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THE JOURNAL OF DIGITAL TELEVISION

Court TV

A winning verdict for digital

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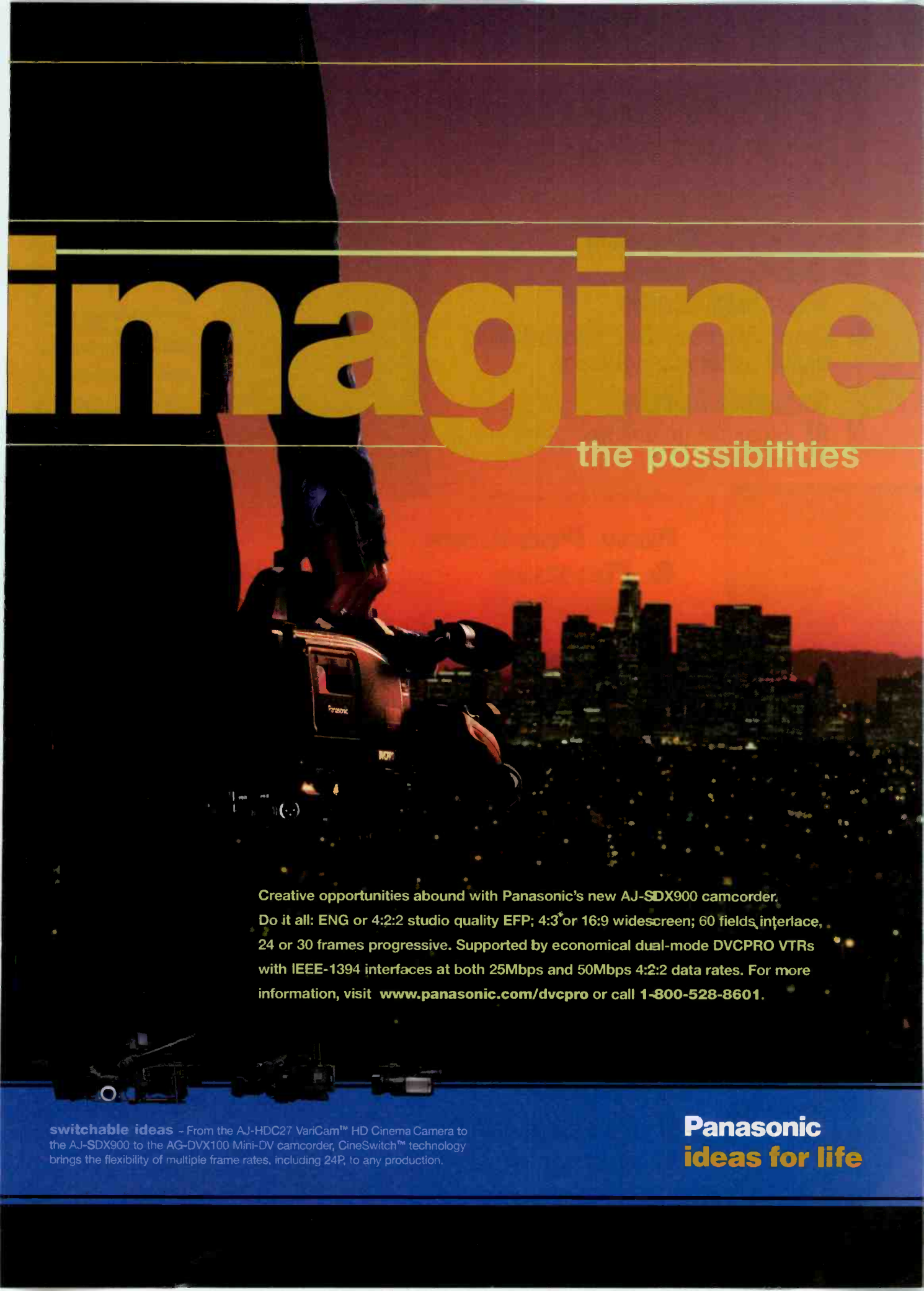
DIGITAL HANDBOOK

ON THE COVER:

Court TV's network facility has remained unchanged until recently. With 3200 square feet, the master control room is now the highlight of the network's new digital operations center. Photo courtesy George Kopp. Inset photo: Fenway Park in Boston installed Sony's HDC-900 studio camera and connected it to the fiber-optic cable for broadcasting upcoming events in HD. Photo courtesy Sony.

(continued on page 6)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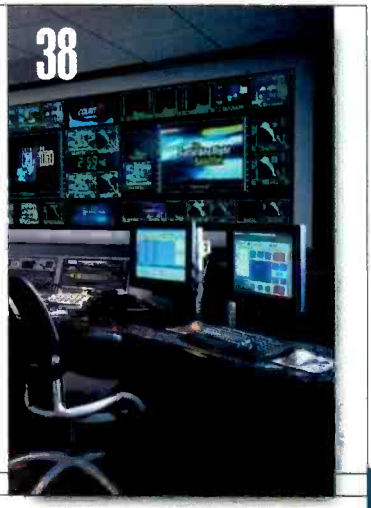

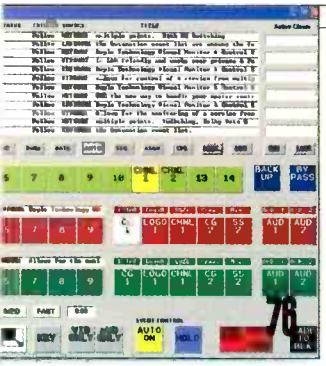

New Products & Reviews

Applied Technologies

Field Report

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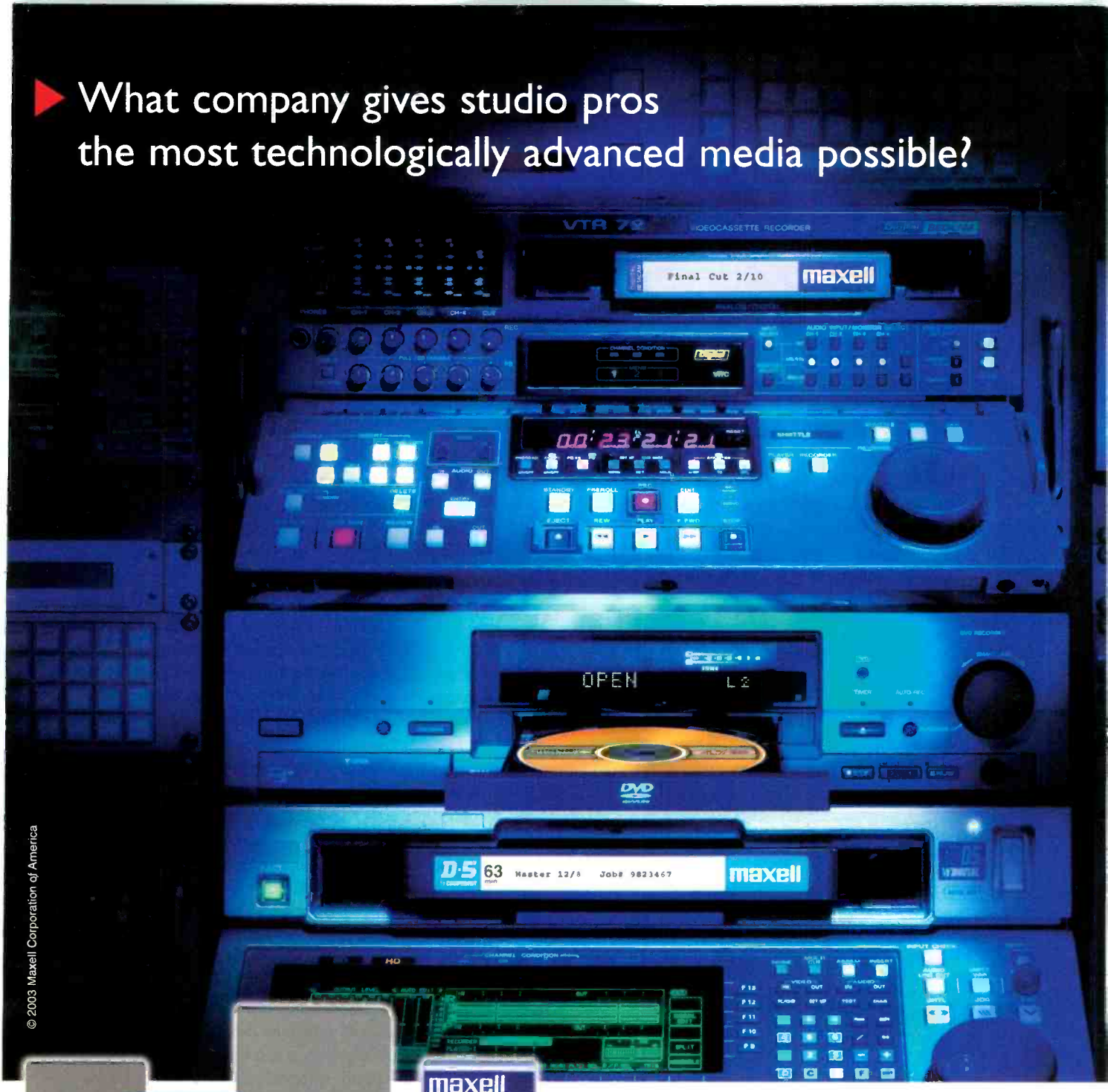
New Products

Departments

Pick Hits?

Identify these two cleverly named winners of a 1997 Pick Hit award: What automation product reminded NAB attendees of "Area 51"? What storage product's name was out of this world?
Winning entries must contain the correct answer to both questions. Correct entries will be entered in a drawing for *Broadcast Engineering* T-shirts. Enter by e-mail. Title your entry "Freezeframe-August" in the subject field and send it to: bdick@primediabusiness.com. Correct answers received by Oct. 17, 2003, are eligible to win.

What company gives studio pros the most technologically advanced media possible?



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NAB eats crow

It's not often that you find a major trade association publicly eating crow for its actions, but the NAB's changing position on ownership caps has resulted in a full plate special for the lobbying group.

The NAB has been lobbying hard against the FCC's recent actions to increase the station ownership caps. The new caps were raised to 45 percent from 35 percent and would allow cross-ownership between newspapers and TV stations in some markets. The FCC's action was generally greeted as good news by large stations and groups, and bad news by small stations. Congress, knowing that there's an election just a year away, saw the split FCC action as too good a target to pass up and used the opportunity to collectively pound their chests for more media "diversity." It was the perfect opportunity for both Democrats and Republicans to pour further scorn on those greedy media moguls.

Many in the industry were surprised (okay, I was surprised) at NAB's initial position against raising the caps. After all, the rest of us knew that major broadcasters were interested in a round of M&As. But when ABC dropped its NAB membership, maybe Eddie and the guys saw this as the perfect chance to kick sand in the face of Michael Eisner and the other networks.

Shortly after the FCC's action, we found the NAB's president, Eddie Fritts and friends wandering the halls of Congress expressing sympathy and support for those legislators wanting to invalidate the FCC's actions. Much of the public posturing seemed positioned under that wonderful banner called diversity. To read the comments, you'd have thought that media diversity was the miracle pill for broadcasting's ills.

But at the last minute, NAB changed positions. Now it supports the higher ownership caps. The organization blamed the position change on "amendments" made in the Senate Commerce committee. NAB said that it still wanted a 35 percent ownership cap, but that it was "politically and legislatively infeasible." Let's see, does this mean you want the cap or you don't want the cap? One can only wonder what damage the NAB's blunder has done to broadcasting's image on the Hill.

As I said last month, station ownership caps need to be raised, and any effort to prevent that is shortsighted and anti-capitalistic. Broadcasters need the freedom to be able to sell, buy and merge, just like other companies. You can demand all the media "diversity" you want, but unless broadcasters are allowed to trade facilities as needed to financially succeed, everyone – viewers, investors and broadcasters – will lose.

The problem now is that our industry's primary lobbyist, NAB, is having to publicly eat crow because of its ill-thought decision to try and undo what was the correct FCC decision. Alliances have been broken, trust damaged and friends alienated. Big mistake guys. This is going to hurt all of us in both the short and long run. Enjoy that crow Eddie. Unfortunately, the indigestion you'll get will be with all of us for a long time. BE

Brad Dick

editorial director

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Reaching viewers

Dear Mr. Arland,

In a June 30 article in *Beyond the Headlines* [*Broadcast Engineering's* e-newsletter], you are quoted as saying that broadcasters need to move to high power now, citing "broadcasters who have a 'lack of commitment' to full-power broadcasting" as the cause for poor over-the-air DTV reception. It's good to hear that Thomson is working on increasing the sensitivity of its digital tuners. Your plan to utilize multipath cancellation technology from LINX Electronics in future generations is also good news.

However, you should probably research your claims about the current status of reception more thoroughly. I'm based in the Philadelphia TV market and I have done extensive testing of terrestrial DTV signal propagation in all kinds of terrain, including many places where I was told there would be no reception. Lo and behold, I received signals in many of these locations, even though they were not all that strong. 8VSB reception does not always depend on stations broadcasting at full power. The trick is in handling multipath. If a weak signal has severe multipath echoes that drop below the receiver's noise floor, nothing will be picked up. When moderate multipath exists, you would be amazed at how well 8-VSB signals get out. I know – I have hundreds of spectrum analyzer plots and digital photos as documentation.

You have said that a station's low-power digital signal may not reach all of the homes in that station's analog coverage area. This is a common misconception about a "threshold" DTV system. The carrier-to-noise levels don't need to be as high as they do for analog. In many cases, the homes and apartments where I tested DTV reception had marginal to poor analog reception, but were able to receive the DTV station. Problems with DTV reception often have nothing to do with RF – they have more to do with PSIP and MPEG.

Thomson would be better advised to take a strong corporate stance that broadcasters should be sending out correct PSIP info. Many broadcasters don't do this, and the FCC doesn't even mandate PSIP, which is a mistake, in my opinion. PSIP is what makes DTV more user friendly.

Many of the DTV reception problems I have investigated turned out to be PSIP-related rather than RF-related. Manufacturers will have problems with store returns of 8-VSB set-top boxes as a result. The tuner may actually be picking up a signal, but may not be able to decode the PSIP stream correctly.

I'm not providing a justification for broadcasters not broadcasting full power, but even with lower power levels, these signals get out much better than most would expect. And in some markets, going to high power means raising the carrier level perhaps 3dB to 6dB at best. That can easily be made up in with a better antenna and low-noise preamp.

The main problem with receivers is the use of cheap components in the front-end RF stages and mixer. Compression and poor third-order intercept performance here will doom any receiver. The best bet is to use a moderate gain, low-noise first RF stage driving a passive diode ring mixer, which has the highest dynamic range of any receiver front-end. Such a setup ought to have a noise figure under 3dB and a 1dB compression point in excess of 0dB.

If broadcasters are "guilty" of anything in the DTV transition, it is not paying attention to PSIP and MPEG encoding issues. Broadcasters who do not implement even static PSIP correctly are shooting their digital channels in the foot. Manufacturers should be jumping all over this issue as it can affect future sales of terrestrial STBs.

If your STB engineers would like to discuss this further, I'd be happy to oblige.

PETE PUTMAN, KT2B
ROAM CONSULTING

Dave Arland responds:

If every market in America was like Philadelphia (or even Indianapolis), there would be no reason to point out shortcomings.....because there wouldn't be any!

We stand by our technical report and recommendations made in our submission. We HAVE been beating the drum for an FCC requirement on broadcasters to use the A/65 PSIP standard for many years. Still – the biggest issue in this transition has NOTHING to do with broadcasting. It's cable.

The average consumer will expect HDTV to work with cable. Period.

DAVE ARLAND
RCA/THOMSON MULTIMEDIA

Editor's note: If you would like to receive the weekly newsletter Beyond the Headlines, *go to www.broadcastengineering.com and under* Free Newsletters, *click on* Beyond the Headlines. **BE**

IN ADDITION

Statements have been abbreviated for space. Visit *www.broadcastengineering.com* for a full discussion of reception issues.

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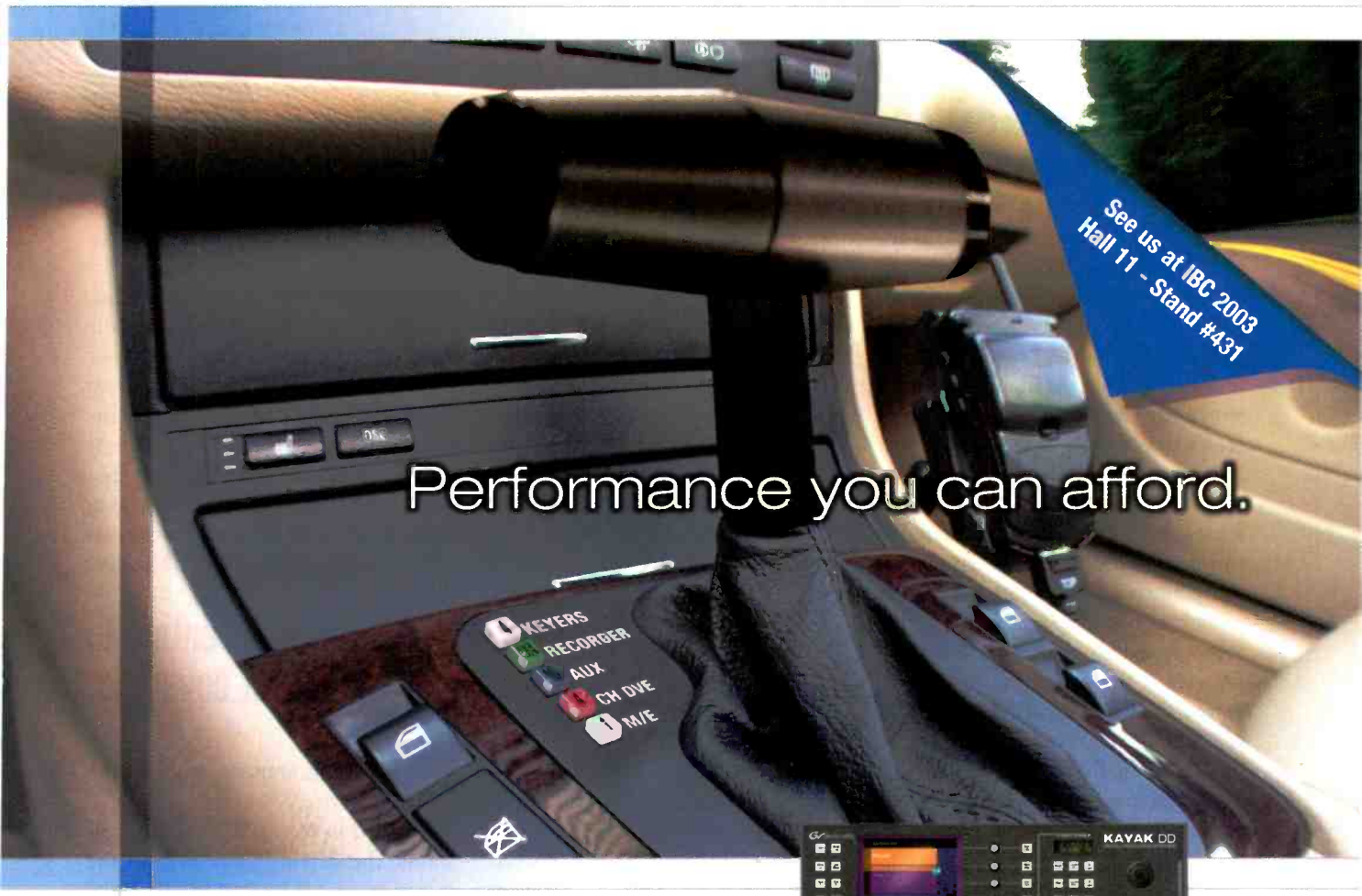

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HD sports:
A whole new ballgame

BY CRAIG BIRKMAIER

According to AP sports writer Alan Robinson, the broadcast industry has been waiting for a "killer app" that will make consumers give up tried-and-true analog technology for the "brave new world of high definition." Sports may be the opening broadcasters have been looking for. Coverage of live sporting events has become a hallmark of broadcast television: a constant supply of *fresh* content that holds viewers' interest – between trips to the refrigerator and the bathroom. The combination of sports and TV has even created an alternative TV viewing venue, the sports bar, which inspired the DTV Drafthouse at this year's NAB. What better way to promote the benefits of the HDTV viewing experience than on the big screens of your local watering hole?

So why has it taken so long for HD coverage of sporting events to gain the critical mass suggested by ESPN's recent announcement of the launch of ESPN HD? And what does this announcement say about HDTV broadcasting?

Up close and personal

For the most part, the broadcast networks have limited the coverage of sporting events in HD to a handful of big championship events. NBC has virtually ignored HD sports. The network did allow HDNet to provide delayed coverage of the 2002 Winter Olympics in HD, but did not air any HD coverage via its broadcast stations and affiliates. FOX decided that widescreen 480p was good enough, even for the Super Bowl. ABC offered one season of "Monday Night Football" (MNF) in HD, then punted; but MNF will be back in HD on ABC this fall, along with "Sunday Night Football" on ESPN HD. CBS has provided the most extensive coverage of sporting events in HD; however, the network elected to produce SD/HD simulcasts from a single remote production unit. The compromises that SD/HD simulcasting impose reveal much about the network's attitude toward HD. Here's the dilemma.

There are more than 250 million legacy TV sets. These sets typically have screens smaller than 30 inches diagonal, and are limited in resolution by legacy analog compression standards – NTSC, PAL, etc. There are now about 5 million HDTV-capable displays in American homes. Less than 500,000 of these displays are capable of receiving DTV broadcasts: Most get their HD programming from a DBS or cable service.

In contrast, broadcasters have little incentive to provide HD sports coverage.

As noted in recent "Download" columns, the driving force behind the recent increased interest in HD is the perception that it is becoming an economically attractive premium niche market. Those willing to fork out the bucks for an HDTV-capable big screen TV are typically among the most willing to pay for premium cable and DBS programming tiers.

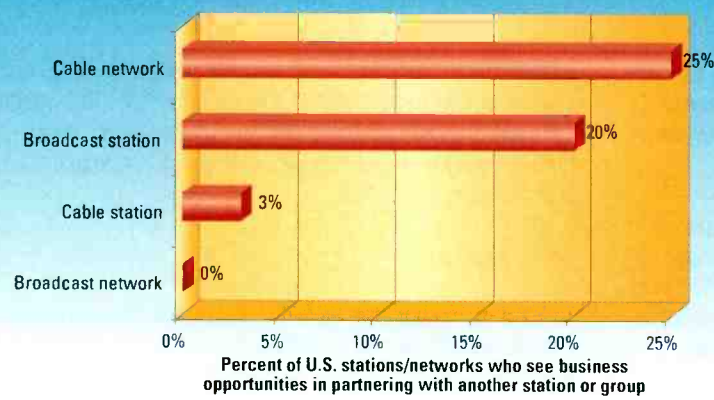
In contrast, broadcasters have little incentive to provide HD sports coverage. The audience is still statistically insignificant, and the increased costs can be considerable, especially if versions optimized for the SD and HD audiences are produced. The situation is exacerbated by the fact that most of the networks have been losing money on their major sports packages.

Because of the legacy of small screen size and resolution inherent with analog television, sports production techniques evolved into the "up close and personal" medium that dominates today. The enhanced resolution and

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

Stations consider joining forces

Some broadcasters see business opportunities in partnerships



SOURCE: TrendWatch www.trendwatch.com

wider screen aspect ratio of HDTV are often cited as major advantages for sports production. But these advantages are really *differences* that make it quite difficult to extract a standard-definition version of an event from the HD version.

When ABC produced "Monday Night Football" in HD, they understood these differences, and decided that HD is a different medium – a big screen medium – that demands a different approach to sports production. Thus two production crews and associated equipment were employed for each broadcast. ABC will continue to produce separate SD and HD versions next season.

Despite the advantage of producing a feed optimized for HD screens, the MNF producers and directors struggled at first with the new medium. They gradually learned that they could pull the cameras back and sit on wider shots for longer periods; they had to overcome decades of instinct to provide up close and personal coverage.

The simulcast techniques developed by CBS are driven by the need to serve the larger SD audience. Wide shots come from HD cameras, while the close-ups and slow-motion replays come from widescreen SD cameras that are upconverted for the HD feed. Extra care is needed to keep critical action within the 4:3 "safe area." The HD audience sees more of the action thanks to the wide screen, and they get the benefit of HD on the wide shots. But the full HD experience is compromised, and image quality varies considerably during a broadcast.

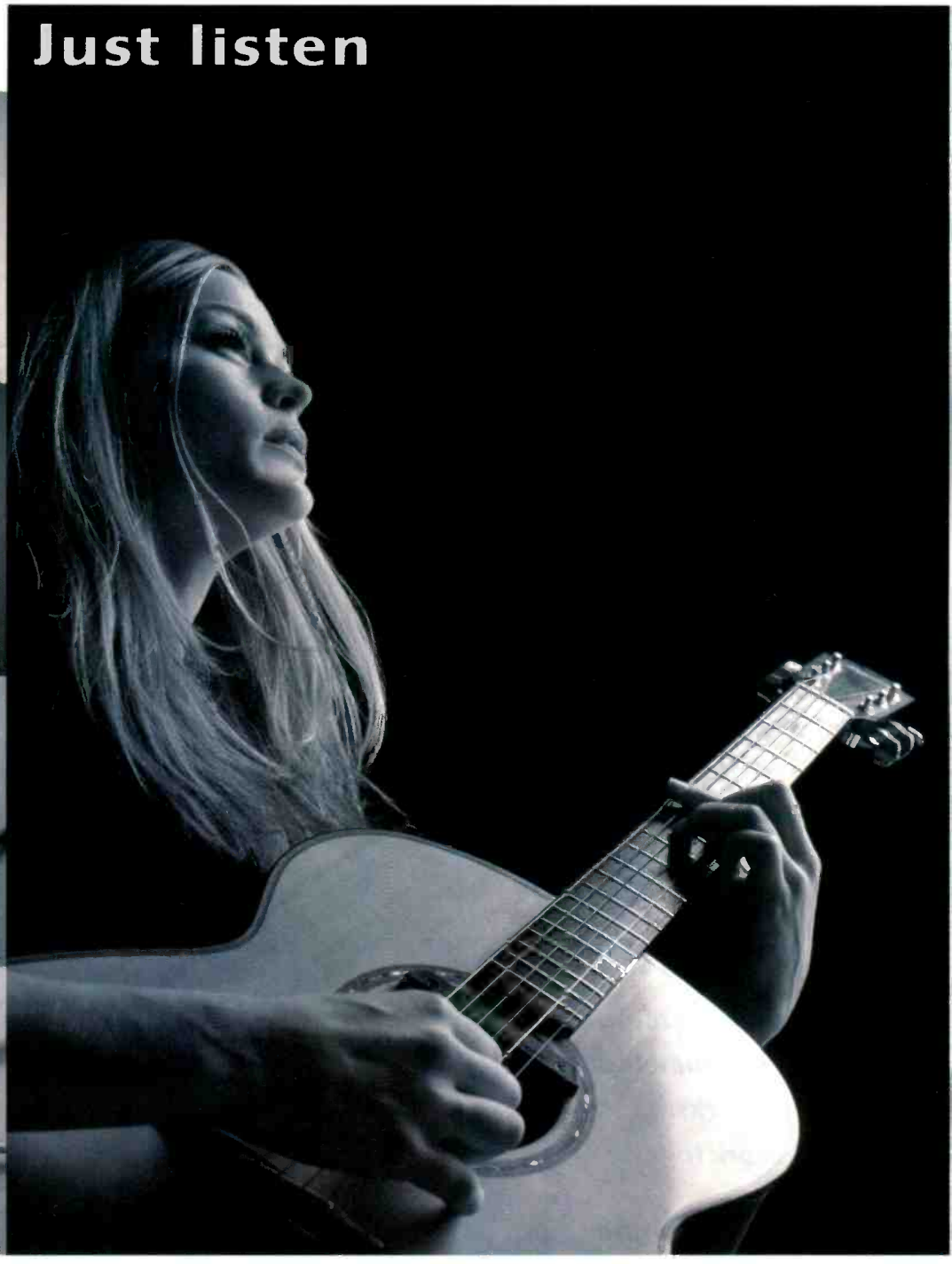
The networks are beginning to get into HD sports production, supported by a new generation of HD remote production trucks. For instance, NMT's HD4 unit has signed on to broadcast ABC's "Monday Night Football" in HD.

I versus P

To make matters worse, there is another dilemma for the companies that provide the remote production facilities to the networks that produce HD sports. The ATSC standard provides a Chinese menu of format options. FOX uses widescreen 480@60p; CBS and NBC use interlaced 1920x1080@30i; ABC and ESPN prefer progressive scan

Trust your ears

Just listen



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1280x720@60p. The cost of an HD-capable remote production vehicle is typically about double that of an SD production vehicle with equivalent capabilities. The latest generation of HD trucks cost between $7 million and $10 million, and typically have a minimum of 16 HD cameras.

From an image processing perspective, it is relatively easy to build production gear – including video mixers, DVEs and graphics systems – that can operate using either 1080@30i or 720@60p.

Cameras are another issue. Most vendors have focused on 1080@24p or 720@24p for the digital cinematography market, and 1080@30i or 720@60p for the live events markets. This changed at NAB 2002, with the introduction of the Thomson Grass Valley LDK 6000 MK II Worldcam. This camera uses an oversampling sensor that allows it to provide outputs for both 1080@30i and 720@60p, which is useful in the remote production vehicle market. To support the growing markets for HD sports production, National Mobile Television (NMT), NEP and New Century Productions have built a new generation of multiformat remote production vehicles with complements of Thomson Grass Valley Worldcams.

Panasonic has enjoyed considerable success in HD sports production with the AK-HC900 HD point-of-view camera. This 720@60p "box" camera weighs in at 3.9 pounds, lending it to use for a variety of unmanned camera positions and for use on lightweight booms and movable camera rigging.

It is likely that the debate over the advantages of interlace vs. progressive formats for sports production will grow in volume in the coming year as "the rubber hits the road." The progressive proponents note the dramatic improvement in slow-motion playbacks. Many HD sports productions have used SD super-slo-mo systems that are upconverted to HD resolution.

And then there's the question of digital compression efficiency. High-action sports can produce some of the most demanding scenes that an MPEG-2 encoder will ever encounter. Panning cameras and athletes running in and out of the shot – often in different directions – can stress the motion-compensated prediction algorithms in MPEG-2.

Web links

NEP Supershooter 20HD production vehicle
guardian.nepinc.com/packages/ss20/index.php
National Mobile Television HD production vehicles
www.nmtv.com/facilities/fac_trucks.asp
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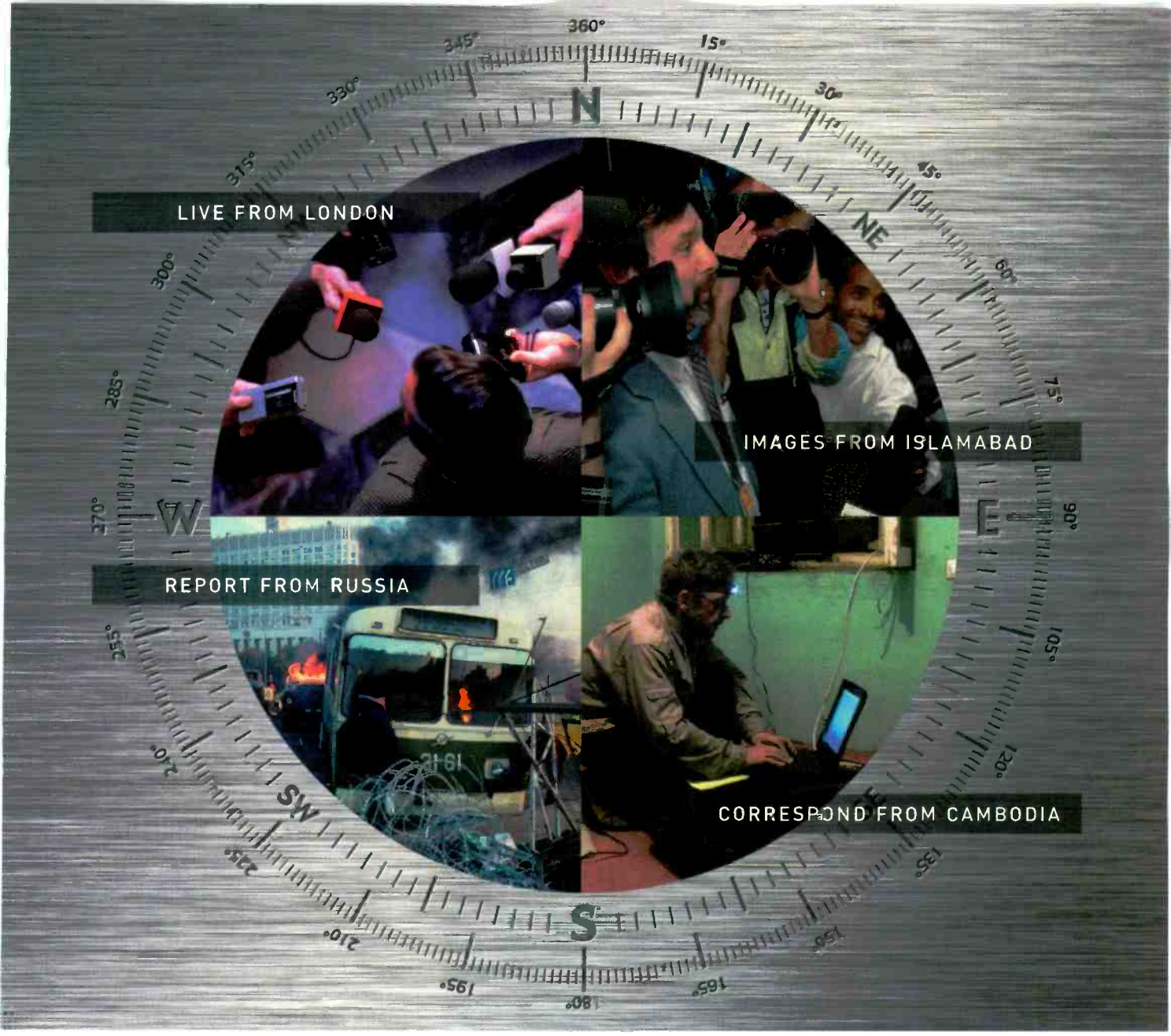

TRACKING DOWN THE STORY MIGHT BE HARD. SENDING IT WON'T.

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Many sporting venues have crowds that are close to the action; basketball and tennis may have a large portion of the background in wider shots filled with hundreds of faces that are in reasonably sharp focus. Lighting issues may affect SNR, especially when panning across dimly lit stands; and still photography flashes can create dramatic momentary changes in video levels. All of these issues can add up to produce severe compression artifacts, or the need for resolution-limiting prefiltering to prevent them.

It is generally held that 720p compresses more efficiently; however, the delivered quality may vary based on downstream interformat conversions. During the recent NBA finals there were reports of widely varying image quality in different TV markets. ABC delivered a contribution quality feed to affiliates, which have different house formats and encoders – interformat conversions and variations in encoder implementations and/or setup may have been responsible for the observed differences.

The stage is set

In the coming year, hundreds of sporting events will be covered in HD. It appears that the majority will be optimized for the HD audience. So the stage is set to answer some competitive questions. There is little doubt that

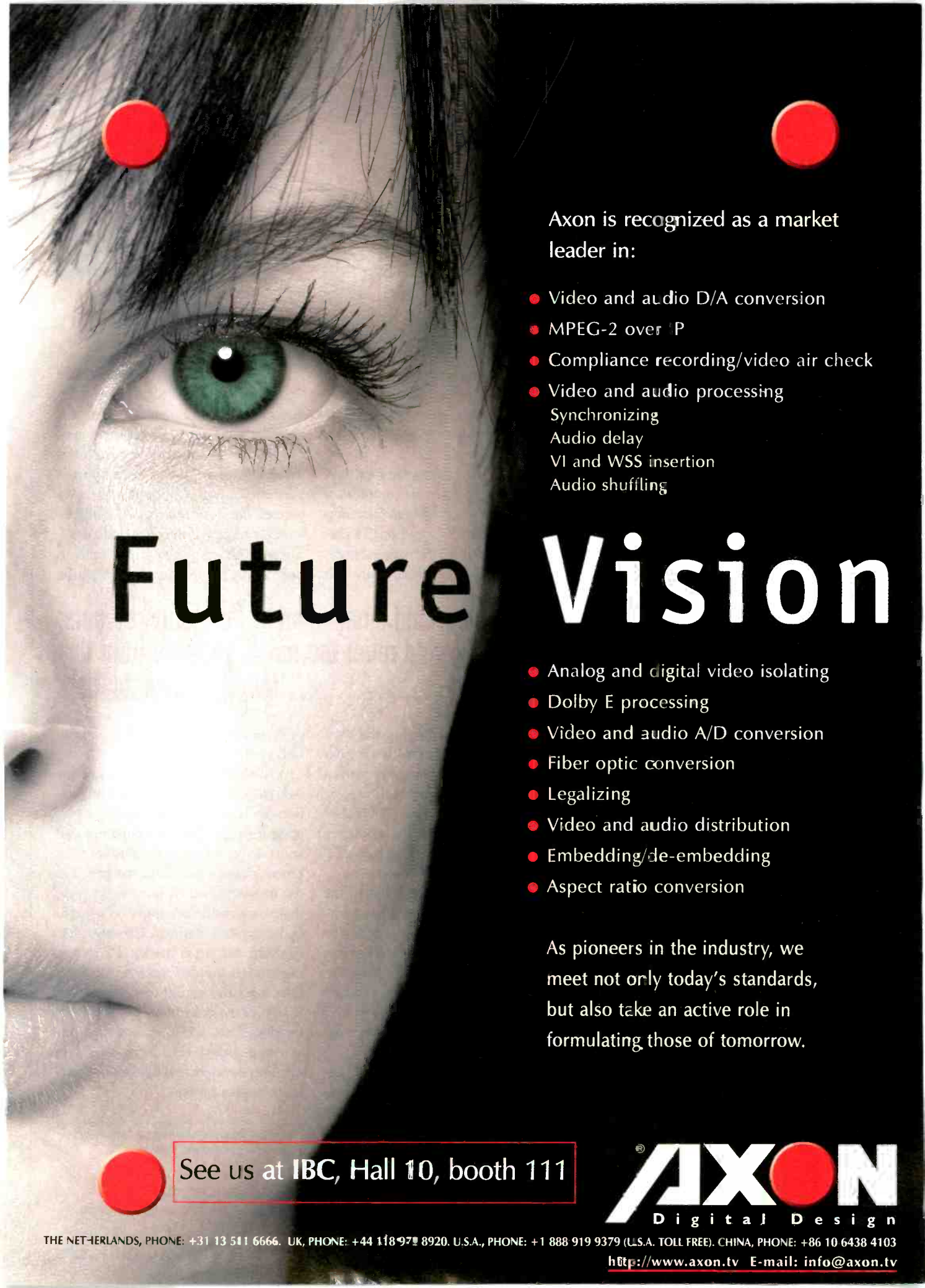
HD sports will be the cornerstone of strategies being developed by the cable and DBS industries.

HD sports coverage is going to help the consumer electronics industry sell more HD-capable TVs. Likewise, HD sports will be the cornerstone of strategies being developed by the cable and DBS industries to contend for premium subscribers.

Will HD sports be the "killer app" that will kick the broadcast DTV transition into high gear? Or will it be the technology that causes sports to migrate from "Free TV" to subscriptions services? BE

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

SEND Send questions and comments to: cbirkmaier@primediabusiness.com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BEYOND THE HEADLINES

New TV multiple ownership rules adopted

BY HARRY C. MARTIN

Twenty months and 500,000 comments later, the commission, by a 3-2 vote along party lines, adopted its new media ownership rules on June 2, 2003.

The new rules for television are as follows:

First, the commission modified the *Local Television Multiple Ownership* rule. The eight-station test established in 1999 has been replaced by a three-tier rule:

- In DMAs with between five and 17 TV stations, a company may own up to two stations, but only one of these stations can be among the top four in ratings.
- In DMAs with 18 or more TV stations, a company can own up to three TV stations, but only one of these stations can be among the top four in ratings.
- In DMAs with 11 or fewer TV stations, companies can seek a waiver which would permit two top-four stations to be commonly owned. The FCC will evaluate on a case-by-case basis whether such station combinations would provide their local communities better service than would be the case if the stations remain under separate ownership.

In addition to modifying the local television ownership rules, the commission also increased the *National Television Multiple Ownership* limit from 35 percent to 45 percent of the national audience. The national audience share will be calculated by combining the total number of TV households in each market in which the company owns a station. At the same time, the Commission will maintain the "UHF discount," which reduces the audience share of a particular station by half if it is UHF.

The commission also eliminated the *Radio-Television and the Broadcast-Newspaper Cross-Ownership Rules* for markets with more than nine television stations. For smaller markets, the commission adopted the following rules:

In markets with between four and eight TV stations, combinations are limited to *one* of the following:

- A daily newspaper; one TV station; and up to half of the radio station limit for that market (*i.e.*, if the radio limit in the market is six, the company can own no more than three) OR
- A daily newspaper; and up to the radio station limit for that market; (*i.e.* no TV stations) OR
- Two TV stations (if permissible under the local TV ownership rule) and up to the radio station limit for that market (*i.e.* no daily newspapers).

For those markets with three or fewer TV stations, no cross-ownership is permitted among TV, radio and newspapers. The commission will consider a waiver request if the parties can demonstrate that the television station does not serve the area served by the proposed acquisition (*i.e.*, the radio station or the newspaper).

The medium and small-market TV station owners, who needed relief the most, got little from this round of deregulation.

As is evident from this summary, the new rules provide significant deregulation for large companies already operating in large markets, companies that want to combine newspapers and broadcast stations in large markets, and the networks, which want to increase their nationwide inventory of owned-and-operated stations. However, the medium and small-market TV station owners, who needed relief the most, got little from this round of deregulation, in spite of the quadruple threats of DTV buildout costs, no DTV must-carry, increasing competition from cable and satellite providers, and diminishing network compensation. BE

Dateline

The renewal cycle for television stations begins in 2004. On April 1, 2004, stations in Maryland, Virginia, Washington, D.C., and West Virginia must begin their pre-filing renewal announcements and then file the renewals on June 1, 2004. In the meantime, stations in Alaska, Florida, Hawaii, Iowa, Missouri, Oregon, the Pacific Islands, Puerto Rico, the Virgin Islands and Washington must file their biennial ownership reports by Oct. 1, 2003 and, also by Oct. 1, place their annual EEO reports in their public files and on their Web sites.

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

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SONY

it's a digital world:

MPEG Times

Over 900 TV stations broadcasting in digital

The DTV transition reached another milestone as the NAB count of digital stations exceeded 900 this week. Some 98% of U.S. TV households are in markets served by at least one DTV broadcaster. 78% are served by fu

OVER 1,000 MPEG IMX DECKS DELIVERED TO U.S. TV STATIONS AND PRODUCTION HOUSES

Sony's MPEG IMX production system achieved another plateau this month as cumulative sales in the United States surpassed 1,000 units. Over 8,000 units have been shipped worldwide. Users praise the format's phenomenal picture quality, l operating costs and backward compatibility with decades of assets reco and Betacam SP®, format

Over 380,000 DVCAM units sold

Fastest growing professional recording format ever introduced by Sony

worldwide sales exceed 380,000 VTRs and corders, the DVCAM format has scored l achievements as Sony's fastest-growing the world's number one pro digital video format. DVCAM products have proven popular for television news, corporate and event videos, documentaries and digital cinematography.

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Remote control monitoring

BY JASON RIEG

As the transition to digital television continues, the television transmission facility has grown to accommodate the addition of another "channel" to the broadcast plant. Engineers today are responsible for maintaining an analog transmitter, the analog backup, the DTV transmitter and, eventually, a DTV backup and all the auxiliary digital equipment. This is in addition to taking care of all the transmission site equipment – tower lights, HVAC, security systems, etc. – often in a distant location. It is no wonder that the need for more flexible and robust remote control monitoring equipment is growing.

Traditionally, remote control stood for a one-on-one relationship between the transmitter and monitoring equipment tethered by parallel connections and a phone line at the site. This later evolved into troubleshooting for a limited number of parameters, but these systems had a limited number of access options and very few ways to actually exploit the information to pinpoint failure points or problems.

Transmitter control is evolving to include a network transaction using a Web interface system with a dedicated server to port transmitter information to a remote computer. Server style varies, depending mainly on the control system characteristics of the transmitters. On some systems, Web servers are available that are integrated within the transmitter by way of off-the-shelf industrial PLC systems used for control. These systems communicate basic graphics and system information using pure HTML for transmitter control.

A new breed of add-on transmitter Web servers was announced recently by a number of manufacturers. An example of this is the Harris eCDI Web interface, shown in Figure 1. These servers interface to the transmitter and exciter(s) serial interface and serve the information to a standard Web browser. The Web interfaces for these transmitters lend themselves to more sophistication, with at least one using a Java environment with graphics and XML for data transfer, saving the more basic HTML for setup and login functions. Some add-on Web servers also provide multi-level control access, SNMP agents for network management, e-mail/pager fault notification, and "microbrowsers" for interfacing to wireless PDAs and Web-enabled cell phones. Due to security concerns, no station to date has implemented wireless control.

Due to security concerns, no station to date has implemented wireless control.

Add-on configuration allows manufacturers to create a common interface architecture for all current and legacy products. Commonality of interfaces helps station personnel that are familiar with one transmitter navigate the interface of another, less familiar piece of equipment. This would come in handy when installing a new digital exciter or taking care of a collocated FM when the transmitter supervisor is on vacation. This commonality also becomes extremely important with facilities containing multiple transmitters of different architectures, such as a solid-state VHF analog and an IOT UHF digital.

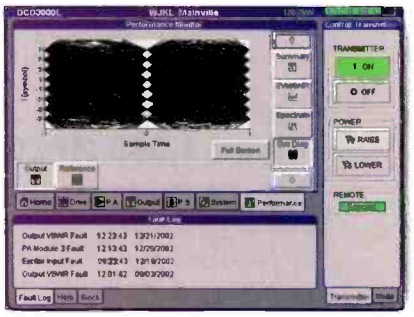

Figure 1. The Harris eCDi performance monitoring screen provides remote monitoring of 8-VSB signal quality. The Web interface provides transmitter status and control in addition to performance monitoring for all Harris digital television transmitters.

All stations are sensitive to network security and only the bravest (read: foolhardy) are willing to put transmitter control on an open Internet connection. Luckily, an effective solution is most likely already installed on most networks – a virtual private network. These saviors of security are widely used, and an out-of-the-box system can be picked up for a song at any local computer retailer.

At least one manufacturer is taking control and management even one step further and creating a software package with greater breadth of monitoring, allowing multiple users to simultaneously control, monitor and view the status of multiple devices at multiple locations. Centralized monitoring and control solutions from transmitter manufacturers will offer service expertise and insight from the people who know the product best. BE

Jason Rieg is product line manager for Harris Broadcast Remote Control-eCDI.

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Colorimetry
standards

BY MICHAEL ROBIN

The electromagnetic spectrum visible to the human eye occupies approximately one octave, from 380nm to 760nm (1nm = 10^{-7}nm). (See Figure 1.) The way the human visual system perceives light is by associating colors (or hues), a perceptual artifact, to frequencies. The eye has a maximum sensitivity at the green color and lesser sensitivity at red and blue.

Color perception is associated with a specific set of 6 million to 7 million cells, called cones, situated in the eye retina. Studies indicate that there are specialized types of cones responding to red, green or blue stimuli. The cone cells have a low sensitivity, resulting in achromatic (no color) perception at low light intensities. They also have a low sensitivity to picture detail.

Low light intensity, achromatic light perception and picture detail are due to a second type of cells, called rods, also situated in the eye retina. There are between 110 million and 130 million rods. Rods have a high sensitivity and afford a high resolution of picture detail.

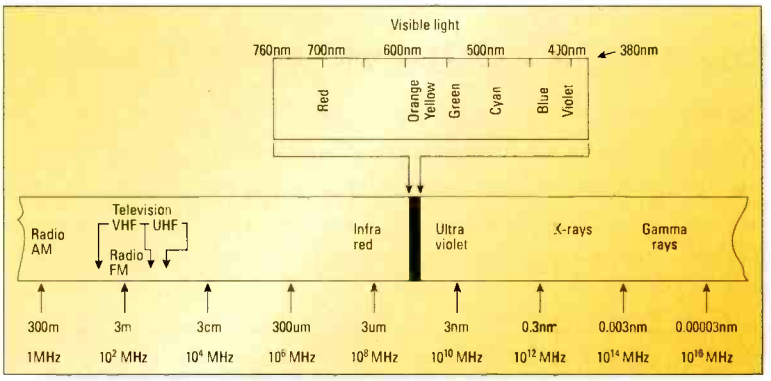

Figure 1. Spectrum of electromagnetic radiations

The CIE color diagram

The 20th century witnessed an explosion in the recording and reproduction of still (photographs) and moving (television and movies) images. Among the early preoccupations of the dream factories (Hollywood and others) was the correct reproduction of colors.

In 1931, a group of scientists under the umbrella of Commission Internationale de l'Eclairage (CIE), or International Lighting Commission, developed a bi-dimensional (x,y) representation of the visible colors, the so-called CIE diagram, shown in Figure 2 on page 26. This diagram allows the user to specify colors by assigning values to x and y variables. All visible colors are confined inside a horseshoe-shaped area. Saturated colors occupy positions on the curve. Lower saturation colors occupy positions nearer to the center of the display.

In addition to defining colors, the CIE diagram identifies the white light as a set of x and y values describing a point in the central area of the diagram. Various standards define the white using different pairs of x,y coordinates related to the temperature to which a black body has to be raised to generate the specific white.

Colorimetry standards in color television

Color television relies on the light properties that control the visual sensations known as brightness, hue and saturation. All visible colors of the spectrum can be generated by a proper combination of three primary colors.

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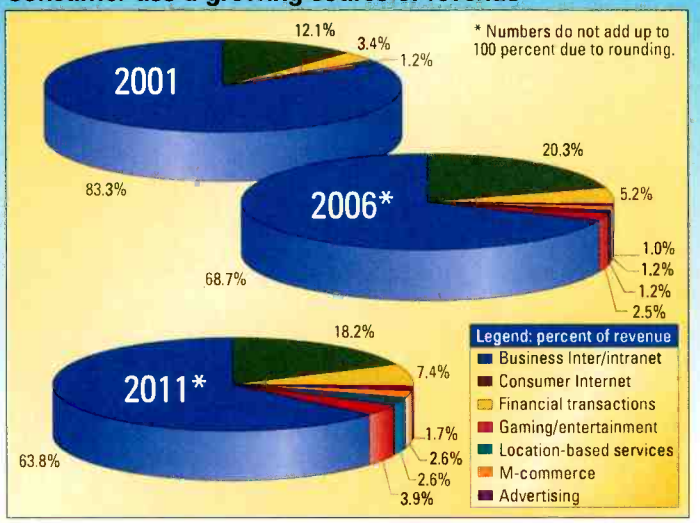

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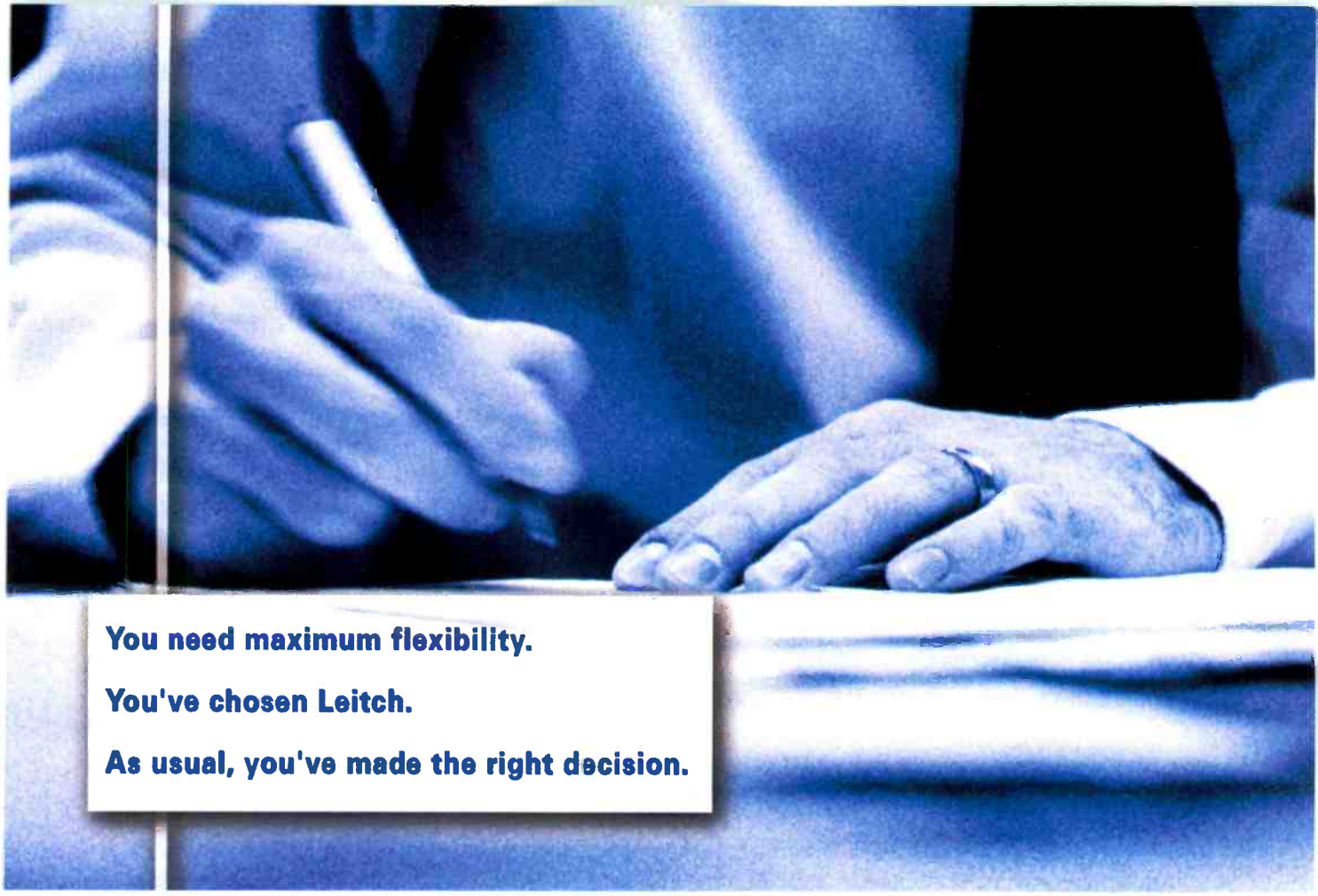

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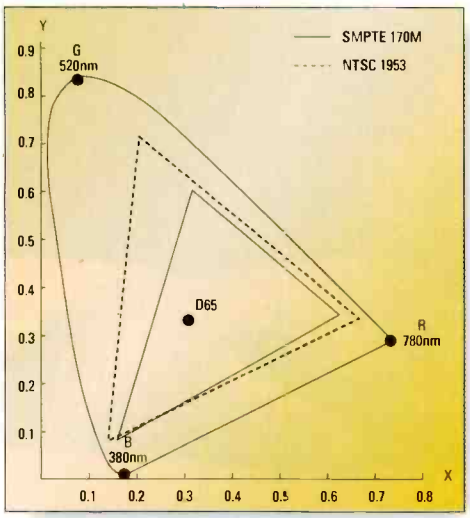

Figure 2. CIE color diagram showing location of primaries and outlines of NTSC 1953 and SMPTE 170M color triangles

The definition of a group of three primary colors is that none of the three could be generated by adding the other two. The process of generating various colors using three primary color sources is called additive color mix. All light sources generate additive colors.

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

The television primary colors are red with a wavelength of 700nm, green with a wavelength of 546.1nm and blue with a wavelength of 435.8nm. Any other set of primary colors could have been used, but the choice was determined by the ease with which (in 1953) relatively efficient red-, green- and blue-colored phosphors could be manufactured. The x,y coordinates of the chosen phosphors delineate a "phosphor color triangle."

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

• *The x,y coordinates of the color primaries and of the reference white.* This involves the specification of the x and y coordinates representing the primary colors and the reference white.

• *The transfer characteristics.* The transfer characteristic of the CRT is inherently nonlinear. The transfer function is approximately exponential and commonly referred to as "gamma" curve. Gamma is mainly a light reproduction function of the CRT. In order to achieve an overall linear transfer characteristic, the nonlinear-ity of the CRT is compensated for elsewhere in the system. Figure 3 on page 28 shows how a nonlinear CRT display is compensated for by a pre-correction of the original signal. Historically, the compensation is carried out in the camera and is referred to as gamma correction. This results in red, green and blue signals pre-distorted to match the reference characteristic of the CRT as follows:

$$G_{transmit} = G_{pickup}^{1/\gamma} = E'_G$$
$$B_{transmit} = B_{pickup}^{1/\gamma} = E'_B$$
$$R_{transmit} = R_{pickup}^{1/\gamma} = E'_R$$

The NTSC standard defines a gamma of 2.2, while the PAL and SECAM standards define a gamma of 2.8. It is important to note that ITU-R BT.601 doesn't specify the x,y coordinate nor the gamma. Some organizations use the NTSC values, and others use the PAL values. More recent standards, such as ITU-R BT.709, specify complex mathematical expressions, which are applied to linear R, G, B signals to compensate for defined CRT nonlinearities. This has, as a side effect, a positive effect on the noise influence on the reproduced picture. The human eye is more sensitive to noise in the dark areas, where the gamma behavior of the CRT reduces the visibility. The transfer standards will eventually have to be revisited in order to reflect the appearance of non-CRT display technologies featuring linear transfer characteristics.

• *The luminance equation.* This involves the specification of the matrix coefficients related to the E'_G, E'_B and E'_R primary signals

• *The color-difference equations.* This involves the specification of the matrix coefficients related to the E'_G, E'_B and E'_R primary signals.

The ITU-R.BT.470-4 (NTSC 1953) defines parameters of the NTSC color television system, adopted for transmission in the United States in 1953. These

Standard	Color primaries			Transfer characteristics (gamma)	Matrix coefficients
	Primary	X	Y		
ITU-R BT.470-4 (NTSC 1953) Composite analog format	Red	0.670	0.330	Gamma = 2.2	$E'_Y = 0.59E'_G + 0.11E'_B + 0.30E'_R$
	Green	0.210	0.710		$E'_{B-Y} = 0.493\,(E'_B - E'_Y)$
	Blue	0.140	0.080		$E'_{R-Y} = 0.877\,(E'_R - E'_Y)$
	White (C)	0.310	0.310		
ITU-R BT.470-4 (PAL B, G) Composite analog format	Red	0.640	0.330	Gamma = 2.8	$E'_Y = 0.587E'_G + 0.114E'_B + 0.299E'_R$
	Green	0.290	0.600		$E'_{B-Y} = 0.493\,(E'_B - E'_Y)$
	Blue	0.150	0.060		$E'_{R-Y} = 0.877\,(E'_R - E'_Y)$
	White (D65)	0.313	0.329		
SMPTE 170M (NTSC 1953) Composite analog format	Red	0.630	0.340	$V = 1.099Lc^{0.45} - 0.099$ for $1 \geq Lc \geq 0.018$; $V = 4.5Lc$ for $0.018 > Lc \geq 0$	$E'_Y = 0.587E'_G + 0.11E'_B + 0.299E'_R$
	Green	0.310	0.595		$E'_{B-Y} = 0.493\,(E'_B - E'_Y)$
	Blue	0.155	0.070		$E'_{R-Y} = 0.877\,(E'_R - E'_Y)$
	White (D65)	0.3127	0.329		
ITU-R BT.601 Component digital SDTV	Red	*0.630	*0.340	$*V = 1.099Lc^{0.45} - 0.099$ for $1 \geq Lc \geq 0.018$; $*V = 4.5Lc$ for $0.018 > Lc \geq 0$	$E'_Y = 0.58*E'_G + 0.11E'_B + 0.299E'_R$
	Green	*0.310	*0.595		$E'_{B-Y} = 0.564\,(E'_B - E'_Y)$
	Blue	*0.155	*0.070		$E'_{R-Y} = 0.713\,(E'_R - E'_Y)$
	White (D65)	*0.3127	*0.329		
ITU-R BT.709 Component digital HDTV	Red	0.640	0.330	$V = 1.099Lc^{0.45} - 0.099$ for $1 \geq Lc \geq 0.018$; $V = 4.5Lc$ for $0.018 > Lc \geq 0$	$E'_Y = 0.7152E'_G + 0.0722E'_B + 0.2126E'_R$
	Green	0.300	0.600		$E'_{B-Y} = 0.5389\,(E'_B - E'_Y)$
	Blue	0.150	0.060		$E'_{R-Y} = 0.635\,(E'_R - E'_Y)$
	White (D65)	0.3127	0.329		

* Assumed but not specified

Table 1. Various colorimetry standards used in TV production

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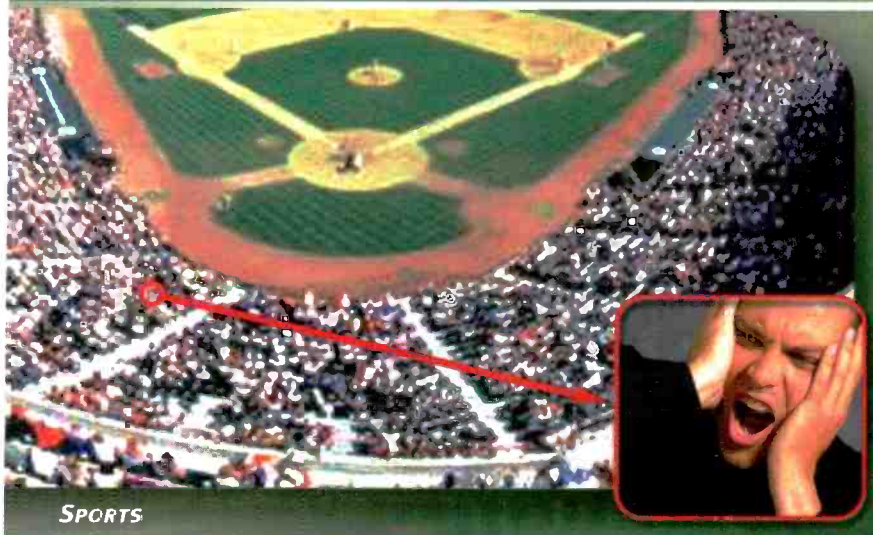

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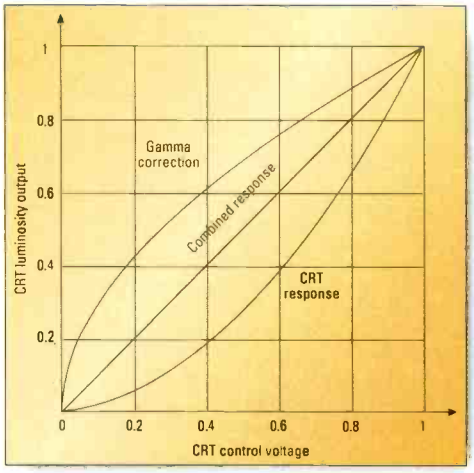


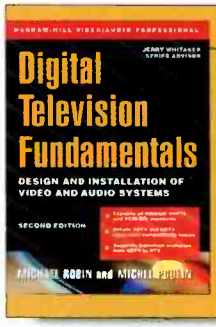
Figure 3. Correction of CRT nonlinear transfer curve

parameters reflected the CRT technologies in existence at the time. Early versions of the PAL and SECAM systems used the same parameters. Later CRT technologies used phosphors with different chromaticities. This necessitated a review and update of the colorimetry standards. The ITU-R.BT.470-4 (PAL B,G) used different parameters. The NTSC specifications were reissued in 1995 as SMPTE 170M and used parameters similar to those used for PAL and SECAM. The ITU-R BT.601 standard specifies the parameters of the SDTV component digital format. Note that the color-difference scaling factors are quite different from those used for NTSC and PAL. This is due to the fact that these signals have a peak-to-peak signal amplitude equal to that of the luminance signal unlike NTSC and PAL. The ITU-R.BT.709 standard is the specified version for HDTV.

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

Michael Robin, a fellow of the SMPTE and 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, and recently translated into Chinese and Japanese.

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



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Media asset-management systems

BY BRAD GILMER

If you have it but you can't find it, you don't have it. In a sentence, this describes why media asset-management (MAM) systems are important. They help the user locate content. MAM systems have been a part of broadcast operations for years. The first MAM systems were file cards and sheets of paper. As collections grew, broadcasters and post-production facilities began to use computers to track material in their archives. The archive was viewed as an end-of-pipe process, and MAM systems were largely confined to simple catalog systems.

MAM systems have evolved significantly, and the role of the archive has changed dramatically.

MAM systems have evolved significantly, and the role of the archive has changed dramatically. MAM systems now can locate and track content throughout a facility. Broadcasters have created a new category of archived, shared-content storage, that often operates at the center of networked production facilities.

MAM anatomy

MAM systems have several functional areas, including ingest, annotation, cataloging, storage, retrieval and delivery. Although these are described linearly here, work may occur simultaneously in these areas.

Ingest. During the ingest process, storage systems capture essence (video and audio) in digital form. Usually, they capture low-resolution and full-resolution content simultaneously. Ingest operators or automated systems link the captured material to a metadata record in the MAM system, and enter some preliminary information. Once the ingest process has started, the essence may be available for further processing. (Some MAM systems require that the ingest process be complete before users can begin working with the system.) Most MAM systems can also track material that is not ingested, such as tapes on shelves.

Annotation. During annotation, a user types in notes while viewing the content. Typical annotation clients include VTR-like functions that allow the annotator to pause the content while entering notes. It is extremely important that the annotation and VTR commands be intuitive and quickly accessible from the keyboard. Most users perform a quick annotation as the system ingests the material. For important content, they may go back and perform an in-depth analysis.

Cataloging. During this extremely important phase, users enter information that others will later use to retrieve the content. They typically enter title, date, location and keywords, along with other information such as segment length, overall length, and talent. Since this information is critical to retrieval, users might employ a limited thesaurus to restrict the entries allowed in certain fields. The MAM system may also use automated cataloging technologies to capture keyframes, closed-caption text and other information. MAM systems can also populate their catalogs with information from editing and automation systems.

Storage. MAM systems continuously store material. During the initial ingest process, the MAM stores essence and metadata. Additional metadata is stored during annotation, cataloging and automated analysis.

Retrieval. Users employ the retrieval process to locate, identify, and view previously cataloged and annotated content. The first and most common way to retrieve material is a text search. The retrieval client may use simple or complicated searching techniques to look through the catalog and annotations, and return a list of content matching the search criteria. But, more commonly, the system presents the user with a view that includes still images of the search results. In some cases, the client will even take users to the area of the content where it found a match. This can be useful if you are trying to locate a particular scene in a two-hour movie.

Figure 1 shows a screenshot from a MAM product made by Artesia called TEAMS. In this storyboard view, the system presents the user with keyframes to quickly locate important content.

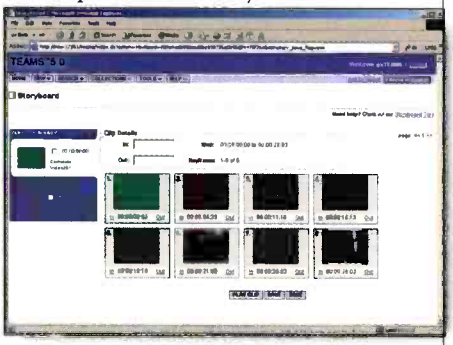

Figure 1. In this storyboard view from Artesia's TEAMS MAM system, the user is presented with keyframes to quickly locate important content.

Delivery. In some cases, the retrieval function is also the delivery function. In other configurations, the MAM system

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delivers high-resolution content by file transfer. Sometimes, the MAM retrieval process is part of a larger retrieval function where users view low-resolution proxies to quickly locate material in the system or in an offline library.

Workflow support

Several years ago, production workflows were much more linear than they are today. A news feed would come into a facility, someone in the tape room would record the feed, an editor would pick up the tape and begin editing and, finally, the completed story would be delivered to the control room for integration into the evening news. Then if the story was particularly important, someone would put it on a shelf in the library and perhaps catalog its location for later retrieval.

But technology has enabled major changes to this workflow. In new workflows, the archive serves as a central repository for content, and the MAM system allows people to quickly locate the material they need. Several editors can work on the same source material at the same time to create different products. For example, a producer may send a particularly important news story directly to air as it arrives from the field. At the same time, the system feeds the material into a central repository. Editors begin creating rough-cut stories from the incoming feed almost immediately. Taped pieces begin appearing within a few minutes. As this is happening, different groups of editors may have already begun working on pieces for the 6:00 p.m. and 11:00 p.m. news.

The point is that many people may want access to the same content at the same time. This was difficult to do when editing systems were primarily tape-based. But as we move to networked editing environments, it becomes possible for the user to change from a linear workflow to a more collaborative environment. Once material is stored on a server and different groups begin putting various completed pieces back on the server, some sort of content-tracking system becomes critical. That is the function of a MAM system – to keep track of where content is located and help users find it.

The MAM dilemma

While MAM sounds great, there are challenges in implementing these systems. One challenge is figuring out how to pay for them. MAM systems typically incur costs in one area, but deliver value in that area and other areas as well. It may cost a significant amount of money to purchase, install and train personnel to operate the systems. Additionally, an archive group may incur additional costs in time and personnel during annotation and cataloging. The benefits of MAM systems typically accrue to users of the system – researchers, post-production departments and

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on-air promotion people, for example. This usually means that the archive group gets hit with all the cost, while other departments receive the benefits.

Where does the metadata come from?

Another dilemma facing owners of MAM systems is how to obtain metadata such as cataloging information and annotations. It is one thing to go to a search engine on the Web, type in a word or phrase and have hundreds of likely Web pages appear. Search engines parse text to build databases that yield quick search results. It's quite another to search video content.

The dilemma for video is simple to explain, but difficult to resolve. Who do you designate to watch movies or news stories and type in the information that others will later use to retrieve the video or audio? If your organization already has an archive, it is likely that someone there is familiar with its contents. If the volume of new material entering your archive is low, then it may be possible for this person to enter detailed information on a scene-by-scene basis. But many larger organizations face a huge task, either because they have large amounts of new material coming into their facilities or because they have a huge backlog of material waiting to be cataloged. In either case, any single individual is likely to burn out quickly if asked to complete this task.

Faced with this problem, one facility hired students to help with its cataloging effort. While the students cataloged a great deal of material in a relatively short period of time, it was not long before those using the system found that some of the catalog information was missing, some was in error, and much was either irrelevant or did not include terms for which someone was likely to search.

What's next?

But better solutions are appearing on the horizon. Cataloging technology is improving. Speech-to-text, on-screen text recognition, closed-caption capture and other automated tools may improve the cataloging process. Metadata-aware file formats such as MXF and AAF may also aid in the metadata-collection process. Slate information from an MXF camera may be retained in an MXF file. Editor comments may be held in an AAF file. Later on, a MAM system can collect metadata from these files that can be used to locate a particular piece of video. BE

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

Send questions and comments to: brad_gilmer@primediabusiness.com

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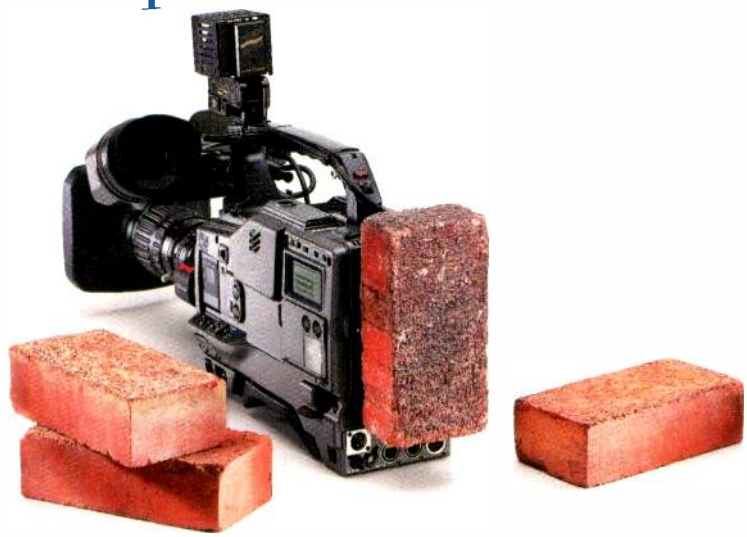

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Wireless
ENG/EFP cameras

BY BENNETT LILES

The world of terrestrial live shots exists largely in metropolitan canyons between steel and concrete, which have long caused havoc with terrestrial analog microwave transmission in the form of multipath interference. A single carrier bouncing off buildings arrives at the receiver with mutually canceling time delays, causing fading or complete dropout. Static multipath is tricky enough, but when an attempt is made to move the transmitter, dynamic multipath problems cause such wireless links to be tenuous.

ESPN used Link Research's LinkXP1 digital wireless camera to broadcast the Stanley Cup.

The primary reason for official adoption of the COFDM as the European DVB-T standard has been its performance in severe multipath environments. American TV news engineers also noted that its use of multiple carriers, each of which is modulated at 90 degrees to those adjacent, provided less range but better multipath reception than the Canadian/American 8-VSB, though gains in 8-VSB performance have been made. COFDM actually eats multipath signals and grows stronger. With larger transmitters, news helicopters have reported an effective throw of 50 miles or more with omni patterns, compared with 90 to 100 miles with directional analog microwave under similar conditions.

A small amount of the total information stream is put on each of nearly 2000 narrowband carriers, and enough data is included to enable reconstruction and even reinforcement of the signal among the multipath variants seen at the receiving end. The secret of its robust RF performance is in the limited bandwidth and data rate on each carrier. Another advantage of wireless ENG cameras is the selection of data rates for specific conditions. Operators can choose between QPSK, 16 QAM or even 64 QAM modulation to custom-tailor the data rate for varying degrees of signal/noise performance vs. spectral efficiency, with QPSK offering the lowest bit rate and most robust performance.

Another selectable parameter exists in the transmission pattern. Small, omni-directional antennas for COFDM transmission have even made live shots from moving vehicles a relatively simple task. In static situations, however, range can be increased by using antennas with switched 90-degree segments, enabling the concentration of power over a narrower polar pattern. This represents a significant ENG advance because antenna alignment has typically stolen valuable time in setting up live shots. Recent developments in auto-tracking antennas promise to further increase range without sacrificing RF durability. In situations where multiple mobile cameras are needed inside a large building, receiving antenna arrays can be strung though the rooms in a manner long used by TV sound people for continuous pickup of wireless microphones. In fact, one new offering for wireless ENG cameras is diversity reception with two tiny truck-mounted rooftop antennas.

Operators must become familiar with the effects of combining MPEG-2 parameters such as 4:2:2 and 4:2:0 chroma sampling with the selectable modulation schemes for COFDM to suit local conditions because results can vary substantially. Adjustable group of picture (GOP) structure, the type of forward error correction (FEC) and horizontal picture resolution have dramatic effects on picture quality, so good results are anything but automatic. Longer GOP intervals will increase latency, a vital factor in cutting these shots with those from wired cameras. Over the past year, latency rates have decreased to less than two frames. Among the current models, the DVCPRO format and wavelet compression are being used, but most manufacturers have stayed with MPEG processing for its ability to get a quality picture onto a QPSK or 16 QAM bitstream.

Package options

As the technology has evolved, its box has shrunk and moved from trucks to the cameras themselves. The latest stage has seen standard battery mounts applied to the transmitters for mounting directly on the back or side of the camera batteries. Makers of dockable cameras have enabled substitution of the recorder section by a matched-mount COFDM transmitter. Of course, this trades local recording capability for increased live mobility. BE

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

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SYSTEMS DESIGN SHOWCASE

Court TV's

When Court TV was launched as a start-up operation on July 1, 1991, its original location was not built with the intention of it becoming a broadcast facility. It was essentially pieced together without the infrastructure that is essential for such facilities. This included unsuitable HVAC and power. Twelve years later, the network's viewership had grown to nearly 80 million viewers, but the basic facility had remained unchanged. It was time to upgrade the entire operation. After that long on air, the original infrastructure and equipment was nearing the end of its life. The facility had to be upgraded in all aspects, from the building essentials to the technology being used. It was decided to find space in the network's existing Manhattan building for a new network operations center (NOC).

After several venue changes, the building's 20th floor was settled upon as the final location for the new NOC. The team allocated about 3200 square feet for an electrical room, a mechanical room, HVAC, a new master control room, equipment center, some network operations support space and a staff break room.

Above: Court TV's new master control room is the showpiece of the network's new digital network operations center. Three 67-inch Barco Janus projection screens driven by Hydra processors assist operators in monitor the health of the facility's systems and ensure that media shows up on playlists where it is needed. Photos courtesy George Kopp.

new NOC

BY JOSEPH SCHWINGHAMMER

Converting to digital asset management

Project goals

In addition to the total redesign of the facility and an upgrade to digital technology, a fundamental goal was to achieve improved content movement and facility workflow through a digital asset management system. Such a fundamental alteration would be based upon the creation of a centralized machine room that would serve as the foundation for a networkwide technology makeover. A.F. Associates of Northvale, NJ, was brought in for guidance on the overall facility design and implementation. Concadia Solutions provided expertise for the asset management portion of the redesign.

There are significant challenges in a conversion to a digital asset management system. Operations workflow issues in this kind of environment constitute a whole new way of working technologically, and getting all hardware and software vendors to ensure compatibility is important. Even getting different companies to work together can be a challenge. In the case of the new facility, they all came through and no serious problems were encountered, due largely to an extensive advanced planning stage.

Even when logistical issues are solved, it is still a significant challenge to get internal staff to think differently about the way they work. That is a big adjustment. The jobs of operators at Court TV have changed. Instead of pushing buttons and timing segments, they are checking logs and monitoring the health of the facility's systems. They are also doing more things up front to set up processes and ensure that the media enters the system properly and shows up on playlists where it is needed.

So in order to move forward with a better looking and sounding signal, laying a digital framework was critical. Also, to move to a digital asset management system, obviously a change to digital was mandatory – beginning by converting the assets into a digital format.

One of the fruits of going digital was eliminating tapes moving about the facility. It also allowed the implementation of a system that relied much less on the human element and more on technology and software. This meant converting the facility to an entirely server-based environment supported by a digital robotic archive. The final result was a facility with high reliability and consistency.

Profile XP servers were selected for many reasons, including Court TV's positive experience with Thomson Grass Valley's line of video servers. The new facility utilizes two PVS 1026s for play to air, and one PVS 1044 for ingesting the content. Each server is equipped with 1.8TB of storage. The network encodes its material at a bit rate of 18Mb/s. The servers are driven by Sundance Fast Break Automation in a mirrored configuration backed by a digital archive.

One of the fruits of going digital was eliminating tapes moving about the facility.

Technical plant

The team chose a Sundance system with a high level of redundancy. The facility uses a main and backup air station for both the East and the West Coast. The List Sync backup air station receives automatic updates from the primary air station. This ensures that playlist changes are reflected on both stations without manual intervention on the backup.

Sundance also wrote a codec to allow the automation log to be pushed to the DNF 3040 controller. The 3040 drives a server port on the ingest server, providing yet another layer of redundancy and diversity.

At the heart of the archive system is EMC's AVALONidm software running on a Sun Microsystems V880 server backed by an ADIC Scalar 10K robotic archive. The robot is equipped with 10 Sony AIT-3 tape drives. The AIT-3 tape format was chosen because its storage capacity and media costs offered an attractive combination. Sundance issues archive requests through AVALONidm to the ADIC library. The system combines the storage of on-air footage under control of the automation system, and the digital video contained in the servers. The latter material, as high-resolution files, are managed by the AVALONidm software. The V880 is directly connected to approximately 4TB of disk cache storage. Policies established within Avalon determine what media files reside on the disk cache and what files will be moved onto digital tape in the Scalar 10K.

Content files that haven't been accessed for a user-defined time period

are automatically deleted from the disk cache system, while all files are saved for long-term backup on data tape. This keeps the disk cache system free for new or more frequently used files.

When material is sent to the archive, the asset management software also copies a file to a Dell Power Edge running Telestream's Flip Factory. Telestream flips the files into a 1.5MB MPEG-1 file with embedded frame-accurate time code that is sent back to the array. These proxies can then be accessed across the facility's wide area network from a standard Windows or Macintosh workstation by virtue of the Avalon XDSM file system client. Concadia also provided Court TV with an asset management system for graphics assets based around Canto's Cumulus product, which provides check-in/check-out and Web publishing. The graphics elements are also stored on the spinning disk cache and in the ADIC robot.

The machine room shown above contains the core infrastructure for Court TV's network operations center, including a Thomson Grass Valley Trinix 256x256 SDI router, a Sun Microsystems V880 running AVALON, an LSI Logic spinning disk cache, and Motorola's DigiCipher II transmission platform.

Concadia also tied the asset management system into the editorial department to expedite the flow of station promos to air. Telestream allows editors working on an Avid Unity system to take files and post them in a hot folder. Telestream grabs those files and converts them to the Profile's GXF server format and puts them on play-to-air servers. This removes a step by allowing promos to be cut and sent straight to air without having to go through the intermediate stage of recording to tape and sending that tape to playout. The system permits going both ways, to and from the edit suites.

An Axon TX-Compliance recorder allows the sales department to record digitally in an MPEG format. Previously the network used VHS machines for recording air checks. The recorder provides 90 days of storage at 500kB. Each day's program can be segmented into small sections of user-defined length. These segments can then be viewed by time and date and even edited. When programming issues arise, the segments in question can be e-mailed to the appropriate parties.

Metadata is attached and media is encoded into a digital format at encoding stations in the facility. The encoded media is then pushed to the archive using AVALONidm software.

Another goal of the NOC rebuild was to allow for truly discrete master control switching for the East and West Coasts. In the past, the West Coast was simply a three-hour delay of the East Coast feed. Ad sales requested the ability to carry discrete programming and commercials to a West Coast audience.

To help facilitate this, the team installed two Thomson Grass Valley

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Project team

Court TV
- Joe Schwinghammer, VP, eng.

A.F. Associates
- Tom Michaels, project manager
- Mario Patuto, automation

Concadia Solutions
- Patrick Turner, sr. system arch.

Equipment list

Thomson Grass Valley
- Profile XP servers
- M2100 MC switcher
- Trinix DV 33-256 router

Sundance
- Fast Break Automation
- List Sync

DNF 3040 controller
EMC AVALONidm software
Sun Microsystems V880 server
ADIC Scalar 10K robotic archive
Sony AIT-3 tape drives
Telestream's Flip Factory
Avid Unity
Axon TX-Compliance recorder
Chyron
- Duet LEX CG
- MAX! graphics system

Leitch Logomotion
Motorola DigiCipher II platform
Middle Atlantic Products equipment racks

M2100s. Evertz X1202Ss are used for backup switching. Graphics elements are derived from two Chyron Duet LEX character generators with clip player option. Other graphic elements such as bug and ratings information originate on two Leitch Logomotions. A Chyron MAX is also employed for supplying the newscrawl. For inserting the caption and XDS data, an Evertz 8084 is being used. Orban Optimod 6200s handle the audio processing.

The team decided on a centralized router with a chassis big enough to expand as needed. This would be a critical component in the next phase of the facility rebuild and it was important to size it appropriately. Court TV chose to run with embedded audio and installed a Thomson Grass Valley Trinix DV 33-256 router with an Encore control system.

EMC's AVALONidm software on a Sun Microsystems V880 server, backed by the ADIC Scalar 10K robotic archive shown above, is at the heart of the facility's new digital asset management system.

The facility also employs the Motorola DigiCipher II platform for transmission compression. The primary DC II encoder is located at the new facility. A second encoder is located at the Ascent Media uplink site in Northvale, NJ. This provides separate, yet redundant processing while offering central control over both units from the NOC. The project also included the addition of the DigiCipher Event Manager for administering affiliate cue tones.

As a signature of the conversion to digital, it was decided that the master control room should be turned into a showpiece. To provide the eye candy, three 67-inch Barco Janus projection screens were installed and stitched together to appear as one large screen. The projectors are driven by three Barco Hydra processors. This allows up to 90 images of any size to be displayed at any one time. All sources can be displayed with tallies, alarms and audio metering. Forecast Consoles provided all of the furniture in master control.

Court TV has taken a huge step forward. Working with the engineering and design teams at A.F. Associates and Concadia, it has created a state-of-the art facility that meets current needs and is prepared for the network's future. BE

Joe Schwinghammer is vice president of engineering at Court TV.

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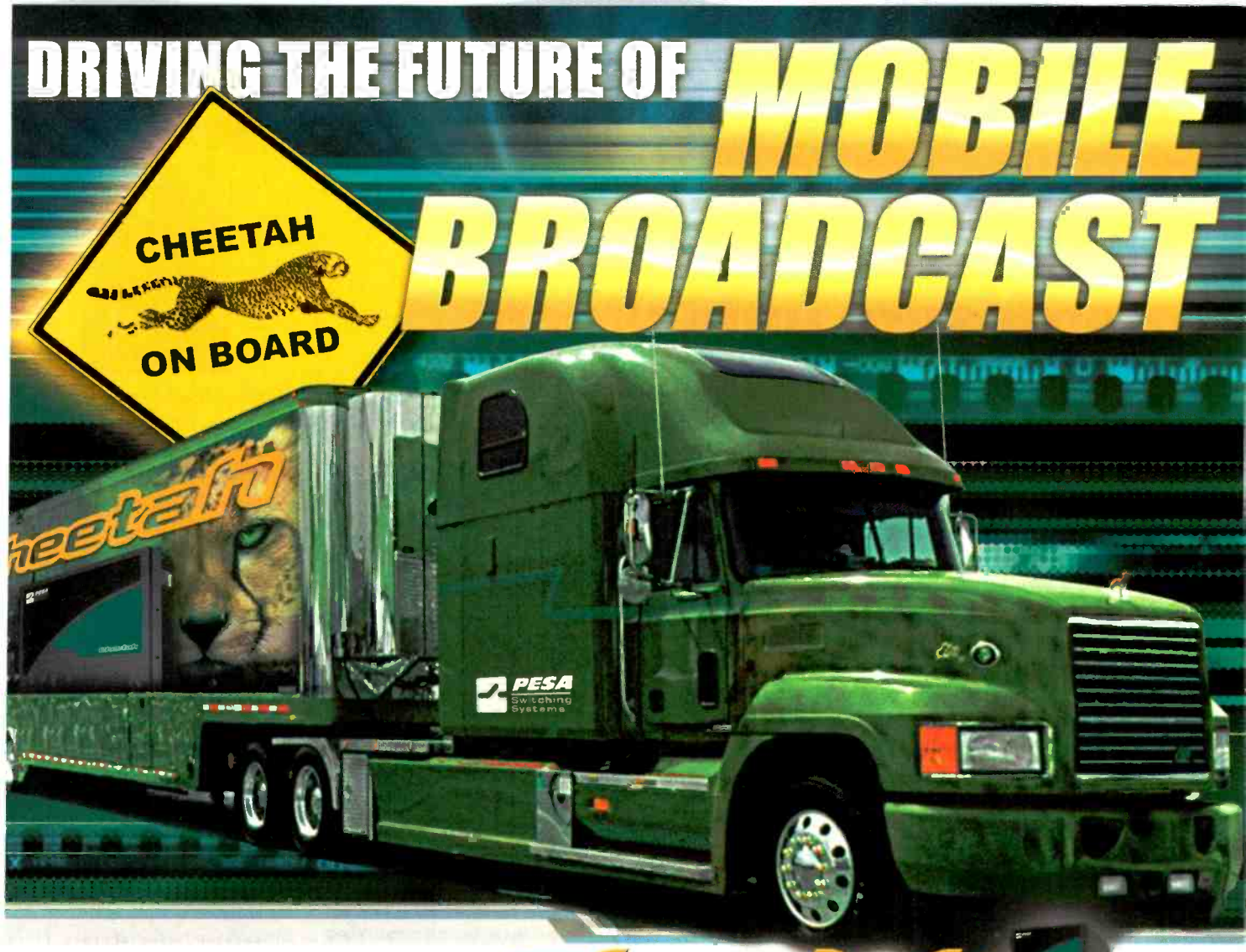

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RF exposure guidelines

BY DON MARKLEY

This month's column might be called "Avoiding the toasty-critter syndrome" or "How to fight fear and superstition." Either of these would be equally appropriate for those unfortunate enough to have to defend their existing or proposed RF facilities in a public forum.

If your proposed station modification requires the approval of a zoning board, zoning board of appeals or any similar group, the question of exposure to non-ionizing radiation is bound to come up. You need to accept the fact that some well-meaning members of the community are honestly and sincerely concerned about the health and safety of themselves and others. Such people deserve your attention and a full explanation of the possible effects of your proposed facilities. There are also those who aren't worried; they realize that you aren't going to turn them into toast. But, inevitably, you will have some kooks who arrive with a 1952 article from *Popular Mechanics* that they claim holds the definitive word on the matter.

Be informed

Prepare for these meetings by making an immediate and concerted effort to inform yourself of the applicable regulations. Start with our old friend, the Rules and Regulations of the FCC. Section 1.1310 is a brief but meaningful little paragraph that refers you to OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation." You will also find charts of the basic limits for and definitions of the terms "occupational/controlled exposures" and "general population/uncontrolled exposure."

Several government agencies provide guidelines that facilities should use to limit people's exposure to non-ionizing radiation (see article).

Exposure levels

Essentially, there are two levels of exposure about which you need to be concerned: one for people who work at commercial RF transmission sites, and one for the general public. The occupational/controlled level applies in areas where all personnel are aware of the hazard and the exposure is transient and carefully controlled. The general population is protected to a greater degree because they may not be aware that the exposure is occurring. Such exposure might occur where a roof-mounted transmitting antenna exposes people in an adjacent building or people simply walking by the site to RF radiation without their knowledge. The guidelines call for exposing the general population to a level of radiation no more than one fifth that allowed for occupational areas.

The exposures in the rules or contained in the standards are for whole-body exposure averaged over a finite period. For controlled areas, the limit is six minutes; for uncontrolled areas, its 30 minutes. The standards are hard to apply to very localized exposures, as in the case of the state trooper who sued over claimed damage from his radar gun. He had a habit of leaving the device on and placing it in his lap until ready to take a reading – probably setting a new standard for stupidity. You should take reasonable precautions to protect yourself.

There is a wealth of material available to help you prepare to argue your case. Go to good old *www.fcc.gov* (it should already be on your "favorites" list) and then go to "Engineering and Technology."

FRAME GRAB

A look at the consumer side of DTV

Cable growth slowing

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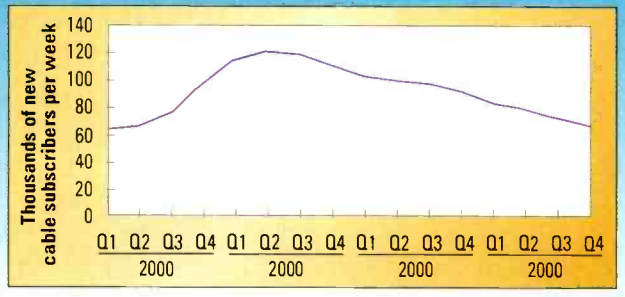

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Educating the layman

The first big challenge is to make sure you inform and educate the public officials involved in the hearing. The general public goes into a semi-comatose state whenever they hear the word "radiation." They really aren't sure what it means, but they automatically assume that "non-ionizing" means that they will be sterilized, vaporized, atomized and generally cooked by any exposure. If you're lucky, the officials whom you must convince are a bit more educated than that – but don't take a chance. The commission prints a document titled "A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance." Download that publication and make sure you distribute it to every member of the board(s) you face, along with a copy of OET Bulletin 56, "Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields." (Notice that the government really isn't big on short, catchy titles.)

FAQs

Finally, those who plead your cause should read the list of frequently asked questions on the Web site with the OET bulletin. That section discusses some of the other agencies that are involved with non-ionizing radiation problems, such as OSHA, NIOSH, Department of Defense, etc., and gives Web pages so that you can review their publications on the subject. The big point here is to be educated concerning non-ionizing radiation and its effects. Even if you fully prepare yourself, it will be difficult to convince some members of the public that they are out of harm's way. You don't have a chance if you aren't prepared.

Modified regulations

The commission has recently proposed a rule that will modify the non-ionizing protection requirements of the Rules and Regulations. Docket No. 03-137 proposes changes to several definitions as well as to the way some radiations are calculated or excluded from calculation. Primarily, these changes affect only the wireless-communications crowd. The existing rules tend to exclude transmitters based on the antenna height above ground. That is being changed to more accurately reflect the distance to the observer, regardless of height. You should review those changes. They might apply to your station's remote-pickup facilities, especially those transmitters and antennas that may be at fixed locations.

In summary, prepare yourself before meeting the public at hearings or attempting to argue your case before public officials. Plenty of good information is available, including OET 56 and 65 (confusing, isn't it), sets of questions and answers, and an excellent guide for public officials.

One problem you might encounter is the desire of local governmental groups to enact their own regulations concerning non-ionizing radiation. Now, that is a rather ticklish area. The Telecommunications Act of 1996 clearly outlaws any regulation of wireless facilities based on the environmental effects of RF emissions. On the other hand, the act doesn't treat broadcast radiation the same way. Maybe broadcasters just don't have as much clout as the wireless folks. But then we knew that, didn't we? BE

Even if you fully prepare yourself, it will be difficult to convince some members of the public that they are out of harm's way.

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

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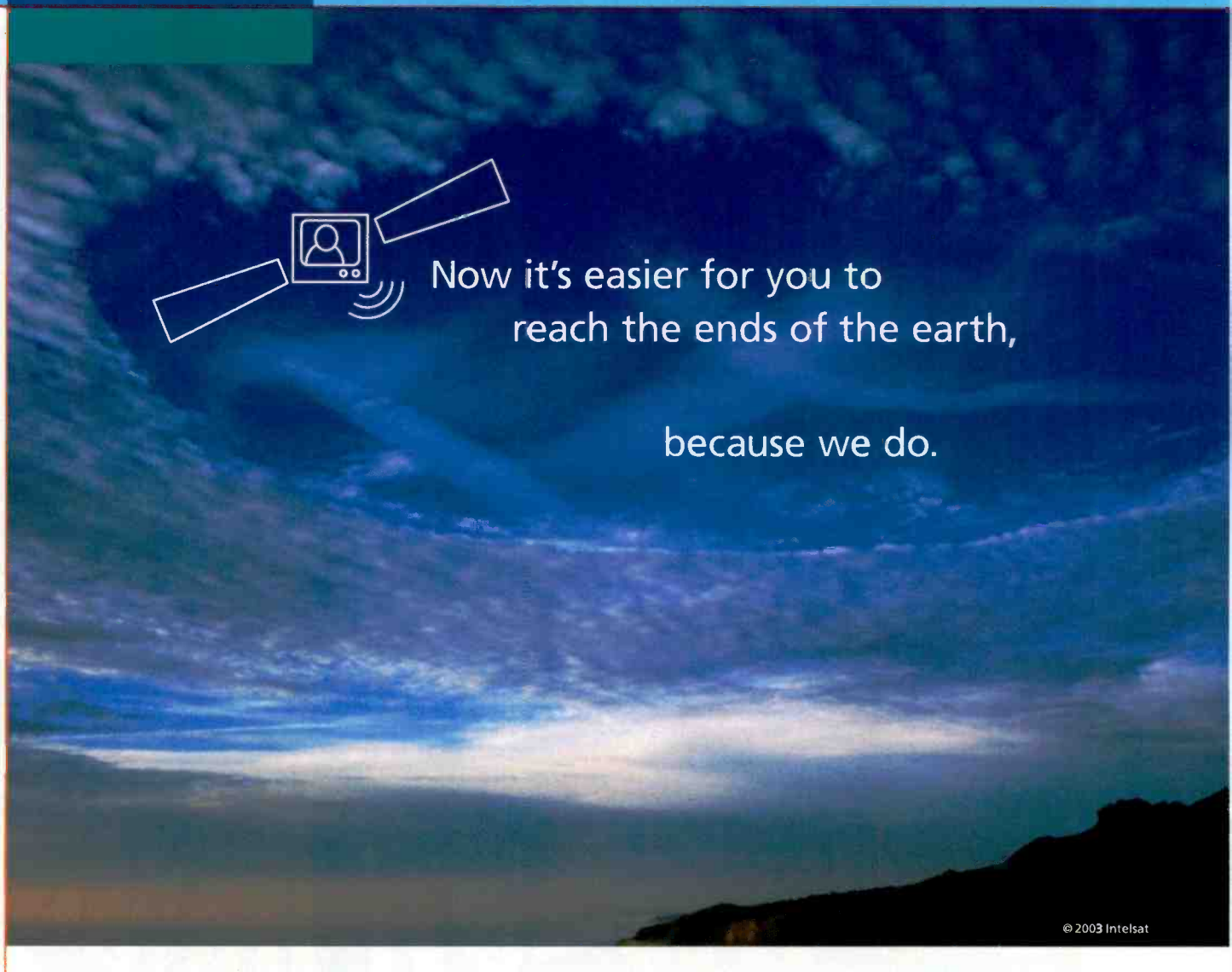

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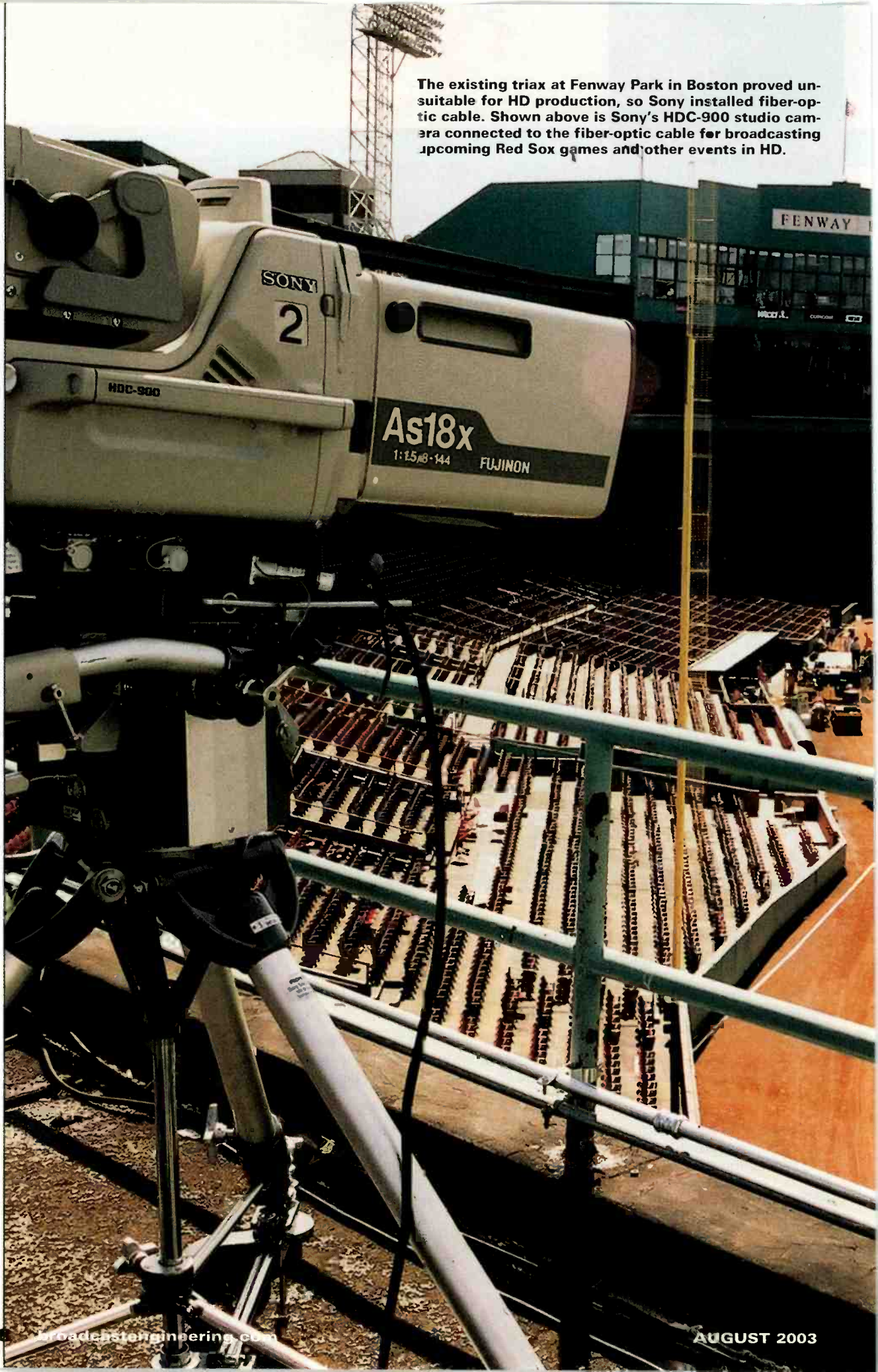
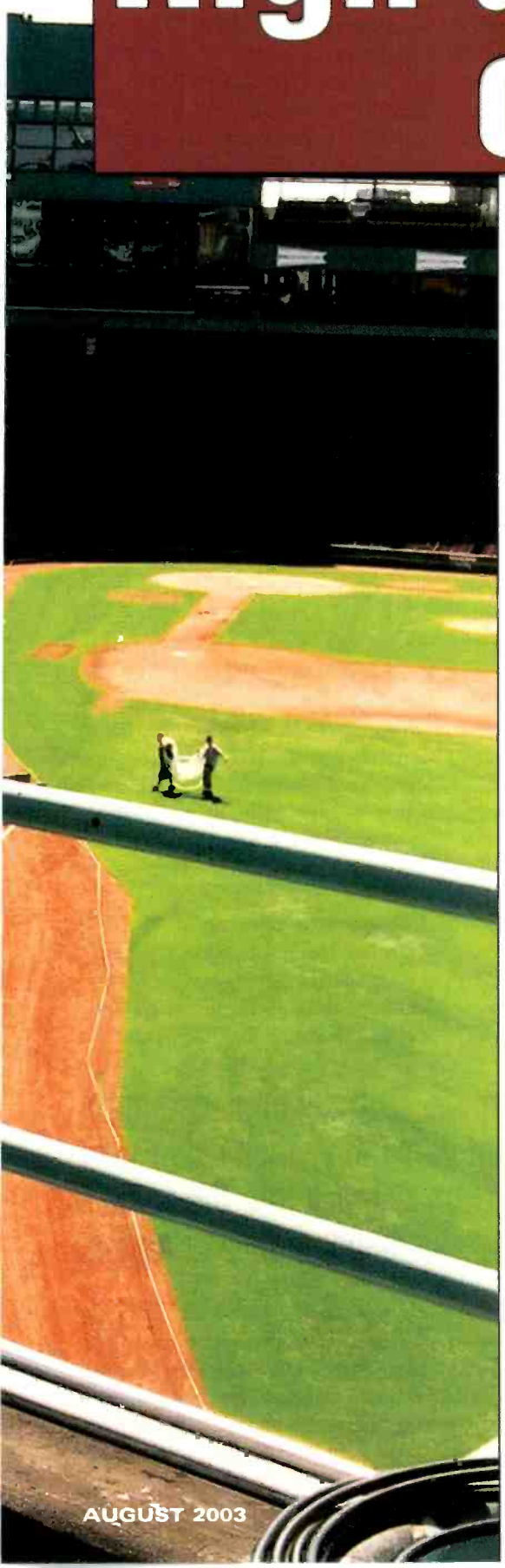


The existing triax at Fenway Park in Boston proved unsuitable for HD production, so Sony installed fiber-optic cable. Shown above is Sony's HDC-900 studio camera connected to the fiber-optic cable for broadcasting upcoming Red Sox games and other events in HD.

High definition over triax



Is it worth the savings?

BY ROBERT P. SEIDEL

Does it make sense to connect high-definition digital cameras to the camera-control unit through analog triax cables? Certainly, the concept has powerful advantages, especially because it represents the current infrastructure in most studios and sports venues. While using triax would eliminate the cost of running fiber-optic cables for each event, the experience of CBS Sports demonstrates that running HD over triax can create visible artifacts on both HD and NTSC home receivers. Further, laboratory tests revealed visible distortions corresponding to timing impairments.

CBS Sports' experience with HD coverage includes a full range of events and venues, including post-season NFL games including Super Bowl XXXV, NCAA football, NCAA Final Four basketball, the Masters Golf tournament, and the US Open Tennis tournament. At the beginning, CBS spent the time and money to connect its cameras to the truck through SMPTE fiber-optic cables.

The quality of fiber

Fiber-optic cable seems the obvious choice because it maintains the camera signal in pure digital form, it offers a range of lengths, and it easily accommodates the bandwidth required for full HD quality. When using fiber, not only does the HD broadcast look great, but the downconverted standard-definition broadcast also improves.

The network recognized that it could save a tremendous amount of time and money if it could use the existing triax infrastructure.

Unfortunately, fiber-optic cable is not permanently installed in most sports venues. This creates a logistical challenge – and an added cost – for HD coverage. HD advertising bears this cost. Consider the typical NCAA football broadcast on a Saturday afternoon. CBS crews need to run miles of fiber on Thursday, broadcast the game in broadband on Saturday, and remove all the fiber on Sunday. Obviously, this is not a good long-term solution.

Initial hopes for HD over triax

The first opportunity to solve the problem was based on an HD-over-triax solution.

The network recognized that it could save a tremendous amount of time and money if it could use the existing triax infrastructure. The goal would be to set up for an HD broadcast in much the same way as for an SD broadcast. The crews could arrive with the truck, install triax jumpers to the breakout panels and broadcast the program – simple and quick.

Figure 1 shows a block diagram of the signal flow from the digital camera(s) through the triax cable in the trial HD-over-triax solution. The camera side of the system includes a digital-to-analog converter and modulation/multiplexing circuitry. On the camera-control unit (CCU) side of the triax cable, complementary electronics include a demodulator/demultiplexer and an analog-to-digital converter. It also includes an auto-compensation circuit that introduces steps of equalization for selected cables lengths.

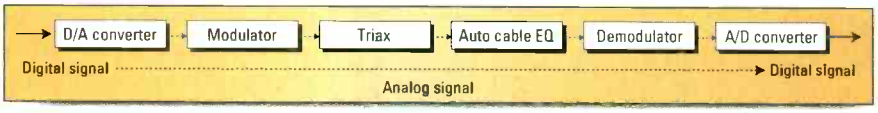


Figure 1. This block diagram shows the signal flow from the digital camera(s) through the triax cable in the trial HD-over-triax solution.

The initial results were disappointing. While the performance of standard-definition component video over triax cable was acceptable, HD runs smack into the cable's bandwidth limitations. Group delay becomes an immediate concern over the 100MHz bandpass required for HD, with horizontal color shifts that can turn a white goal post into separate red, green and blue images. At first, the crew running the test suspected a lens problem, since the image distortions looked like chromatic aberration. Upon further investigation, they realized it was a cable-equalization issue. Also degrading the picture were overshoots and ringing from the band filter and equalizers of the existing triax system.

To be fair, the physical condition of the installed triax infrastructure may also play a role. Installed cables vary widely in terms of age, manufacturer, connector corrosion and exposure to weather and physical abuse. While minor errors due to such physical cable attributes may not be highly detrimental to an SD signal, they can be visibly objectionable in an HD image.

The triax processing generated visible artifacts in the output signals of the cameras. The problems also crept into the NTSC downconverted broadcast. Some knowledgeable viewers complained that the network's traditionally high-quality images were being degraded. More importantly, the HD advertisers/underwriters – which include such companies as Mitsubishi, RCA, Samsung, Panasonic, Sears, Sony and Zenith – were not happy with the pictures.

Laboratory testing

In late November 2002, the entire HD-over-triax camera system was installed in the CBS Engineering lab for detailed testing. Initial tests revealed a delay of about 25 nanoseconds in the red signal relative to the luminance. The effect of the delay was visible on a 20-inch HD monitor. This delay was constant across the image and did not increase with longer triax cable lengths.

While the performance of standard-definition component video over triax cable was acceptable, HD runs smack into the cable's bandwidth limitations.

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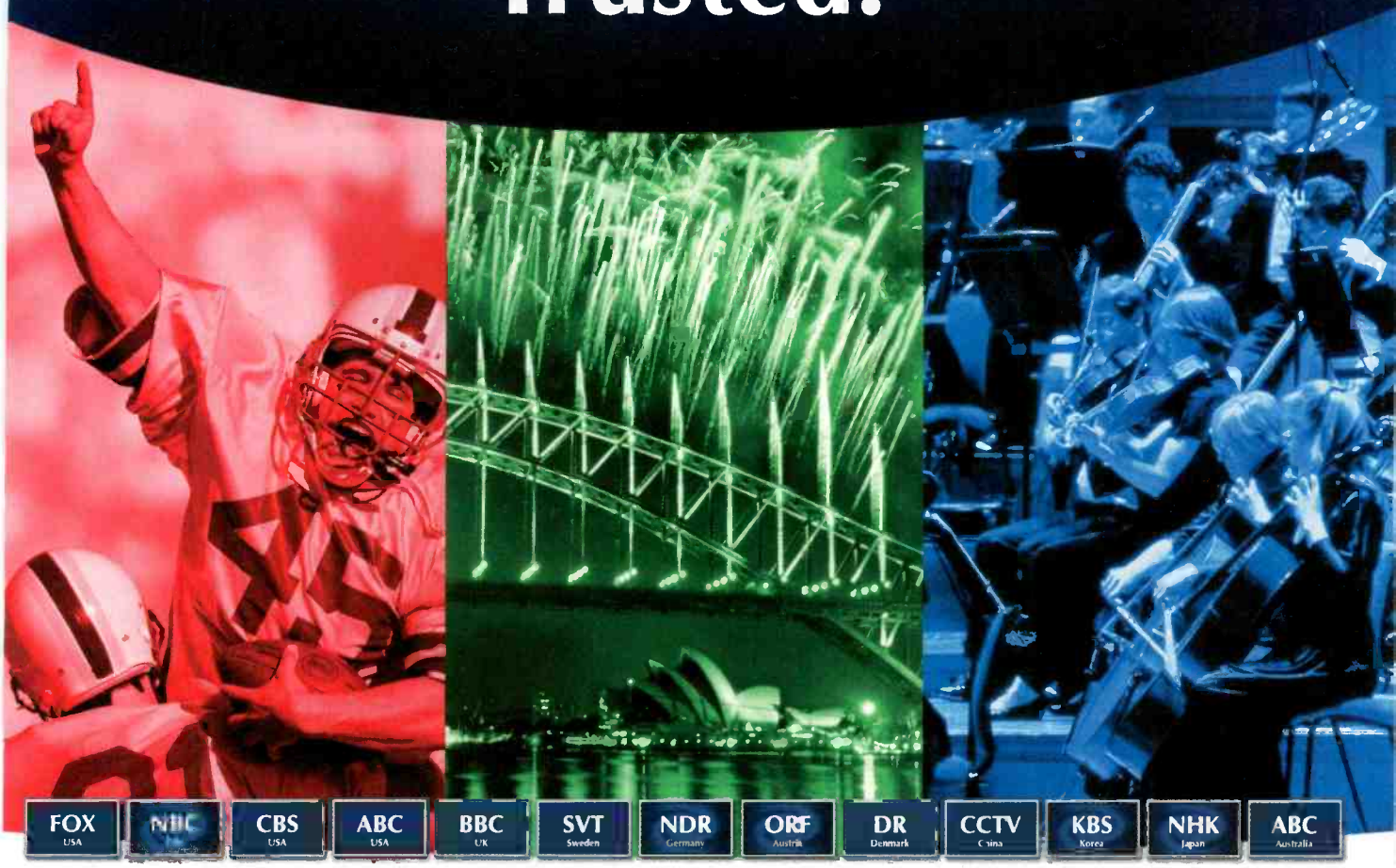

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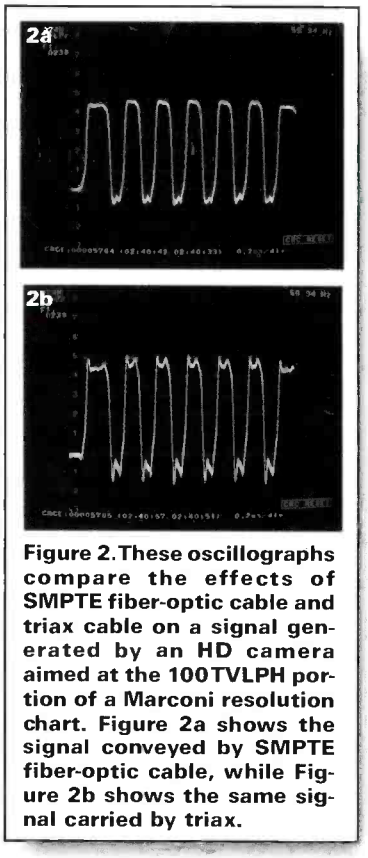

Figure 2. These oscillographs compare the effects of SMPTE fiber-optic cable and triax cable on a signal generated by an HD camera aimed at the 100 TVLPH portion of a Marconi resolution chart. Figure 2a shows the signal conveyed by SMPTE fiber-optic cable, while Figure 2b shows the same signal carried by triax.

The delay was also consistent with the color shifts experienced during actual broadcasts.

For a standard of comparison, CBS technicians aimed an HD camera at the 100-TV-lines-per-picture-height (TVL/PH) section of a Marconi resolution chart and examined the output. Figure 2a shows the camera's signal as carried over SMPTE fiber-optic cable.

Figure 2b shows the 100 TVL/PH signal as carried by triax cable. The HD-over-triax system introduced visible overshoot on the rising and falling edges, distorting sharp transitions.

Adding enhancement at the CCU introduced symmetrical overshoots to the peaks of the 100 TVL/PH signal carried over fiber-optic cable, as shown in Figure 3a. Notice that the peaks are symmetrical. Figure 3b is the same signal carried by the HD-over-triax system and enhanced in the CCU. Note the distortion and asymmetrical overshoots: overpeaked on the rising edge, underpeaked on the falling edge.

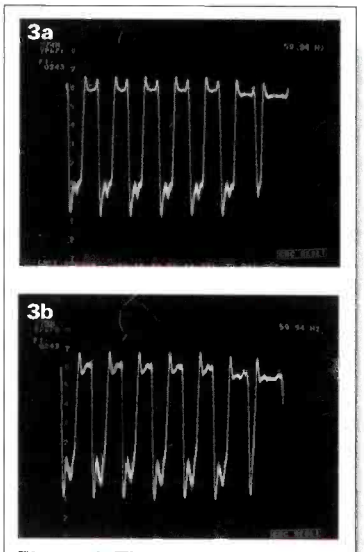

Figure 3. These oscillographs show how enhancements at the CCU affect the signals shown in Figure 2. Figure 3a shows the signal conveyed by SMPTE fiber-optic cable, while Figure 3b shows the same signal carried by triax.

Figure 4a shows the performance of SMPTE fiber-optic cable with a camera signal that includes both 800 and 700 TVLPH. Note the relatively even waveform and the smooth white bar between the test signals. Figure 4b shows this same signal after passing through approximately 150 feet of triax cable. Note the overshoot and ringing in the white bar. The effects are clearly visible on a video monitor. Figure 4c shows the effect of increasing the triax cable length to 600 feet. The problems of overshoot and ringing have become more severe and there is apparent over-equalization of the higher-frequency signals.

It is important to remember that because the cable carries the analog Y, Pb, Pr signals at different frequencies, their resulting equalization and gain is different for each channel. This results in a different set of overshoots and undershoots for each signal. These differences manifest themselves as convergence errors in the resulting picture.

When technicians attempted to conduct interchange tests between different cameras and CCUs, they determined that the transmitter at the camera and the receiver at the CCU needed to be matched pairs to optimize the component signals. This was an unacceptable constraint because it would limit the field crews if they ever needed

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Test summary

Sending HD signals over triax cable resulted in nonsymmetrical overshoots on rising and falling edges, excessive ringing following transitions and unequal color component delays on the order of 25ns. Perversely, the artifacts appear where they are least welcome: before the signals even get to the CCU. The artifacts were visible in both HD picture monitors and in the downconverted signals viewed on SD picture monitors.

A second try for triax

In an attempt to further improve the performance of its HD-over-triax system, the manufacturer subsequently revised the equalization circuitry. Upon evaluation, CBS found that the manufacturer had improved some aspects of picture performance, but only by sacrificing others. It had reduced ringing, but had also reduced frequency response. The results were still unacceptable, and CBS Sports crews have returned to using SMPTE fiber for HD camera cabling.

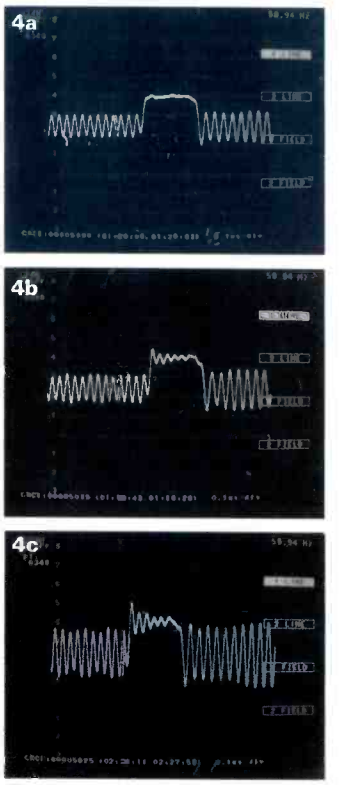

Figure 4. These oscillographs compare the effects of SMPTE fiber-optic cable and triax cable on a signal generated by an HD camera aimed at the 800 TVL/PH portion of a Marconi resolution chart (left) and the 700 TVL/PH portion (right). Figure 4a shows the signal carried by fiber-optic cable, Figure 4b shows the signal carried by 150 feet of triax cable, and Figure 4c shows the signal carried by 600 feet of triax cable.

Stadium cabling: The future

The return of CBS Sports to fiber camera cabling also means a return to the added cost of supplying and removing fiber at venues where it is not permanently installed. But there is reason to hope this annoyance is temporary. The triax cable infrastructure currently in stadiums and arenas didn't get there by accident. It was the result of the cooperative efforts of an earlier generation of executives from broadcasting, sports leagues and teams, and stadiums.

Initial discussions are underway for a similar collaboration to meet the needs of HD broadcasting. The aim is to install permanent fiber infrastructure in stadiums and arenas. CBS supports these efforts. The network believes that permanent fiber installation is in the interest of all the stakeholders: leagues, teams, stadium owners, broadcasters, cable companies and satellite providers. Collaboration to meet industry requirements worked well in the era of SD. It will work again in the era of HD. BE

Collaboration to meet industry requirements worked well in the era of SD. It will work again in the era of HD.

Robert P. Seidel is vice president of engineering and technology for the CBS television network.

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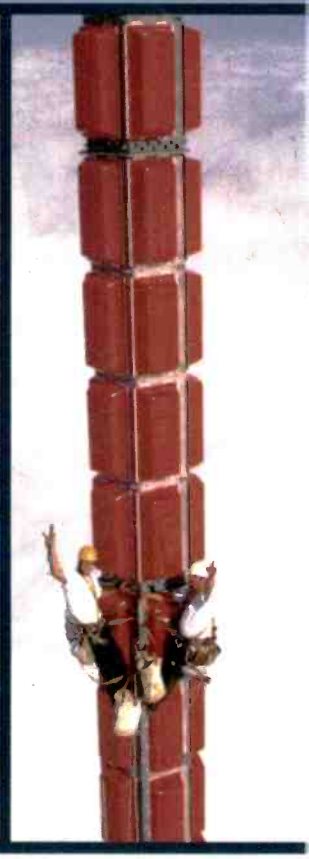

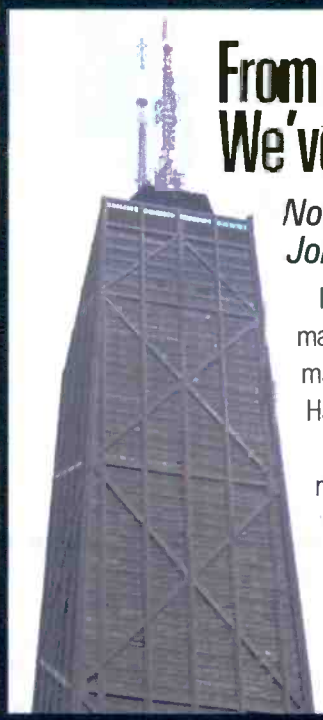

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DTV over digital cable

Reaching a larger audience

BY BILL ZOU

Why should broadcasters concern themselves with having cable operators carry their DTV signals? Well, consider these numbers. Right now, more than 75 percent of U.S. households receive television by cable, and roughly 20 million of these households subscribe to digital cable. Over 91 cable markets now receive HDTV service and the number is growing rapidly. The installed base of ATSC (8-VSB) receivers in the United States is tiny by comparison, currently measured in hundreds of thousands.

It takes more than a new antenna and transmitter to reach U.S. audiences with DTV. Cable carriage of broadcast DTV signals is critically important to broadcasters and station group owners who want to extend their reach to cable viewers.

Digital cable system overview

In the United States, digital cable networks are based on quadrature amplitude modulation (QAM) in 6MHz channels. There are two standard QAM implementations for cable: 64 QAM and 256 QAM. HDTV-capable cable set-top boxes are rather new and operate with 256 QAM. This modulation yields approximately 38.8Mb/s in a 6MHz channel. Many older set-top boxes work with 64 QAM at 26.94Mb/s, but these boxes rarely support HDTV decoding.

Cable headend processing

Figure 1 shows how a typical digital cable system processes incoming signals and remultiplexes them for digital cable distribution. The cable headend accepts signals from several sources including satellite feeds, analog local cable programming, off-the-air DTV broadcasts, and direct feeds from broadcast stations over fiber, microwave and WAN. Receivers and encoders process the incoming signals and convert them to asynchronous serial interface (ASI) MPEG-2 transport streams. From there, the streams undergo several processes, including grooming, rate shaping, metadata processing (e.g., PSIP data), remultiplexing and encryption. After processing, the cable system modulates the datastream (using 64 or 256 QAM) and distributes it to its customers over hybrid fiber/coax (HFC).

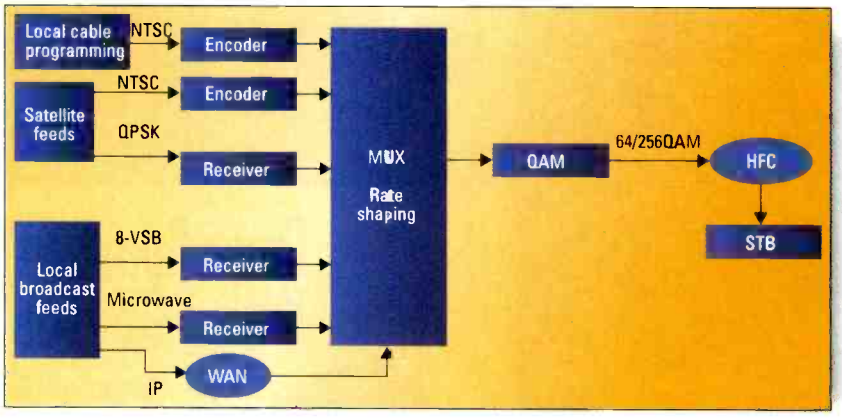

Figure 1. A typical digital cable system processes content from satellite and local broadcast and remultiplexes it for digital cable distribution.

Grooming

From the MPEG-2 transport streams, the digital cable system selects the specific programs and services it wants to carry and groups them into different levels of service for its customers. This process is called grooming. It involves dropping programs and/or services and re-mapping packet identifiers (PIDs) and tables to prevent potential conflicts with existing PIDs and tables. In addition, the grooming equipment must create a new cable virtual channel table (VCT). And, to preserve program-guide information from the incoming PSIP, the equipment modifies the PSIP to reference the new PID numbers. Since this additional processing adds to the cost of the grooming equipment, some cable operators might opt to drop PSIP altogether.

Stations that add new services after the cable system equipment has been configured may find that their new services are not automatically passed to cable viewers unless the cable operator has provisioned them in advance.

Rate shaping

A cable operator often must change the bit rate of incoming datastreams to fit its own bandwidth requirements. To avoid the detrimental effects of fully

This digital cable headend installed in a facility in China accommodates several program sources and is equipped with encoders, multiplexers and stream processors.

decoding and re-encoding these streams, not to mention the added expense of decoders and encoders, cable operators often use a process called rate shaping. it converts one bit rate (usually relatively high) into another (relatively low) by processing the signal in the compressed domain. Rate shaping may also transform video streams from constant bit rate (CBR) to variable bit rate (VBR) or it may reduce VBR to lower rates. But rate shaping also has its limitations.

The rate-shaping process first involves removing any null packets, which reduces the bit rate without degrading video quality. It then analyzes the MPEG-2 transform coefficients – the mathematical information that MPEG-2 uses to describe the video – and rounds them off in a process called requantization. This process achieves further bit-rate reductions. But requantization is a lossy process and, under stressful conditions, it may result in artifacts. Requantization is relatively harmless to MPEG-2's B frames, but it must be applied very judiciously to I and P frames because they contain the reference information that the process uses to reconstruct the predicted P and B frames.

Removing null packets and performing requantization are the only tools that rate shaping can use to reduce bit rate. By contrast, modern MPEG encoding implements complex strategies such as motion estimation, coding mode selection, GOP structure and other compression tools. Good encoders constantly evaluate video complexity, varying their encoding strategy to maintain optimal performance.

When the amount of bit-rate reduction is small compared with the incoming bit rate – for example, when reducing the bit rate from 10- to 8Mb/s - the rate-shaping process typically yields good video quality. But when the reduction is relatively large (for example, from 3- to 2MB/s), rate shaping yields poorer results than MPEG decoding/re-encoding. Rate-shaping systems perform best when reducing rates by less than 25 percent.

Rate-shaping systems perform best when reducing rates by less than 25 percent.

Statistical multiplexing

Video complexity is a function of both motion and detail. Highly complex pictures (such as basketball game in HD) combine intense motion with high detail. Program material complexity varies over time. Even programs that we associate with high complexity have interludes of little or no motion. Likewise, simple programs have transitions and camera movements that create intense motion for short periods. Statistical multiplexing takes advantage of unevenly distributed peaks and dips in individual streams by dynamically allocating more bits to the programs with the most complexity, statistically averaging the complexity across several channels. A disadvantage of this process is that the coincidence of high motion and high detail in two or more program streams can adversely affect the picture quality of a third, low-motion, low-detail program. The best way to avoid this is to avoid grouping complex channels (such as HD sports channels) together and, instead, group each complex channel with a relatively simple one (such as an SD news channel).

How cable handles broadcast TV

Multiplexing two ATSC channels, each with a payload of 19.39Mb/s, into a single 38.8Mb/s 256 QAM cable channel is a straightforward process. Of course, the cable operator would have to remap any conflicts in PIDs. It may also have to drop broadcast PSIP tables and create program-association tables (PATs) and program-map tables (PMTs). Cable set-top

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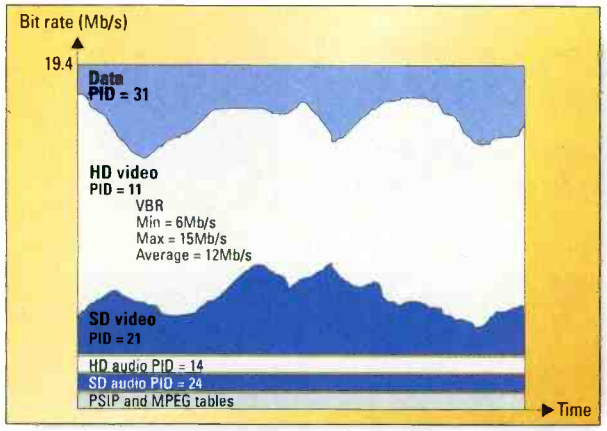

Figure 2a. Station X transmits one HD program, one SD program and broadcast data, and encodes all three services at a variable bit rate.

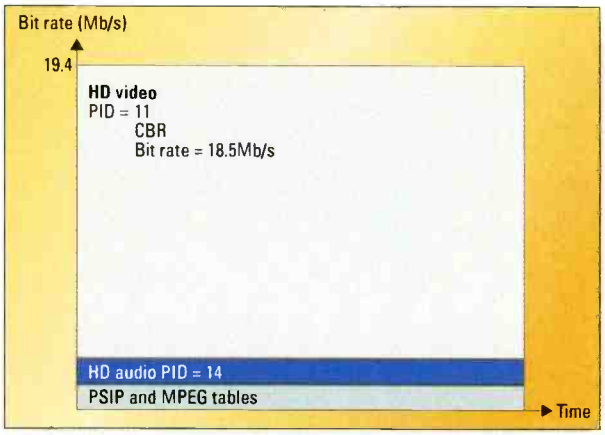

Figure 2b. Station Y operates a single HD service at a constant bit rate.

boxes do not use PSIP, although this may become important when cable-ready DTV sets become available. Because PSIP processing adds to the cable companies' cost, the companies are unlikely to implement it in the absence of cable-ready DTVs.

Figures 2a and 2b show examples of two DTV transport streams prior to processing at the cable headend. Station X transmits one HD program, one SD program and broadcast data. It encodes all three services at a variable bit rate for efficient use of the 19.4Mb/s ATSC transport stream. Station Y operates a single HD service at a constant bit rate of 18.5Mb/s for HD video. Both stations use an identical PID for their HD video streams.

The cable operator combines the streams from Station X and Station Y, modulates the combined transport stream in 256 QAM and transmits it through a digital tier in a 6MHz channel. Figure 3 shows the new combined transport stream for digital cable. The cable operator has changed the Station-Y PID for the HD service from 11 to 111 and the audio PID from 14 to 114. The operator has also decided to drop this station's PSIP tables to conserve bandwidth. For the Station-X transport stream, the operator has dropped the broadcast PSIP tables but retains the same PIDs.

MSOs will have to do more than grooming to carry the increasing number of higher-bit-rate HD programs available. Combining three DTV/HDTV signals in a 256 QAM transport is an option. But transmitting three broadcast DTV/HDTV signals in 6MHz requires rate shaping to get the total of 54Mb/s (an average of 18Mb/s per signal) down to 38.8Mb/s for a 256 QAM channel.

Opportunities and challenges

Clearly, broadcasters prefer that cable operators retransmit their DTV signals without rate shaping or reducing original content. But, to conserve bandwidth, cable operators must often do one or the other – or both. The question for broadcasters then becomes: What are the alternatives?

Rate shaping works well when the cable company requires only a small percentage of bit-rate reduction – typically, less than 25 percent. For the example of three HD programs in a 256 QAM cable channel, the average bit rate per HD program is approximately 12.5Mb/s. Therefore, the ideal input to a rate shaper ranges from 12.5 to 16Mb/s. Cable operators could obtain optimal results by operating the encoder at the lowest bit rate that achieves high-quality pictures prior to rate shaping.

VBR encoding of the original broadcast DTV signal may provide a more

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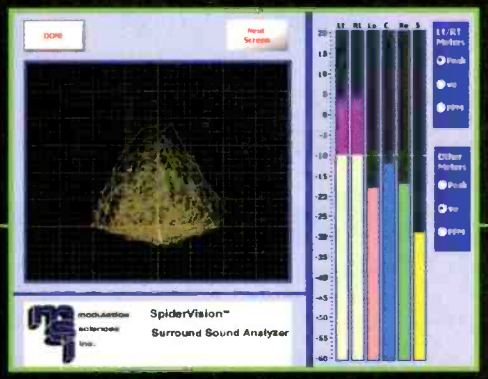

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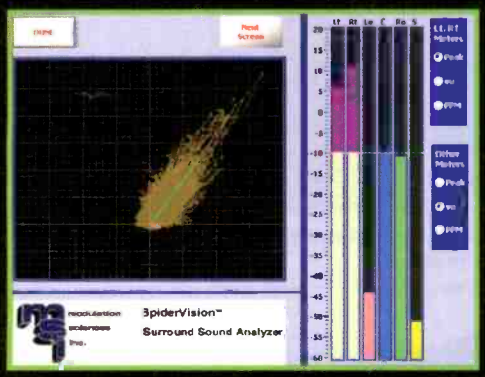

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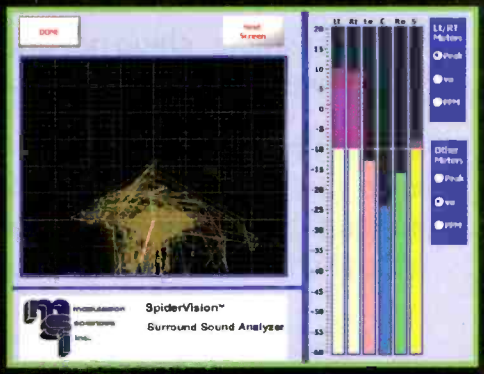
The built-in, full color display is bright and easy to see. In a half-rack wide case, ***SpiderVision*** has the same form factor as a standard waveform monitor for easy mounting. With a simple push-button or remote screen selector, ***SpiderVision*** is a true "plug and play" instrument. Some important user selectable features include operating level adjustment, vu, peak or ppm metering standards and ***SpiderVision*** or standard XY display modes.



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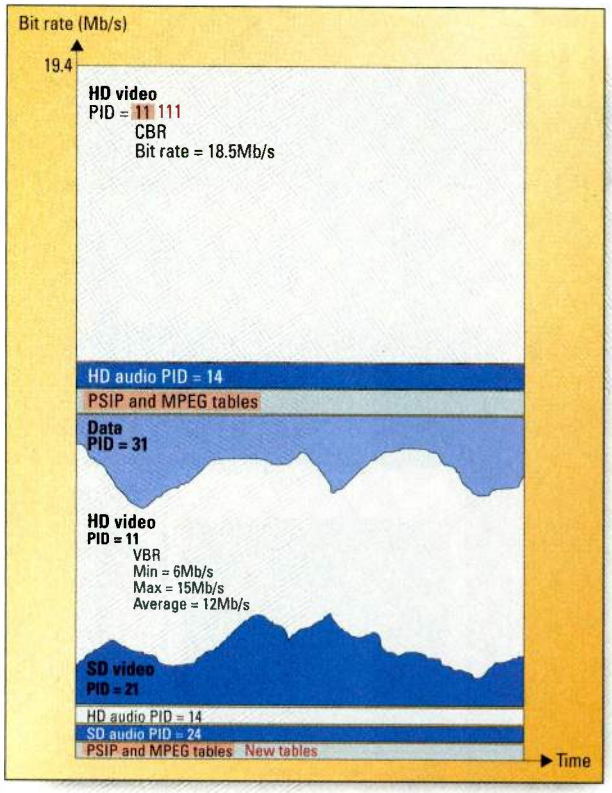

Figure 3. The combined streams from Station X and Station Y

optimal input to the rate shaper than CBR. It is difficult to select the optimal CBR encoding rate. If the encoding rate is too low, the program or picture shows artifacts. If it is set too high, the rate shaper operates outside the optimal reduction range much of the time. A high-efficiency VBR DTV signal is likely to optimize the rate shaping process.

Broadcasters could improve and thus control picture quality by cooperatively encoding a statistical multiplex pool with a direct feed to the cable company. For example, three local stations could avoid rate shaping by the cable operators if they were to work together using closed-loop statistical-multiplexing encoding to form their own 38.8Mb/s cable feed (see Figure 4). This approach provides better quality than the alternative of three stations independently encoding and distributing their programming to the cable operator. Of course, the local stations would have to cooperate closely and provide dedicated encoding for cable carriage.

Another concern is that rate shaping will worsen artifacts generated by the encoding process. If the original encoder is stressed enough to produce even slightly visible artifacts, these artifacts are likely to become more pronounced after rate shaping. Therefore, it is always a good idea to use efficient, high-quality encoders for the emission and last-mile-delivery processes.

As with carrying NTSC programming, broadcasters know that carrying their DTV signals over cable is vital to reach a majority of their viewers. Now that many DTV transmitters are up and running, the time is right for broadcasters to contemplate DTV carriage over cable.

Acknowledgement: The author would like to thank Michael Guthrie at Harmonic for his contribution in writing this article. BE

Bill Zou is Broadcast Solutions Marketing Manager for the Convergent Systems Division at Harmonic.

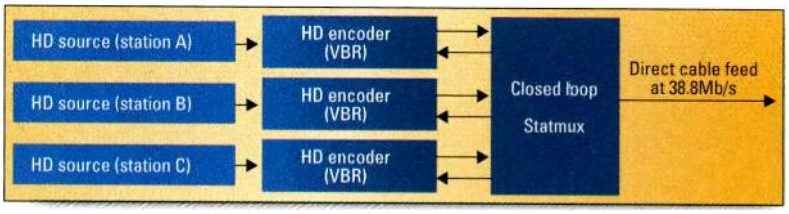

Figure 4. Three local stations could use closed-loop statistical-multiplexing encoding to form their own 38.8Mb/s cable feed.

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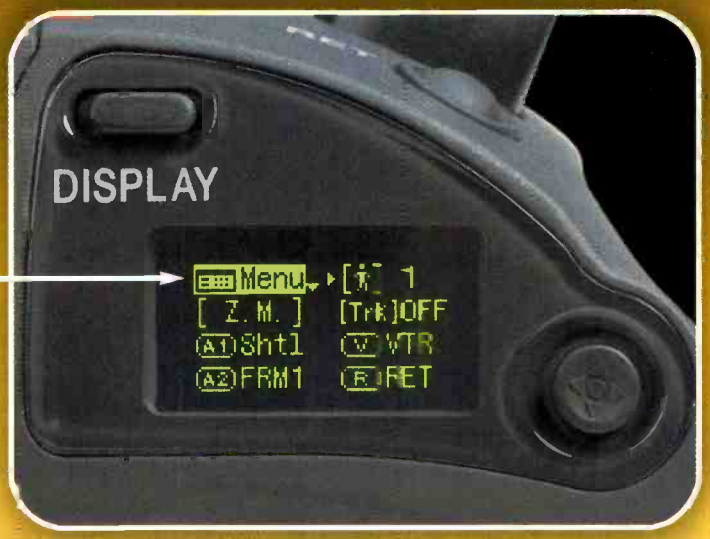

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CMOS image sensors

Making HDTV cameras affordable

BY LES KOZLOWSKI AND
MARKUS LOOSE

Today's broadcasters are confronting challenges that arguably are the most daunting they have ever faced. On the one hand, tight budgets and shrinking resources are forcing deepening cutbacks. Yet, there has never been as much competition in our shrinking world, nor as strong a need to do more with less. To top it off, there is the pending mandate to shift from good old NTSC to HDTV. In essence, the choice is to have lunch or to be lunch. Fortunately, the semiconductor industry – the engineer's equivalent of the US 7th Cavalry – has been winning similar battles for several decades.

This photo shows the ProCamHD 3530 CMOS image sensor in a standard 65-pin PGA package. Three such sensors are incorporated into the new HD cameras being developed by JVC and Ikegami.

The tireless march of Moore's law has transformed consumer electronics, and will transform broadcast and ENG cameras in much the same way. Broadcast professionals have already benefited from complementary metal-oxide-semiconductor (CMOS) application-specific integrated circuits (ASICs). Now, CMOS image sensors permit creative and affordable HDTV production. Ultimately, they will yield programmable electronic film with unprecedented video sensitivity.

Keep the noise down

CMOS-based image sensors, like the ubiquitous charge-coupled devices (CCDs), are made with silicon and use photodiodes to detect light. But the similarities end there. They differ radically in the way they handle the resulting electric charges.

CCDs noiselessly shift the photo-generated charge from one charge-handling bucket to the next until the packet reaches the output structure. Unfortunately, this structure generates noise in the electronic bandwidth of the ensuing video signal. The supporting video ICs remove some of the noise – specifically, the reset noise from the "sense" capacitance that converts the charge into a voltage – using correlated double sampling. The supporting ICs then digitize the video stream. The noise not removed by these ICs remains in the video stream. This noise rises with frequency at about 3dB per octave and restricts the camera's signal-to-noise ratio (S/N).

By contrast, CMOS sensors can handle the signal in a way that significantly reduces noise. In the lowest-noise CMOS sensors, the photo-generated current is immediately converted to a voltage at a relatively narrow electronic bandwidth. Successive stages of analog and digital processing in the CMOS imaging system on chip (iSoC) suppress the temporal and spatial noise to the level allowed by the underlying CMOS technology.

Size matters

The photolithography process that semiconductor manufacturers used in the early '90s to "print" the pixels and supporting circuits in nascent CMOS image sensors was crude by today's standards. The size of the smallest structures on these sensors was about one micron. And each CMOS chip held no more than about one million transistors. Nevertheless, these devices still look modern compared to the transistor-based metal-oxide-semiconductor (MOS) sensors that originally competed with CCDs in the '70s and '80s in the "luggable" camcorders of the time. During that era, MOS-sensor pioneers struggled to produce low-quality video using only tens of thousands of transistors.

In stark contrast to those MOS-based ancestors that used transistors

Above: JVC and Ikegami are the first camera makers to take advantage of Rockwell Scientific's CMOS image sensor in their new HD cameras. Pictured above is JVC's prototype CMOS HD camera.

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of only one polarity or the other, the latest MOS-based sensors use CMOS technology and deep-submicron photolithography for structures no larger than 0.25 micron. The same technology that produces ever-faster, ever-cheaper, multi-GHz microprocessors also produces CMOS iSoCs image sensors with ever-increasing performance and sophistication. CMOS technology offers both n-type and p-type transistors and, consequently, provides ultra-low-power operation of the self-contained subsystems. And each CMOS iSoC can contain over 100 million transistors.

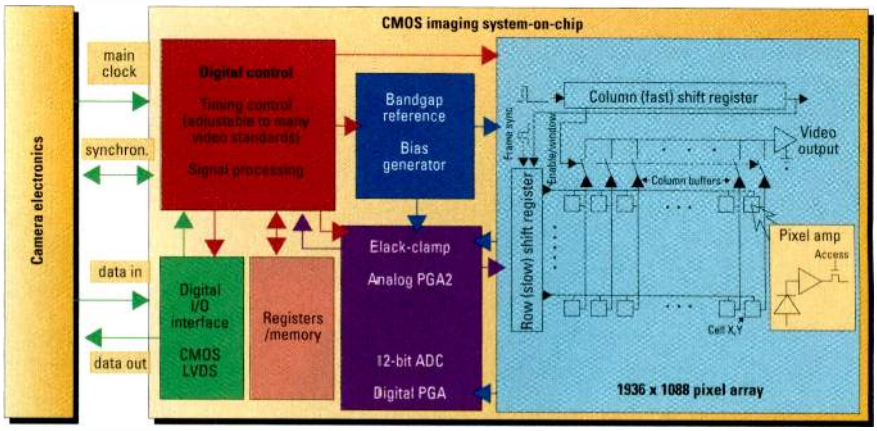

Figure 1. This simplified block diagram of CMOS iSoC image sensor shows the functional blocks that perform signal detection, analog-to-digital conversion and signal processing.

More support, free logic

At the 2003 NAB show, Rockwell Scientific (Camarillo, CA) announced the commercial availability of its CMOS iSoC image sensor, the ProCamHD 3530. Ikegami and JVC are now incorporating this chip into professional HD cameras. Figure 1 shows a block diagram of the chip, which converts the photons collected at each pixel into 12 digital bits. About one dozen functional blocks perform signal detection, analog-to-digital conversion and signal processing. By contrast, the support circuitry in a CCD sensor includes only the unity-gain analog amplifier(s) necessary to pipe the analog video through one or more video taps. To facilitate higher composite video rates, the trend in CCD design is to simply include more video taps that must be electronically stitched together and equalized by the camera.

In sensor design, adding features

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is attractive only to the point at which their accessibility and the resulting camera operation become overly complicated. In this respect, CMOS technology has a further advantage over CCDs because the digital logic that simplifies multimode operation essentially comes free – except, of course, for the non-recurring design cost. Thus, Moore's Law continually affects CMOS image-sensor development through ongoing performance improvements, relentless cost reductions, rapid growth of embedded functionality, and expansion of operating modes with easier operation.

Mixed signals, higher resolution

Some CCD camera designers and marketing teams are currently pushing interlace-mode imaging to reach f10 sensitivity at 2000 lux. To do this, they use two-line mixing (co-adding two adjacent lines) to double the signal strength. (Keep in mind that progressive-mode line mixing is not possible with CCDs.) But interlacing creates irreparable defects in the video. The outcome is much like buying a beautiful home that overlooks the local landfill. CMOS technology, on the other hand, allows analog, digital and analog-with-digital (i.e., mixed-signal) processing. This promises to deliver sensors with programmable multi-line mixing for both interlaced and progressive imaging later this year.

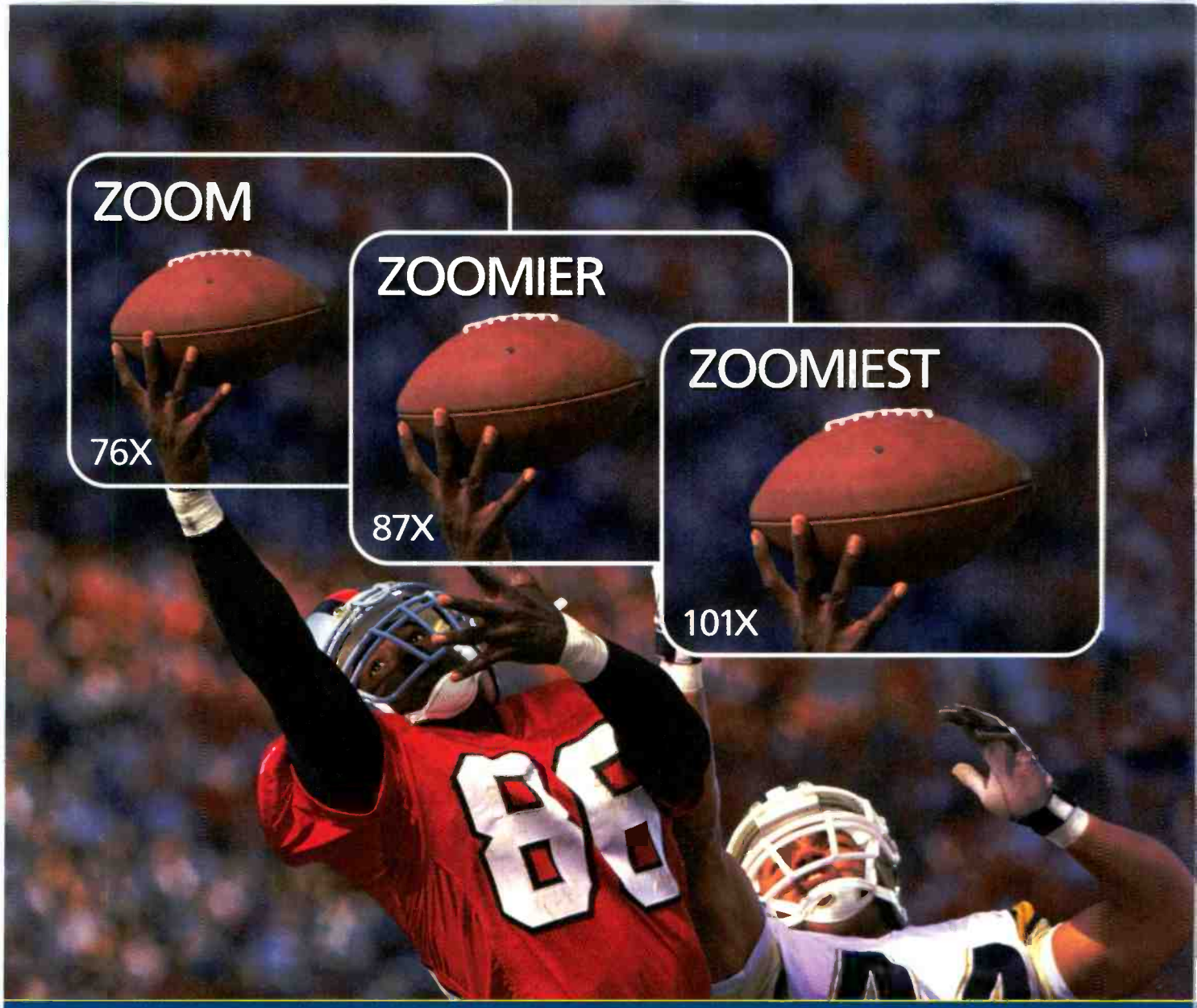
Perhaps even more importantly, CMOS cameras promise high-quality images even under adverse illumination. While the effective nine-bit resolution of CCD-based HDTV cameras is impressive considering the pixel size and video frequency, broadcast engineers nevertheless lament their sensitivity loss (one to two f-stops) compared to NTSC cameras. But CMOS provides a clear path for progressing beyond the current S/N benchmark of 54dB (f8 at 2000 lux) for interlaced HDTV cameras.

CMOS cameras promise high-quality images even under adverse illumination.

CMOS' smaller noise bandwidths and diverse signal processing options enable progressive-scan imaging with increasingly higher S/Ns – corresponding to 10- to 14-bit resolution – as the technology matures.

The plot thickens

Figure 2 plots the read noise and the



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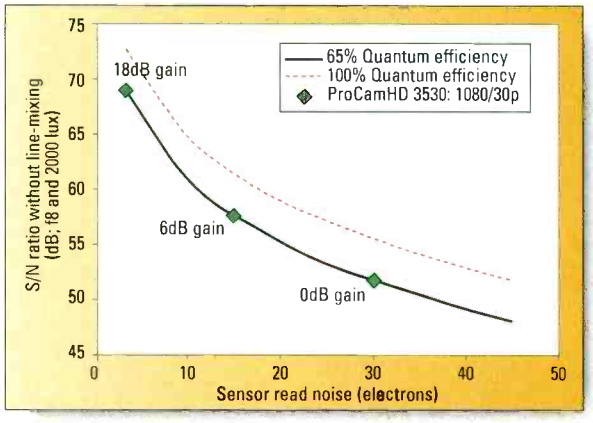

Figure 2. This graph shows the read noise and the corresponding theoretical S/Ns for two sensors that don't use line mixing.

corresponding theoretical S/Ns for two sensors that don't use line mixing. (Line mixing can improve S/N by 3dB to 6dB beyond those shown in the graph.) One plot assumes that the detector's quantum efficiency (QE) – its ability to intercept incoming photons of light and convert them to electrical charges – is 65 percent. For comparison, the other plot is for an ideal chip with a theoretical QE of 100 percent. The graph also shows the 3530 sensor's S/Ns at 0-, 6- and 18dB gain. The total iSoC noise for this studio-grade sensor limits its S/N to 52dB at 0dB gain. Increasing sensor gain to 6dB boosts the S/N to 57.5dB. Pixel-limited sensor noise of three electrons at a gain of 18dB yields an S/N of 69dB and an ISO speed greater than 1600.

Looking ahead

Considering the incremental HD CCD advances over the last decade, it is now clear that to similarly improve CCD-based cameras would require adding many output taps to each CCD at the expense of more camera complexity, higher power dissipation, shorter battery life and higher cost. In the meantime, the CMOS iSoC will further mature by advancing existing microlens technology (tiny lenses that sit atop each pixel), lowering the system-on-chip noise to the pixel-limited noise of three electrons, and applying line mixing (if not objectionable due to the associated degradation in vertical definition). This will clear the path to the first-ever, end-to-end 12-bit HDTV. In terms of electronic film speed, the ISO speed with CMOS-based HD cameras will improve from today's 200 ISO to 1600 and beyond. BE

Les Kozlowski is chief technology officer and Markus Loose is manager of CMOS sensor design for the CIS Business Group at Rockwell Scientific.

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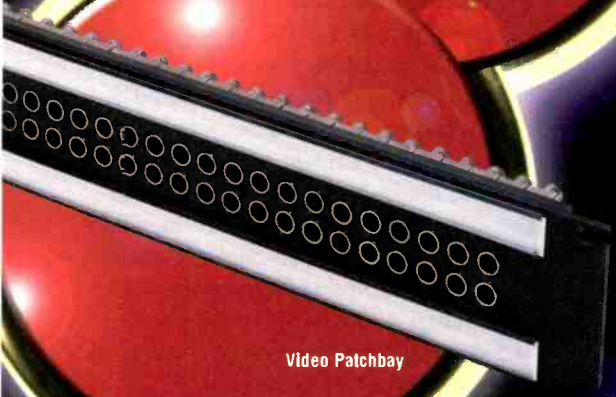

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Scopus' Intelligent Video Network

BY OVADIA COHEN

Traditional cable infrastructure is changing. Competition among telco, satellite and cable companies is stimulating this process and pushing cable operators to quicken deployment of on-demand services. Infrastructure will need to support multiple services and users, and will have to evolve beyond that employed in existing standard networks.

Challenges

Today, cable networks employ a variety of systems to deliver video, data and voice services. With complex networks leading to higher operations costs, cable operators are facing challenges in several areas:

- Capital expenses – every new service entails increased management and transmission costs.
- Operational expenses – video, voice and data running on different networks or protocols require highly capable manpower with the right skill sets to manage the headend equipment.
- Increased complexity – adding services and users increases the complexity of managing the network and content flow.

Competition among telco, satellite and cable companies is pushing cable operators to quicken deployment of on-demand services.

- Future technology trends – being prepared for future technologies such as MPEG-4 part 10, Windows Media and other compression formats.
- Future business trends – ensuring future technologies means designing the system with several factors in mind, including Triple Play (video, voice and data), digitization of content, compatibility with customer-premises equipment (CPE) and everything on demand (EOD).

To address the above challenges, broadband operators need an architecture that is scaleable, manageable, reliable and future-proof. It should offer the following features:

- Architecture scalability – the ability to extend the network physically and logically while maintaining stable and consistent performance.
- Architecture manageability – the meaningfulness of the operational status information that the system can report, together with the degree to which it can be manipulated to support system objectives.
- Architecture reliability – the effectiveness of network redundancy, monitoring and management to maintain the infrastructure.
- Future-proofing – corporate financial managers must be convinced that the initial investment will not be squandered by future requirements.

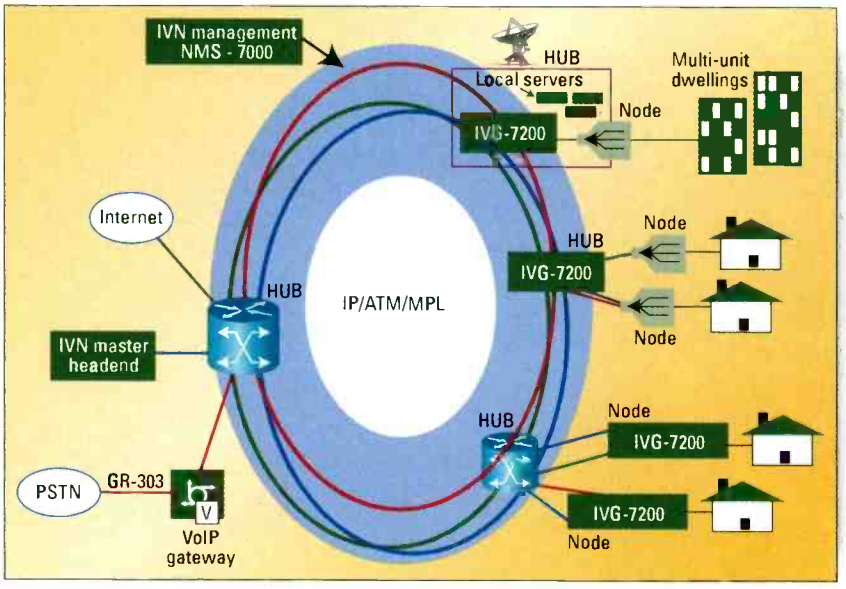

Figure 1. The IVN topology employs video routers, loop design, and an interactive video gateway to help cable companies manage on-demand services.

IVN

The Intelligent Video Network (IVN) concept represents the next-generation topology for cable video networking (see Figure 1). The IVN systemwide architecture supports an end-to-end solution from the master headend through the backbone and regional headend and down to the street corner, the node. It brings the strengths of routing capabilities into the video world to support on-demand services to large numbers of subscribers. It also enables processing at the headend alongside "edge" processing capabilities to optimize the access network.

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Video routers

In much the same way that telecom and data routers handle voice and data, video routers process, control and route digital-to-digital video signals with a combination of software and hardware. Answering the needs of direct-to-home (DTH) broadcasters as well as video contribution-and-distribution (C&D) service providers, IVN's comprehensive architecture uses the entire network infrastructure and enables two-dimensional control over bandwidth to support end-to-end solutions.

Multicasting

Accordingly, the architecture features loop system design rather than point-to-point or point-to-multipoint design. Any site can add content and route it within the system. The operator works in a loop circuit so that content distribution to the customer or the various headends comes from video servers around the network or from a central station. While it doesn't eliminate existing headends, the system acts as an addition and enables faster and more precise answers for on-demand applications.

IVG

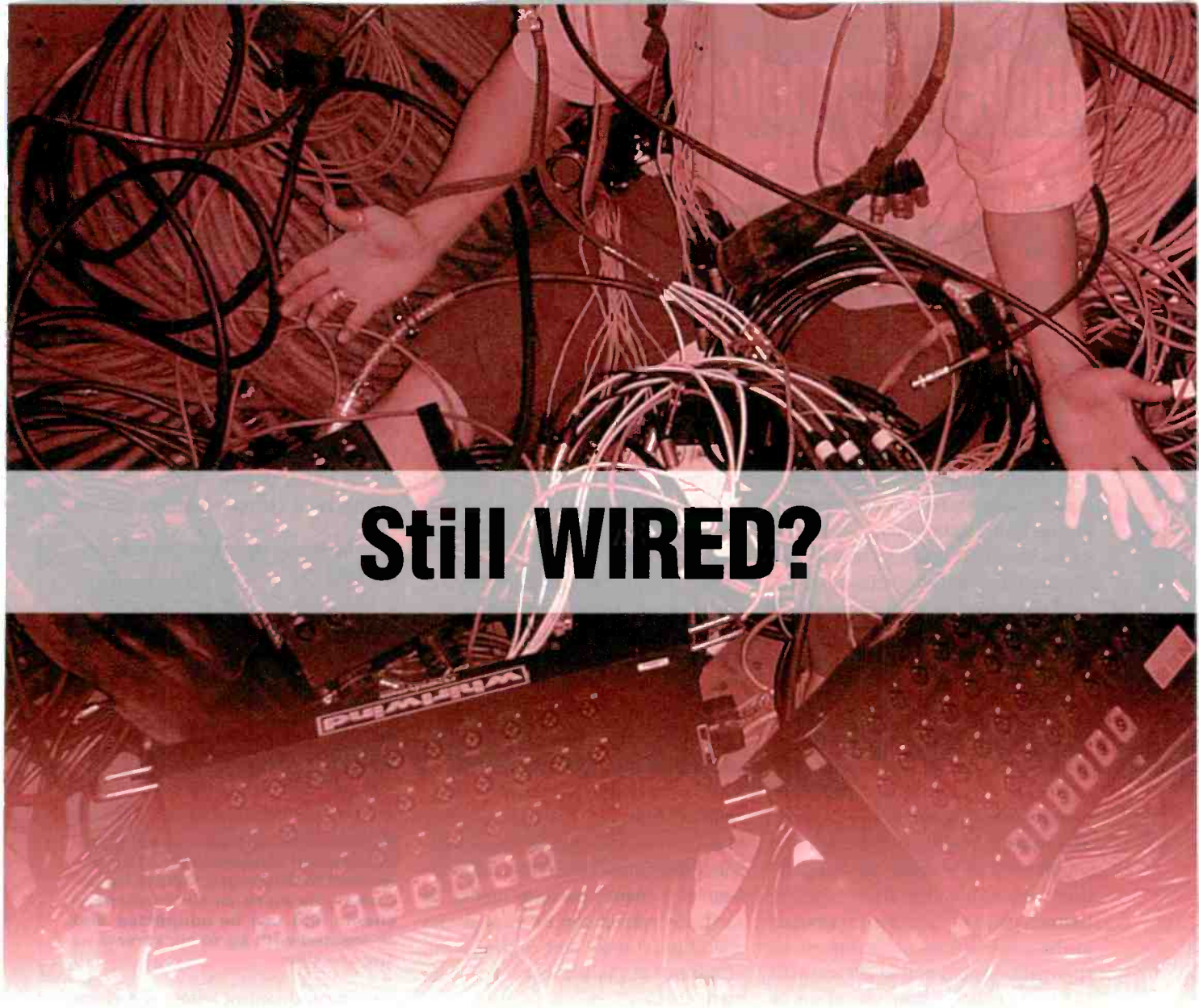
A fundamental element of the system is the interactive video gateway (IVG). The IVG provides the ability to route the video across the network. It performs digital-to-digital processing statistical remultiplexing, rate reduction, grooming and conditional access, and supports different types of backbones – asynchronous-transmission mode (ATM) or Internet Protocol (IP) controlled – as well as quadrature amplitude modulation (QAM) outputs for the hybrid fiber/cable (HFC) networks. Embedded in the IVG is a management "entity" that works at the service level to yield additional advantages, especially when the network supports many services along the transmission chain.

A path to the future

IVN represents a natural migration path from the traditional broadcast world to the on-demand world. It enables full digital-to-digital processing in scalable deployments to provide cable operators with a competitive advantage over telco and satellite players to meet future challenges.

Cable operators now have the chance to become the leaders in providing enhanced video, voice and data services. But, to reach this goal, they need a new paradigm for the cable-access infrastructure. Operators will need highly integrated, well-standardized systems with scalability, high performance, and distributed and efficient network management. BE

Ovadia Cohen is co-founder and vice president of marketing at Scopus Network Technologies.



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DoyleTechnology's VMC control system

BY JOHN E. HARTWELL

The transition to digital television and the emergence of high-definition television (HDTV) has created a new and increasingly difficult landscape for broadcasters to navigate. Changing production requirements and challenges have necessitated a new way of approaching traditional broadcast-related tasks. Further, facilities must find a way to bridge the gap between traditional broadcast operations and new revenue-generating models within the DTV environment.

This is especially critical for small- to medium-market facilities, which must make significant investments in order to comply with the digital mandate being imposed upon them, while simultaneously staving off competition from cable and direct satellite technologies. One solution for stations in these markets is to implement an aggregation solution that allows them to continue their digital transition, as well as reducing operating costs by increasing the efficiency in the master control environment. An example of this type of solution is the Visual Monitoring and Control (VMC) system, developed by Doyle Technology Consultants in cooperation with NVISION, Sundance Digital and Dolby Laboratories.

The system uses software to integrate the monitoring and control of cross-vendor and functional hardware systems, and targets broadcasters that have been trying to figure out what to do in both the transition and eventual business of DTV. By making their operating environments more efficient and ultimately more productive, it is essentially an enabling tool that facilities can use to examine new and different ways of operating through the transition to a DTV multi-services business model.

The software essentially functions as an extension of the roles that system integrators have traditionally played in a broadcast facility, designing signal systems through the managing of connections between individual pieces of equipment, with the goal of making an environment operator-friendly. In VMC's development, computer networking technology is used in place of dedicated cable connections to enhance the system's operation and conform to a client's business model. As such, the system can be viewed as a collection, display and control point of parameters in the signal management chain.

The technology components of the solution, introduced at this year's NAB, include an integrated signal management and master control engine built around NVISION's Pick Hit award-winning NV5128-MC master control/multiformat routing switcher, which features 128 system inputs, as well as mixing, keying and voice-over capabilities; built-in squeezeback; and a logo store.

Sundance Digital's Titan automation system, which is designed for multichannel, server-based broadcast facilities, can support several business models including datacasting, time shifting and cooperative plants such as duopolies, as well as those needing to centrally automate operations across widely dispersed locations.

Finally, a comprehensive visual monitor and control system allows operators to fully monitor the entire operation on a single screen. The system, which is fully server-based, allows operators to visually monitor branding operations while simultaneously maintaining override control, monitoring upcoming automated events, monitoring and managing AC3 audio encoder settings, and displaying program service information in human readable form.

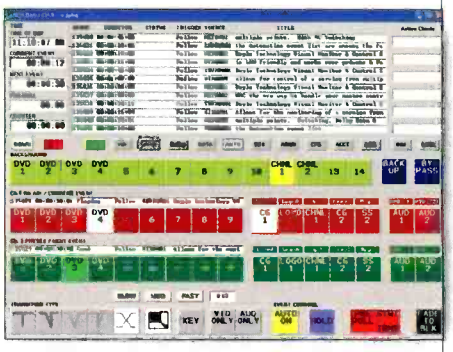

Figure 1. VMC servers are software-based client stations that can be networked throughout a facility for access by as many as six concurrent clients and can be supported and connected with up to six servers at any one time.

VMC gives operations the tools that allow them to be creative in how they run their businesses.

In other words, it gives operations the tools that allow them to be creative in how they run their businesses.

As the broadcaster moves closer toward a DTV multi-services operation, master control environments will be required to monitor and control a diverse collection of automated systems. Traditionally, this has meant a dedicated data display for each system: one display for an automation channel, a

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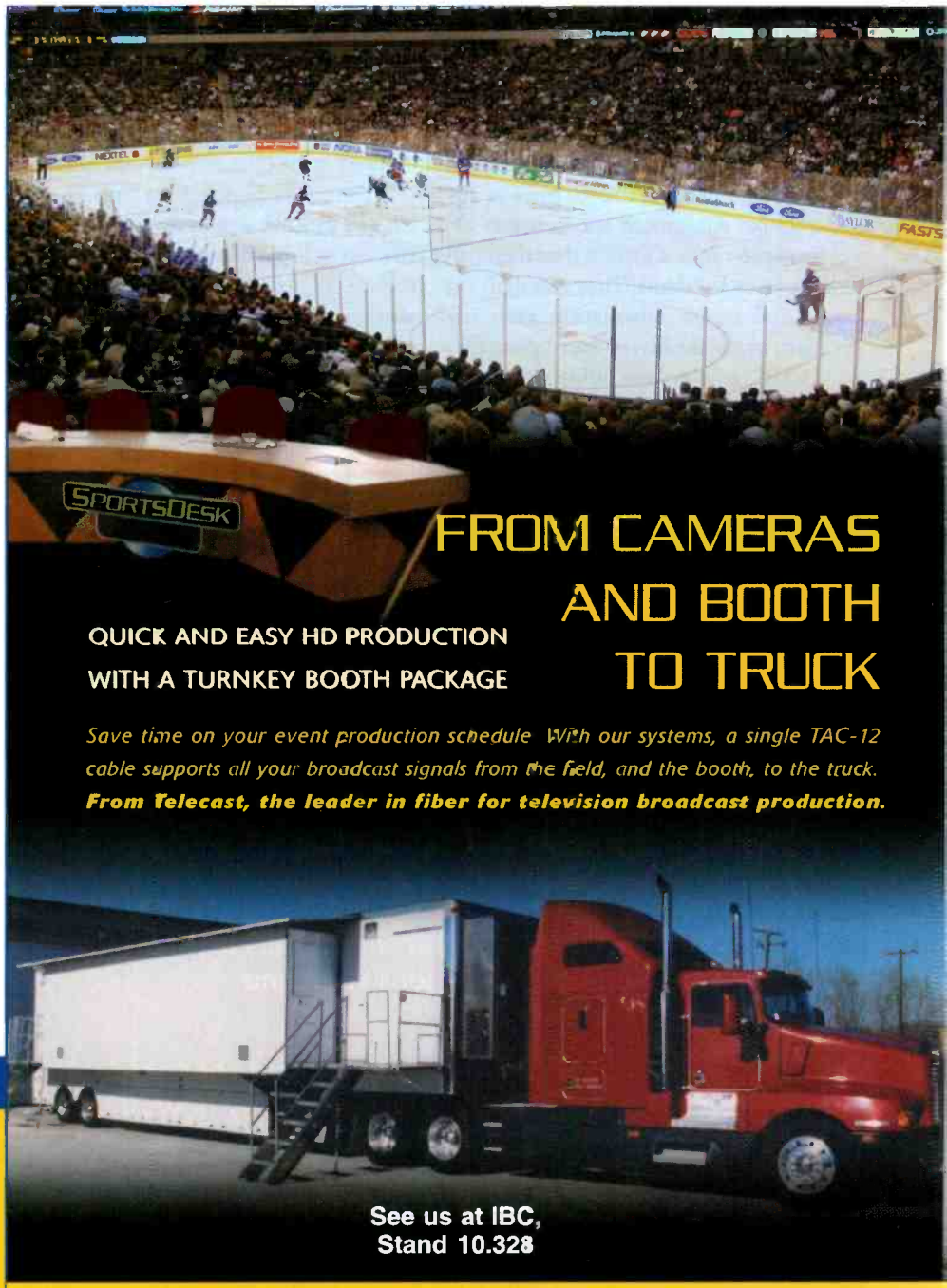

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control panel for master control, one for error monitoring and so on. In this case, operators find themselves dividing their attention between displays, and acting more as a "firefighter" when a system sounds an alarm. To reduce the clutter for the control operator, KVM switches have been used by some solutions to bring each system to a single display one at a time.

Instead of trying to use KVM switches, which potentially can cause operators to get confused as to which screen they're on, the control and monitoring system actually aggregates all the data and information onto one screen. It interfaces to each piece of operational equipment and converts information into a format that then can be passed to clients. They can then log on and access information from any place in the facility, or even remotely.

VMC, as a system, allows the control room environment to be more operator-friendly, in that operators now only have to go to one point to get their information, rather than view several screens to find out what's happening. It enhances the ability of a single operator to manage several service streams.

Each system server can also service multiple clients. The software-based client stations can be networked throughout a facility, allowing a client to actively monitor and control the on-air channel it logs onto. Each channel has its own server, supporting up to six concurrent clients, and a client can connect with up to six servers at any one time. (See Figure 1 on page 76.)

It's as much a way to delegate information as it is a client-server configuration. It also helps distribute the workload among several people and aids a facility in managing its personnel. For example, if a master control operator calls in sick for a day, another operator or the chief engineer can easily fill in by connecting to the system through a LAN, logging on as a client, and monitoring operations from their desk or even from home.

The business and operations of broadcasting are changing, from the present simple management of signal flow, to the management of information delivery in data formats. The tried-and-true methods employed in monitoring an NTSC transmission, mainly percent of modulation, will need to be augmented with the monitoring of the used and available data space in the ATSC transmission. The VMC system, with its software architecture, provides the means for the broadcast facility to evolve as required to meet monitoring and control needs for the new business models of DTV. BE

John E. Hartwell is chief technology officer at Doyle Technology Consultants.

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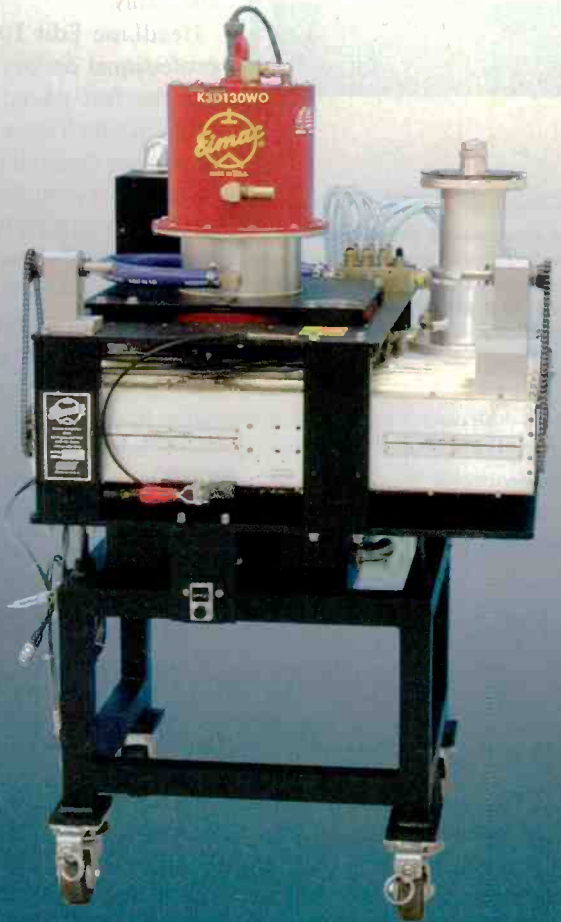

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OmniBus' HeadLine Media Editor series

BY DAVE POLYARD

Until now, nonlinear news editing systems designed for broadcast applications have been proprietary systems available only at a high cost. Although some of these systems are extremely powerful and feature-rich, they may command a six-figure price tag that's likely out of reach for most news operations. The low-cost systems that have been available are generally pieced together rather than being purpose-built for the special requirements of news editing. So, while the price may be right, these systems have not proved themselves up to the task.

Signficant customer input has led to the conclusion that there is a keen demand for reasonably priced systems that address specific aspects of news editing. News editing should no longer be considered one application – it should actually be broken down into a number of applications, with smaller, well-defined products designed to address each area. OmniBus realizes that the idea of creating one all-encompassing news editing system that can do everything for everyone is a rather archaic notion, and has determined that a better approach would be to create individual, application-specific products that address particular requirements within news editing.

This new approach is reinforced by journalists' increasing demand for editing capability in the field, a demand that necessitates the implementation of portable systems that are compatible with in-studio systems.

The OmniBus HeadLine Media Editor series is designed to fill the gap in the market and address the changing requirements of news editing, all at a fraction of the cost of proprietary systems. To help meet the right price/performance balance, the product features a scaleable design incorporating three models, each of which addresses a particular workflow or application within the broadcast news environment. Breaking the product into three separate functional blocks enables users to purchase only the functionality they need.

The strategy behind the development of the series was to create timeline-based editing products specifically for news and sports production. Because it incorporates Windows Media technology, the system allows users to work with multiple video formats within a single project timeline.

The series' three models share a common interface and core functionality, with variations to suit the specific needs of a particular news application.

Figure 1. OmniBus Systems developed three news editing systems to meet broadcasters' specific editing needs at a reasonable price point. For instance, Headline Edit 3000 (shown above) is a stand-alone system designed primarily for journalists in the field.

The new scaleable system

The series features a user interface and A/V editing capabilities that allow editors and journalists of any experience level to compile polished news packages quickly and easily.

HeadLine Edit 1000 is a professional desktop editor for the fast-paced newsroom in which on-air deadlines often demand that editing begins even before recording is complete. Editing of browse-quality media can begin within five seconds of the start of a recording – a feature ideal for cutting highlights packages for live events. In addition to source and program windows, users are provided with one stereo audio track and trim functionality, so they are able to carry out split A/V edits.

There is a keen demand for reasonably priced systems that address specific aspects of news editing.

When used with the OmniBus newsroom automation system, completed EDLs are published to the OmniBus system for playout direct from the broadcast server, minimizing time to

air. Alternatively, versions of the edit can be saved either locally and reloaded at a later stage, or centrally, allowing a different journalist to pick up the timeline and modify it. The Edit 1000 is MOS-compatible. It runs as an ActiveX plug-in inside all leading newsroom production systems and is integrated with OmniBus' media asset management solution, giving full access to all clips that have been registered with the asset management system.

HeadLine Edit 2000 offers the same editing features and core functionality as Edit 1000, but it works with prerecorded media in any format that is supported by the PC and offers advanced audio facilities including two stereo audio tracks and one stereo voice-over track. These can either be run in stereo or to the left- or right-hand side alone. This is particularly useful when re-cutting a news feed with effects on one side and a voice-over on the other. Audio pan controls are also provided, and a "duck" feature drops the audio to a preset level for quick and easy dipping of sections of the audio track.

HeadLine Edit 3000 is a stand-alone system designed primarily for journalists in the field. (See Figure 1.) It features a DV capture card, an ingest tool and simple vision effects. Ingested media is presented as a series of scene changes with keyframes marking the start of each sequence. Completed packages, saved as DV files, can be sent back to base via FTP.

The approach OmniBus has taken with the development of the HeadLine Media Editor series enables delivery of competitively priced technologies that give broadcasters a fair price for the functionality they require – no more, and no less. BE

Dave Polyard is vice president of sales and marketing, North America, for OmniBus Systems.

WXYZ-TV automates with Crispin

BY RAY THURBER

Each year engineering departments set out to address technical issues and set goals for their facilities, targeted at news, programming and other departments. In the last two years, one challenge has touched virtually every department at WXYZ-TV: automation. After an in-depth review of products in the marketplace, we chose Crispin software to change the way we work.

An automated digital master control eventually tied the facility together, but it was news automation that started the process. The DNA Newsroom system is now second nature. Using 4x speed Panasonic Newsbyte editors and SGI Origin 200 servers the station plays 3000 clips to air a week. It relies on Crispin news automation to control the SGI for playout and interface to the facility's Newstar newsroom system.

With news automation accomplished, a total station solution was needed, so we invited Crispin to demo its new System 2000 at the station. Crispin installed its automation system and allowed the staff to run the system for a week of evaluation. This was enough time to prove system stability and give us the needed confidence to make a software purchase. There were several criteria the staff was looking for in an automation system. The system needed to provide device control of the SGI and Profile servers to tie news and programming together through common control point. It also needed to control an M2100 switcher and an SMS7000 router from Thomson Grass Valley. Other requirements included database control of news feed and syndicated recordings, and over program and newsroom deletion. A system was needed that would handle breaking news events eloquently.

Crispin's System 2000 automation provides a common control point for news and programming, leading to greater efficiency. Upgrades to the system also provided the ability to balance two daily news shows.

Our master control has been running System 2000 for over a year now. The database controls all record and delete processes in the facility. Closed loop recon with the traffic system has reduced man-hours in accounting. Automation in master control and news has led to greater efficiency and "cleaner air" — two things that are sometimes hard to balance.

Automating with Crispin has helped WXYZ-TV balance greater efficiency with "cleaner air."

WXYZ also produces a daily one-hour news show for WKBD-TV, the Detroit UPN/CBS-Viacom station. The time frame was tight to get "Action News at Ten" up and running. The challenge faced was providing simultaneous news and master control operations every night without jeopardizing our 11:00 "Action News" franchise. Upgrades to the System 2000 automation were added via email, and in one week, we had the technical capability to meet this exciting challenge. "Action News at Ten" is now second nature. The station will likely look to Crispin for a MOS interface for newer newsroom software and a possible archiving solution in the near future. BE

In the last two years, one challenge has touched virtually every department at WXYZ-TV: automation.

Ray Thurber is chief engineer for WXYZ-TV, Detroit.

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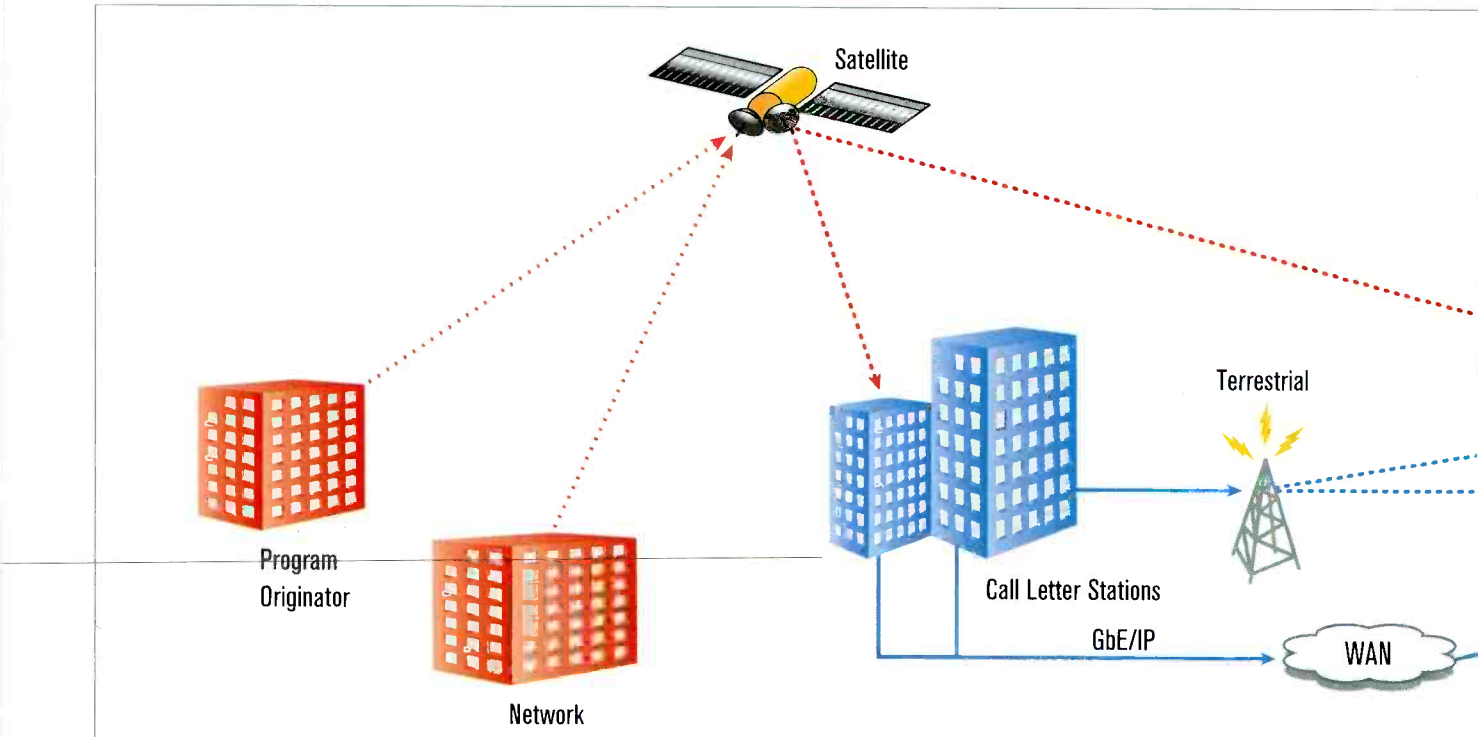

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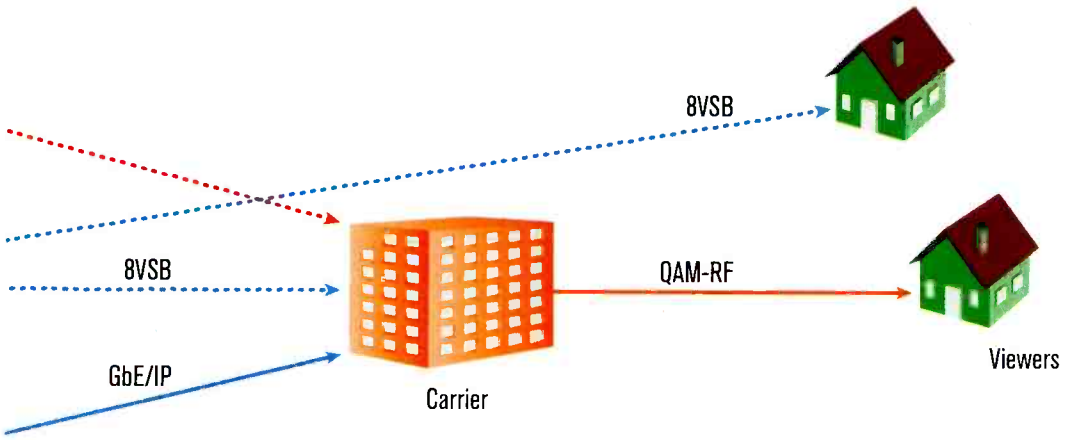

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Newsroom automation

BY JOHN LUFF

Newsroom processes have always been carefully thought-out. The need to hit deadlines requires attention to a set of work assignments and priorities that have been set to ensure the final success of a group effort.

Before computers, multipart forms were used, and wire copy was sometimes cut with a pair of scissors and taped together to "edit" the text. Teleprompter copy ran on a conveyor belt under a camera to get the text in front of the journalist on camera. The orchestration of all of this without errors was fun to watch and quite a challenge to do while managing the craft of journalism. It was sometimes hard to spot the sneaker net delivery of the next story, or the deft editing of the rundown by shuffling stories on the control room desk.

The salient underlying workflow is still the stuff of media newsrooms. Words and pictures still must be collected, collated, edited and presented. A well-crafted newsroom automation system is less "automation" than it is the embodiment of the workflow required to achieve a well thought-out and produced newscast. The computer software does not cut the pictures or edit the text. It simplifies the mechanical tasks and manages the flow of information within the newsroom.

For newsroom software to succeed, it must allow professionals the freedom to do their jobs. Modern systems can be customized to achieve personalization for each station. Before workflow can be automated, however, the software firm must help you set goals that are realistic and achieveable with their product.

For the most part, modern newsroom automation systems are broadly applicable and extensible to include future upgrades to control devices, integrate desktop editing and browsing, and asset management and archive services. The Associated Press, Avid Technology, Dalet and EZNews provide such systems.

A major part of newsroom automation today is integrating the control of character generators, video servers and robotic camera systems into the seamless whole they can be. If the goal is to save costs by implementing a software solution, then one most logically would try to find a solution that manages hardware without additional labor cost involved.

Many systems do this using Media Object Server (MOS) technology. The MOS protocol allows developers to abstract hardware from the actions desired so that you don't need to know the lingua of the character generator, only that a lower third with specific text needs to be inserted at a specific point in the rundown. MOS is about much more than device control. It can also be the basis of communication with asset management, ingest and browse services, Web publishing, and other interfaces.

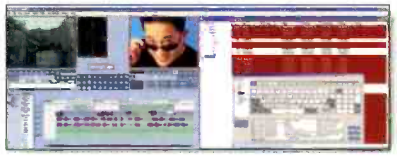
iNEWS, Avid's newsroom computer system, allows users to access scripts, wires and databases in the newsroom or in the field via LAN and WAN connectivity.

The goal of newsroom automation is to create a seamless whole from the pieces of the newsroom environment, where changes in one area propagate to the appropriate interface points without thinking. One might conceive of a system that allows a single individual to control the entire production from a technical script. Such systems exist and tie into newsroom automation systems, although there is considerable work to create the production script from the rundown imported into the system.

One could make the argument that the cost savings in labor are so persuasive that the potential risk with all eggs in one basket is moot. Many stations have implemented just such a system. A related wrinkle is to have middleware control the devices as a separate engine, communicating with the main rundown as needed.

Finally, when news is centralized, one might have segments of a program originating from a central site, while others continue to be produced at the local station. In such a case, the master rundown might have related segment rundowns that follow with the master program quite completely. Sinclair has made much news with NewsCentral, and the ability to use one newsroom automation system in a seamless whole would make such an initiative much more powerful. BE

John Luff is senior vice president of business development for AZCAR. To reach him, visit www.azcar.com.



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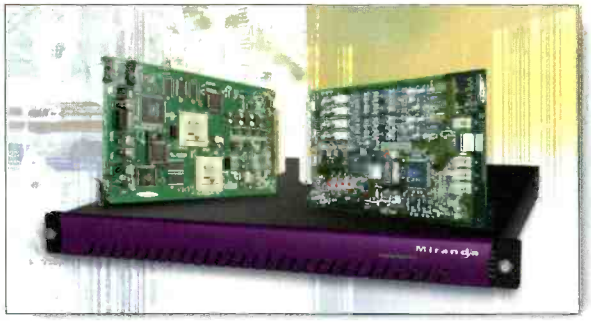

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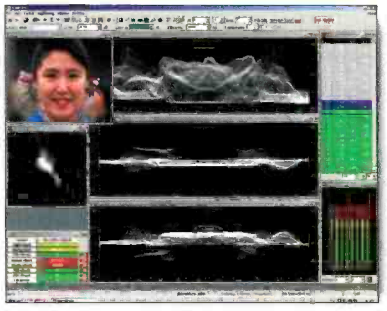

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Putting your money where it works

BY PAUL MCGOLDRICK

So it seems as though we are finally coming out of the latest downturn in business. Companies that I have talked to generally agree that since the middle of 2002 things have been ticking up more positively, with the notches getting larger in the early months of this summer.

But while we now see more spending on advertising and promotion of products, we need to wake up a good number of suppliers about how business should be conducted, even (or especially!) through hard times. I have been associated with a venture that started in the months before Sept. 11 and has persevered through the worst of times to come out ahead of the game – cash-flow positive and growing – simply by staying in there and doing it right. Nearly everywhere else I have seen the cutbacks, the layoffs, the plant closings and the hiring freezes which, unfortunately, are part of the mindset of American business. Many companies live month to month, like minimum wage employees live paycheck to paycheck.

David Ogilvy, the genius who was founder/CEO of Ogilvy and Mather, is not someone we can all probably agree with all the time. Some of his rules for marketing are so patently obvious; however, no person who has corporate responsibilities or marketing in his/her job title should be allowed to forget them. The most important and probably the most easily forgotten in business America is, "Regard advertising as part of the product, to be treated as a production cost, not a selling cost." When times get tough it is not the moment to cut back on promoting your products, whether it is advertising or the size of your NAB booth. That's just a recipe for making a prediction of doom and gloom an absolute reality. But I would challenge any company in our industry to show that isn't the direction it has taken in the last 18 months...

If your product is a success you need to promote that success, reinforce its success, assure your customers that it is a success. Commit long term to your promotions. Short-term exposure rarely works; consistency always does — with the right creative. If you have losing products dump them fast. Promoting losing products is a much worse, embarrassing, misuse of funds. Yes, I know that sometimes a product becomes the boss' baby and getting rid of it is not easy, but you have to do it.

Commit long term to your promotions. Short-term exposure rarely works; consistency always does.

Promoting your products when others are backing away from commitments dramatically increases your share of even a declining market.

Use time periods like these – and it's still not too late to take advantage of the situation, even as we begin to emerge with more confidence in our business – to find and recruit the additional designers you're going to need to further push your position. These people are difficult to recruit during boom years, and easy to recruit during down times. A company that lays off anybody during a downturn automatically scares those that remain.

There is one semiconductor vendor that I have been carefully watching over the last two years. As its competitors have been losing really good people – not because their jobs are in immediate danger, but because the atmosphere suddenly changes when you see support staff and customer service staff being laid off – it has been gaining them. As a result it is spinning out a lot more new products in a terrific growth spurt, at a time when the others are still wondering how to go about securing a recovery. Every time I have seen a corporate statement in the last 18 months about "lacking visibility of the immediate future," or "the cuts we are making today will put us in good stead when things recover" it makes me cringe, and wonder how some CEOs actually get their jobs.

Company development in difficult times is very little different from investing in the stock market: If you take a long-term view of the market and consistently invest the same amount of money each week/month whether prices are going up or down, overall you will be successful. If you try to second-guess forces that are totally out of your control you will lose. In the corporate equivalent, you have to consistently invest in people, designs and promotions to reap the benefits over time.

Next budget cycle, don't allow anyone to leave the table before you see the promotional expenses for a new product included in the "Cost of Goods Sold." If the product is a winner you automatically have more budget to promote further assurances to the market; if you have a loser the budget disappears with the product's demise. It's the right way to think. BE

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

Send questions and comments to:
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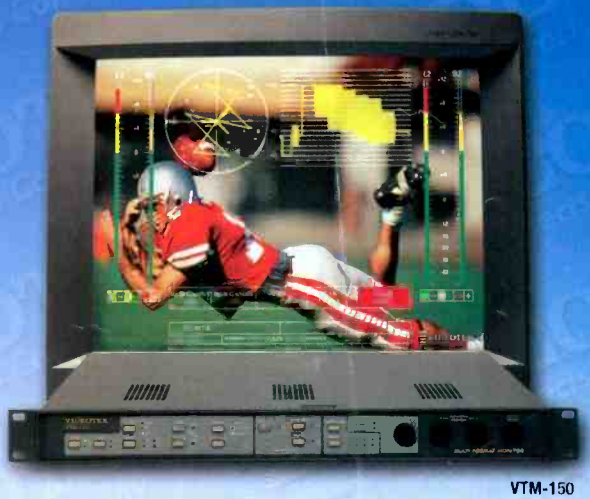

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