs) was spurred by the need to replace obsolescent analog composite VTRs with digital VTRs that had analog I/O ports. A number of manufacturers developed such products, identified as D2 (Sony and Ampex) and D3 (Panasonic) digital VTRs. Subsequently, a wide range of compatible $4f_{SC}$ digital video studio-quality equipment appeared on the American market. In Europe, however, interest in $4f_{SC}$ VTRs was limited because these VTRs cannot handle SECAM.

This article discusses the sampling and quantizing characteristics that govern these VTRs as specified in the SMPTE 244M standard.

General specifications

The SMPTE 244M standard sets the sampling frequency at four times the subcarrier frequency, or 14.3181 MHz (14.3 MHz nominal). The sampling clock is derived from the analog signal's color burst. Figure 1 shows the sampling spectrum of the $4f_{SC}$ NTSC. The shaded area represents the suppressed subcarrier and its sidebands. In this example, the sidebands are limited to ±600 kHz. The sideband bandwidth depends on the NTSC encoder design. The SMPTE 170M standard allows narrow-bandwidth (±600 kHz) and wide-bandwidth (±1.2 MHz) chrominance sidebands.

There is a significant gap between 4.2 MHz, the maximum nominal NTSC baseband frequency, and 7.16 MHz, the

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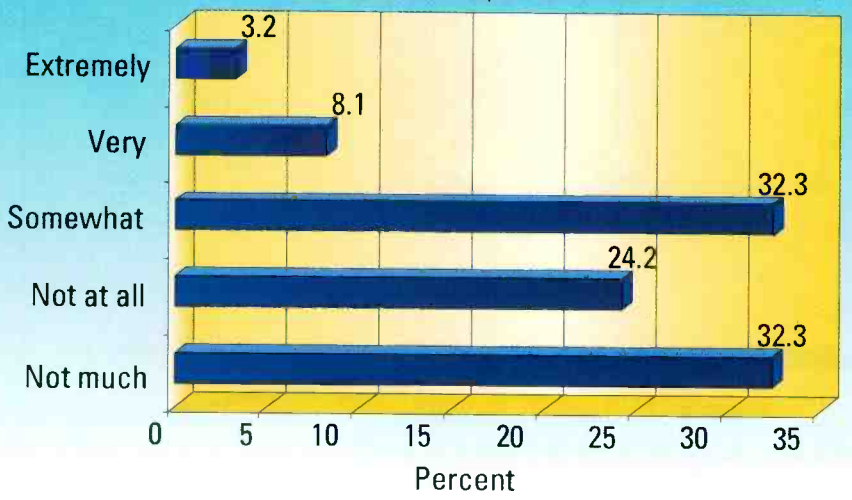

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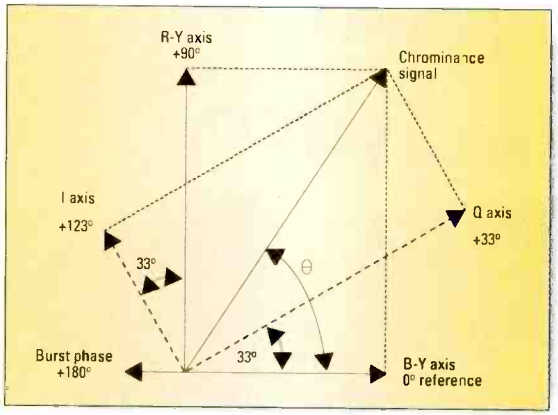

Figure 2. Phase diagram showing the relationship between the chrominance vector projections on the B-Y/R-Y axis system and the I/Q axis system.

Nyquist frequency. Unlike the ITU-R BT 601 component digital standard, SMPTE 244M does not specify the characteristics of the anti-aliasing and reconstruction filters. The manufacturer has the choice of developing complex and costly wideband, brick-wall, ripple-free filters that yield an extended baseband frequency response, or a moderate cost, 4.2 MHz, low-pass filter with a gradual roll-off.

The sampling structure

The SMPTE 244M standard was developed with reference to the original (1953) specifications, which used I/Q encoding instead of the B-Y/R-Y encoding currently used. Figure 2 shows that any chrominance vector can be represented by I/Q or B-Y/R-Y vectors. The original intent of the NTSC standard was to assign different baseband bandwidths to the I signal (1.2 MHz) and the Q signal (600 kHz), thus providing a better resolution of the orange visual information. Figure 3 shows the block diagram of a typical 1953 encoder. The first block of the encoder, the matrix, converts the gamma-corrected E'_G, E'_B and E'_R primary signals into E'_Y, E'_I and E'_Q signals. A low-pass filter limits the bandwidth of the E'_I signal to 1.2 MHz and another low-pass filter limits the bandwidth of the E'_Q signal to 600 kHz. The E'_Y and E'_I signals are suitably delayed to match the delayed narrow-bandwidth E'_Q signal. The two chrominance components feed dedicated suppressed-carrier amplitude modulators in phase quadrature. An additional subcarrier phase shift rotates the two vectors with respect to the B-Y reference, as seen in Figure 2. A modern I/Q encoder as per SMPTE 170M would use equal-bandwidth I/Q signals, so the low-pass filters would be identical and there would be no need to delay the E'_I signal. The I/Q-encoded NTSC signal can be decoded along the I/Q axes, with equal or unequal bandwidths, or along the B-Y/R-Y axis, with equal wide or narrow bandwidths. In NTSC transmitters and receivers, the baseband bandpass is limited to 4.2 MHz. Attempting to decode chrominance signals beyond 600 kHz would result in severe I to Q or B-Y to R-Y crosstalk due to upper chrominance vestigial-sideband effects, so receivers never take advantage of wider-bandwidth chrominance components when they are present. Very few I/Q decoding monitors or receivers were built because the circuit complications would not yield any visible picture improvements. It is surprising that SMPTE 244M was developed using obsolete chrominance signals.

As Figure 4 illustrates, the sampling

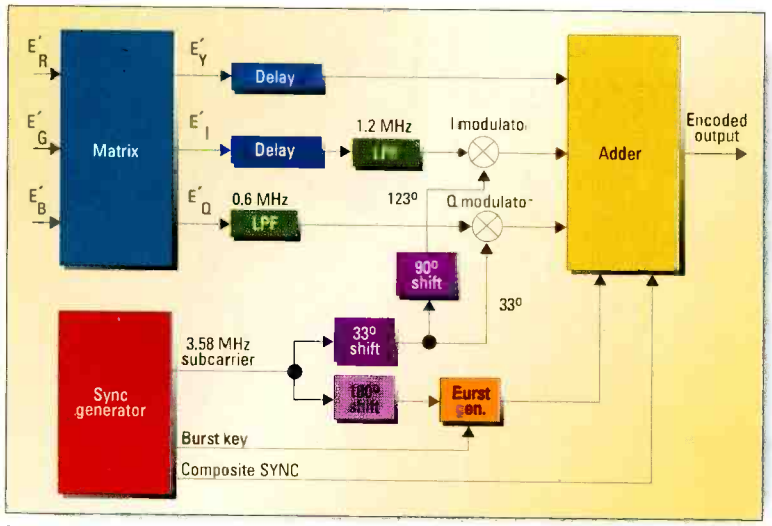

Figure 3. Simplified block diagram of an NTSC I/Q encoder

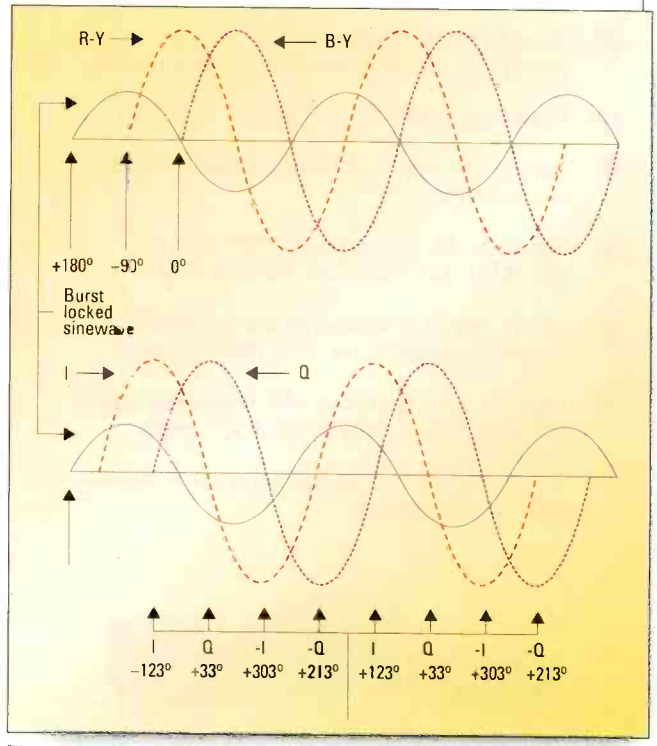

Figure 4. $4f_{sc}$ sampling instants of NTSC composite analog signal

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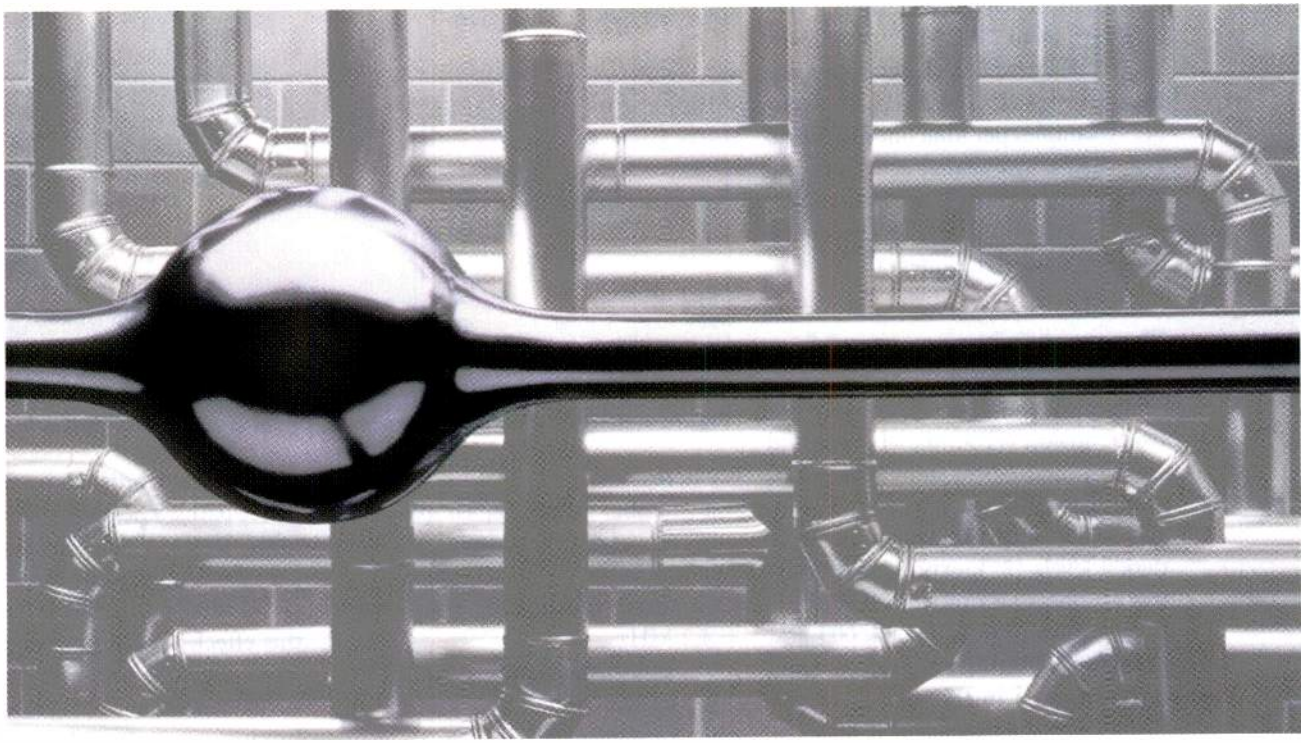

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instants coincide with the peak positive and negative amplitudes of the I and Q subcarrier components. The upper part of the drawing shows that these sampling instants provide an adequate representation of the B-Y/R-Y information. Given a sampling frequency f_S = 14.3181 MHz (nominally 14.32 MHz) and a horizontal scanning frequency f_H = 15,734.25 Hz, the number of samples per total line is equal to f_S/f_H = 910. The digital active line accommodates 768 samples. The remaining 142 samples comprise the digital horizontal blanking interval.

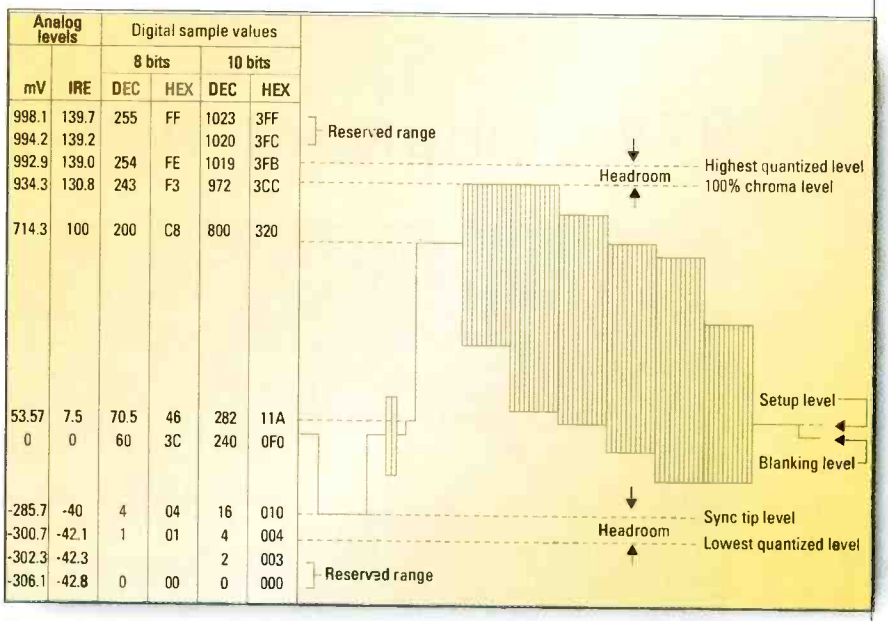


Figure 5. Relationship between analog signal levels and digital sample values

The quantizing range and its implications

Figure 5 shows the relationship between analog NTSC signal levels and eight-bit and 10-bit sample values of a 100/7.5/100/7.5 color bars signal. The 10-bit approach provides 1024 digital levels (2^{10}), expressed in decimal numbers varying from 000 to 3FF. Digital levels 000, 001, 002, 003 and 3FC, 3FD, 3FE, 3FF are protected and not permitted in the digital stream. This leaves 1016 digital levels, expressed in decimal numbers varying from 4 to 1019, or in hexadecimal numbers varying from 004 to 3FB, to represent the video signal. The sync tip is assigned the value 16 decimal or 010 hexadecimal. The highest signal level, corresponding to yellow and cyan, is assigned the value of 972 decimal or 3CC hexadecimal. The standard allows a small amount of bottom headroom (some call it footroom), levels 4 to 16 decimal or 004 to 010 hexadecimal, and top headroom, levels 972 to 1019 decimal or 3CC to 3FB hexadecimal. The total headroom is on the order of one dB, and allows for misadjusted or drifting analog input-signal levels. This reduces the signal-to-RMS quantizing-error ratio (S/Q_{RMS}) by the same amount. The theoretical S/Q_{RMS} of a $4f_{SC}$ device with analog I/O interfaces is given by the following formula:

$$S/Q_{RMS}(dB) = 6.02n + 10.8 + 10 \log_{10}(f_S/2_{fmax}) - 20 \log_{10}[V_q/(V_W-V_B)]$$

where:

n (number of bits per sample) = 10

f_S (sampling frequency) = 14.32 MHz

f_{max} (maximum baseband frequency) = 4.2 MHz

V_q (quantizing range) = 1.3042 V

V_W (white signal amplitude) - V_B (blanking level) = 0.7143 V

Given the above values, the calculated value of S/Q_{RMS} for a 10-bit system is 68.10 dB.

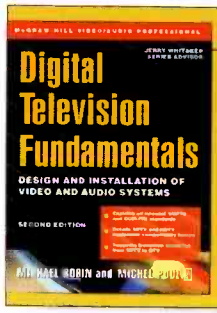
In an eight-bit system, 254 of the 256 levels (01 through FE) are used to express a quantized value. Levels 00 and FF are protected and not permitted in the data stream. The calculated theoretical value of S/Q_{RMS} for an eight-bit system is 56.06 dB.

In retrospect

D2/D3 digital composite VTRs appeared on the market at a time when Betacam SP composite analog VTRs were in the process of capturing the market. Betacam SP proved to be the more popular format, especially for newsgathering, because of the availability of a field unit featuring a piggyback camera, as well as complete compact editing systems. To avoid multiple NTSC decoding/encoding picture-quality degradations, editing suites used an S-Video connection with separate luminance and chrominance paths. The performance figures of the D2/D3 VTRs were superior, especially if parallel or serial digital (143 Mbits/s) interfaces were used. To this effect, several manufacturers offered digital composite production switchers with serial digital interfaces. In most cases, the D2/D3 VTRs were used as drop-ins in an NTSC analog composite environment. The appearance of competitively priced component digital video equipment has tilted the market in favor of component digital video. BE

Michael Robin, former engineer with the Canadian Broadcasting Corp.'s 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@primediabusiness.com



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Gigabit Ethernet primer

BY BRAD GILMER

In 1965, just four years after the first planar integrated circuit was invented, Gordon Moore predicted that the number of transistors per integrated circuit would double every 18 months. In the years and decades since then, Moore's prediction has, for the most part, held true. Memory capacity, disk-drive capacity and processor speed have increased rapidly, while the costs of these components have remained constant or have fallen. This dramatic increase in processing power has not only allowed designers to create more capable computers, it has also allowed engineers to create powerful networking technologies. And powerful, high-speed networks are particularly well suited for moving the large amounts of data generated by digital video.

We're all familiar with unshielded twisted-pair (UTP) Ethernet wiring. This cabling has been used with 10 Mbit systems (10Base-T) for many years. As of 1997, 85 percent of all network connections were Ethernet, representing over 118 million connections. Given the tremendous growth in networking over the last five years, it is likely that UTP wiring is now used for over 90 percent of all network connections. Network engineers have worked hard to build on existing technologies to allow a smooth transition to new technologies while preserving as much of the infrastructure as possible. Given that, on average, over 50 percent of UTP infrastructure is still in place five years after installation. Reuse of this infrastructure is an important part of the overall plan for all the "x"Base-T technologies.

Gigabit networking is available on a number of different wire technologies – UTP is only one of the options.

The 1000Base-T specification was ratified by the IEEE Standards Committee in June of 1999 and is formally known as 802.3abTf. It describes how gigabit Ethernet (also known as "Gig-E") is to be carried over four balanced unshielded pairs of CAT 5 cable using V.90/56k encoding and compression.

Designation	Type	Modal bandwidth	Length
1000Base-CX	Balanced shielded copper	N/A	25 meters
1000Base-LX	62.5 µm multimode	500	2-550 meters
	50 µm multimode	400	2-550 meters
	50 µm multimode	500	2-550 meters
	10 µm single-mode	N/A	2-5000 meters
1000Base-SX	62.5 µm multimode	160	2-220 meters
	62.5 µm multimode	200	2-275 meters
	50 µm multimode	400	2-500 meters
	50 µm multimode	500	2-550 meters
1000Base-T	Unshielded twisted pair	N/A	100 meters

Table 1. Comparison of gigabit networks

1000Base-T's success is due in part to the large installed base of UTP cable, and it works to preserve as much of that installed base as possible. 802.3abTf expands upon earlier UTP technologies by offering the following features:

- Allowing auto-negotiation between 10Base-T, 100Base-T and 1000Base-T
- Continuing to use Ethernet Media Access Control (MAC) technology
- Using the same clock rate as 100Base-T (125 MHz)
- Providing the same robustness as 100Base-T (with a bit-error rate of $1x10^{-10}$)

1000Base-T can fit an order of magnitude more data into the same "cable" by using four pairs, each running at 250 Mbits/s. This higher data rate is achieved by leveraging the existing V.90/56k encoding algorithms (Phase Amplitude Modulation 5 and Trellis coding) rather than using 4B/5B encoding as is implemented in 100Base-T technology.

Gigabit networking is available on a number of different wire technologies – UTP is only one of the options. Gigabit networking is also implemented on optical fiber, in both single-mode and multimode, and balanced shielded copper. 1000Base-LX is the designation for single-mode fiber at lengths of up to five kilometers. 1000Base-SX describes gigabit networking over multimode fiber up to 550 meters. 1000Base-CX is the designation for gigabit Ethernet over balanced shielded copper at lengths up to 25 meters. Table 1 compares the various flavors of gigabit networks, cables and characteristics.

Backward compatibility is accomplished through an elegant combination of technologies, illustrated in Figure 1.

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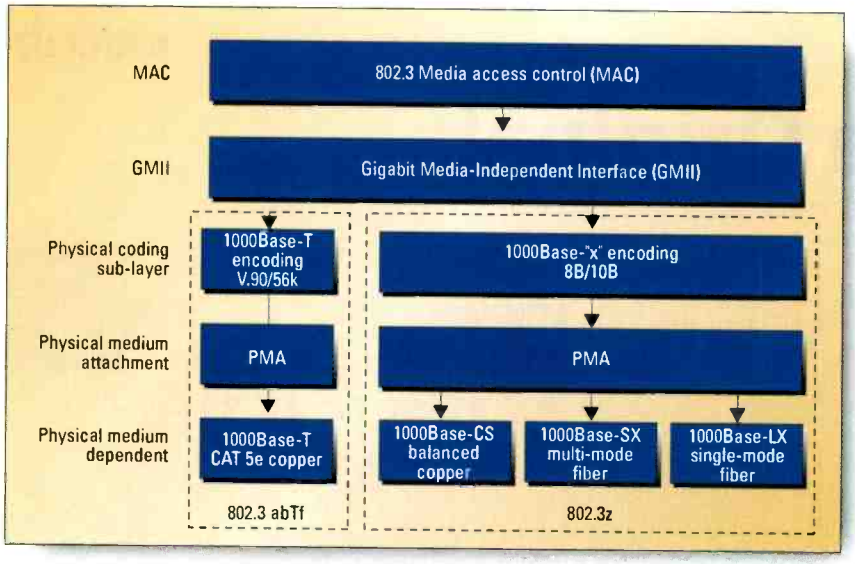

Figure 1. The layers of a gigabit Ethernet network

These technologies are implementations of the Data Link Layer and the Physical Link Layer in the OSI seven-layer model.

At the top of Figure 1 is one of the cornerstones of Ethernet networking, the 802.3 Media Access Control (MAC) layer. The MAC layer takes data from an overlying application and packages it into Ethernet frames. The MAC layer is also responsible for network addressing and scheduling. Below this layer is the Gigabit Media-Independent Interface (GMII). The GMII layer provides a consistent interface to the MAC layer, regardless of whether the packets will be sent via fiber, UTP or coax.

The next layer is the Physical Coding Sub-layer. 1000Base-T uses a different encoding scheme for data on the wire compared to all of the other gigabit Ethernet technologies. For this reason, different physical coding sub-layers are introduced into the 1000Base-T stack and the stack for all other gigabit media types. 1000Base-T employs V.90/56k (Phase Amplitude Modulation 5 and Trellis) encoding, while the other technologies use 8B/10B encoding.

The Physical Medium Attachment Sub-layer consists of the electrical interfaces, and the Physical Medium Dependent Sub-layer describes the physical attachment of the wire or fiber.

When transitioning from 10Base-T or 100Base-T to gigabit Ethernet, the most important thing you can do is test your existing wiring to see that it meets the Gig-E specifications. If you have CAT 5e wiring, you can be pretty sure that the wire will meet the Gig-E specification. If you have CAT 3 wiring, you can be pretty sure that your wiring *will not* meet Gig-E specifications. If you have CAT 5 wiring, the only way to know is to test it. Many different cable testers are available.

The only way to know if it will work with gigabit Ethernet is to test it.

When testing for Gig-E compliance, the most important measures are return loss, equal-level far-end crosstalk (ELFEXT) and near-end crosstalk (NEXT). Return loss is a measure of how well the impedance of the cable matches the impedance of the transceivers (for those of you who are ham-radio operators, think SWR). ELFEXT is a measure of unwanted signal from a near-end transmit pair that crosstalks into a neighboring pair at the far end, relative to receive signal at the far end. NEXT is a measure of unwanted signal from a near-end transmit pair that crosstalks into a neighboring pair as measured at the near end.

When migrating from lower-speed technologies to Gig-E, we really have to thank the designers of all the "X"Base-T Ethernet specifications. The advent of auto-sensing adapters, switches and other hardware has made it possible to migrate from one technology to another relatively painlessly.

It makes sense to deploy Gig-E where it is needed. The most likely places for

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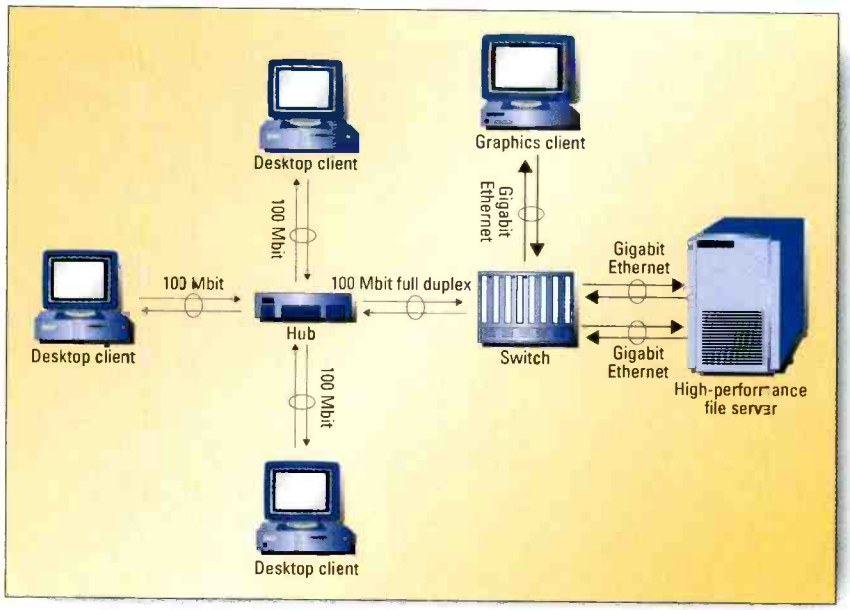

Figure 2. This digital-video network uses a dual Gig-E link between the switch and a high-performance file server, and a single Gig-E link between the switch and the graphics workstation.

Gig-E are areas that require very high network speed. For example, Figure 2 shows a dual Gig-E link between the switch and a high-performance file server. Also, a single Gig-E link runs from the graphics workstation to the switch to ensure that this high-bandwidth client has the maximum bandwidth available at all times. For other desktop clients who will be viewing video at a lower resolution, you can use lower-cost 100 Mbit links. Note that this bandwidth is shared among all of the desktop clients through a very low-cost hub. If at some point you need more capacity at the desktop, you can change the hub to a switch and increase the link speed between the large switch and the hub to Gig-E. Ultimately, you can change the entire network to Gig-E, but by that time, you will probably want to upgrade the large switch and the file server to 10Gig-E (but that's another story). BE

Brad Gilmer is president of Gilmer & Associates, executive director of the AAF Association and technical moderator of the Video Services Forum.

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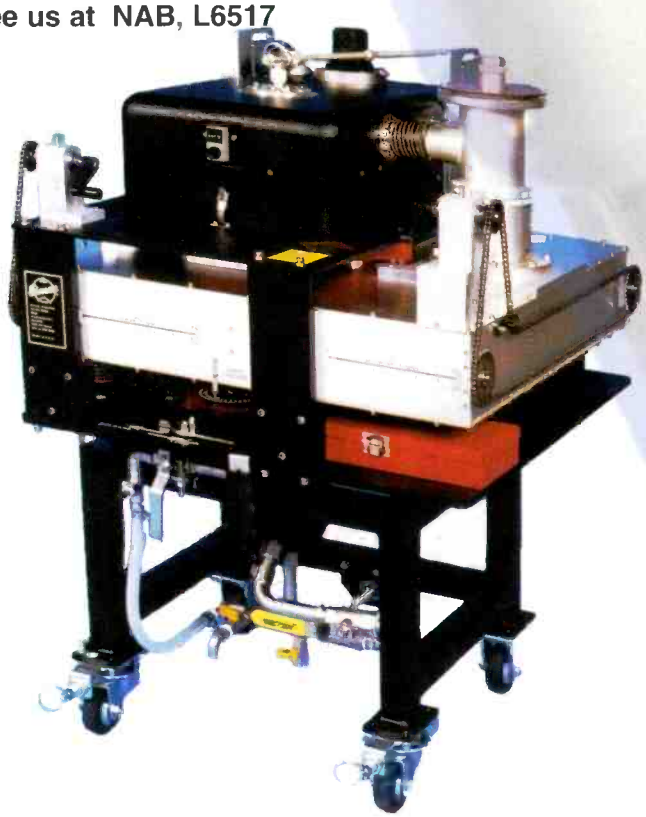

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Surround audio mixing for broadcast: A primer

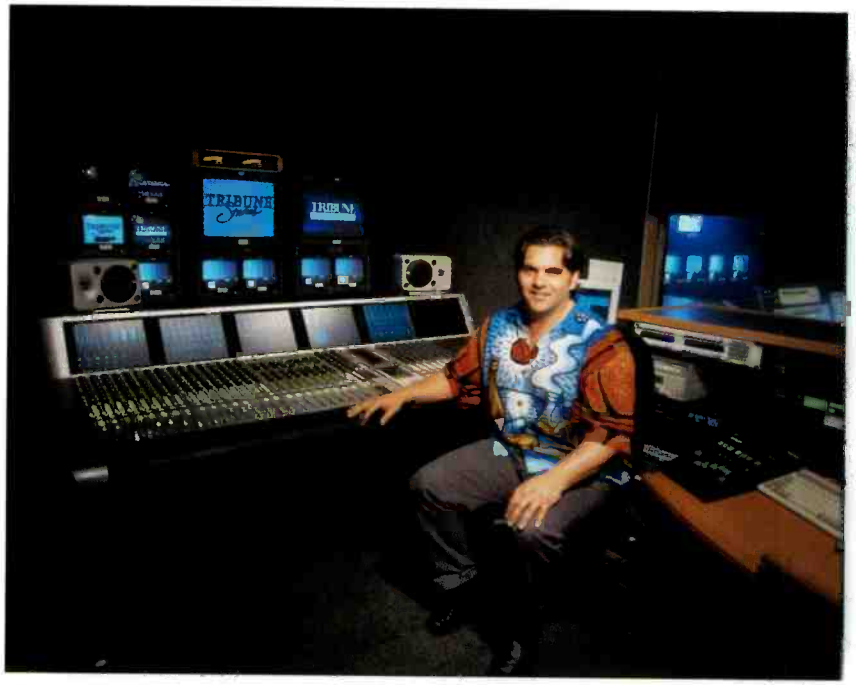
BY DAVE HANSEN

Whether your facility is getting ready for digital broadcasting, high-definition TV or you are looking forward to a future where surround audio is a day-to-day part of broadcasting, consider your next console's capabilities. Someday that live concert, football game or movie of the week will be broadcast with a sound that envelops your audience. Considering the technical challenges of combining multichannel production techniques with traditional live broadcast mixing will enable your facility to smoothly integrate the programming of the future.

The film industry has long understood that when sound envelops the audience, it transforms the theater experience. It was the film industry that first adopted the now ubiquitous discrete 5.1 Dolby or Digital Theatre Systems. And thanks to the popularity of the DVD format for consumer entertainment distribution, home audiences are starting to realize the benefits of a six-channel 5.1 system based around their TV set to more fully realize the potential of their entertainment systems.

Now that the DTV and HDTV specs include provision for 5.1 surround, it is only a matter of time before surround sound becomes a commonplace enhancement to broadcasts. Every facility that is planning an audio upgrade should consider incorporating surround capabilities. Retrofitting existing consoles is an awkward proposition at best. A surround-capable console and installation can make the transition from stereo to 5.1 simple.

It is only a matter of time before surround sound becomes a commonplace enhancement to broadcasts.



Jim Toten, Tribune's director of engineering and technology, is pictured with the Euphonix System 5. Broadcast facilities such as Tribune in Los Angeles are revamping their systems for all-digital broadcast and live-to-tape and are considering surround sound with an eye to the consumer market.

A "5.1" speaker system generally consists of a left channel, center channel, right channel, left surround and right surround (usually placed behind the viewer) and the ".1" subwoofer for low-frequency reproduction. This setup duplicates what one finds in a movie theater. For the home market, Dolby Digital and DTS are currently the most prevalent multichannel formats.

When mixing sound for a 5.1 production, an audio console requires a higher degree of technology than audio consoles of the 1980s, especially in the area of bussing and monitoring. The good news is that most console manufacturers are now aware of multichannel mixing through supplying consoles to the film and post industries, so most features are readily available.

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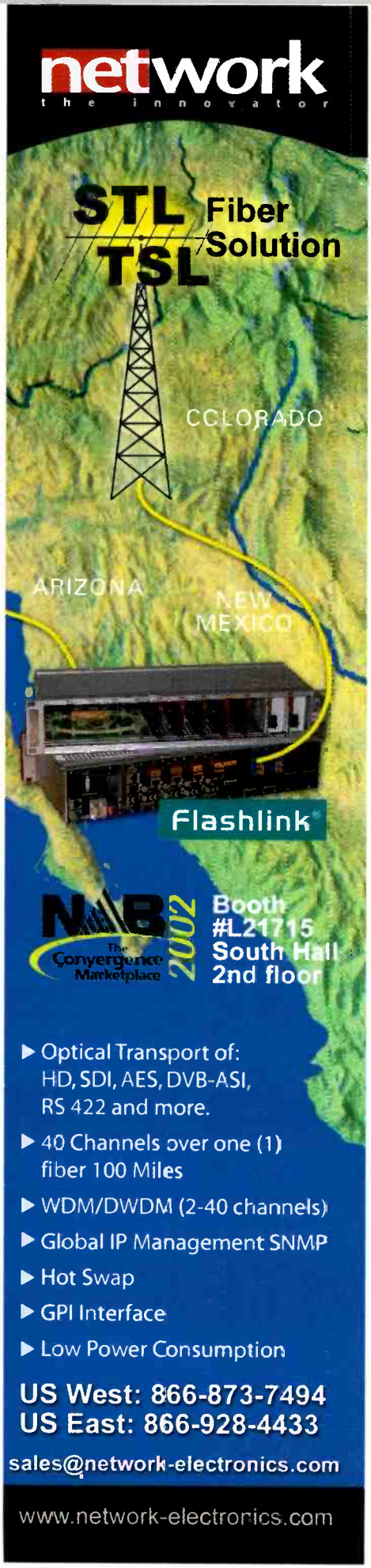

flexibility for monitoring, fold-down and signal routing while maintaining the critical outputs for any configuration from mono and stereo to 5.1 surround. For maximum flexibility, one should bear in mind that a digital console will more easily integrate with your digital video equipment.

Accordingly, the first step in achieving multichannel audio support is a flexible console bus structure. Many consoles provide an eight-channel program/mix bus and an eight-channel monitor bus, so you can output eight channels from the console and simultaneously listen to them. The eight channels easily allow 5.1 mixing (the extra pair are useful for companion stereo mixes). The next part of a monitoring system is a monitor insert, preferably eight channels as well, to match the monitor bus. The monitor insert should be a switchable insert that lies in the signal chain before the monitor ports and the cut switches. This is used, for example, to listen to the decoded Dolby signal while you are mixing and feeding the stereo signal to the Dolby encoder.

Bass management capabilities are useful for easily controlling what gets sent to the sub-woofer or LFE (low-frequency effects).

Another capability required to support surround mixing is a monitor matrix with a multichannel path into the monitors. This is used to set up multiple paths for the audio mix, one to the live broadcast or tape, which may be stereo, and one to a monitor section so you can listen to that signal.

Monitors should also easily "fold-down" the mix and listen to it in different speaker configurations. Fold-down allows the mix engineer to check the quality of the mix in all the formats that the consumer will possibly hear without destroying the integrity of the program output.

Video will undoubtedly continue to have mono or stereo printed right onto the tape. Currently, if a production needs an accompanying surround, it is usually supplied on a separate DA-88 format audiotape from a Sony or Tascam recorder. Supplying program material on two elements like this is not optimal for many television networks, at least for the moment, as they introduce additional administrative and technical procedures. The new Dolby E format is designed to allow 5.1 program data to be stored on a pair of channels on a single videotape. This simplifies these procedures and doesn't require significant investment in new hardware.

Further innovations to HD audio are aimed at enhancing the entertainment experience for home viewers.

Many new audio consoles employ a joystick controller for panning audio between all five speakers. Some consoles have a "divergence" setting for the joystick panning, which allows the signal to spread at varying amounts between other speakers as the audio is panned.

Further innovations to HD audio are on the horizon, aimed at significantly enhancing the entertainment experience for home viewers. The cable companies should be poised to provide the appropriate distribution for this technology. Soon, consumers will find home systems that are as affordable and highly integrated as the professional equipment is today. BE

Dave Hansen is the vice president of product marketing at Euphonix.

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To allow for a lower grid height, KPOM installed fluorescent-based lighting and painted everything in the ceiling area black. Photos by David Huff of Bob's Studio of Photography.

KPOM-KFAA creates news, moves to digital

BY EVIE HUTCHINSON

Small-market television stations face their own brand of economic challenges today. Conservative estimates show that stations' total capital budget often is only $250,000 per year for all acquisitions, and the cost to convert to digital can run as high as $5 million. However, some have not been deterred. KPOM-KFAA, a small-market NBC affiliate in Arkansas, recently undertook the mission of expanding their market, building a new local news product from the ground up and converting to digital all at once. The owner, John W. Griffin, made a conscious decision to make a large initial investment to start the expansion on the right foot.

The decision to expand from their old location, Ft. Smith, to Fayetteville, AR was based on research conducted by KPOM officials to determine the desire for a local news product in northwestern Arkansas. The response was overwhelming. Tremendous growth in the marketplace prompted officials as well. This decision came after the station had taken an eight-year hiatus from producing local news, due to economic reasons.

After scouting somewhere around 30 potential locations in and around Fayetteville, station officials chose the Campbell-Bell building, a prominent century-old former department store that had already been part of a major downtown revitalization effort. Renovations to the building had already begun by developers and owners, who planned to spend around two million dollars total on the building. Leasing this existing space saved both time and money while bringing business and visitors to downtown and integrating KPOM into the historical center of Fayetteville. Although there is history associated with the building, the only historical reconstruction occurred on the outside, meaning KPOM was free to conduct an interior finish-out.

Once they decided on the site, KPOM enlisted the help of Rees Associates, a Dallas-based facilities design and planning firm, to fit their ideas for their new station to the existing space. The design team consisted of Ralph Blackman, Rob Genter and Song Chia of Rees Associates, owner representative Marvin Shirley, and a local contractor. Fred Beck of Beck Associates provided system

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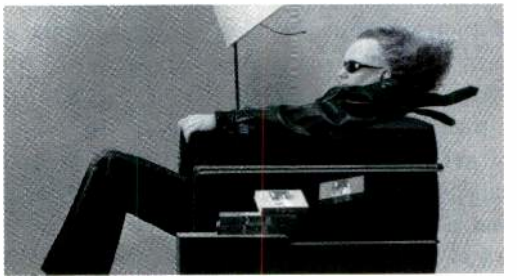

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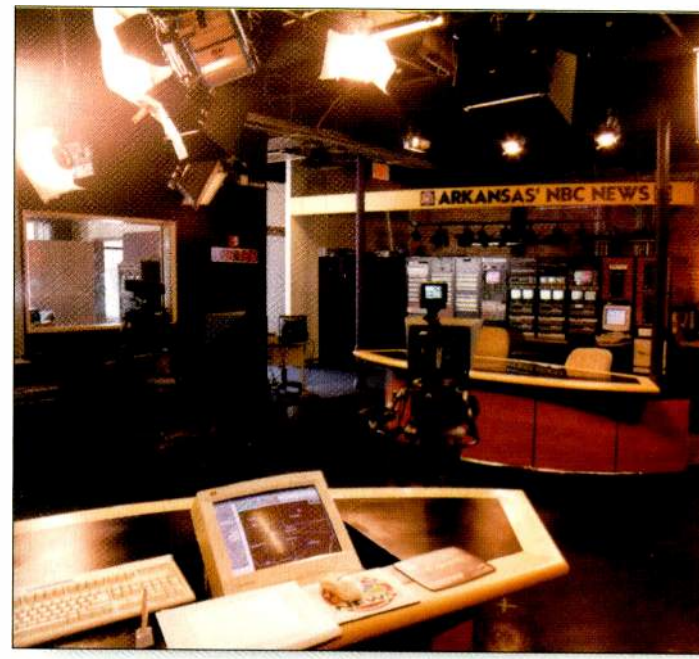
integration. In terms of the time frame, programming, design and construction documents all took between six and eight weeks to prepare, and the actual construction took about three months. KPOM personnel moved into the building in the last week of June 2000 with construction still going on — leaving about a month until their first live broadcast on Aug. 3, 2000.

There were several considerations designers took into account. Among them were cost reduction and saving time while outfitting KPOM for news production and digital conversion, though most of the design concerns related in some way to the age of the building. Low ceilings were a potential problem; the building was only 14 feet from floor to floor. Fluorescent-based lighting by Barbizon helped in their mechanical-electrical modes and also allowed for a lower grid height. Also, an optical illusion was created by painting everything black in the ceiling area.

The floor was another structural challenge. The original wood floor existed on top of a crawl space and was uneven, so it was completely covered with a leveling compound. Tile flooring was then placed on top of that to achieve the necessary levelness for the studio cameras. Also, no accurate documentation on the building exists, obviously leading to some surprises during demolition. There was one column in particular in the middle of the anchors' desk, which was in the way but could not be moved. The decision was made to paint it black, helping it blend into the background, while at the same time leaving the possibility of mounting a monitor on it later.

In terms of acoustical considerations, there were significant concerns about possible noise coming from the occupied town houses above KPOM's entire space. The team routed all drain lines out of the studio space and installed a sound-isolated ceiling over half of the area. Otherwise, ambient newsroom noise is a welcome element.

Once the simple design problems were taken care of, the focus turned to what would be seen on camera. For a small-market station, Rees wanted to give the KPOM news set a large-market feel, while still appearing informal and friendly. Rees Associates created the designs for the set, and station officials brought in a local cabinetmaker to build them. Simplicity dominates the design — they merely exposed available architectural elements for use as part of the working set, such as original capitals on cast-iron columns in the building. A long exposed brick wall running the length of the space was retained for use as a backdrop for the anchors, enhanced by red and amber gels. The interior is saturated in bright colors like reds, purples and yellows, giving KPOM a distinctive look.



KPOM-KFAA, a small-market NBC affiliate in Arkansas, recently undertook the mission of expanding their market, building a new local news product from the ground up and converting to digital all at once.

KPOM-KFAA undertook the mission of expanding their market, building a new local news product from the ground up and converting to digital all at once.

The relatively small studio (900 square feet) has been fully maximized. Up to six different shots are possible within the studio using camera angles, lighting and different backdrops. The remainder of KPOM's facility contains four edit bays, control room, satellite feed/record area, offices, engineering maintenance, ENG storage and the newsroom, among other things.

Both station officials and Rees designers liked the idea of the control room being visible to the public. Therefore, both the studio and the control room are at the front of the building, which fortunately is the most column-free area of space. Through the storefront-like windows in the front, passersby can look into the control room and see what the director is doing, or look into another area and see the anchors sitting at the desk during broadcasts.

Beck Associates worked closely with Rees to ensure a successful, working combination of architecture and equipment. A wide variety of equipment manufacturers were used, with reliability, ease of use, and upgradeability in mind. Every effort was made to choose manufacturers who periodically upgrade their systems. Almost all the equipment operating systems are software-based, most relying on Windows NT. A Jupiter control system supported by a fairly basic Philips/Thomson router allows analog video to be integrated into

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digital video and also transports it to various places in the newsroom, operational area and news control room. Taping is all digital — a Panasonic DVCPRO camcorder package is used in conjunction with DVCPRO VTRs for news playback. User-friendly Leitch SD monitoring DAs are used for analog-to-digital frame sync conversion.

For newscasts, a Ross Synergy 3 digital production switcher includes 32 inputs, a dual-key border generator and VTR remote controls. Other control room features consist of Pinnacle graphics and Telex/RTS intercom. A Nucomm microwave system came recommended by engineering consultants. Satellite dishes were engineered by Superior Satellites. One satellite is dedicated to CNN and AP, and another is dedicated to NBC News Channel and NBC's video on demand. There is also a steerable analog dish for in-house use. And though the focal newsroom is in Fayetteville, the station is actually licensed in Ft. Smith and Rogers since the two cities are closest to the station's transmitting towers. The KPOM tower near Ft. Smith feeds the broadcast to the KFAA transmitter near Rogers.

Price and performance steered station officials to choose the Hitachi Denshi Z3000W TXD1 studio package. The SP-8 Wheatstone audio console is also used.

Also from Beck Associates came a roll-around cart for a video monitor, speaker and clock, and they made a custom raised floor under which wiring is consolidated near the front of the facility. Extra cable was laid everywhere to make future additions or changes easier.

Expanding to a new locale and building a brand-new news product from the ground up can be daunting tasks for small-market television stations, especially while also purchasing a full studio of new digital equipment. With innovative design and creative use of space by Rees Associates, KPOM has managed to do these things on time. They have also captured the look and feel of a station of a much larger market, putting them a step ahead of the competition already. BE

KPOM created a distinctive look by retaining a long exposed brick wall enhanced by red and amber gels as a backdrop for the anchors. Bright reds, purples and yellows saturate the interior.

Equipment list

Hitachi Denshi Z3000W studio cameras
Fujinon A15x8BEV lens
Vinten Osprey pedestals
QTV prompters
Telex/RTS intercom system
Telos Link telephone interface
Gentner Autocoupler
Wengler Qtel IFB field telephone
Sennheiser MD421 microphone
Shure U124D/58 wireless microphone system
Telex/RTS TT44 IFB base transmitter
ESE clocks
Panasonic AW-E600 camera
Philips serial 601 video and two-channel analog audio
Philips BVS1616 analog video router
Philips Jupiter control system
Leitch VSM6804 SD monitoring DAs
ADC patch panels
Tektronix SPG-422 sync generator
Tektronix vectorscope
Tektronix audio monitor
Tektronix WFM601A waveform monitor
Ikegami color/black and white monitor
Panasonic AJ-D850 DVCPRO edit VTRs
Panasonic AJ-D450 DVCPRO VTRs
Leitch DFS3005A frame syncs with audio delay
Ross Video Synergy 3 digital production switcher
Pinnacle FXDeko

Evie Hutchinson is a staff writer for Ballas & Partners.

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KVEA moved some of its operations, including the news assignment desk, to building A as part of a remodeling project to support the expansion of its news coverage to 17 hours per week. Photo courtesy Telemundo.

SYSTEMS DESIGN SHOWCASE

KVEA-TV/KWHY-TV updated news operations

BY RICHARD LAHTI

KVEA-TV, Channel 52, is part of the Telemundo Television Network and has been on the air in Los Angeles since 1985. Los Angeles is a fiercely competitive market — the largest Spanish-speaking television market in the United States. KVEA-TV competes with a dozen or more stations, including all of the major network O&Os and some independents, as well as other Hispanic stations. To improve its position in the market, KVEA decided to go from two half-hour daily newscasts per week to 17 hours of news coverage per week.

KVEA-TV was a small UHF station that had evolved over its 17 years of operation without any long-term planning. The station utilized a mix of old broadcast and consumer equipment to bring programming to air. Add-on fixes and operational patches had become unwieldy to operate and maintain. It became necessary to consider a rebuild of the entire facility in order to maintain an appealing look and feel for KVEA-TV's programming. The expansion of its news presence was within the station's technical abilities, and KVEA-TV was on the air with the expanded news format by Jan. 15.

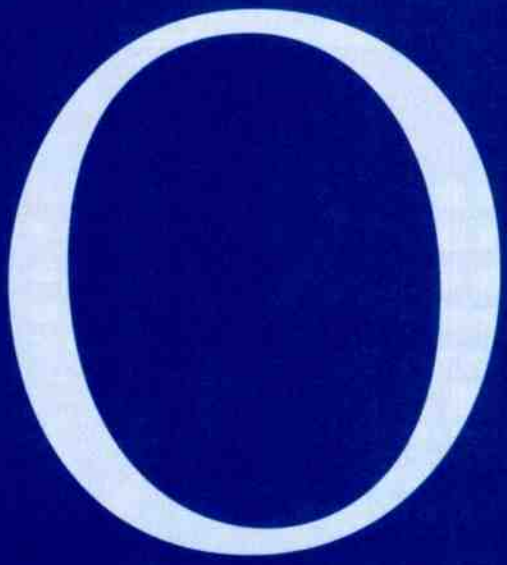
Nearly every area of the station had to be addressed: master control, production, editing and ENG.

Design considerations

In a little over a year, KVEA-TV has gone from an NTSC facility that was last updated about 10 to 12 years ago, to a modern state-of-the-art digital facility that not only houses KVEA-TV, but its newly acquired sister station, KWHY-TV. KVEA-TV remained on the air throughout the entire rebuild.

Nearly every area of the station had to be addressed: master control, production, editing and ENG. There was virtually no documentation and minimal spare equipment. There was no redundancy in the critical path to air, so any failure put the station in danger of going off the air. The STL up to Mt. Wilson was a 15-year-old system that wasn't up to the standard of performance needed for digital.

SONY



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SYSTEMS DESIGN SHOWCASE

KVEA-TV's physical plant consisted of two buildings, each about 15,000 square feet. Administration, news, traffic, engineering and production were housed in building A. Sales and an additional stage were in building B. Since building B wasn't fully utilized, KVEA-TV decided to move the administration and traffic departments there. The news department was moved into a temporary area while about 40 percent of building A was remodeled. Upon completion it became the assignment desk area, tape library, news executive offices and an 80-seat newsroom.

Another 40 percent of building A was remodeled to accommodate office space, a maintenance shop, a new equipment room, master control and an "edit bullpen" housing Grass Valley Group's Vibrint editors and GVG Profile XP ingest, edit and playback servers. The remaining portion of the building, including the old master control, equipment room and stage, remained in service until the new master control was completed.

KVEA-TV started to build the new equipment room and master control room in April, using the old control room until the end of July, and went online at the end of August. KVEA-TV then moved all production, including the news and sports set and the robotic cameras, to the unused stage in building B to allow the old master control, equipment room and stage area to be remodeled.

problems, for all practical purposes, the station didn't have backup power. To eliminate this trap, KVEA-TV chose a Caterpillar 500 kWH generator with the Cat UPS package, which uses flywheel technology and is capable of sustaining 300 kWH for 60 seconds after a power interruption.

KVEA-TV/KWHY-TV master control with KWHY-TV monitors, switcher and other equipment on the left, and KVEA-TV, a mirror image on the right. Photo courtesy Teklogic.

As the remodeling project progressed, the technical facilities, such as master control, the tape room, equipment room, edit stations, computer room and networks, assignment desk, and phone system, were backed up with emergency power.

The transmitter didn't have backup power either, so the station purchased a used 300 kWH Detroit generator and installed it at the transmitter site.

There was no redundancy in the critical path to air, so any failure put the station in danger of going off the air.

A 30 kW emergency generator covered only the critical path to air, so if the station lost commercial power, only master control and the tape room were still up and running. The rest of the facility went dark until power was restored. With California's energy

To accommodate the planned digital infrastructure, the BTS router and master control switcher had to be replaced. The master control operation used older JPEG Profiles and didn't have machine control so the air log was transferred to a pair of Leitch servers for commercial playback. They replaced the master control switcher with a Grass Valley Group MC2100 SDI switcher that has squeezeback. The BTS router was replaced with a GVG 7500 SDI series wideband router (128x128). It was populated 96x64 and will be expanded to its full 128x128 in 2002.

A Clear-Com system was purchased and installed to improve production communications.

KVEA-TV's tape format was a mix of Beta SP and SX. News stories were put together in one of five cuts-only cubicles with control panel editing. One Sony ES7 nonlinear system was added to handle news specials.

In addition to expanding news coverage, it was decided to improve the on-air look with linear keys and other effects. As an interim measure, KVEA-TV rented a GVG 250 to work with the station's old workhorse GVG 1600 switcher, which was fed by a Spencer still store and a Chyron Winfinite CG.

Two Shook ENG microwave vans were in use with one ENG microwave receive point located on Mt. Wilson at

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the transmitter site and a TSL to get the signal back to the studio.

KVEA-TV added three complete ENG field packages to enable better news gathering in the field, including a Sony SX camera and lens, RF microphones, Sony SX laptop editors, a light kit, and the necessary batteries and tripods.

The station also added ENG receive sites on Santiago Peak to the south and Oat Mountain to the northwest.

To increase its field capabilities, the station ordered two additional Ford Explorers for ENG, supplemented its existing Ford Explorers with portable 2 GHz microwave transmitters and purchased an ENG Corp. news gathering van with 2 GHz and 6 GHz microwave systems. KVEA-TV is licensed on 6 GHz, and shares a 2 GHz channel with another Los Angeles television station, KCOP-TV. The additions gave them a total of nine ENG field units, three with microwave and laptop editing.

Transmission operations center (TOC). Microwave, STL, TSL, Satellite Fiber and ENG all pass through this center. Photo courtesy Telemundo.

Audio mixers and waveform monitors were added to the existing edit rooms in the studio.

Two Collage graphic workstations from Pixel Power were installed to enhance production graphics.

To get the studio news operation up and running, four Sony studio cameras were purchased — three 950s and one 750, all with Vinten 2000 robotic pedestals. They were in operation by January 2001. The station also added a Leitch Logomation, GPS receiver time of day and time code distribution system.

As things were well underway with the upgrades at KVEA-TV, Telemundo announced in March 2001 the purchase of Los Angeles station KWHY-TV, Channel 22. Both operations had to be consolidated in the KVEA-TV plant in Glendale, CA, in time for the beginning of the fall schedule.

Teklogic Systems, a local integrator, was hired to help the station move forward with the plant upgrade and co-location issues in a timely fashion while addressing the day-to-day needs of the station. Preliminary work began, and the stations were on their way toward a dual operation.

A quick inventory of KWHY-TV's equipment in Hollywood determined that they would bring over their M Cast automation system, their Pinnacle server and NVision router, the DTV system fed from the Pinnacle server and four Vibrint nonlinear editors. The team decided to co-locate the two master controls in the same room, as mirror images of each other. This necessitated the purchase of an additional GVG MC2100 switcher with squeezeback. The two stations also now share a common ingest workstation where commercials are transferred to both the Leitch and Pinnacle video servers.

Teklogic Systems designed, documented and installed the KWHY-TV gear for master control and the news edit systems — Vibrint nonlinear edit with Profile XP video servers for acquisition and play to air.

In addition to expanding news coverage, it was decided to improve the on-air look with linear keys and other effects.

KWHY-TV also moved its news set to stage B, where both news broadcasts are done with robotic cameras through the temporary production truck. This will go on until the new control room and stage in building A are finished. BE

Richard Lahti is director of engineering for KVEA-TV/KWHY-TV, Los Angeles.

Design team

Teklogic
John Joannou, project management and systems design
Debra Vos-Reyna, operations director
Nicole Tafralian, project documentation manager and systems design
Esteban Ortega, systems design
Paul Dietrich, implementation manager

KVEA
Brian Edwards, project engineer

Equipment list

GVG MC2100 SDI switcher
GVG 7500 SDI series wideband router (128x128)
Caterpillar 500 kWH generator
Cat UPS package
Sony ES7 nonlinear editor
Pixel Power Collage
Sony 950 and 750 studio cameras
Vinten 2000 robotic pedestals
Leitch Logomation
GVG Profile XP video servers
Vibrint nonlinear editors

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So, you need to pick a new tower . . .

BY DON MARKLEY

Many broadcasters go through their entire careers without having the joy of building a new tower. For many others, this particular activity only occurs on a few occasions and doesn't allow for the build up of enough bad experiences to help make the best choices. Even if a new tower isn't necessary, the need to modify an existing structure can add problems to one's job that are not true joys.

For this column, the problems of zoning, FAA clearances, building permit, etc. will be ignored. This time the emphasis will be simply on the structure itself. That alone can create enough worries to last until next month.

First, the issue that often comes up is whether a new structure is really needed or if the existing tower can be modified in a reasonable manner. If changes are to be made to the tower loading, as when adding more antennas and lines, it is usually necessary to have a structural engineer or the tower manufacturer analyze the tower to see if the additions can be made without endangering the tower. One problem in this case is determining the standard that must be used in evaluating the structure.

The current standard for towers is ANSI/EIA/TIA 222F. A new standard, 222G, is in the works and may be issued by the end of 2002 to become effective in early 2003. For new towers, the applicable standard is always that which is in effect at the time of the design. That is the standard that represents the latest thinking in the design of a reliable structure.

The issue that often comes up is whether a new structure is really needed or if the existing tower can be modified in a reasonable manner.

If the existing structure was designed to 222C and it is desired to change it slightly, it is not always necessary to bring it up to 222F standards. This will be dependant upon local requirements and the insurance carrier. If a building permit is required for the changes proposed, local regulations may require that any changes comply with the latest version of the standard. In a like manner, the station's insurance carrier may prohibit any modifications that do not bring the tower into compliance with the applicable standard. Upgrading the tower to comply with the latest version of the standard is often prohibitively expensive to the point that it may be more economical to simply replace the old tower with a new one.

On the other hand, if the old tower is in good condition, maintaining compliance with the standard that was in effect at the time of its construction may be a viable option. After all, there are a lot of towers standing that were designed to older versions of the standard that have a lot of usable life remaining. This is a decision that needs to be made with the help of the structural engineers doing the study.

If the decision is made to replace the tower, the first step is to fully determine the anticipated loads. That is, just how many antennas and lines are to be installed and the loads presented by each load. Don't make the mistake of only considering the loads to be installed at the present time. Towers offer valuable vertical real estate for rental income. Even if no additional broadcast antennas are anticipated, there is usually a market for communications systems with multiple small antennas and lines. It is highly advisable to plan on loading up the tower with such systems. It doesn't cost much for the additional

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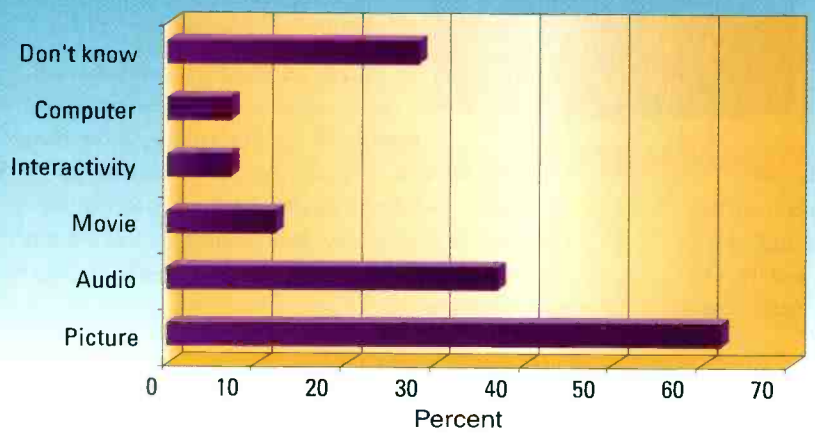

SOURCE: StrategyOne/NAB www.nab.org

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steel and even less for additional construction costs if they are included at the time of the initial fabrication and installation. On the other hand, the costs can be great to modify the tower later by adding loads.

After the initial loading is determined, contact the desired bidders for the project. They will need to be provided with those loads and the guy radius for the tower. If the tower is in an area where ice can be a problem, an allowance should be made to accommodate that problem. Again, the amount of ice loading to be requested should be determined with the aid of either your consulting engineer or a structural engineer. Simply identify what you want the tower to hold and the structural engineers at the manufacturer will determine how best to hold those loads.

There is a long-standing argument as to whether solid steel legs are preferred over hollow structural tubing. Either will provide a good tower with a long life expectancy if done properly. If hollow tubing is used, demand that it be galvanized inside and out. The galvanizing should be done before the ends of the tubing are sealed by plates or flanges. In addition, long runs of hollow tubing should be provided with drain holes to avoid the buildup of water inside the tubing.

Before accepting the tower for installation, require that a complete set of the design calculations showing compliance with the applicable standard be furnished and stamped by the registered structural engineer responsible for the design. If there still is any feeling of uneasiness about the design, have those calculations checked by an independent engineering firm so that there won't be any questions about the design in the case of a failure. In addition, those calculations can then be furnished to your insurance carrier.

The contract with the tower installer should clearly show that the tower manufacturer and/or installer, if separate, are totally responsible for all liability associated with the erection. The station should be shown on the builders insurance to be held harmless from all claims associated with the construction in any way. It is usually a good idea to have the station listed as co-insured on the builder's insurance policy. In addition, require that the builder waive all rights of subrogation. This is also not a bad time to have the station's attorneys involved.

The intent here has been to bring up a few points that should be considered when dealing with even the best manufacturers. If it is decided to avoid those companies and have your tower built by the guy out at the edge of town who built a windmill once, you are on your own. BE

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

Send questions and comments to:
don_markley@primediabusiness.com

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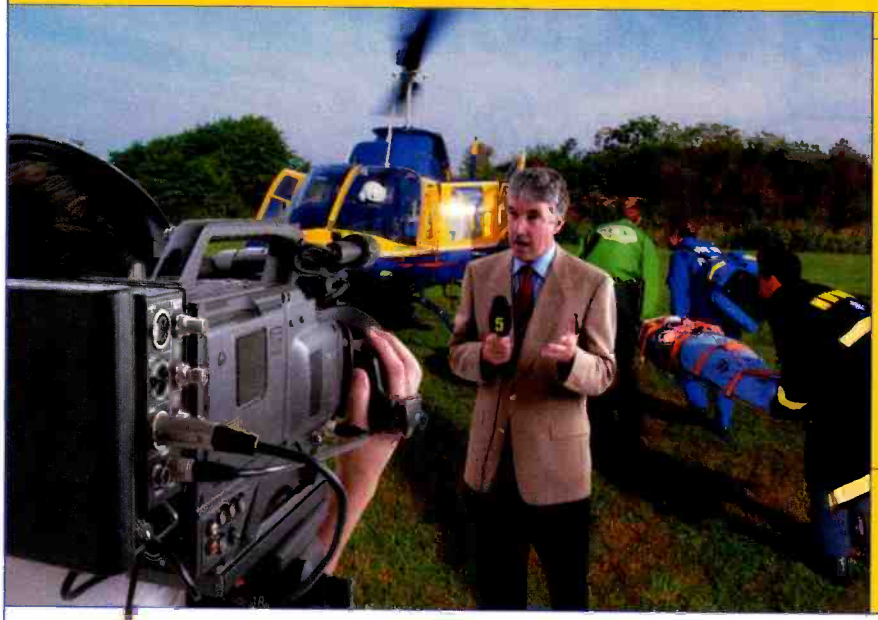

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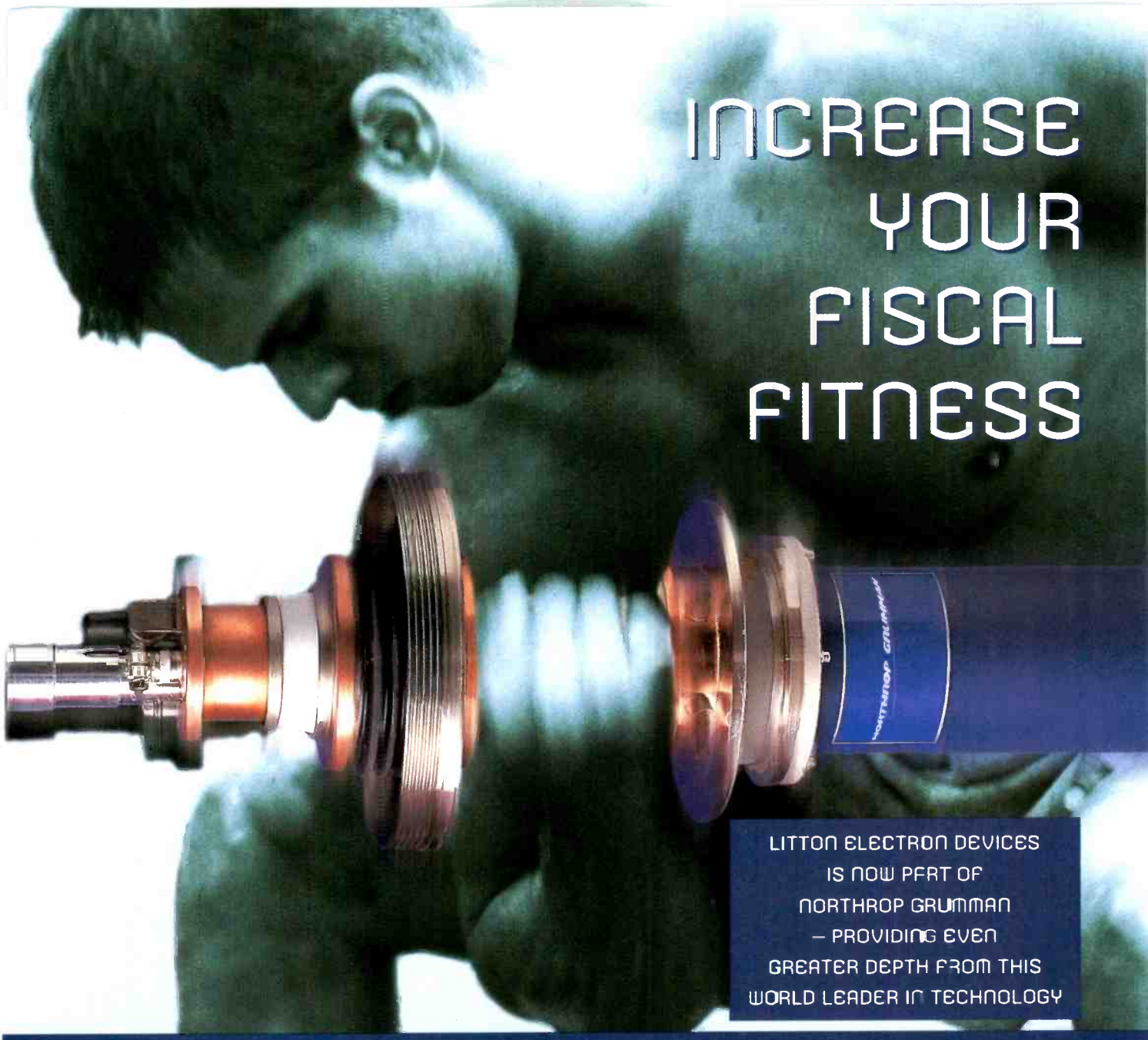

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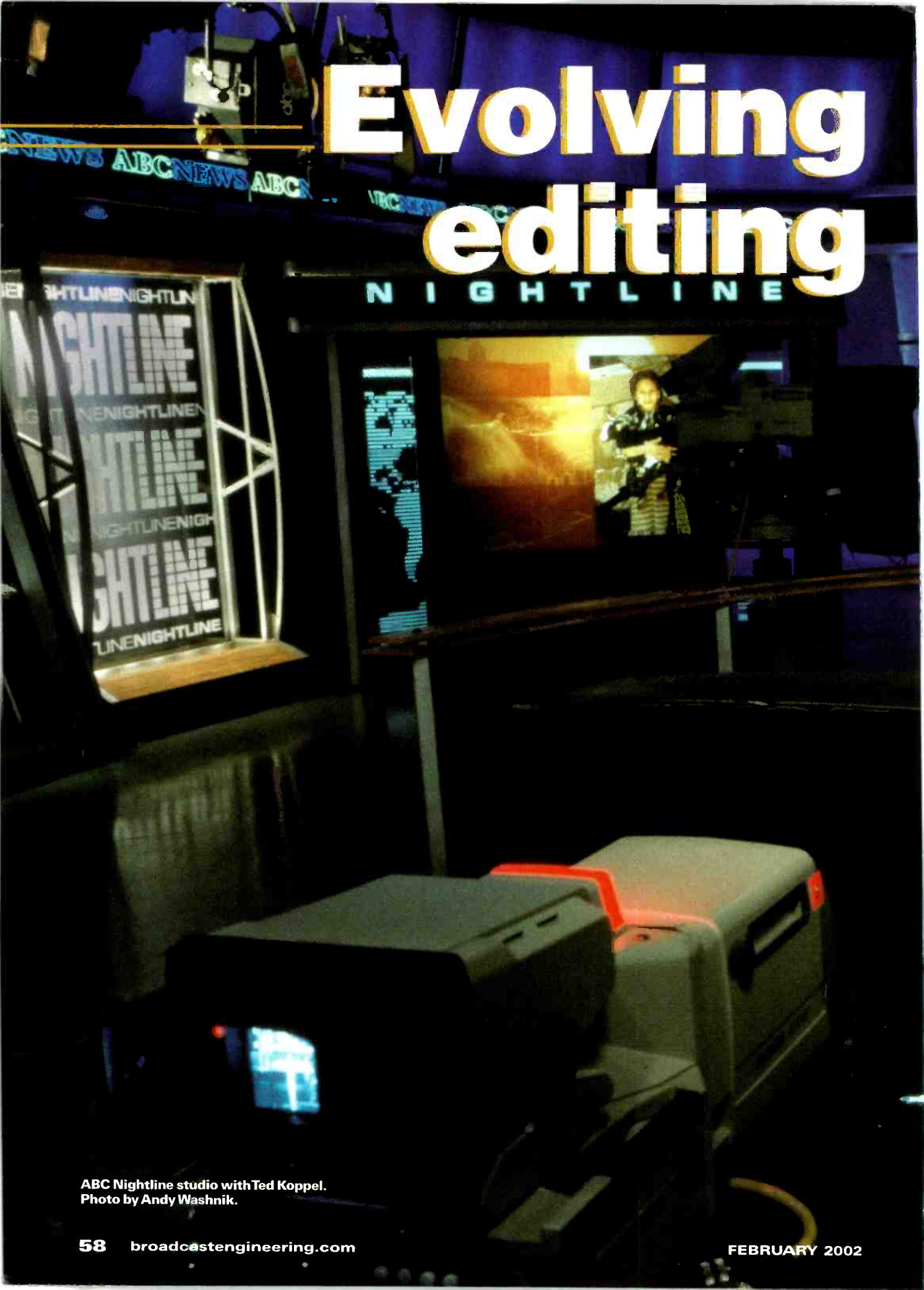
Evolving editing



ABC Nightline studio with Ted Koppel.
Photo by Andy Washnik.

broadcast trends

NIGHTLINE
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Evolving broadcast editing trends

As the movement builds for this switch, several trends are becoming apparent, including radical changes in operational processes. Portable laptop editors in the field, journalist workstations with browser/editors back at the studio, and workstations fully integrated with the station's servers, newsroom software and airplay software all became more common over the past year. The integration trend includes the growing importance of more extensive and standardized metadata integrated with essence media.

The Sept. 11 tragedy and the resulting war in Afghanistan also drew the attention of broadcasters to new technology used to cover the news. These events may have been the most crucial test in years for the speed and efficiency of broadcast news technologies.

Let's examine each of these trends.

Laptop editing systems

Events in Afghanistan have certainly advanced the popularity of portable editing systems. One trend is the apparent evolution from the Sony and Panasonic linear laptop to the nonlinear laptop computer with NLE software. This trend away from linear portable editing technology does not dispute the previous success of the linear laptops, nor does it imply that such units do not continue to be used successfully. However, after several years of NAB press conferences where these manufacturers were asked when there would be the promised hard disk replacement alternative to the record-side VCR, I cannot help but wonder if these two manufacturers missed an important opportunity.

When discussing this trend with various news organizations, several aspects of this switch from linear portable systems to nonlinear software on computer laptops became evident. First, the low cost of this portable solution was a major factor in the decision to invest in laptop editing systems for field use. The weight of the equipment was one of the most popular features with users. Interestingly, when discussing this technology with the

Avid increases editing efficiency for Nightline

Gordon Swenson, an Emmy Award-winning editor for Nightline, utilizes the editing technology of Avid Suite 4 in ABC's Washington news operation. The integration of editing systems like this one with other newsroom systems offers the benefit of increased operational efficiency. Photo by Andy Washnik.

BY ELIZABETH WAKEMAN

Long before Nightline became a part of ABC's evening lineup, Emmy Award-winning Gordon Swenson was busy editing broadcast productions on film, and later, on tape.

Swenson is one of six editors at Nightline. He came to ABC in 1977 as a film editor and has seen quite a few changes in his day, including ABC's recent switch to nonlinear editing. One of ABC's uses of Avid's nonlinear newsroom editing equipment is to cut down the interview section of the show for time requirements. They also edit entire segments from field tapes, such as the recent series on the Congo. The equipment allows the editors to pick what they want from the taped footage, capture it into digital form and play it back from the Avid. It also allows them to move pictures and sound around without doing it in real time.

According to Swenson, their material is first loaded onto a large Avid Unity for News server, which immediately allows the editors simultaneous access to that material from their respective editing suites while it is being recorded. This enables all six editors to work on one piece together.

The Nightline editing staff uses several Avid products to create each episode. These include the Unity for News server; Avid MediaManager, which manages everything on the server; Avid NewsCutter, which is the editing

device and gives the editors unrestricted access to all media, and Avid iNEWS newsroom computer system, which handles the wires and script generation as well as the rundown of the show.

According to Swenson, the Avid system provides the Nightline editing staff with the ability to create many different versions or lengths of a story. Sometimes the staff is still expanding the story within minutes of airtime. The system's special effects and its ability to layer video and audio help shape each piece into a nice, clean package. The system's organizational abilities and color correction are also helpful tools for the staff.

"Its versatility is great, but it's also a wonderful tool to be creative and artistic with," Swenson said. "You can always juggle things around and refine and refine, just moving things a tiny little bit. It's just a wonderful storytelling tool."

The Avid system has changed the way the newsroom staff operates as well, Swenson said. They used to take feeds in from all over the world, and the producers would log in exactly what they were seeing on videotape and the time code of when it occurred. Now, all of that can be done through the ingest process. While the feed is coming in, locators are entered to identify selected shots, which enables the system to build a whole locator list that the producers and editors can look at instantly. They don't have to reel back and forth on tape like before. Swenson said they still do take information in on tape as a backup method, although it's clear that the staff would prefer to stick with the Avid system.

"Recently we had a scare where they thought we would have to go back to the videotape editing rooms and cut a show on tape. Half of us may have forgotten how. We didn't want to go back," Swenson said. BE

journalists and photographers who use the various products, ancillary uses such as word processing, e-mail and expense account management on the same lightweight laptop that contained the editing software were often cited as major benefits. Network management also spoke highly of the ease of use and minimal training required before the journalists or photographers felt proficient in the use of the nonlinear software. Stations noted benefits of adding the low-cost units to microwave trucks.

Another surprising detail became evident in these discussions. Many of the purchasers making the final decisions did not fully understand certain aspects of the technology they were purchasing. For example, the biggest complaint mentioned was the time-consuming frustration associated with the need to ingest and log before beginning the edit. When asked why a software package that allowed direct-to-the-timeline editing was not selected, the users of this technology, and frequently their supervisors, expressed surprise that such software was available.

The inclusion of Web tools in editing systems allows broadcasters to bring rich media to the Internet even as they bring news to air. SofTV offers this functionality in their Presenter.2 editing software (shown above).

The trend toward browser/editors integrated to newsroom solutions may soon be derailed by new, low-cost editing products.

Other technologies worthy of notice are the alternative output subsystems and associated hardware/software packages that work with NLE editors. A modem has proven to be especially useful in remote locations for transferring edited stories via the Internet. For example, FASTtransmit, the mobile ISDN/satellite component of the FAST.purple laptop news editing package from FAST (now a division of Pinnacle Systems) demonstrated its usefulness in Afghanistan. WDR, one of the largest public television broadcasters in Germany, brought FAST.purple and FASTtransmit to Afghanistan. Edited video was transmitted via the Inmarsat mobile satellite unit. FASTtransmit allows for one to four tiny 64K satellite transmitters to be ganged together for up to 256K bandwidth. WDR used two transmitters for 128K bandwidth. This technology features what FAST calls a "store and forward" capability, meaning if the transmission is broken, the transfer is started automatically where it left off. The receiving server is then able to reassemble the data automatically into a completed file ready for play-out. The entire transmission system folds into a portable unit often as small as the laptop.

While this is a slow-bit-rate technology, its worth was quite apparent in Afghanistan and Pakistan, where colleagues from other TV stations were asking for permission to use it for their transmissions as well. Please remember this was for edited stories where other means of getting the "on-location" stories back in a timely manner did not exist. Other journalists used Internet connections back at their hotel or telephone dataport connections to transmit edited files, thanks to the new alternative output

capabilities of the laptop nonlinear editing software.

Journalist workstations

Browser/editor software packages originated with media asset management software. The browser was used to search for audio, video and graphic images. Journalist workstations were personal computers where newsroom applications could appear in a window, scripts were written in a second window and images could be found to supplement the created text with the browser in a third window. These browsers began adding those clips to a timeline. This was supposedly done to help the editor, but soon it was realized that these timeline "edits" could go straight to air — skipping the editor's workstation. One of the most important features of this new concept is the way it can be part of an integrated newsroom solution, complete with shared storage and metadata, and instant access by the technical director to completed stories. The ability to link selected clips to portions of the text or script and to have these links shared with editors or newsroom computer systems became a significant benefit for operational workflow. The low cost of this type of editing solution is another obvious benefit.

Many of the server architectures for browser/editor solutions featured dual servers – a high-resolution clip server linked to a separate lower-resolution networked proxy server. One example of this type of solution is the Sony NewsBase system, featuring an MPEG-2 proxy server that offers fast access to files by Sony's ClipEdit browser/editor. ClipEdit offers the ability to do A/B roll effects editing and to insert voice-overs and mix the VO with other audio tracks.

There were over two dozen browser/editor models displayed at NAB2001. Other popular browser/editors include: Avid's MediaBrowse, KEYVIA MediaWorks, Leitch BrowseEdit and Omnibus HyBrow (also offered by Quantel).

Low-cost news editing solutions

The trend toward browser/editors integrated to newsroom solutions may soon be derailed by new, low-cost editing products. For example, today Avid offers an editing solution featuring the Xpress DV editing system or NewsCutter XP news editing system with the Unity LANshare Ethernet-based workgroup shared storage system. (Note: NewsCutter fully integrates with newsroom solutions, but Xpress DV does not.) The Unity LANshare connects with up to 10 clients (or six dual-stream clients) – which would fit in well with many small-to-midsized broadcast news system requirements. With this option, browser/editors with proxy servers begin to seem less attractive.

On the other hand, if your newsroom features higher-resolution nonlinear editing systems, advantages remain for the client/proxy server model. First, the browser/editor interface is usually less intimidating and frequently integrates better with the newsroom software than the Xpress DV or competitor systems. With more compressed proxy server video, you can keep a much larger amount of source proxy audio/video online. Browser/editors may also make it much easier to have more journalist workstation clients on the network and to incorporate equipment from multiple manufacturers.

There are several manufacturers that promote low-cost digital solutions. For example, Omneon Video Networks offers a low-cost newsroom solution featuring either Pinnacle Systems' Windows-based FAST.purple nonlinear editing system or Apple's Final Cut Pro editing software package on the Mac. Leitch offers a low-cost newsroom server solution featuring either the new BrowseCutter or their NEWSFlash-II editing system.

For most broadcasters, operational costs play a far more important role in purchase decisions than software costs.

Interactivity

Broadcast Engineering's contributing editor Craig Birkmaier points out that the way people receive their news is changing, and predicts that "within five years, many people will browse TV news from their local set-top cache." Today's editing systems can serve as tools to help broadcasters bring rich Web content to their users, as well as putting better news on the air.

Interactive video is going to be pushed by manufacturers this year, in spite of a recent Statistical Research study on how people use interactive television that indicates there is little interest in the technology among viewers (other than for program guides and VOD). Both browser/editors and editing software will begin to feature a track on the timeline for HML/HTML

Laptops with nonlinear editing software, such as Pinnacle Systems' FAST.blue (shown above) are gaining popularity as an alternative to linear portable systems, due in large part to the low cost and light weight of the equipment.

markers. For example, browser/editor softTV.net, Media 100 and Discreet all offer this feature. Grass Valley Group does not integrate Web tools such as ContentShare, WebAble and the Aqua encoder, or interactivity with their editing solution, choosing to keep them as separate applications.

Avid is also integrating Web tools in their editing systems. Avid has included a timeline for HML/HTML on their Media Composers and offered ePublisher with the XpressDV PowerPack, creating a video-synchronized interactive authoring tool. Avid will also be introducing HyperClip with Version 3 of NewsCutter. HyperClip associates a piece of audio and/or video with a word within the script and translates that linked text and video to HTML and lower resolution proxies as a background task while the editor starts working on the next story.

Integrated newsroom solutions

For most broadcasters, operational costs play a far more important role in purchase decisions than software costs. Therefore, in-depth analysis of the benefits of full integration of news editing into the newsroom, production and playout server operations is a major consideration when making the switch to a digital plant. Efficient operations have led to considerable cost savings over traditional processes – even when factoring in training and technical support costs. These process improvements include field logging to journalist workstations, instantaneous access to edited video and automatic delivery to Web pages and the transmitter. Metadata standards, media asset management and robotic archiving all play a role in making operations both faster and more efficient.

When designed properly, nonlinear technology is much faster than the linear systems of times past.

While the SMPTE/EBU metadata standards continue their development and approval processes, editing metadata has become standardized and widely accepted by manufacturers. AAF and its newsroom/server subset MXF have been adopted by leading manufacturers of MPEG and DV-based systems. (MPEG and various DV formats have made provisions for metadata content containers within the formats.) Rich metadata will facilitate improved media access management, more efficient operations and compatibility between equipment/software made by multiple manufacturers. Please see the AAF Web site, www.aafassociation.org, for more information on the benefits of metadata in the editing environment.

Editors work on Grass Valley Group's NewsEdit at WJAR-TV in Rhode Island.

Integrated newsroom solutions frequently offer redundancies and protections as well. Redundant RAID storage is often part of the solution. Remote maintenance and predictive failure of components keep systems running. In general, chief engineers are finding the switch has resulted in maintenance savings.

Nonlinear editing systems will work best when they are fully integrated into the digital infrastructure of the station or network – working with the servers, the newsroom computer software, the playout software and the Web creation applications. Companies providing NLE technology for broadcast news include Avid, Sony, Grass Valley Group, Apple, Leitch, Pinnacle Systems, Panasonic and Quantel. When designed properly, nonlinear technology is much faster than the linear systems of times past, and the operational cost can be significantly less than the traditional methodology as well. Integrated systems enable news staff to quickly find all of the pieces needed to repurpose a story – saving editing time. Most importantly, today's systems are robust enough for mission-critical applications.

More powerful yet cost effective! What more can broadcasters want? (That question will be answered at NAB 2003.) BE

Bob Turner is a contributing editor for Video Systems *magazine and operates Bob Turner Post Production Services.*

Applications in interactive TV

BY BENNETT LILES

After decades of promises, predictions, hype and experimentation, it appears that the technology, standards and content for the bundle of ideas collectively known as interactive TV have sufficiently matured and integrated to begin powering up a $20 billion annual enterprise.

This year will likely see a tidal wave of press, promotion and new buzzwords for the services and technologies involved. It's time to sort out the flavors and decode some jargon so that broadcast engineers, managers and the public can surf this promotional tsunami effectively.

Origins

The concept of interactive TV is nearly as old as television itself. In the mid-1950s, a Saturday morning cartoon called "Winky Dink and You" promoted a kit, available in toy stores, that included a transparent sheet to place over the TV screen for drawing. During every episode, children watching the show were asked to place the sheet over the screen and connect numbered dots to form a bridge, train or airplane that Winky needed to get away from the bad guys.

The concept of interactive TV is nearly as old as television itself.

Of course, most kids couldn't wait for the kits, and marked up the TV screen itself with crayons. An army of mothers ran to the toy stores in a panic, and the kits sold by the thousands.

Later efforts at interactivity yielded some experience for developers, but not much value for American viewers. The technologies used were thinly developed and too expensive. Delivery networks provided little real market penetration beyond a few experimental communities, and many of the offerings appeared to be solutions seeking problems. One success, however, was the widespread deployment of Teletext in the UK and many other countries. Using the vertical blanking interval (VBI) of analog TV to deliver digital, viewer-selectable text information, Teletext has become an integral part of TV viewing outside the United States. The primary American use for this technology has been closed captioning.

The turn of the 21st century has seen a convergence of development in the underpinnings of interactive TV. Satellite and cable networks now have a substantial customer base, and they have furthered the cause of niche programming begun by PBS affiliates. Viewers have come to expect a

Interactive applications like subscription video on demand are changing the way television viewers interact with their TVs. Scientific-Atlanta's digital networks and Explorer interactive set-tops are designed to support interactive TV.

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widening diversity of programming. Standards are being implemented and trials have given content producers a more sophisticated feel for the market. But the most powerful enablers for iTV have been the Internet and CD-ROM.

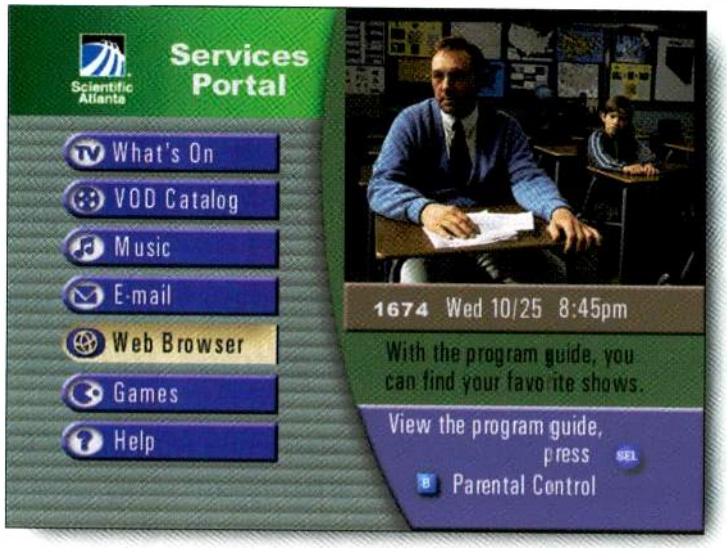
Above: On this screen of the Interactive Music Choice Europe Channel on Sky digital in the UK, the viewer is able to browse through 44 audio channels available on Sky digital to see what song is currently playing. The viewer can then press select on the remote control to hear the song. Photo courtesy NDS.

While these interactive tools are not identical to iTV, they provide some useful examples of technical protocols, marketing and production techniques. The five top companies in iTV – OpenTV, Liberate, Canal+, Microsoft and PowerTV – are expanding their marketing efforts in the UK and Europe, which have a substantial lead over the United States in the field. With all these factors now in place, the real marketing flood is about to wash over us.

The door

The Electronic Programming Guide (EPG) or Interactive Programming Guide (IPG) is the portal application for all iTV offerings on a service. These menus allow the viewer to select programs, set times for local recording, and go on to increasingly specialized or personalized choices. They are also key components for advertisers. By tracking the clickstreams on these menus, advertisers can quickly develop a precise and personal t-commerce profile. This valuable information can make advertising much more efficient and give viewers more customized choices as the system learns their preferences.

The next iTV area is generally referred to as enhanced TV. Its content features Web-like hyperlinks that appear at various times and places on the screen. These displays can move, and they can be opaque or semi-transparent. Such digital services use device-centric broadcast HTML to mix the displays with the MPEG video stream. Hypervideo displays can also offer forms on which viewers may enter information for online purchases.



The Electronic Programming Guide (EPG) or Interactive Programming Guide (IPG) is a tool that offers a dual benefit, giving viewers the ability to select programs or set times for local recording, and allowing advertisers to develop targeted customer profiles by tracking viewers' choices. Photo courtesy Scientific-Atlanta.

These clickable mechanisms bring about several more iTV concepts. Individualized TV allows users to alter the outcome of a drama, to personally select cameras on a sports event, or to select answers to questions asked by an instructor. As with the initial EPG, advertisers can read the user input during programs to create personalized advertising. Predictive Networks has developed sophisticated personalization software for following viewer preferences. Its "Digital Silhouette" technology can track individual viewing habits for targeting advertising data without collecting or storing personal information. Personalization and privacy concerns are a significant part of iTV development. A recent report by the Carmel Group on TV personalization can be found at www.carmelgroup.com.

Video on demand (VOD) has proven to be a solid iTV success. Although it is fairly expensive to deploy, a number of experimental market trials have proven that it will become a staple of any iTV system. Also popular is near video on demand (NVOD) in which broadcast channels are used to make a specific set of movies available at fixed time slots.

To date, the VCR has been the ultimate instrument of personal video scheduling. But a new piece of hardware known as the personal video recorder (PVR) has advanced the idea of personal TV. The device has a large hard drive that allows simultaneous viewing and recording. It also automates recording by program title, time slot, rating, actors or theme. Removable disks for these devices are currently in development. Some of the active vendors are TiVo, Replay, Echostar, WebTV and Pace. One clear trend is the union of these PVRs with set-top boxes. An example of this integration

The most powerful enablers for iTV have been the Internet and CD-ROM.

SprinTx

making headline news

See us at NAB - Booth No. L23200

In the history of any successful company, there is usually a moment or project, which encapsulates their vision and ethos. Life in a Newsroom or Sports studio is always hectic, so it's critical to have a system and environment that operates like clockwork: IBIS *SprinTx*, conceived and developed in 1996 specifically to address CNN's needs, has continued to evolve - becoming a vital component for the modern newsroom.

CNNSI was created in 1996 as the first joint Time Warner and Turner Broadcasting project, well in advance of the corporate merger, and the team had a blank slate on which to develop a fast, automated, tapeless system that would give customers the best programming possible.

The realisation of this objective was recognised in 2001, when CNN received an Emmy for outstanding achievement in technological advancement. In accepting the award for 'Pioneering effort in digital asset management for television news", CNN paid tribute to the role that IBIS has played as an "essential contributor in the digital systems at Sports Illustrated and the media sources system used by CNN Operations".

Recently Kevin Ivey, then CNN's Vice President, Research & Development explained how this accolade was achieved and resulted in the bundle of IBIS applications – *SprinTx* - now installed by major broadcasters in the US, UK and Australia.
"The development team from CNN Sports created a wish-list document, detailing our vision of how we would like to operate in an ideal world. A great deal of that was based on conventional workflow, with an eye toward leveraging technology. We asked a number of companies to tell us how they could make it happen – and we only had six months to make it a reality. "In any news environment speed to air is critical, as material has to be turned round to air - sometimes in as little as 30 seconds after it is received – but sports news presents a special problem; it's usually feast or famine.

Games are lumped around the evening hours and weekends, so we have very heavy periods of incoming video. That leaves us with hundreds of hours of material to sort through and edit to provide the best highlight material."

IBIS was chosen by CNN to provide controlling software, and develop CNN SI's 'Triage' application – cutting down and prioritising the most important information from the incoming feeds.

The specification for the software performance was to record incoming material, control a routing switcher to select the feeds reporters wanted, control the recording of feeds to Clipbox ports and back-up VTRs, provide the ability to identify and mark specific clips for the editors, and interface with the newsroom system, informing them of which highlights had been created so that they could see what material was available to go to air and create rundowns for programming.

IBIS provided the original Triage prototypes, with sixteen Triage stations linked to each of four Clipboxes, controlling the router to select the feeds. Further progress led to the development of IBIS ServerMirror, for transfer of material between the production and the "air" Clipboxes, and IBIS ServerPlay to control playout of edited material to air. The system also includes IBIS ServerBase, an overarching database of the content resident on all six Clipboxes, which allows constant materials management. The Media Manager, operated from a single console, under a password-protected system, can check and delete material directly from any of the Clipboxes. This was the birth of *SprinTx*.

So successful was the CNNSI model that when UK broadcaster, Carlton, decided to move to a tapeless digital environment, *SprinTx* was the natural choice. There is a saying that when you simplify something, complexity doesn't disappear, it just moves somewhere else. But Carlton's Dave Peregrine, Head of Technical Resources, Central Region disagrees, pointing to the simplicity of the solution he has adopted at Abingdon, UK.
Charged with the task of refurbishing services, Peregrine made a conscious decision that there would be no VTR machines in the edit suites – all media would be digitised.

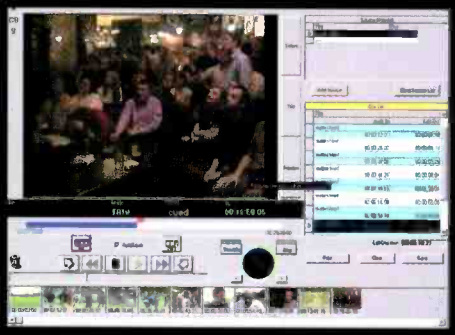
"Experience showed us the benefits of working with one large server for ingest, shot selection at journalists workstations and playout," says Peregrine. "So much time was spent searching for tape and we wanted to remove that stress by eliminating the need to move media around – everyone knows the frustration of needing to produce a tease or promo from the same material in use by someone else."

Anticipating a battle over such a radical change, Peregrine says that there was actually very little opposition. "When the tape comes through the door, the journalist takes it to media processing for digitising and by the time he or she has made a cup of coffee and settled down to work, most of the material has been loaded to the server and is ready for reviewing. We encourage journalists to start cutting their promos and teases and marking up their interviews frame accurately before they go down to editing. They then write their script and, if there is time, we encourage them to mark up best shots. We reckon that the time taken to rough cut a 90 second news story has been reduced by about 50%."

According to Peregrine, one of the most significant aspects of the project was the way the IBIS, Quantel and Carlton personnel worked together. "We were really a team – not client and vendors.
At every stage our requirements and concerns were addressed. *SprinTx* is very user-friendly, running on standard PCs, without third party software and monitoring, which tends to clutter up the operation between the server and broadcast systems," adds Peregrine. "The *SprinTx* package is a mature product and they have a great deal of experience controlling Quantel servers."

cont...

At Abingdon, a combination of IBIS software and Flash panels ingests material into the Clipbox. IBIS ClipFeed streams up to four monitored channels into the Media Processing Area, along with any library media or incoming live feeds. Material in the server is available in the newsroom for viewing and shot selection at the desktop, or in the edit suites.
Once edited, material is played out from the transmission gallery. Material archived from a playlist is run back to tape via IBIS ServerPlay. IBIS ClipTrim is also used to generate material from the server to the company's website. Everything is done from the server – there is no movement of media at all.
As one of the cornerstones of the operation, this requires straightforward, yet efficient, naming and numbering conventions.



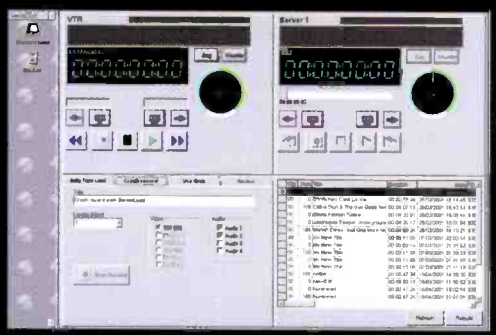
On ingest, each set of rushes is given a 'slug' title, which remains with the media throughout, whether it is a story, promo, or tease, and whatever numbers are subsequently allocated. IBIS ClipTrim has full search capability so journalists and editors can select appropriate clips simply by entering the 'slug' name. Material is only numbered once it is ready for transmission, triggering IBIS ServerMirror to duplicate material to the Quantel Clipbox Studio for back up - and the conventions used reflect information such
as date, type of clip and which bulletin the material is for.

Going digital, says Peregrine, has enabled staff to work to their full potential. Technical operators have become proficient at editing, producing a turnover of staff, which at first was perceived a problem. However, because professional development potential is now much higher, there is greater job satisfaction.

"Because of the simplicity of the IBIS interface, once basic training in digitising material is done, actual operation is very easy to pick up and staff become highly competent in a very short space of time. Engineers can be moved off the front-line into support roles - there's nothing more wasteful than a system engineer having to be an operator - so support levels become extremely high - and we have found that streamlining our operation in this way has actually improved both productivity and the technical quality of the material transmitted."

Since Abingdon was completed other Carlton operations are now *SprinTx* supporters, along with ITV network provider, GMTV, the UK's premier commercial breakfast broadcaster.

According to Geoff Wright, Chief Engineer of GMTV in London, the automation had to have a very user-friendly interface, with generic windows command formats and require minimum training.
"The automation system should not prohibit access to any material – even while feeds were in the process of being ingested, journalists and the production team had to be able to browse edit and manage the server content, whilst maintaining our familiar workflow practices", says Wright.



"One of my major aims whilst designing this system was to maintain as much as possible of our existing user interfaces. Broadcasting from 6am, in a pressurised live environment, it was very important to retain a certain amount of operational familiarity, even though the underlying technology was to be completely different."

Another important aspect of working with IBIS is their 'back office' response and commitment.
"If someone tells us they can turn something around in a short space of time, it is essential that we can trust that to happen. We are on air for three and a half hours of live TV and we are probably the only company in the UK – or even Europe – that has such a large block of intensive live television broadcast on a daily basis."

Although originally developed to control the Quantel Clipbox, *SprinTx* is completely server independent and IBIS partners include all the major server manufacturers.

– edit - stop

SprinTx

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IBIS

is Scientific-Atlanta's plans to embed Metabyte's MbTV software into its Explorer 8000 PVR. Together with Scientific-Atlanta's interactive television navigator, the software is expected to automatically recommend programming, including advertising, that matches each subscriber's viewing tastes. Pace has integrated OpenTV's middleware and Device Mosaic application technology into its Di4000 interactive cable home gateway.

Of course, delivery of Internet TV and e-mail will be a central part of interactive services. But in the iTV environment, these applications will need to accommodate a wide range of viewer input devices and desired levels of interactivity.

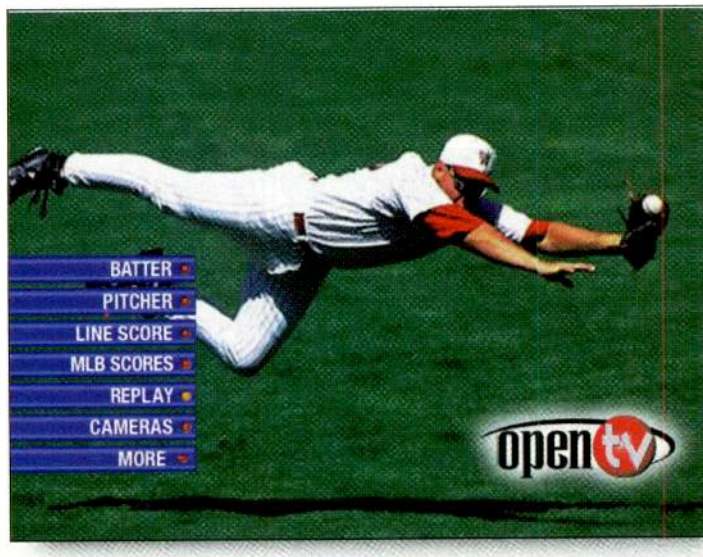
If you're looking for a dark-horse "killer app" in all this, a good bet is play TV. This category encompasses all forms of interactive gaming and simulation. Kids represent a major force in TV viewing and Internet use, and we can expect a huge share of iTV applications to be targeted at gamers. This segment will likely be the source of technical and programming innovation that will carry over into other areas. Potential applications for gaming and multi-participant simulation are vast and powerful. The early leader, having established a strong following in Europe with its PlayJam Channel, is Static 2358, a wholly owned subsidiary of interactive media giant OpenTV. Launched in December of 2000 on the BskyB digital satellite platform, PlayJam now claims to have hosted over a billion games. Some of its more engaging statistics indicate that over half of its players are female, and 61 percent of users are aged 16 to 34.

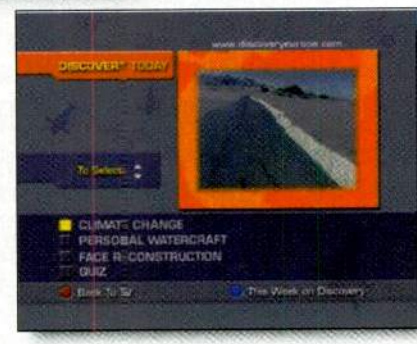
Video on demand (VOD) has proven to be a solid iTV success.

Bringing it home

In America, when educational television became distance learning, it gained interactivity with groups in schools but not with individuals at home. In the nineties, distance learning used Ku-band satellite distribution with a telephone conference-call back-channel. Educational networks were also offering group videoconferencing over fractional T-1 lines, but these lines are expensive, difficult to maintain and they still require participants to gather at central points for the class. Corporate videoconferencing has largely followed the same path, using meeting rooms with large screens. The Internet can combine distance learning with videoconferencing by offering video, document sharing and whiteboarding on the desktop, but acceptance and implementation of Internet videoconferencing has been very slow. iTV doesn't promise to bring new features to distance learning and videoconferencing, but it will widen the user base substantially. Distance learning and videoconferencing also share a need for higher back-channel bandwidth. Most of the services use an asymmetric back-channel where the return data path does not need to have as much bandwidth as the downstream channel. Any service using two-way video or complex simulation data will require a higher-bandwidth back-channel than those registering occasional clicks on a viewer's remote control.

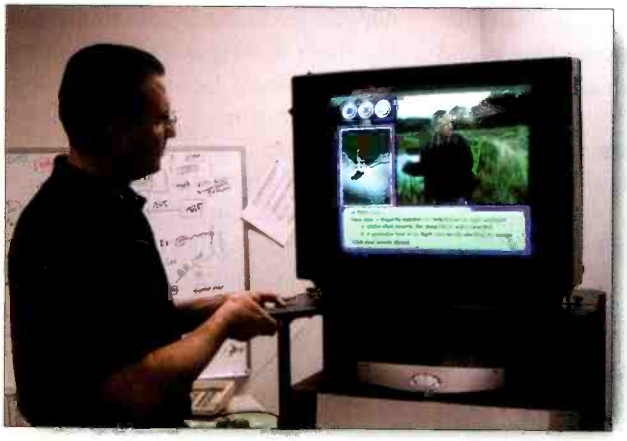
One buzzword sure to be heard this year is synchronized TV. A recent study showed that the number of people using the Internet while playing a TV in the same room rose from eight million adults in 1998 to 27 million in 1999, and the number was projected to be over 50 million by the end of 2001. This explains the noticeable increase in co-promoting TV-program Web sites during the shows. These tele-Webbers combine the conventional, one-way TV experience with use of the Internet for accessing the program's coordinated, enhanced TV displays – and as an interactive back-channel to the show. Where the iTV





Top: Individualized TV allows viewers to make decisions about the content of the programming they watch, allowing them to alter the outcome of a drama or to personally select cameras on a sports event. Photo courtesy OpenTV. Right: This screen shot displays an enhancedTV application for "DiscoveryToday" on the Discovery Channel on Sky digital in the UK. The enhanced service offers additional information relating to on-screen items and a seven-day program guide for the Discovery Channels available on the Sky digital platform. Photo courtesy NDS.

Applications in interactive TV



Jonathan Schembor, director of custom solutions at Triveni Digital, demonstrates interactive technology. Triveni Digital is collaborating with PBS to implement interactive TV trials based on PBS prime-time content such as "Scientific American Frontiers" and "Life360."

operators supply broadband access and Internet TV, these two synchronized TV channels will be combined in the TV.

VEIL

VEIL Interactive Technologies offers a different technical approach to interactivity. VEIL stands for video-encoded invisible light. On analog systems, it uses the actual video signal as a transmission medium. This offers some key advantages over systems that use the vertical blanking interval. Riding on the video signal, VEIL data can be transmitted by broadcast, cable, Direct Broadcast Satellite or home video, and it can be received by economical, chip-driven devices anywhere in the broadcast coverage area. An additional advantage is that, unlike VBI signals, VEIL data cannot be stripped out by cable operators and it works on any TV transmission format with no modifications. It works with compressed video and can even be recorded by any currently used video recording device. VEIL II is the higher-bandwidth version, and its receiver chips can be incorporated easily into TV remotes, PDAs and cell phones so that these devices can act as the interactive back-channel. Advertisers can use it to track their commercials and verify that they have run in the desired time slot. CMR, a provider of strategic advertising and marketing information, has incorporated VEIL technology into its Broadcast Verification Service to track the occurrence of television programming and commercials.

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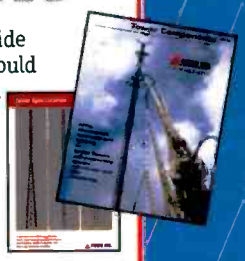

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synchronizes video, text, still pictures and sound. Recommended by the W3C in 1998, SMIL 1.0 is commonly used for Internet video streaming. SMIL 2.0 received a W3C recommendation in August of 2001. Although it has been somewhat neglected, it does work and holds potential for iTV. The biggest advance for SMIL has been the fact that RealNetworks, a leader in Internet video streaming, based its enormously popular RealNetworks G2 Player on this technology. In doing so, it has kept SMIL in the Internet spotlight. SMIL presentations, including hyperlinks, can be incorporated into DTV broadcasts to provide enhanced TV. There are also economical, easy-to-learn authoring tools available for SMIL presentations. Long touted as the tool for "bringing TV to the Web," SMIL, or a form of it, could reach even greater acceptance by doing just the opposite – bringing the Web to TV. Veon, of Herzliya, Israel, has contributed significantly to the development of broadcast HTML for Hypervideo applications. Veon was acquired by Philips in April of 2001.

One buzzword sure to be heard this year is synchronized TV.

Global TV

One interesting programming shift that iTV will carry among its convergent technologies is the ability of local entities to broadcast to a global audience while local cable operators field requests for international programs – some featuring automated translation. Our increasingly global economy and mobile population will eventually drive the market for international programming to and from local communities.

Standards

The most significant factor that has limited widespread implementation of iTV applications has been the absence of worldwide standards for transmission and content enhancement. To deal with this problem, several iTV industry groups are at work on standards. These include Digital Video Broadcast - Media Home Platform (DVB-MHP), Open Cable Application Platform (OCAP) and Advanced Television System Committee DTV Application Software Environment (ATSC DASE). Asia, Europe and South America have implemented the DVB-MHP platform, while groups in the United States and Canada are developing OCAP and ATSC DASE. A common thread in these efforts has been the inclusion of Java technology in the quest for a worldwide "create-once, play-everywhere" environment. This goal, also described as a "write-once, play-anywhere" environment, will play a central role in standards development. In this effort, OCAP and ATSC DASE are expected to incorporate the well established DVB-MHP into their standards.

The Advanced Television Enhancement Forum (ATVEF) is an alliance of industry companies formed to develop HTML-based protocols to promote the standardization of enhanced TV for digital delivery. ATVEF is the organization that devised the technology specification that enables broadcasters to send data through the vertical blanking interval on analog systems.

This year will see more worldwide corporate partnerships and standards debate. But the tremendous revenue waiting to be mined with laser-targeted advertising will be the driving force behind vendor competition and product interoperability. In the meantime, we'll all have to learn the basics to ride the new wave of services called interactive TV. BE

Bennett Liles is a freelance writer and TV production engineer in the Atlanta area.

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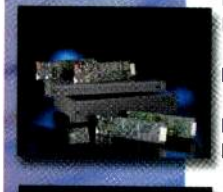

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NBC's Tandberg
Television digital distribution system

BY BARRY HOBBS

NBC selected Tandberg Television to provide its digital distribution system after evaluating several systems for functionality, reliability, the amount of customization needed, image and sound quality, and other benefits such as the ability to handle data encapsulation.

As of autumn 2001, all 182 NBC Skypath affiliates began receiving feeds through the digital distribution equipment solution specifically proposed to the network.

The majority of the feeds originate from NBC's New York City site, with the Burbank, CA, site serving as a backup uplink site.

NBC Network News used Tandberg Television's E5425 mobile contribution encoders for breaking news coverage around the world. The new digital distribution system is a much larger scale purchase. Comprised of five redundant multichannel systems, this solution allows NBC to digitize a total of nine network feeds, providing the affiliates with improved picture and sound quality.

Five Alteia *plus* receivers at each receive site address the switched feed services that the network provides to its affiliates. These receivers were integrated into racks and installed at the affiliate sites by Livewire Network Services. The receivers are tuned under control of an automated scheduling system developed by Andrew Corp. The system customizes the feed for each affiliate and switches them to the appropriate feed at the correct time, providing hands-off operation. For example, a station can be switched live between basketball games if necessary. The network can flexibly control the systems from the main sites.

The receivers offer another advantage to NBC through its built-in frame synchronization feature. With this additional feature, the network can synchronize the signals received at the affiliate sites to each local station without an extra frame synchronizer. Not only does this save the affiliate money by eliminating the need for additional equipment, but it also simplifies the system with fewer boxes in the program path. As a result, installation and subsequent maintenance is simplified.

The network can flexibly control the systems from the main sites.

Since the system has launched, NBC is now equipped to transmit multiple channels of programming, including commercials, promotions and other services provided by the network to a satellite transponder via E5611 encoders. Following transmission, that same material is received at the affiliates where the automation system switches between the nine feeds.

The system is intricate, but simple to run. The encoding systems are set up so they will not be altered and remain intact as installed. Each system encodes nine channels of signals that originate from Genesis, NBC's disk-based program origination facility. The new digital system allows NBC to deliver improved video and audio to its affiliates.

Built into each encoding system is an evolution *5000* statistical multiplexer to handle all multiplexing needs as the signals are encoded and sent out to the satellite. Tandberg Television's 4:2:2 statistical multiplexing solution provides bit rate flexibility, which allows NBC to send network streams unimpeded while also sending additional data through available bandwidth on the satellite without any operational impact.

NBC also utilizes the company's 8PSK modulation in order to pack more bits onto each satellite feed. The openness of the system allows for an upgrade path. The network's equipment racks are pre-wired to allow room for expansion. Tandberg Television also offered a support contract that simplifies NBC's maintenance operation, covering standard warranty repair services, on-site spare units and continual firmware and software upgrades, in addition to preventive maintenance and Web-based product updates.

In addition, Tandberg Television is maintaining the system's conditional access database, a unique attribute for the network. Since launching the system, NBC now has a fully digital means of distribution to provide high quality audio and video to its customers. While the network's affiliates and viewers surely benefit, NBC itself enjoys greater flexibility in terms of available bit rates and additional satellite space. BE

Barry Hobbs is director of new technology for Tandberg Television.

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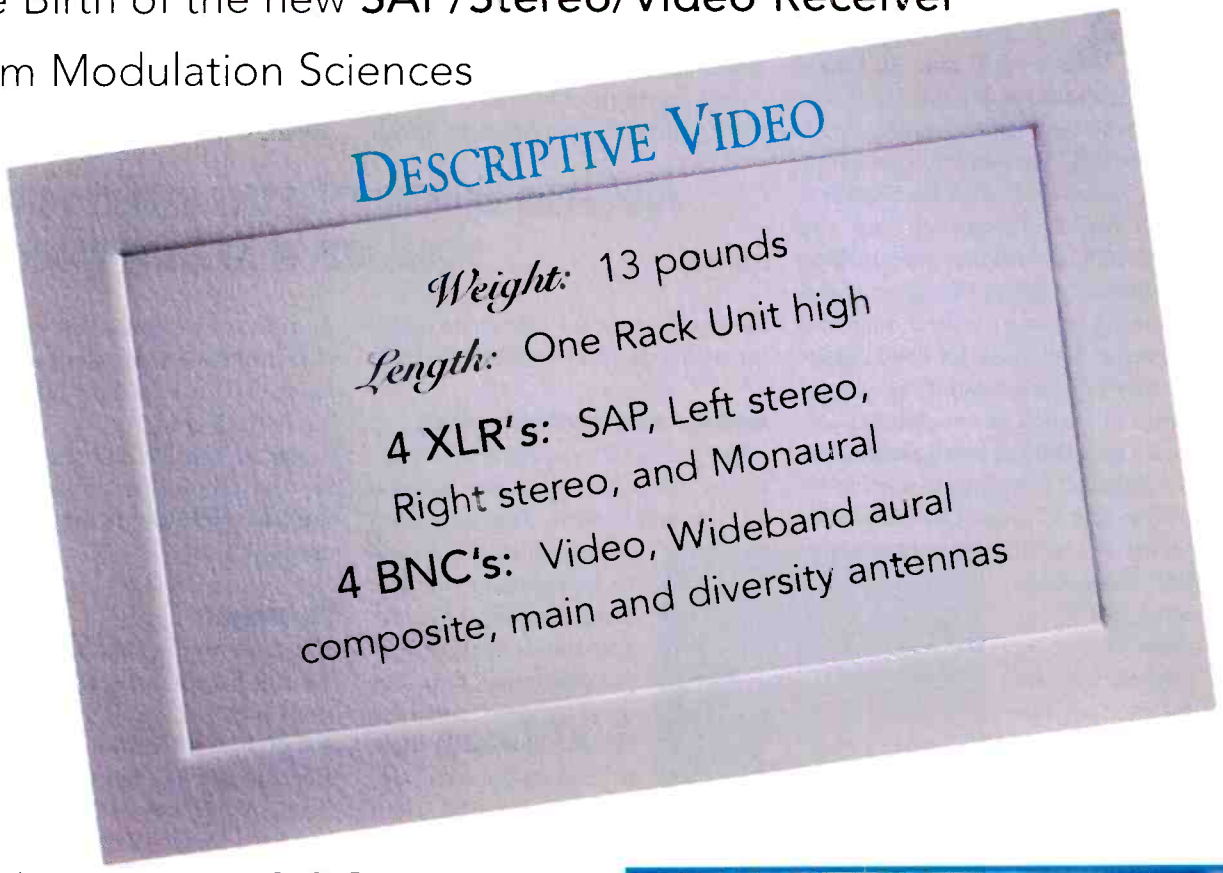

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Wet antenna effect

BY BEATRIZ SOARES

As more and more satellites are launched and capacity on C and Ku bands runs out, the natural migration in satellite communications is to Ka band. But, Ka band has some unique properties to contend with. Ka band is a much higher frequency and the beamwidth is much narrower, making pointing accuracy of the reflector and mounting structure critical. Rain is a big factor. Signals on Ka-band antennas may experience significant degradation in rainfall in wet climates. Diversity sites that use small antenna reflectors rather than large to achieve the EIRP is one solution. Choosing a reflector material that minimizes signal loss is another.

Tests performed at Andrew using the setup above have shown that signals on Ka-band antennas may experience significant degradation under wet conditions. The material chosen for the reflector may minimize this loss.

Water droplets and even air humidity can attenuate and depolarize the signal and cause degradation, according to Louis Ippolito's "Propagation Handbook for Satellite Systems Design." Because wet antenna reflectors can add to signal loss, aluminum and composite earth station antenna reflectors were tested under controlled conditions in an artificial rain environment to quantify signal loss at two frequencies. Research has shown that water on a feed horn accounts for greater signal loss than a wet reflector. In these tests, the feed horn was kept dry so losses recorded were solely attributable to one of the wet reflectors.

Tests found the composite reflector when wet recorded more than double the signal loss of the aluminum reflector, which showed very low signal loss.

Aluminum antenna reflectors exhibit very low signal loss at Ka band when wet.

Setup, calculations, data

The Tx and Rx antennas were positioned 280 meters apart and tested at 20 GHz and 30 GHz. The rain-generating equipment was built to specifications of IEC Environmental Guidelines and set up on a transportable trailer. Tests were done outdoors at night. Winds subsided at night to 0 to 4 mph and the temperature dropped, minimizing water loss from evaporation.

The path loss formula used was:

$$L(R,f) = \left[\frac{\lambda^2}{(4\pi R)^2}\right]$$

where R = distance between the two antennas

λ = wavelength

Link budgets were calculated with both the path loss and the antenna gain formula:

$$G = \frac{4\pi A_{eff}}{\lambda^2}$$

where A_{eff} = effective area of the antenna.

The first set of tests was conducted at 30 GHz, the frequency at which greater signal losses are expected. Rain intensity increased from 27 mm/h (0.6 gallons per minute) to 53 mm/h (1.0 gpm) during the test time. Data was collected for both the aluminum reflector and composite reflector antennas at 20 GHz. This is the design limit for the composite reflector antenna. Test conditions replicated those of the aluminum reflector at 30 GHz. Rain intensity was 19.14 mm/h (0.65 gpm).

Data for the 20 GHz test was taken for the aluminum antenna under similar conditions as those done for the 30 GHz test.

Findings

Tests showed an average of 0.5 dB losses for the aluminum reflector antenna at 20 GHz and 1.5 dB at 30 GHz. A 4 dB to 6 dB loss for the composite reflector antenna was observed at 20 GHz. A possible reason for this significant signal loss could be the uneven surface of the composite antenna, which allows for water to settle and not bead up and roll off the surface. This reflector took a long time to dry because of greater surface area interacting with the water. The surface of the painted aluminum reflector was smooth and did not allow large drops of water to settle on the surface.

According to the test data, aluminum antenna reflectors exhibit very low signal loss at Ka band when wet. A series of tests are planned to determine if the application of hydrophobic treatments would further decrease signal loss and if treatments would be cost-effective. BE

Beatriz Soares is a systems engineer for the earth station antenna department at Andrew Corp.

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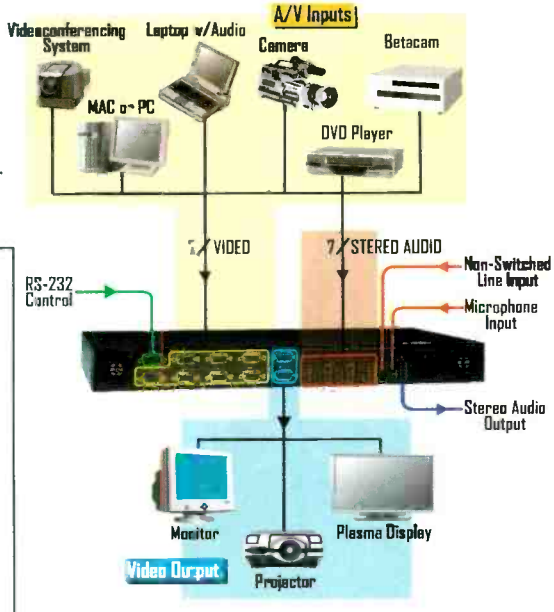
PresentationPRO Connectivity Diagram



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Automation software

BY JOHN LUFF

For the next four months this column will focus on four interrelated and interdependent areas of television technology: automation software, data archive systems, newsroom automation systems and media asset management systems. Each one of these topics is represented by manufacturers with specific expertise, but all of these areas of technology are dependent on other classes of products to automate portions of the operations at a television broadcast plant. This month the topic covers the first of the four, which is sometimes misunderstood as a monolithic single-product industry. To the contrary, the spectrum of offerings is quite broad and leaves plenty of room for manufacturers to define a niche and fill it well.

In the most general sense, automation is used to simplify the recording and playback of television programming for on-air operations. Software products are thus needed for a range of operations differing in scale and complexity. At one end of the spectrum are products suited to large operations, like DirecTV or EchoStar in North America, or BSkyB in Europe. These DBS operations handle the ingest and playback of hundreds of channels in one facility. The needs of the air log are unique to the type of continuity string they manage, which often has fewer unique events per stream than a large-market television operation. Also, the portion of daily operations that is conducted live is more restricted. To be suitable for such an operation, an automation system would need to be highly scalable and provide redundant databases and hardware to insure the system is quite tolerant of potential faults.

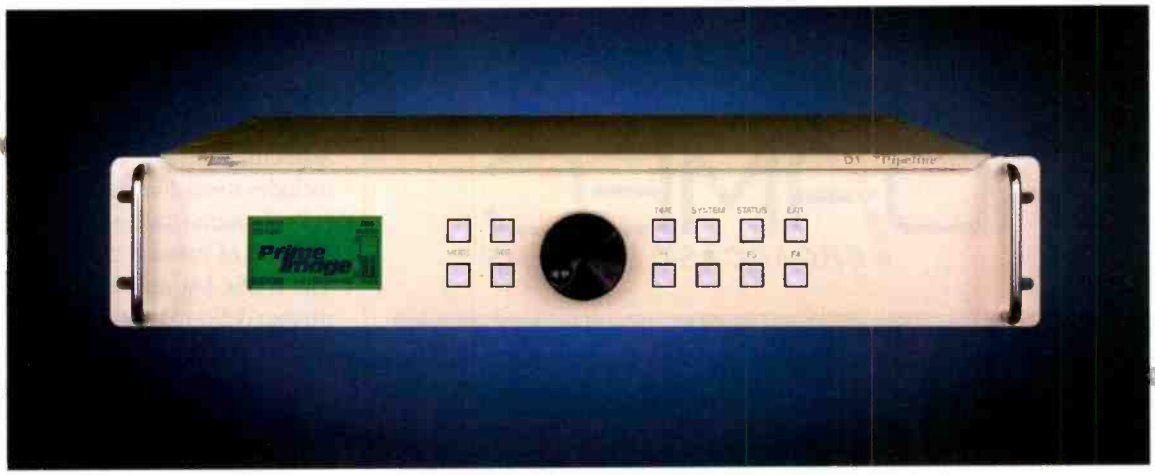
The monitoring of such a complex system by a small number of operators requires a different type of operator interface, one that can easily highlight potential faults and missing media and bring the details to the foreground of the operator's attention. One might, for instance, have a simple monitor screen with many channels displayed with a minimum of information about each. When a fault occurs the channel requiring attention could be brought to full screen with all the detail about the status and potential current fault, or abnormal condition sensed for later in the air log. Some manufacturers have designed "heads up displays" that put essential information over the output video in a bid to simplify the visual field of the operators.

A full-service television broadcaster used to worry about only one outgoing program.

Sundance Digital's FastBreak automation system at KCBA in Salinas, CA, as part of a centralcasting solution. Broadcasters generally should choose an automation system based on the unique needs of their operations. Photo by John Lanning.

A full-service television broadcaster used to worry about only one outgoing program. In the last decade many local stations have taken on regional feeds for cable channels (usually news, but not always), complicating the single-stream operation. While such situations are abnormal, it is no longer unusual to have duopolies or LMAs operating in one building with multiple outputs. A two-stream operation is considerably easier to monitor and control, with the simplest case being two logs on two separate screens, or perhaps two logs on one screen. It is quite normal for a single operator to man the control point during non-live programming, though live sports may well require more attention than one operator can give to two outputs.

Announcing a technological breakthrough: A serial digital interface audio video delay.



Delaying everything for up to 10 seconds is as easy as pushing a button. Delaying everything for as long as an additional 20 seconds is also an option.

The new D1 Pipeline is Prime Image's popular Pipeline audio/video delay device, but with a serial digital interface. D1 Pipeline features 10-bit video processing, with primary as well as an auxiliary/alternate video input. Audio processing is 24-bit, with four channels in and out; select AES/EBU, digital or analog. Four auxiliary/alternate audio channels (also AES/EBU, digital analog) can be switched with, or independent of, auxiliary video. All that, in a rack-mounted unit just 2U high.

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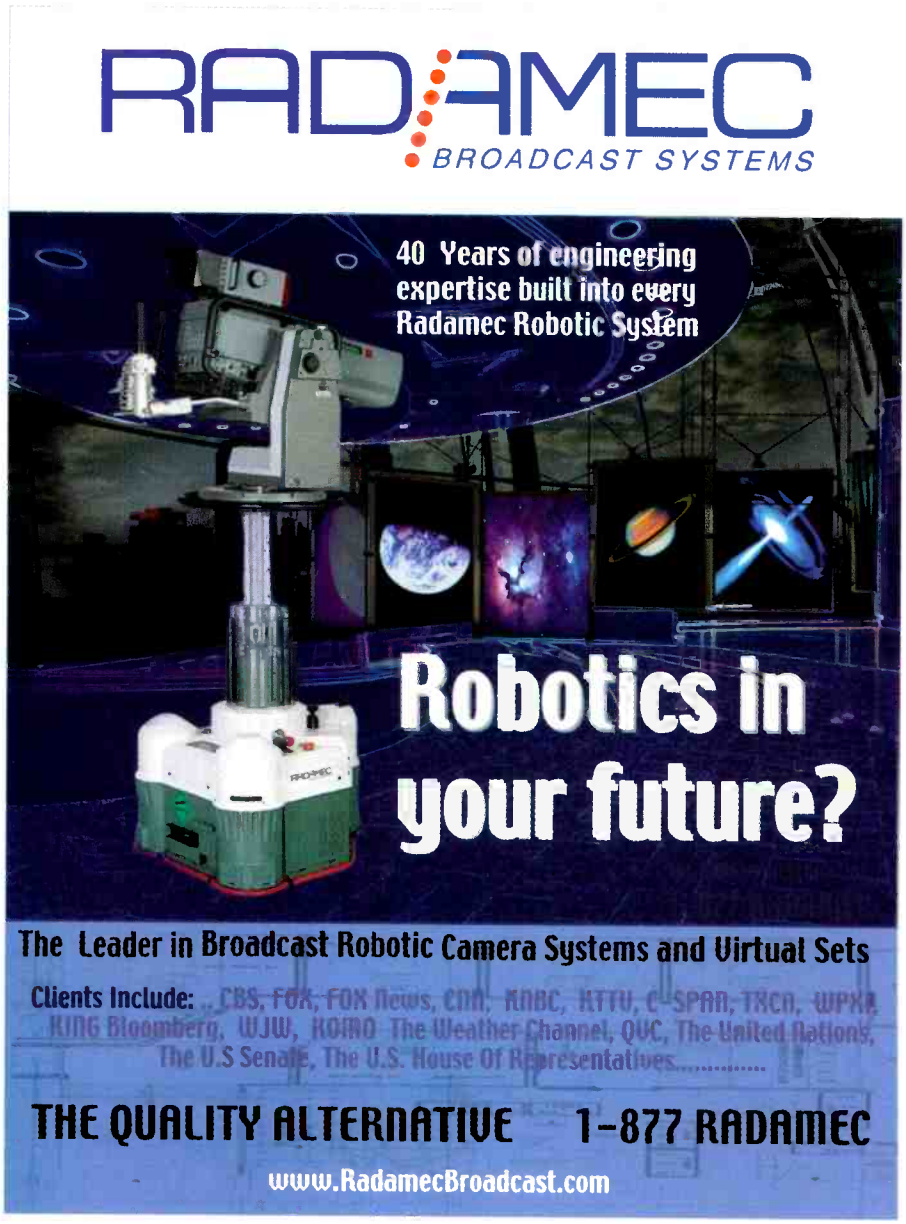
At the far end of the scale are systems simply intended to manage spot inventory and playback. The system does not handle program content, and often is sold bundled with a video server. In small markets where labor cost is low this may well suffice to increase the reliability of spot playback over aging video cart machines, which are not well supported today.

Then there is recording of media, which is assumed, but may not be focused on during initial evaluations of products or product families. Ingesting spots to a server is not trivial by any means. There are serious questions about how to set up the database so that the traffic system air log can be easily tied to the database of spots. The system must provide a method of handling kill dates and purging media that is no longer needed. Some of that information can be gathered from the traffic system, but caution is always advisable. If a spot will be run for only four weeks in the current buy, that doesn't mean it will never again be used. Human intelligence may provide better guidance in some cases.

There is a broader question on the input side of a system, though. Assuming program content is to be automated, one must get complete detailed and accurate information into the automation system database about each program and each segment. The metadata needed certainly includes items like the program series, episode name and number, and start and end of message for each segment. The traffic log may have approximate timings delivered by the network or syndicator, but the precise times could be many seconds off. If the content must be acquired by satellite it is appropriate to have the automation system control the dishes and tune the receivers. Unfortunately, not all systems have satellite recording modules as standard equipment or even as options. Some vendors offer satellite packages that are closely coupled external modules purchased from a third party. While not necessarily a problem, you should be cautious when asking about support for such packages.

What about the software and hardware itself? In this age where labor is cut short it seems prudent to look hard at the options for redundant hardware. This might mean backup computers running in parallel as the ultimate in protection. Some vendors utilize standalone device control engines for connecting to VTRs, servers and switchers. Connecting multiple control engines to a single source requires effective switching of remote control lines without introducing a new failure mode. In addition to control hardware and automation engine redundancy, it is wise to look carefully at a strategy for redundant databases of automation information. A name brand computer may make you more comfortable, but most vendors utilize industrial com-



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puters, or house brand preferences without allowing the user to choose the brand. This permits the vendor to offer simplified support for fewer devices with a staff less skilled in general support of complex computers, but leaves the customer at the mercy of the vendor's support department. It is wise to ask loads of questions about support, for it is one of the defining differences among many vendor choices.

The motives behind instituting automation often begin and end with money.

In general, most automation vendors support all popular products for playback, record, switching and ancillary functions like EAS and other requirements. It is wise to carefully go over the list of devices you anticipate with a vendor to be sure they have interfaced to your specific choices in the past. If they have not, get a specific quote on the custom work, in writing.

Economics rule the day in many operations, and indeed the motives behind instituting automation often begin and end with money. Believe it or not, even with a single-stream station the costs can vary by a factor of 25. Systems for simple operations can be purchased for under $10,000, or over a quarter of a million. The system may be a one-time purchase with annual maintenance as an option, or the client may only lease the software and continue to pay forever. Choose the package carefully. Cheap does not always win, but neither does buying the most expensive system always get you the protection you need.

The options are many, but when coupled to other pieces of the puzzle the options in some cases become narrower. In the next installment I will discuss archive systems, a topic that becomes more important as the industry swings away from linear tape and into the tapeless world. BE

John Luff is vice president of business development for AZCAR.

SEND Send questions and comments to: john_luff@primediabusiness.com

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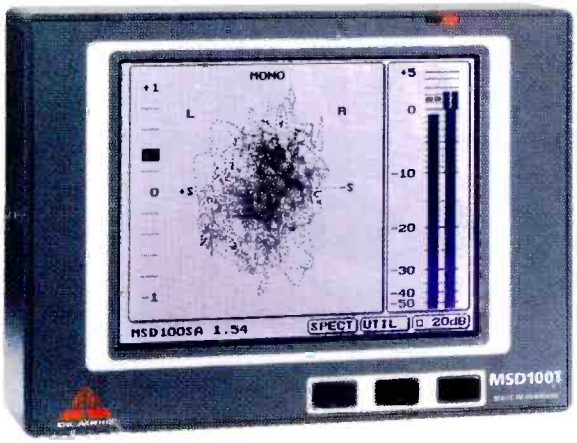

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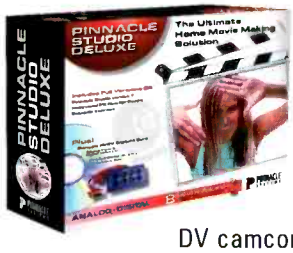

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Pinnacle Systems Studio Deluxe: includes a PCI-board, Studio 7 software, and a small breakout box; can use either an analog or DV camcorder; captures footage; uses three different editing techniques; add music, titles, transitions and voice-overs; output video on VHS tape, CD or burn to DVD.

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Thomson Multimedia Jupiter Configurator 6.2: makes settings and modifies entries; includes automatic data entry of required fields and automatic updates of related data; features drop-down menus for data entry; edit quickly with fill down, fill right, increment down and increment right program; has a quick find utility; includes open validation and automatic validation of all tables; identifies errors immediately.

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Zenith Electronics DTVMOD30: creates an 8-VSB Trellis-encoded signal from an ATSC MPEG-encoded bit stream; signal uses a standard 44 MHz intermediate frequency output; features Trellis-encoded modulation, a SMPTE 310M standard bit stream input and a microprocessor control on board; pre-correction circuits are built into the system.

847-391-7000; 847-391-7253; www.zenith.com

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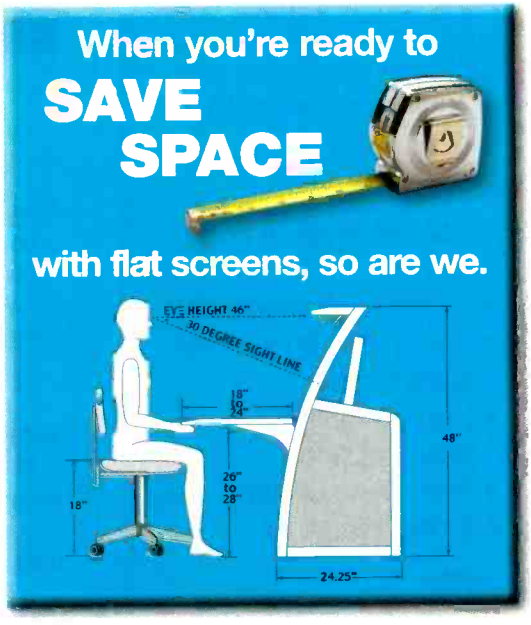

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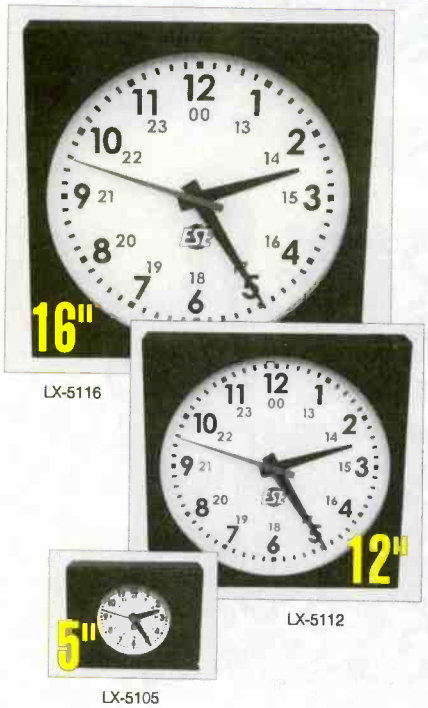

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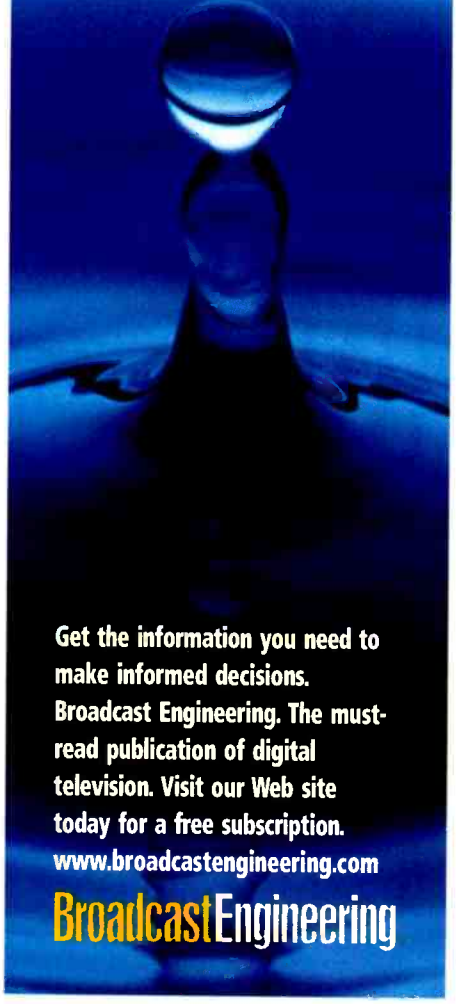

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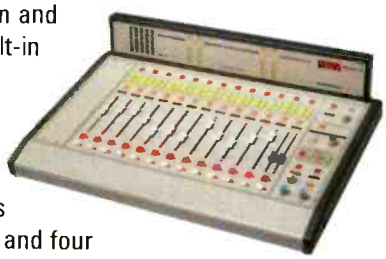

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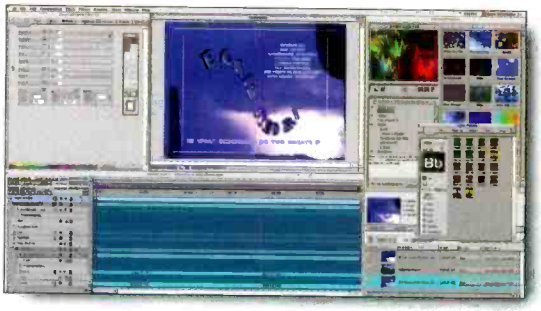

Boris FX Boris RED 2.1: offers expanded host application support, faster 3D rendering and interface improvements to enhance productivity; includes new buttons for one-click creation of new tracks, 3D and title containers, vector text pages and user defined filters; features shortcuts for adding drop shadows, reflection maps, wireframe view and motion paths.

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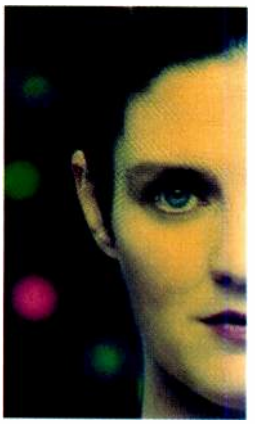

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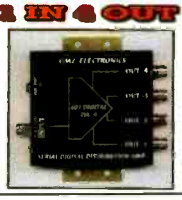

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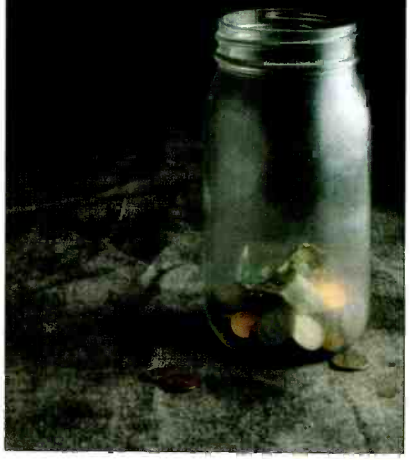

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Editorial Director: Brad Dick, bdick@primediabusiness.com
International Editor: Jerry Walker, jwalker@primediabusiness.com
Technical Editor: Donald Keller, dkeller@primediabusiness.com
Sr. Assoc. Editor: Susan Anderson, sanderson@primediabusiness.com
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Publisher: Dennis Triola, dtriola@primediabusiness.com
West Coast Sales: Duane Hefner, dnhefner@pacbell.net
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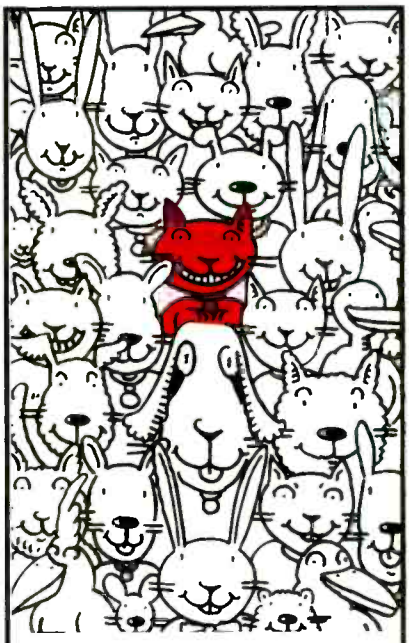

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Am I blue?

BY PAUL MCGOLDRICK

You surely have to be a real villain to get into a legal spat with Disney, an operation we all associate with happiness and fun, right? But move away from the ground at Disneyland to the boardroom and there is no mercy given. So we should not have been surprised at the lawsuit that flew at ReplayTV and parent SonicBlue over the ReplayTV 4000 from the ABC, CBS and NBC networks, and various other entities of Disney, Viacom and NBC.

You might have thought that the Supreme Court ruling in 1984 — that "fair use" of VCR replays was not anti-copyright — would have stopped this action dead in its tracks, but SonicBlue went rather further (the litigants claim) by allowing users of the ReplayTV 4000 to bypass commercials. The machine can also be set up to deliver digital video over an Ethernet in real time or at the rate your broadband connection allows over the Internet.

Just two weeks before this lawsuit the company was lauded by the television industry with a 2001 Technological/Engineering Emmy. Maybe the acceptance speech at the Emmy banquet woke up the industry seated in front of the podium. "Digital video recording is clearly changing the way consumers watch television," said Anthony Wood (founder of ReplayTV), "providing customers with the power to choose what they watch and how they watch it." Oops!

The ReplayTV 4000 started shipping in November 2001 amid rave reviews from those pundits who had already tried them out. Those reviews were seconded by the Consumer Electronics Association (CEA), who gave the company an Innovation Award for the ReplayTV 4000 and for their Rio digital audio center. The CEA also proudly showcased the products at International CES in Las Vegas in January 2002. SonicBlue has lots of friends in the music industry as well.

In most legal suits involving technology there is inevitably a challenge for attorneys to understand what they are saying. In this case there is a fundamental misunderstanding of what the case is about, and one has to hope that if the suit gets to a jury things will be explained properly. A spokeswoman for NBC was quoted at the time as saying that, "this [ReplayTV] goes above and beyond fair use [with VCRs] in allowing consumers to distribute programs by e-mail, which will undercut subscription services such as Showtime, HBO and pay-per-view programs. Although consumers may fast forward through and skip commercials during playback with current VCRs and digital video recorders," she said, "the new devices do not allow viewers an opportunity to see them at all."

The networks would like to have a captive audience for the commercials they live on.

From a technology point of view this statement is nonsense. The recording is complete with commercials; it is the viewer's choice during playback whether to skip them or not. All the technology is doing is saving the viewer from holding fast forward on the remote control.

So, the networks would like to have a captive audience for the commercials they live on. And, of course, the viewer would prefer not to see any at all. Big surprise. And viewers will only become more miserly with their commercial-viewing time as it keeps coming at them from all sides. Think of those many minutes of television-style advertising movie theaters are now running before the even more annoying "Coming Attractions" reels. Moviegoers will rebel and the advertising will then be recognized as totally counterproductive... everywhere but the concession stand.

If, instead of panic lawsuits, the networks just sat down and thought a little while about how ReplayTV is assessing the location of commercials, then they could also come up with a way of confusing them. Both Viacom and NBC are investors in ReplayTV (isn't that scary?) and apparently had no idea this was coming their way. But we have had high-end VCRs available for some time that can skip the ads.

And of the claim about distributing perfect digital copies over the Internet? The "high" setting in the recorder is reported as being about 6 Mbits/s (which agrees with a 13.5-hour recording time on the entry model's 40 Gbyte drive.) I don't think many of us in the broadcasting industry would think of 6 Mbits/s recordings as being perfect copies but, in any case, even on a T1 it would take you eight hours to transfer a two-hour movie, and on a dialup connection you could be talking about two days! Oh, yeah. Lots of people are going to get into that.

I'd like to see SonicBlue come out on top in this one. For the sake of my remote's fast-forward button, and to keep the viewing audience from being left singing the blues. **BE**

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

SEND Send questions and comments to: paul_mcgoldrick@primediabusiness.com

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