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DECEMBER 2002

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THE JOURNAL OF DIGITAL TELEVISION

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The evolution of broadcast

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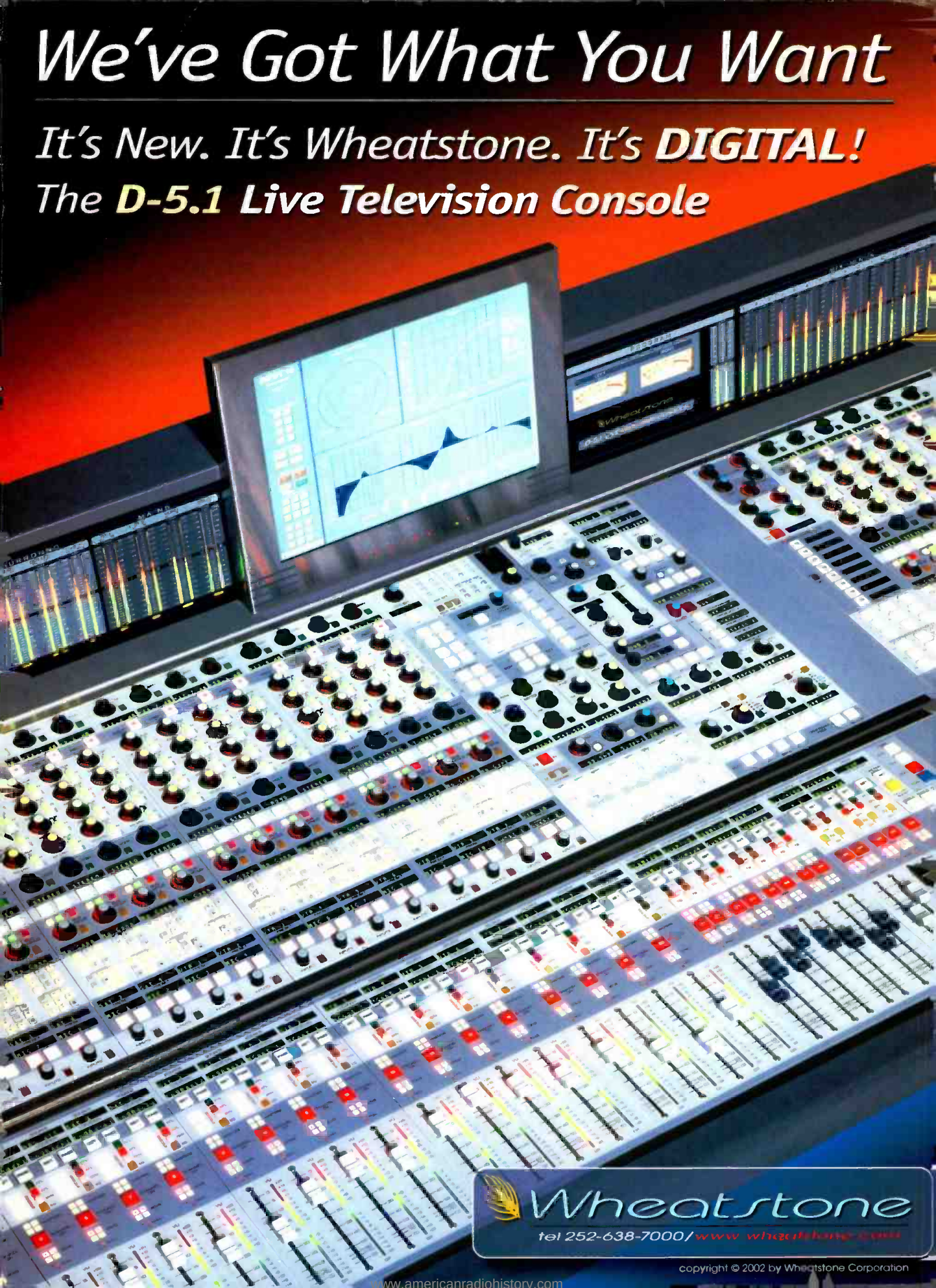
Maintaining quality images

Microphones
New models break traditions

A PRIMEDIA PUBLICATION



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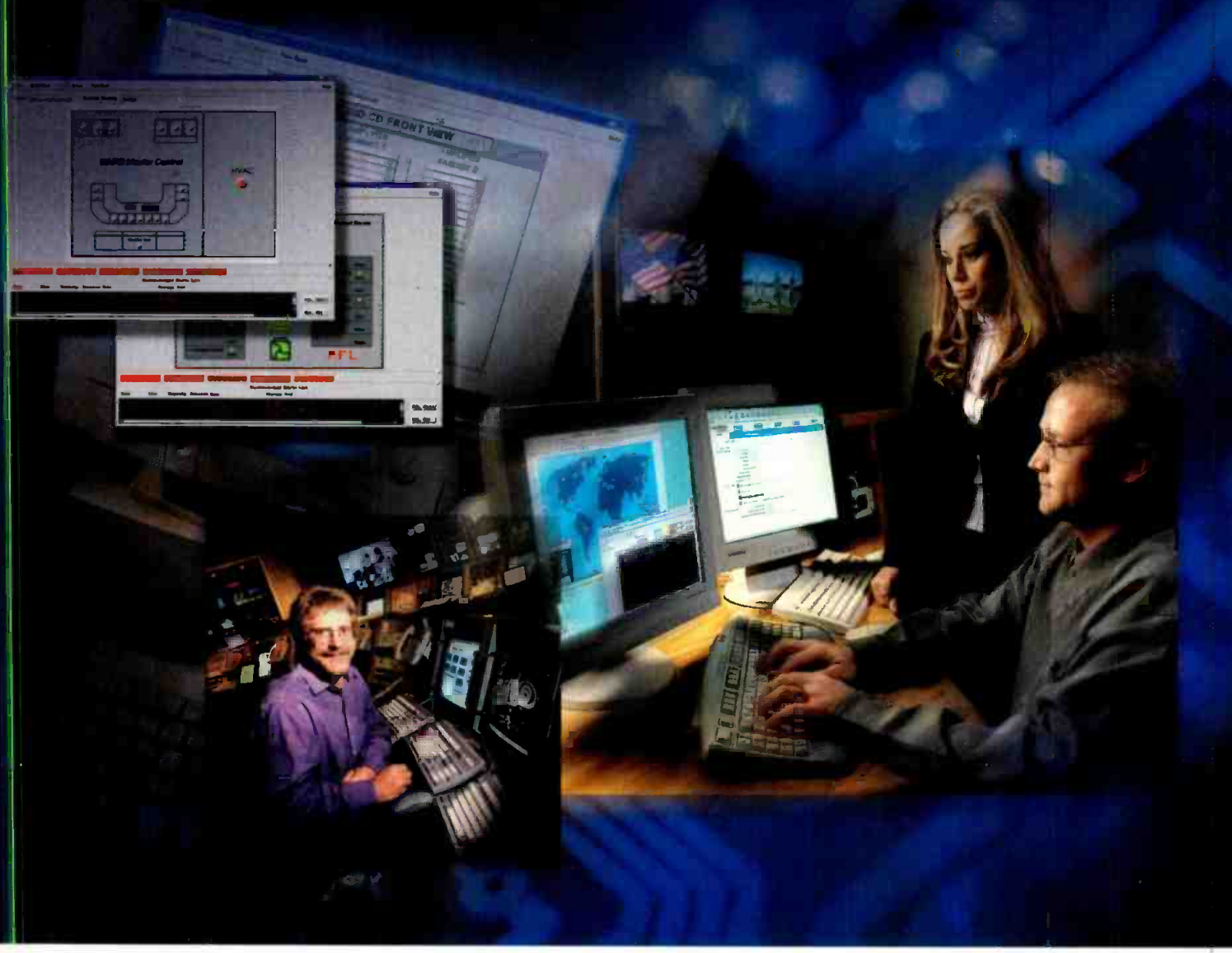

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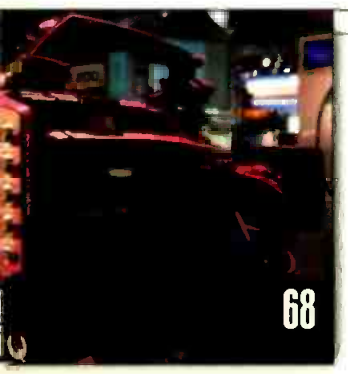

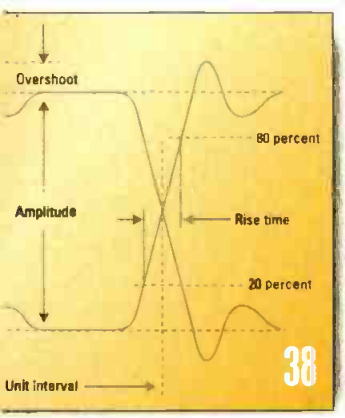

BEYOND THE HEADLINES

DIGITAL HANDBOOK

ON THE COVER: A progression of images shows the many steps a digital signal takes on its way to its final destination – the viewer's home. Pictured from left to right are TANDBERG Television's Voyager Lite; Wheatstone's D-8000 audio console; Real Broadcast Network's IBOC control room (photo courtesy DST); Atlanta CBS affiliate WGCL-TV's new news studio (photo courtesy DST); a tower at Mt. Wilson, CA (photo courtesy Andrew); and a home theater system in St. Louis (photo by Michael Marxer).

(continued on page 8)

The New All-Terrain SD/HD Studio Camera System.

Introducing the first multi-format camera with the guts to go anywhere you do.

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Systems Design & Integration

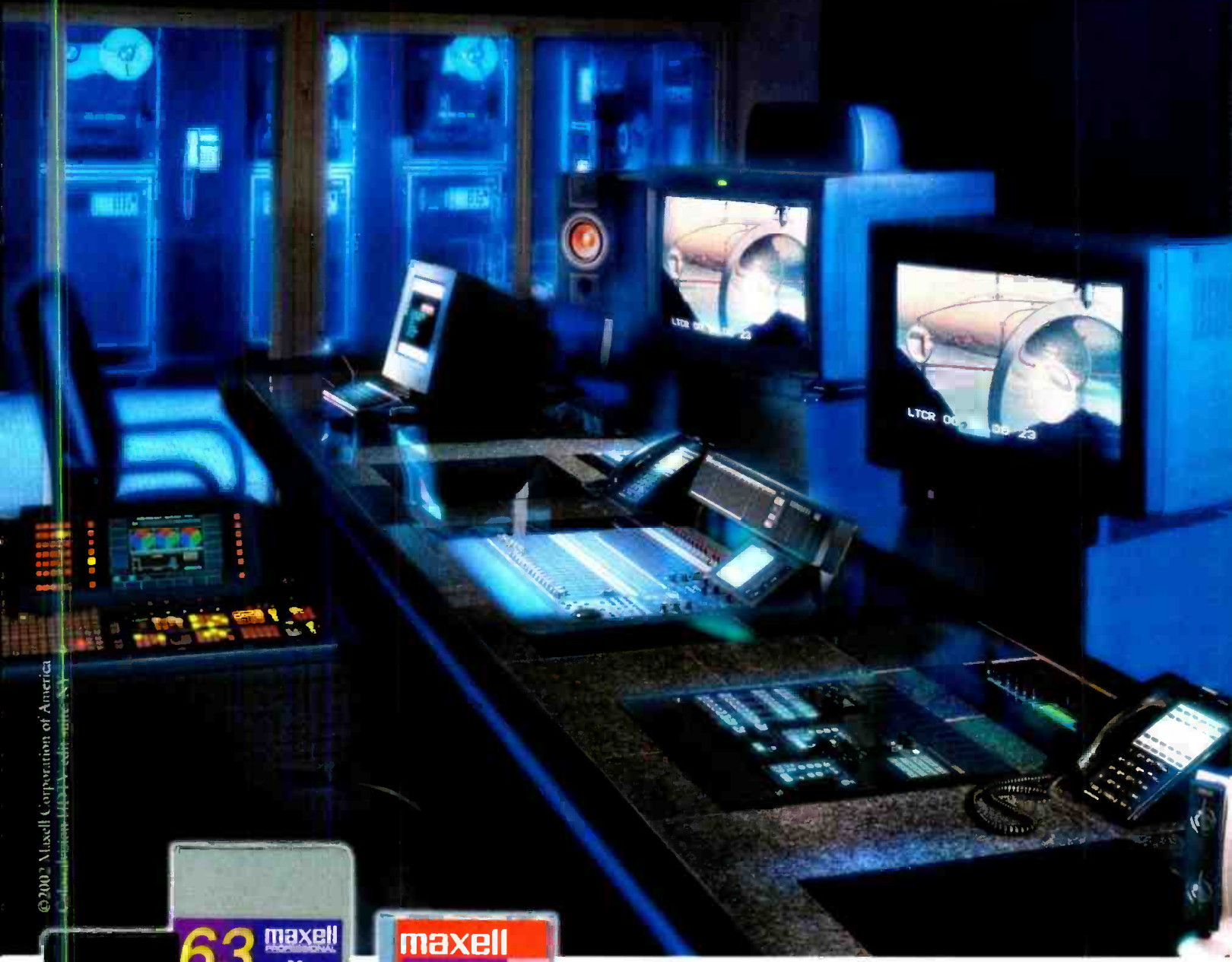
New Products & Reviews

Departments

Name the handheld

Name the brand and model number of this handheld ENG/field camera. It weighed 15 pounds and was part of a series of cameras called "Decade Two" by the manufacturer. Title your entry "Freeze-frame-December" in the subject field and send it to: bdick@primediabusiness.com. Correct answers received by Feb. 17, 2003, are eligible to win.

What company creates advanced media for the new and emerging technologies?



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Focused on advanced technology, Maxell is on the cutting edge of professional media development. Our high-definition products, HDCAM and D-5, meet the needs of even the most demanding applications. New manufacturing processes and tape formulations provide unrivaled performance both on location and in the studio. And, in addition, our data storage products (DVD-R, DVD-RAM and DLT-IV) continue to set standards for storage capacity and archival stability. Thus, Maxell plays a leadership role throughout the recordable media industry. To learn more about Maxell Professional Media, call 800-533-2836 or visit www.maxellpromedia.com.

Recordable Media **Data Storage** **Portable Energy** **Technological Partnerships**

The modern woman

I admit to loving technology - most of the time, anyway. Computers, well, that's something else all together. But when it comes to new video, audio, TVs, games or phones, sign me up! I've been an early adopter since way back. I bought the first stereo Betamax model Sony ever made. I had one of the first Radio Shack TRS-80 computers. And cell phones? My first cell phone cost $500 and came with a calling plan of only 60 minutes a month. If it was new technology, I was there, baby.

Fortunately, being single allows me to buy any technology I can afford. I don't need anyone else's permission. And this is a bit of freedom I'm inclined to want to keep. However, there may be hope yet for we single, but independent, fellows.

The Consumer Electronics Association (CEA) just released the results of a survey on women's interest in technology. The stereotype of women being focused on fashion and jewelry has just been shattered. Today's modern woman apparently loves her electronics about as much as we guys do.

In the CEA survey, 58 percent of women said that they would choose a high-definition television over a one-karat diamond ring, and 64 percent said they would choose a digital camera over half-karat diamond stud earrings.

The survey also showed that women's interest in other technology is also on the rise. Forty-two percent of women expressed interest in consumer electronics products, both established and new. And, when compared to men, women expressed a higher level of interest in both color TVs and digital cameras than did men.

Fifty-eight percent of women surveyed responded that they would choose a high-definition television over a one-karat diamond ring.

Oh my God! Women choosing technology over jewelry? What's next? Will they want hammers and screwdrivers instead of perfume and lingerie? Will men be shopping for women's gifts at Best Buy and Home Depot instead of Victoria's Secret? It's just too much to contemplate!

Imagine overhearing this conversation at the local electronics store. He says, "But honey, this HD set is so expensive – it's $3000." She says, "Yes, I know, but it's the 57-inch model. I was really hoping we'd buy the larger, 65-inch model. And don't forget, we want to replace that old stereo system. We'll need to match this new HD set with a complete new 5.1 channel audio system. The receiver's gotta have at least 500W/channel and, don't forget, the DVD player must have optical outputs. And, dear, it just makes no sense to buy all this new gear without replacing your old speakers with a complete new set of surround sound speakers."

I'd die right there on the showroom floor.

Brad Dick
editorial director

Send comments to: • editor@primediabusiness.com • www.broadcastengineering.com

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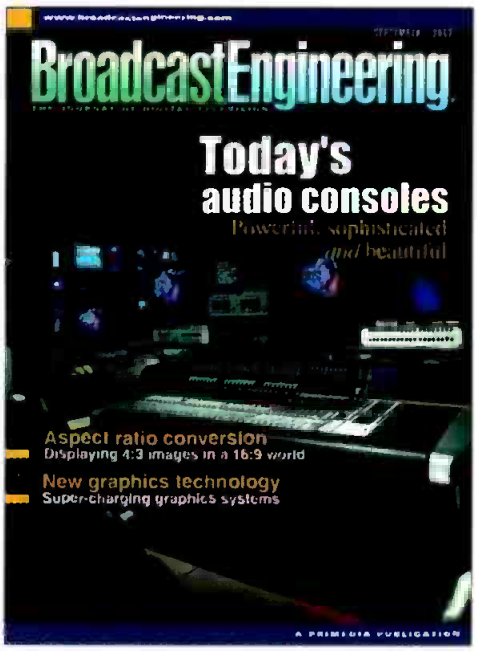

Information on Open Source

Editor,

I went through your Open Source article [from the September *Computers and Networks* column] on the *Broadcast Engineering* site. It is quite interesting. In your article, you mentioned that EBU has an MXF open source implementation. My failed attempts to access a copy of the MXF implementation makes me wonder if it is from the Pro-MPEG group, and if the SDK access is restricted to Pro-MPEG members. Does EBU have their own implementation of MXF, and is it available to non-members?

REGARDS,
PAWAN GUPTA

Broadcast Engineering's European consultant, Bob Pank, responds:

Here's the information you asked for. It was kindly supplied by John Ive of Sony, who is involved with the Pro-MPEG forum.

REGARDS,
BOB

The answers you are looking for are on the Pro-MPEG Web site, www.pro-mpeg.org. There are two software support kits. One is on the Pro-MPEG site for members only. The other is the original EBU software. It is on the EBU site I believe, but for members only. However, a functional demo of the very latest version is available from Inesc. The Web site is linked on Pro-MPEG under "Latest News," I believe.

REGARDS,
JOHN

Measuring audio performance

To Michael Robin:

I had a question about total harmonic distortion measurements, as discussed in your May article. Are your methods of measuring THD compliant with the Federal Trade Commission standards?

THANKS,
GIANCARLO LUJAN

Michael Robin responds:

The THD measurements I presented in my article are typical of those used by broadcasters. While the general principle of measurement is common, international (EBU, ITU), national (NAB) or network (ABC, CBS, etc.) test methods may vary, specifically in terms of the normalized signal level (expressed in dBu or dBm) at which the measurement is carried out. Federal Trade Commission methods appear to be related to audio power amplifiers for home use, so the THD measurement would be carried out at a specific level (expressed in watts). This will depend on the power rating of the amplifier.

REGARDS,
MICHAEL ROBIN

Freezeframe winners

No Freezeframe ran in the June issue.

July Freezeframe:

Name the Panasonic product family represented by the camera.

Panasonic's Recam product family included the AK-100 three-tube prism optics camera, as well as the AU-100 portable VCR and AU-300 playback editing system.

Correct answers:
Gary Maier
Chris Whittington
Tim Stoffel, KNPB

August Freezeframe:

A *Broadcast Engineering* interview in June 1982 reported that this industry leader predicted that HDTV would see early adoption by the [broadcast] industry and acceptance by the public within five years, and certainly not more than 10 years. Who is this acknowledged industry leader and where did he work when he made these statements?

Joseph Flaherty of CBS made the optimistic comment about HDTV.

Correct answers:
Edward P. Caleca
Elmer E. Smalling, III
Randy Patrick
Harvey Caplan
Phil Mikalofsky
Gary Kiffel
Walter S. Ciciora, Ph.D.
Greg Carter
Bernie Dickens
Bill Brister
Ian L. Wayne
Tom Alderson
Jay Mathis
Paul Berger

September Freezeframe:

What company often used this critter in their advertisement, saying "one less alligator"?

No one guessed the correct answer to this question. Otari was the company that used the expression "one less alligator." BE

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There's more, Sony's J series VTRs are a cost-effective way to play back the full range of Betacam Oxide, Betacam SP, Betacam SX and Digital Betacam legacy tapes, in addition to MPEG IMX tapes. Which means you can continue shooting with your current camcorders. And the material you acquire today will still be available, accessible and compatible tomorrow.

MPEG IMX recording is not just about better video. It's about better business.

Sony MPEG IMX Tape

J series VTR

e-VTR

THE MPEG IMX SYSTEM SURPASSES YOUR ANALOG GEAR. TO SEE HOW, VISIT WWW.SONY.COM/MPEG-IMX AND GET YOUR FREE DVD

MPEG IMX

Retransmission control

BY CRAIG BIRKMAIER

We have reached the end of another year filled with all-too-familiar stories. The U.S. transition to DTV is beginning to feel a bit like "Ground Hog Day." We could just make a digital copy of this year's editorial calendar and toggle a few bits during 2003 to reflect the glacial pace of the terrestrial transition.

This column is supposed to tell a story about "broadband for broadcasters." Broadband *vs.* broadcasters would put a more interesting spin on the subject.

In October we looked at conditional access technology for broadcasters. The bottom line is that they don't have a CA system, or an infrastructure to deploy one and collect fees for premium programming. Broadcasting has been built on a foundation of "unconditional access." But that foundation is crumbling because of the digital transition and the threat from the Internet.

According to the media moguls, the ability to make and share digital copies of content is turning consumers into a bunch of thieves and pirates.

This leads one to ask how broadcasters could possibly have survived without retransmission control for all of these decades? And it raises another question: What is stopping consumers from redistributing analog television content via the Internet today?

The answer to the first question is simple: There are laws to prevent the unauthorized redistribution of copyrighted content. There are two possible answers to the second question. First, consumers have no compelling reasons to redistribute TV content via the Internet. Second, they lack the bandwidth needed.

Now you may understand why broadband for broadcasters is not in the picture.

One might assume that existing laws requiring a broadcaster's consent for retransmission adequately protect broadcasters. One might also assume that professional pirates are not going to be intimidated by a few bits in an ATSC transport stream that any hacker can easily get around.

Content owners seem more concerned about controlling their customers than the pirates. They are concerned that the quality of digital – especially HDTV — is too good; that perfect copies will quickly show up around the world, spread via the Internet. For this reason, they will not make their best stuff available to *digital* broadcasters unless it is protected from redistribution via the Internet.

So broadcasters created the broadcast flag. Unfortunately, the October story propagated a bit of misinformation about the flag: "On the surface, the broadcast flag appears innocuous enough. Just a few bits that tell a receiver whether a program can be copied unlimited times, once or never."

A friendly e-mail from the NAB Office of Science and Technology noted an error in this description:

"The so-called broadcast flag <rc_descriptor> effectively has only two states, assertion that redistribution to the Internet should not occur (the descriptor present) and no assertion . . . . It says NOTHING about copy once. See ATSC Amendment 3 to A/65A."

Equipped with a broadband connection, I hit the Internet in search of an understanding of the full scope of the conflict.

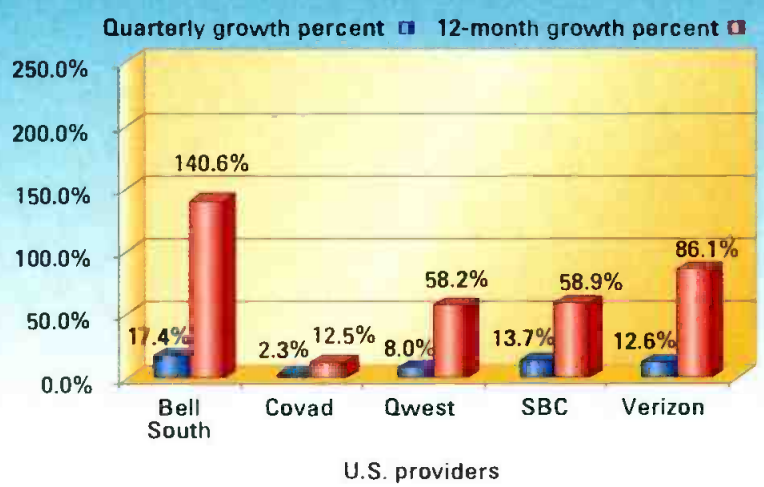
The "hole" story

First stop, the ATSC. Amendment 3 to A/65 tells us that the purpose of the

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

U.S. DSL broadband growing

Operators spending cautiously



SOURCE: Point Topic

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[to serve and protect.]

That's the job of this SeaChange MPEG-2 video server. To safeguard the heart of your operation, your digital assets. Today SeaChange is the global leader in MPEG-2 digital video systems. Our servers are out in force, streaming over 350,000 channels worldwide. With ironclad, scalable solutions for broadcast, broadband and Internet, you can manage your most demanding applications and a variety of content—including play-to-air, video-on-demand, digital advertising and Internet streaming. What's more, the patented design of the SeaChange MediaCluster will keep you on the air all the time, offering the highest fault-resilience in the industry without costly mirroring. Which saves you the expense and complexity of working with redundant servers. So in addition to protecting your digital assets, SeaChange also protects your revenue streams, your technology investment and your business. And you have that from a reliable source.

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Redistribution Control (RC) descriptor is to convey a certain type of redistribution information held by the program rights holder for audio, video or data events, and to signal "technological control of consumer redistribution."

As outlined in the NAB e-mail, the rc_descriptor is either present or not. If present, there is an expectation for control of redistribution. Rather than defining this control, however, the amendment simply states: "It is out of the scope of this standard to assert how any receiving device reacts when the rc_descriptor is present."

The burden of implementing the broadcast flag does not fall upon the broadcasters or the content owners. By enabling one bit for each program in the ATSC transport stream, broadcasters have done their part to control redistribution. The same is true for the content owners; they just put a provision in their contracts requiring that the rc_descriptor be turned on.

The burden falls to the product manufacturers, and the networks that transport the bits. The consumer will be forced to pay for the hardware, software and license fees needed to protect content when the rc_descriptor is present. And the consumer will be subject to the inevitable frustrations of not being able to use products they purchase legally when the technology does not work properly.

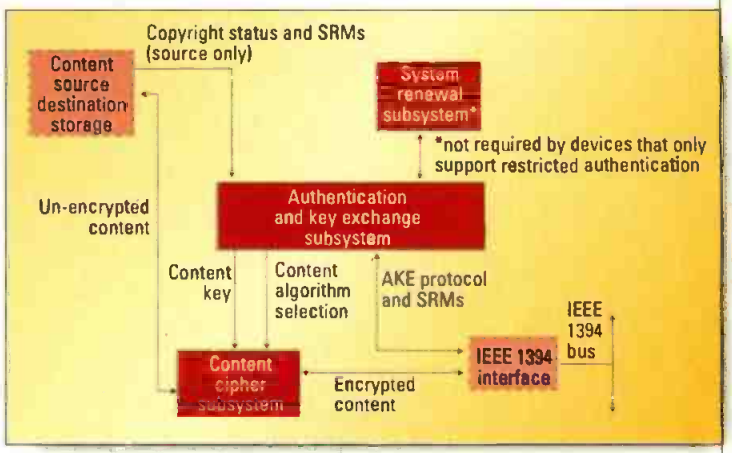

Figure 1. A key authentication and exchange subsystem and a digital encryption/decryption subsystem would typically be required for a device to be compliant with digital transmission content protection, as applicable to the IEEE 1394 interface.

As an example, a cable system recently turned on a content control bit (similar to the rc_descriptor), and consumers with new D-VHS recorders suddenly found that they could not record any programs from the cable system.

The scope of the problem grows larger and larger as the number of digital devices and connections grows.

The consumer electronics industry and broadcasters appear to be in sync

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when it comes to protecting the "fair use" rights of consumers. But there are still disagreements about where fair use rights end, as related to making legal copies of media and moving media files across networks that extend outside the home. For example, you might be allowed to play a DVD you own on a DVD player in your vacation home, but you probably could not use an Internet connection to move a legal copy of a movie or broadcast program to a PVR in your vacation home.

Meanwhile, the content moguls are seeking perfect control – the ability to be compensated for every use of their content. But even if redistribution control is possible with new digital devices, there is still no way to plug the analog hole. A consumer could still point a camcorder at a TV display and use legacy equipment to encode it and distribute it via the Internet. The real question, however, is: Why would they bother?

Encouraging "legal" behavior

Is it really necessary to protect content producers from the consumers who are sending them billions of dollars each year? And how much is all of this protection going to add to the cost of future digital media products?

The movie industry does not appear to be suffering. Box office receipts are at an all-time high, and DVDs are turning into a digital gold mine.

Implementation of the retransmission control descriptor could burden every digital media appliance and networking device with added hardware costs and license fees. A major contender is the digital transmission content protection (DTCP) system. This system requires each device to implement a key authentication and exchange subsystem and a digital encryption/decryption subsystem to protect all content moving over the digital link (see Figure 1).

High-definition displays are now beginning to incorporate the digital video interconnect with HDCP, another form of encryption, to protect the bits that flow between a set-top box or video recording device and a display. If HDCP becomes a required form of protection for HD content, several million first-generation HDTV monitors may not be able to display HD content. The HD source would be limited to 480p resolution for output on analog component connections.

Now you may understand why broadband for broadcasters is not in the picture. And why DTTV is not in the picture for many confused consumers. BE

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

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

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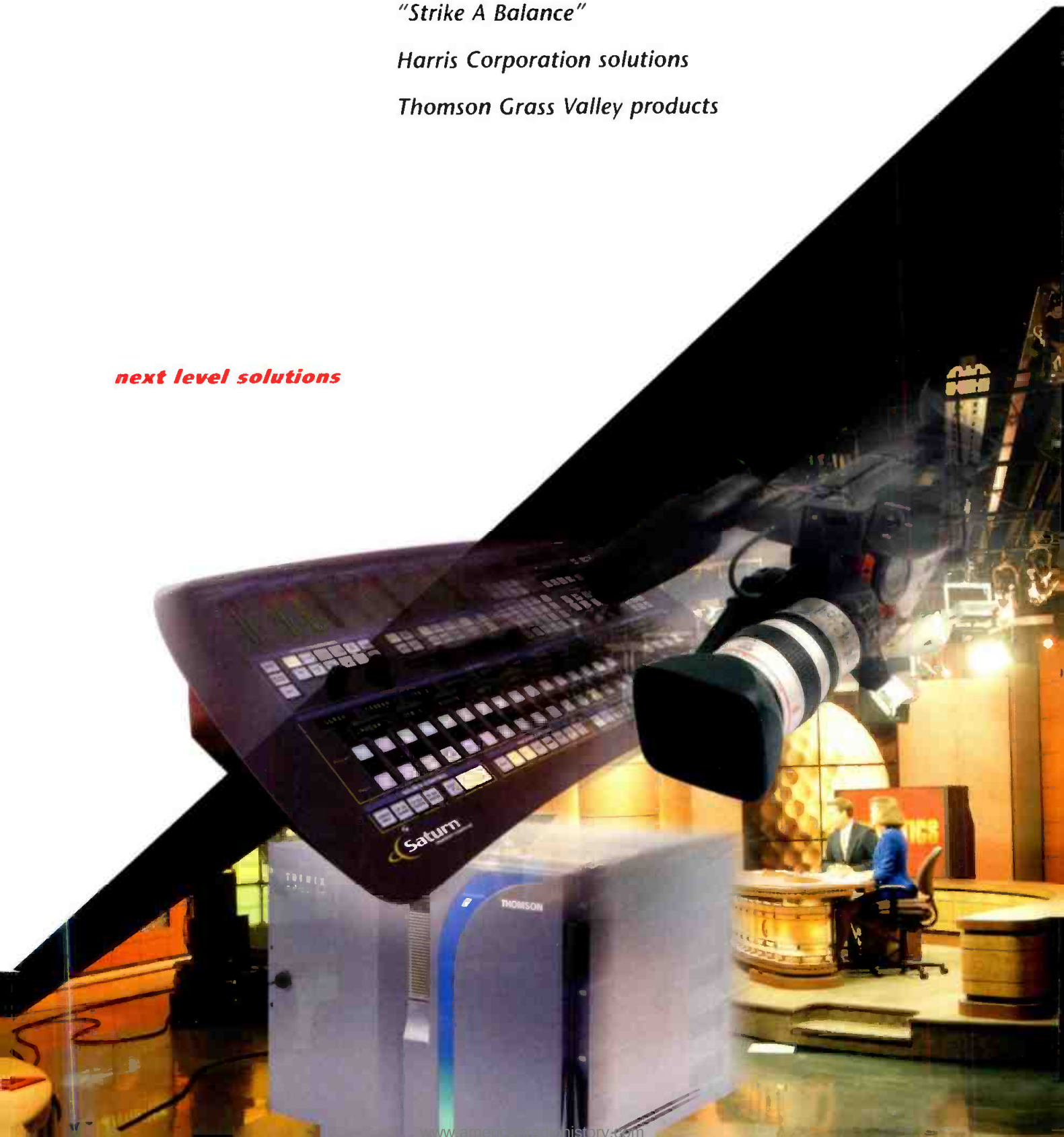

FACILITY INTEGRATION

Harris integrates customer, future-ready systems for fixed and mobile applications. The systems integration team has been designing and integrating systems for the broadcast industry for more than a quarter of a century. With access to products from leading equipment manufacturers like Grass Valley, Harris can design systems with components that precisely meet your requirements. Harris helps you strike the balance you need in your facility with the following services:

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- 24-hour service
- Video networking systems
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Whether you're in need of a cost-effective basic studio or a sophisticated system that relies heavily on external feeds and live music production, Harris has the systems integration capabilities to pull your studio solution together with the proper Grass Valley products that meet your requirements.

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The LDK 5000 is the only camera that lets you shoot in SD today — and in any native HD format whenever you're ready. Its DPM+™ CCD uses 9.2 million pixels to capture extremely high-resolution images. With this over-sampling technology, you get the best possible images with extremely low aliasing in applications ranging from studio and fixed-camera installations to portable, hand-held EFP uses.

LDK 6000

Only the LDK 6000 mk II camera captures true progressive high-definition (HD) images, natively, in multiple formats and frame rates. With three 9.2 million-pixel HD-DPM+™ CCDs, it offers the highest quality picture available for everything from remote-controlled, portable hand-held, and studio applications to EFP uses for SDTV and HDTV productions — even digital cinematography.

LIVE PRODUCTION

When you're on the air, you need integrated tools that are intuitive and powerful. That's why you'll find live production integration solutions from Harris coupled with Grass Valley products that fit your workflow. Get the robust software, networking, and effects products you need put together by the integration leader.

KALYPSO™

The next-generation Kalypso™ Video Production Center puts unparalleled live production tools at your fingertips. This digital system offers powerful mix/effects capabilities with unprecedented levels of keying and compositing and an open, networked architecture for robust operational integration. All from a familiar, intuitive Grass Valley™ interface.

DIGITAL NEWS PRODUCTION

When you commission a news production project, you need a solution that will take into consideration the entire news process while being robust enough to work at your busy pace. When combining integration from Harris with news production products from Grass Valley, you can't go wrong. You'll make sure your stories get to where you need them to go. Since digital news production costs less than tape-based solutions, you'll also increase the value of your news content.

NEWSEDIT™

The NewsEdit™ nonlinear editor is twice as fast as other systems thanks to its ability to show you an edit as it is being made. And with no pre-digitization requirement, you can record directly from tape to timeline, eliminating the need to go back and review your work. You simply go right on to the next edit.

MASTER CONTROL

When you need a system for your master control that is highly configurable and reliable so that you have no interruptions in your operation, Harris can integrate the Grass Valley system that is just right for you. Whether you need a standalone single channel system with internal routing matrices or multi-channel, highly-networked systems that leverage crosspoints of your facility routers, we can balance the perfect solution for you.

SATURN™

The highly configurable Saturn™ master control system supports numerous digital or analog applications — from single-channel, standalone uses to networked, fully automated, multi-channel facilities that leverage the crosspoints of a routing matrix. Letting you mix and match formats easily, it is also tightly integrated with our JupiterPlus™ control system for routing and machine control and offers an external digital effects option.

TECHNICAL CORE

Servers/Shared Storage

Get the server solution that stores more broadcast content than any other in the world with the Emmy® award-winning Grass Valley Profile® Platform integrated by the Harris system team. Get the flexibility you need that supports your signals and formats with future-proofed technology.

PROFILE® XP MEDIA

Supporting everything from broadcast to live production, the Profile® XP Media Platform is the latest generation of our Emmy® award-winning Profile line. Available in standard- and high-definition versions — and distributed or centralized storage architectures — Profile systems can fit any facility design. For mission-critical applications, they offer redundant components, RAID storage, and remote monitoring in an easily scalable platform.

TECHNICAL CORE

Routers & Control

Do you need just a handful of crosspoints or millions? Whatever your answer, Harris can integrate routers from Grass Valley that are intuitive, flexible, and have low power consumption. They're known for unsurpassed flexibility tailored to your specific applications — of any size. Get the control to handle all of your video, audio, and data signal requirements.

TRINIX™

From broadcast facilities to OB vans, our Trinix™ digital video routing switcher family can handle standard — and high-definition signals (SD and HD) from 3 Mb/s to 1.5 Gb/s in the same frame. Available in three dense, fixed-frame sizes up to 512x512, the Trinix family features efficient and redundant — cooling, proactive status monitoring, and front-loading, hot-swappable modules for easy servicing.

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Whatever you application, Grass Valley offers a full range of signal-processing capabilities that can be integrated into your facility with ease by Harris. You can maximize the return on your investments with anything from single-function applications to complex processing of multiple program streams. And, the continued support is unparalleled.

GECKO™ 8900

The Gecko™ 8900 Signal Processing System offers a broad array of discrete conversion, distribution, timing, and processing functions, using 8900 Series modules. You can easily monitor its status using Grass Valley's NetCentral™ software for SNMP-based remote monitoring and Web-based control system. And it's an excellent complement to the Kameleon™ Media Processing System, which offers multifunction modules for complex processing of multiple program streams.

TECHNICAL CORE

VTRs

Grass Valley offers a full line of VTRs available for integration from Harris to suit your format and demanding production needs.

DVCPRO

The DVCPRO format is an affordable choice for digital production and fast, on-air newsgathering. Since its introduction, the compactness, robustness, and playback capabilities of the format — as well as those of DVCPRO-based camcorders, field editing equipment, and studio equipment — have made it the standard choice for news teams and production houses worldwide.

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News Tech summit

BY BRAD DICK, EDITORIAL DIRECTOR

If you were missing your news director and/or chief engineer in mid-October, they were probably at the *Broadcast Engineering* and *Broadcasting and Cable* News Technology Summit in Atlanta. The summit focused on helping attendees and their stations better understand and apply news technology. Corporate sponsors included Avid, CNN Newsource, Leitch, Pathfire, Pinnacle Systems, SGI, Sony, Thomson Grass Valley, Chyron, ParkerVision, Quantel and vizrt.

There is no ROI on news

Perhaps the liveliest session focused on the issue of justifying new technology and equipment for the newsroom.

The audience quickly got into this session. Many questions centered on how to measure the return on the investment in a technology. How, for example, could a chief engineer and news director convince the station's financial managers that a networked newsroom would actually save money? Obviously, the audience had been faced with such questions.

The consensus from the experts on the panel may have disappointed some in the audience: There is no ROI on news technology. The experts told the audience not to expect traceable financial results when adding new technology to a news operation. Purchase new technology because it keeps you competitive, the panel said.

Transitioning the news operation

Attendees were also jarred a bit at the thought of intermixing current 4:3 images with widescreen 16:9 images from the network. Few news directors had given serious consideration to how a station's new set might look when it follows a 16:9 newscast from the network. Also, how will stations combine 4:3 images from their own crews with a possible 16:9 network feed? Consider how to handle bumpers between network and local shows. The network feed is 16:9 and your promos are 4:3. Anyone see a problem building there?

Chief engineers were concerned about the life of their new cameras. They wondered if there is a disadvantage in buying new cameras today if they cannot be upgraded to 16:9 imagers. Or would it actually be better to buy now without an upgrade path because new cameras may later drop in price.

One area attendees and panelists found little common ground on was digital asset management. Audience questions showed that most stations "manage assets" with a labeled cassette. If you can't find the cassette, or if it wasn't properly labeled in the first place, you don't have an asset.

There is no ROI on news technology.

The large organizations represented on the panel, CNN and CBS, already have DAM systems in place. A check showed that no one in the audience did. The disconnect between the large networks and typical stations may be based on the cost of the technology. As prices come down, expect wider use of DAM technology.

Other session topics included centralized graphics storage, centralcast news issues, migration to a digital newsroom, newsroom workflow and the future of television news. Keynote speakers included Walter Isaacson, chairman and CEO of The CNN News Group, and Thomas Wolzien of Sanford C. Bernstein & Co.

Broadcast Engineering and *Broadcasting and Cable's* next technology summit is scheduled for February. Stay tuned for more information. BE

BEYOND THE HEADLINES

FCC ownership studies released

BY HARRY C. MARTIN

The Commission has initiated a top-to-bottom review of the broadcast ownership restrictions covering both the local and national ownership caps for all broadcast facilities. The current duopoly restrictions for TV, as well as the newspaper/TV and radio/TV cross-ownership rules, are in play.

The comment and reply comment deadlines were not announced when the FCC's Notice of Proposed Rulemaking was first released. Instead, those deadlines were to be established upon the release of 12 studies commissioned by the FCC to review the various aspects related to the broadcasting industry. Those studies have since been released, and the Commission established Jan. 2, 2003, as the comment deadline, and Feb. 3, 2003, as the deadline for replies. Links to these studies can be found on the FCC's Web site at www.fcc.gov/ownership/studies.html.

The TV-related studies reached several conclusions pertinent to the FCC's proceeding:

- There is little substitutability between radio, television and newspaper advertising; thus, local businesses will not easily move among the three when faced with increased advertising rates.
- On the other hand, there is evidence of substitutability of daily newspapers, radio and cable, and broadcast TV with respect to news consumption.
- Consumers will substitute among radio, television, newspapers and the Internet for the source of programming, with the greatest substitutability being between:
  - -Internet and broadcast television;
  - -broadcast television and cable television;
  - -cable television and daily newspapers;
  - -radio and broadcast television; and
  - -the Internet and daily newspapers.
- In 10 surveyed markets, the number of media outlets (radio, TV, newspapers, cable and DBS) had increased by 195 percent since 1960, and the number of independent owners had increased by 139 percent.
- Of 10 commonly owned newspaper-TV combinations, five exhibited a similar slant in covering the final weeks of the 2000 presidential election, while five exhibited divergent slants.
- TV stations owned and operated by one of the networks produced substantially more local news and public affairs programming as compared to non-O&O network affiliates.

There have been media reports of complaints from certain trade groups that these studies were intentionally slanted to support the deregulatory agenda which FCC Chairman Powell is thought by some to embrace. Indeed, Commissioner Copps criticized the studies as "bare-bones," and requested that the Commission hold "town hall" meetings to obtain direct public comment.

The Commission is committed to resolve this proceeding by May or June.

Dateline

Issues and programs lists for the fourth quarter must be placed in the public file by Jan. 10. Children's television reports for the fourth quarter (Form 398) must be electronically filed with the FCC, also by Jan. 10. The DTV on-air deadline for noncommercial stations is May 1, 2003.

Enforcement news

The FCC recently announced that in the past fiscal year (Oct. 1, 2001, to Sept. 30, 2002) the agency fined companies more than $28 million. The chief of the FCC's enforcement division claimed that enforcement actions are aimed at benefiting consumers, but that did not stop him from announcing the multi-million-dollar fine total. Among the most frequently cited, and expensive, rule violations involve tower painting and lighting. Here are some recent cases:

The FCC recently announced that in the past fiscal year . . . the agency fined companies more than $28 million.

- The FCC collected $105,000 from a North Carolina company for failing to properly paint, light and mark several towers. Although the original forfeiture notice cited all of the company's towers, the company responded by proving to the FCC that, under its rules, one of the towers in question did not require any painting, lighting and marking. The Commission accepted this, but that shaved a mere $6,000 from the overall fine.
- An FCC agent visited a station to advise the licensee of painting, lighting and marking violations, but was told that the towers were less than 200 feet high and, therefore, exempt from such requirements. Skeptical, the agent returned, measured the towers and determined that they were 230 feet high. Soon thereafter the station received notice of a $15,000 fine. BE

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

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A new age for virtual studios

BY KRISTINA JONES

Are you ready for what virtual technology has to offer? Then the advantages of virtual sets may very well be what you're looking for. The virtual model as a production set is moving towards realism like never before. It offers limitless potential, and is quickly becoming an affordable and viable production solution. Soon, say developers, you won't be able to tell a set is virtual. Although virtual is not yet fully embraced as a replacement for the traditional physical set, broadcasters are taking a serious look at the advantages of digital environments. Virtual technology can provide benefits to the new age of television journalism ranging from significantly improved viewer experience to fast, low-cost production.

With early beginnings in flight simulation, and more recently the gaming industry, real-time 3-D simulations have reached a level of realism that is quickly approaching reality. For a long time, virtual just didn't look convincing or real enough for serious and credible content. It always had a pixilated look that some called cartoonish and too surreal. Clean keying was also a constant struggle. Having a blue edge spill around your talent just emphasized the fact that this was a "fake" background. But recently, all this has taken a huge leap towards an increased image quality that may very well revolutionize what we perceive to be "real."

As virtual technology advances, many broadcasters are beginning to take an interest in the versatility that virtual sets can bring to their productions. Image courtesy Devlin Design Group.

The biggest innovation of late has been the development of pixel and vertex shaders that allow sophisticated real-time effects such as bump mapping, reflections, dynamic lighting and deformations. According to Michael Shea, head of content development at Devlin Design Group, this technology allows effects to be created at the pixel level, freeing artists from the limitations of polygon budgets and texture-only based solutions.

Versatility is one of the most compelling features of the digital world.

The demand for virtual sets is becoming increasingly noteworthy because the cost of hardware has come down considerably. New graphic processing units (GPUs) are allowing mid-range systems to do what previously only high-end SGI reality engines could handle. This shift in real-time performance on desktop systems has widened the market for virtual set technology. High-end production facilities, smaller post houses and production departments, and even Webcasters are taking an interest in virtual content. Eventually, say some, corporations and schools will follow suit, using the full capabilities of virtual for everything from corporate meetings to online education.

Versatility is one of the most compelling features of the digital world. Imagine having the ability to edit and change a set environment instantly. The use of shared resources for multiple productions also saves time and money. You can create a seemingly large expanse in a relatively small studio space and have a very expensive look by designing set elements such as huge video walls, elevators, rotating platforms and mechanical props like moving monitors and graphic panels. Even real-time stats on sports and elections can be piped into the virtual set, along with remote video of anchors in the field or interviews with distant celebrities. All this is possible in the virtual world.

Multicasting may well be the most practical application for many new network duopolies. As more media companies merge, the possibilities of virtual are even more appealing. Imagine shooting your talent in front of a blue screen and piping the signal to multiple virtual systems with different branding or even an entirely different set. It has already been done right here in the United States.

Understanding that it's very much an integration process of system and content is the first step, and it may not always be as easy as hardware manufacturers would like you to believe. With every new technology comes frustrations — long hours of figuring things out, tweaking, adjusting and modifying. Many think it's a plug-and-play solution, but it's just not there yet. So, be realistic, have patience and think ahead. Even though there are dozens of library sets available for immediate purchase, many need to be optimized or configured for the type of system you have. Content creation specialists can offer the added value of knowing what works in the broadcast environment and how to best design for various systems specifications.

As with any production, have a plan and know how you're going to produce

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before making the choice to go virtual. If you're going to invest in hardware, software, content and education, make sure you also have a strong desire and willingness to learn and advance in new directions. This is really the only way you'll gain the experience it takes to successfully run a virtual studio.

It is also important to realize the limitations of producing in virtual space. Talent comfort and choreography in the blue room can be an issue. Everything needs to be mapped out and rehearsed. As long as you realize what you're getting into and do your homework, chances are that it will prove to be a great investment down the road.

It still takes tremendous skill and patience to model a realistic-looking virtual set. You not only have to understand 3-D, but also architecture, geometry, lighting, spatial relationships, color, production value and editing. Don't be fooled by systems and software that claim "do-it-yourself virtual." Unless you've had years of advanced graphic developmental experience, you'll be disappointed in the results. If you want a high-end, professional look, let a professional create your environment.

Even though competition in the production industry is fierce and everyone wants the latest, greatest stuff, there's still hesitation over going completely virtual. One solution is to use a hybrid set that is part traditional "hard" set and part blue screen component, allowing for virtual set integration. Many producers are opting for this solution because it allows them to shoot both real and virtual on the same set. For example, hybrid sets can allow newscasters to customize a look with content-specific graphic panels for special segments, breaking news or franchise packages.

WorldNet IBB, a division of Voice of America, recently called on virtual set firm Devlin Design Group for virtual content for producing multiple projects aimed at various nations around the world. On a restricted budget, they needed the ability to change imagery for each show. DDG provided them a Library SoftSet that was customized to their specifications. Once the model is complete, all they'll need to do is insert various images into the environment. Pre-rendered library sets offer fast, reliable choices and allow producers to see what they're getting before they commit to purchase.

This is the perfect opportunity to be a true pioneer because the more virtual set technology comes into use, the more it will advance and continue to flourish.

If you'd like more information about virtual and/or traditional sets, visit www.ddgtv.com. BE

Kristina Jones is a graphic designer and freelance writer specializing in media matters and design solutions.

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Measuring digital systems performance

BY MICHAEL ROBIN

The need to satisfy complex distribution patterns typical of large teleproduction centers led to the development of the bit-serial digital signal distribution concept. This consists of reading out sequentially the 10-bit parallel data, starting with the least significant bit (LSB) and ending with the most significant bit (MSB), and sending the resulting bit-serial digital signal on a single coaxial cable. For Rec. 601, 10 bits per sample, 4:2:2 encoding this results in very high bit rates, e.g. 270Mb/s (27Mwords/s x 10 bits/word), with an associated spectrum of the order of 1GHz. A special channel coding known as scrambled NRZI (non return to zero invert) is used to randomize the data and ensure an unambiguous and error-free signal regeneration at the end of long coaxial cables, typically between 600 and 1000 feet, depending on the cable-loss equalization capability of the receiver.

Figure 1 shows a conceptual block diagram of bit-serial component video digital signal distribution. The source encoder is the conventional group of three analog-to-digital (A/D) converters, whose outputs are multiplexed into a 27Mwords/s bit-parallel datastream. The transmission channel encoder transforms the bit-parallel datastream into a bit-serial digital signal suitable for transmission by the chosen medium (e.g. coaxial cable). The signal is corrupted by the main source of interference: the thermal noise contributed by the receiver input stage. Excessive cable losses will result in a low signal-to-noise ratio (SNR) and a high bit error rate (BER). The receiver channel decoder deserializes the received bit-serial signal and recovers the bit-parallel digital video signal. The signal decoder is the conventional group of three digital-to-analog (D/A) converters recovering the original analog component video signals.

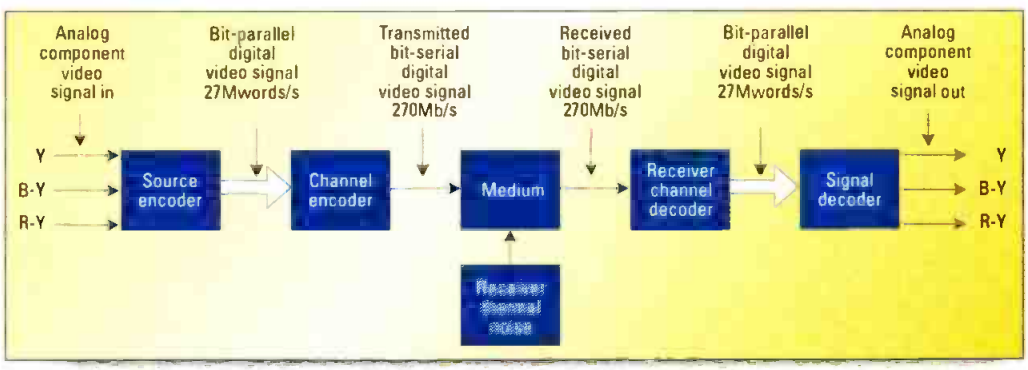

Figure 1. Bit-serial digital video signal distribution begins and ends with conventional A/D and D/A converters.

The standard interface characteristics

SMPTE 259M describes the bit-serial interface for 525/59.94 and 625/50 equipment. It has applications in a television studio using coaxial cable lengths not exceeding the amount specified by the equipment manufacturer, typically accepting a signal loss of 30dB at the clock frequency. The interface characteristics are summarized in Table 1. Figure 2 shows the typical eye diagram of the bit-serial digital signal and some significant characteristics. There are three areas of performance-related engineering concerns as follows: evaluation of

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DTV households on the rise

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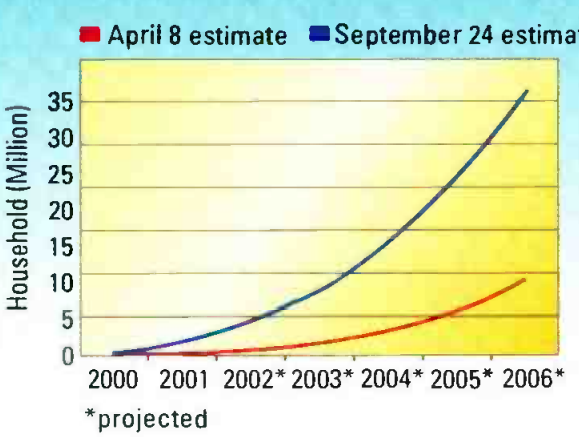

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equipment and technology, post-installation acceptance tests, and maintenance tests. Table 2 lists some performance-indicative parameters and their application.

Measuring transmitter-related parameters

The measurement of the transmitter output signal characteristics requires accuracy, speed and reproducibility. It is advantageous to use a digitizing oscilloscope, with a bandwidth on the order of 2GHz, that can be programmed to measure a set of parameters and display the results on the screen. The parameters to be measured are amplitude, rise time and fall time, overshoot, and jitter. The limits of acceptable performance are as per SMPTE 259M. The measurement of jitter requires the use of a suitable reference either external to the equipment to be tested, resulting in absolute jitter measurements, or derived from the signal to be measured, resulting in relative measurements. The bandwidth of the relative jitter measurement depends on the clock recovery method used, since the recovered clock signal will contain some of the signal jitter characteristics. A jitter measurement bandwidth of 10Hz to 27MHz yields timing jitter values, whereas a measurement bandwidth of 1kHz to 27MHz yields alignment jitter values. When measuring jitter it is important to mention the reference clock source.

Waveform monitors belonging to the Tektronix WFM601 family can be used to carry out signal characteristics measurements. It has to be realized, however, that these instruments have a measurement bandwidth of the order of 300MHz, which will affect the rise time/fall time and overshoot measurements results, and necessitate a correction formula to obtain accurate results. Some waveform monitors have a choice of derived reference clock bandpass, allowing the user to determine the dominant frequency of jitter. The output return loss is an important performance-indicative parameter, especially for relatively short cable runs. Special network analyzers are used to carry out this measurement. Bit-serial digital video equipment, especially large-capacity routing switchers, may generate high levels of electromagnetic radiation (EMR).

Channel coding	- Scrambled NRZI - Input signal polarity: Positive logic - Data word length: 10 bits - Transmission order: LSB of any data word transmitted first
Transmitter characteristics (See Figure 2)	- Unbalanced output - Source impedence: 75Ω nominal - Return loss: ≥ 15dB (5MHz to clock frequency of signal) - Output signal amplitude: 800mV p-p ± 10 percent - OC offset: 0.0V ± 0.5V with reference to mid-amplitude of signal - Rise and fall time: 0.4ns to 1.5ns between 20 percent and 80 percent of signal amplitude points. Differences not to exceed 0.5ns - Overshoot of rising and falling signal edges: <10 percent of signal amplitude - Jitter: 0.2UI (.74ns) between 10Hz and 27MHz
[illegible]	- Unbalanced input - Input impedance: 75Ω nominal - Return loss: ≥ 15dB (5MHz to clock frequency of signal) - Optional cable-loss equalization: 30dB at clock frequency of signal

Table 1. Transmitter and receiver characteristics for bit-serial interfaces are summarized above.

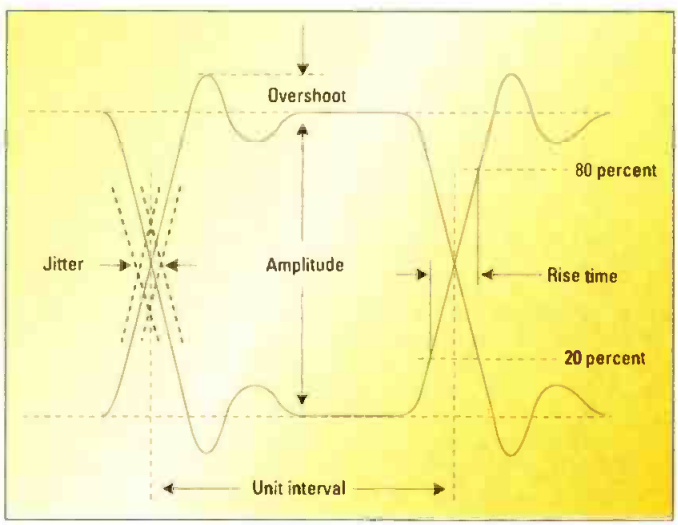

Figure 2. The figure shows the measurement dimensions of a typical eye diagram of the bit-serial digital signal.

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Measuring receiver-related parameters

In addition to the input return loss, there are several additional receiver characteristics that need to be measured. These have to do with the ability of the receiver to extract the original data from a noisy and jittery input signal. Two special test signals have been developed to meet this requirement:

• *The EDH test signal*: The Error Detection and Handling (EDH) concept was developed by Tektronix and issued as a SMPTE Recommended Practice, RP 165. It is based on making cyclic redundancy check (CRC) calculations for each field of video at the serializer and at the receiver. The CRCs are recalculated at the deserializer and, if they are not identical to the transmitted values, an error is indicated. The EDH is used as an in-service test to pinpoint automatically and electronically any system failures.

• *The pathological test signal (SDI check field)*: The fundamental idea behind the test signal is to stress the transmission channel and assess the effects. Sony has developed two special test signals for stressing the bit-serial receiver. One of them, consisting of a one followed by 19 zeros, has a large DC content and is used to stress the cable-loss equalizer. The second stress signal consists of an identical sequence of ones and zeros repeated every 20 bits, which provides a minimum of crossings for clock extraction. SMPTE RP 178 describes a recommended pathological test signal called serial digital interface (SDI) check field, consisting of one-half field of each of the two stress signals described above. This test signal is fed to the input of the equipment under test and the output is monitored on a color monitor. Bit errors affecting the top of the picture are a result of the malfunction of the equalizer, usually because of a coaxial cable length in excess of the equalizer correction capability. Shortening the cable will eliminate the problem. Bit errors affecting the bottom half of the picture are caused by a malfunction of the receiver clock regenerator and could indicate a condition where the free-run frequency of the PLL-controlled VCO in the receiver has drifted from the specified frequency. A readjustment of the VCO frequency will eliminate the problem.

Parameter	Unit	Evaluation	Acceptance	Maintenance
Return loss	dB	Yes	No	No
Signal amplitude	p-p mV	Yes	Yes	Yes
Rise/fall time	ns	Yes	Yes	Yes
Overshoot	percent	Yes	Yes	Yes
Jitter	p-p ps	Yes	Yes	Yes
Bit error rate	Errored seconds	Yes	Yes	Yes
Pathological check	Error/min	Yes	Yes	Yes
EMR	dB µV/m	Yes	Optional	No

Table 2. Performance-indicative parameters are used for the evaluation of equipment and technology, and in post-installation acceptance tests and maintenance tests.

The listed measurements require special test equipment, which may represent a significant investment and necessitate the acquisition of special skills. The high reliability of digital equipment using bit-serial ports creates a false feeling of security. As a result, many organizations do not carry out tests of any kind. This can lead to catastrophic results due to the cliff effect, a typical problem in digital signal distribution. BE

Michael Robin, a fellow of the Society of Motion Picture and Television Engineers and a 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.*

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Building
reliable fiber networks

BY BRAD GILMER

If you want to build reliable fiber-optic networks for computer and video, there are a few basics you should get right. First, you must use the proper cabling and hardware. Second, you should use good techniques, and have a relatively clean work environment. Finally, nothing is perfect — you should have a backup plan that suits the criticality of the service you are carrying.

Proper cabling and hardware

It is very important to choose the correct cable for your application. The equipment you use will determine the diameter and mode of the cable you need. And the application environment will determine whether you use indoor or outdoor cabling. But there are many instances when you need to terminate cables or splice them together. For these procedures, you must use the proper hardware.

There are two types of indoor cables: single-fiber and multifiber. Single-fiber cables contain a single fiber strand with a tight buffer surrounding it. These cables are also available as a "Siamese" zip-cord pair. You can terminate this robust cable directly without any special considerations. Multifiber cables have a common outer jacket that contains two or more tight-buffer cables, each of which contain a single fiber. You can strip the outer jacket away to reveal fibers that are ready for termination. It does not require a breakout kit for termination. (More on breakout kits later.)

Rick Ackermans, director of engineering for Turner Entertainment Networks, examines the fiber-optic cross-connect facility inTurner's new six-story broadcast facility in Atlanta. The room contains over 600 strands of single-mode fiber and over 300 strands of multimode fiber.

Fiber-optic cables designed for outdoor use differ significantly from their indoor counterparts. The outer jacket of the outdoor cable is much thicker because it is treated to resist water and ultraviolet radiation. It contains several loose buffer tubes, each of which contains several fibers. Each tube slides over its set of fibers, which are lubricated by a gel. Thus, no individual fiber strand is surrounded by its own protective jacket. This saves space in the cable, but it means that you must use a breakout kit to terminate the cable.

Usually when connecting outdoor cable to indoor cable, you need some sort of transition. This involves breaking out the loose-tube individual fiber strands and connecting them to a panel. You connect the other side of the panel to indoor cable.

Breakout kits allow you to convert the loose-tube multifiber outdoor cable to a number of tight-buffer individual fiber cables that you can terminate for indoor use with the appropriate connector. The tight-buffer cables are much more rugged and will withstand the environment of a broadcast facility much better than the individual strands of a loose-tube cable. The fibers in the breakout kit are fusion-welded to the individual fibers in the outdoor cable. This precludes terminating the cable in the field.

If your technique is good, you will only lose between one-half and one dB per connector.

It is important to use the proper hardware to keep the fibers from becoming deformed or broken. Typically, a fiber must not be bent at a radius that is less than ten times the fiber core diameter. This is not only to prevent cable breakage, but to prevent light leakage and cable losses as well. Special fiber raceways are available to protect the fiber cables.

Good technique and a clean environment

If you have a large number of fibers, or if your cable runs are such that preterminated cables are not suitable, it might make more sense for you to terminate the cables yourself. But, if you don't have previous experience terminating fiber, you might be better off purchasing terminated cables. Fluke has an on-line training course at www.cableu.net. This course is a good starting point, but it's no substitute for hands-on training.

If you do it yourself, and if your connections are critical, you should use an optical-cable test kit to be sure that your terminations are working properly. If your technique is good, you will only lose between one-half and one dB

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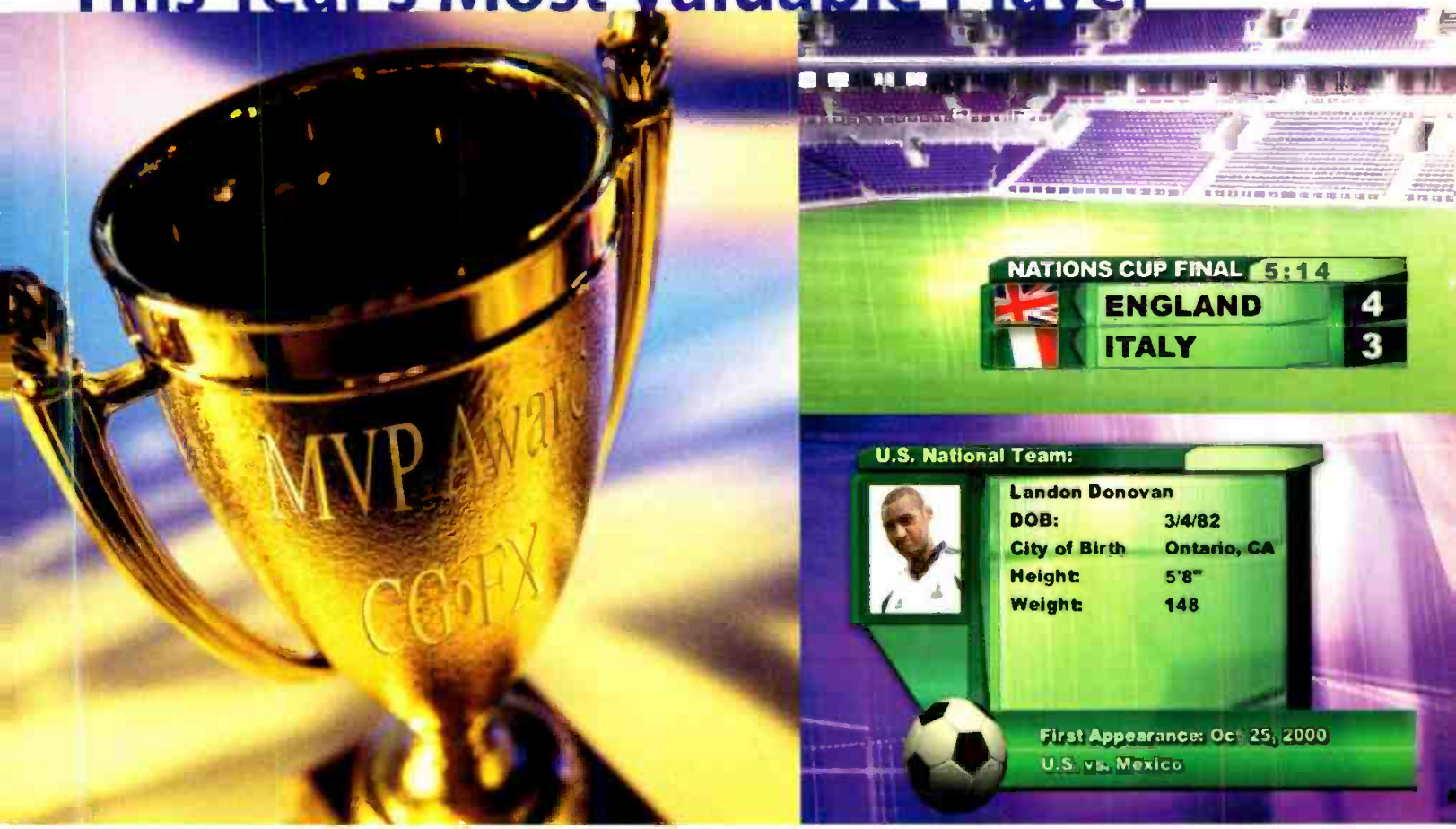

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Purpose-built fiber-optic panels protect cables from being broken while preventing them from bending beyond the minimum bending radius of the fiber. Minimum bending radius is usually 10 times the fiber diameter.

per connector. (Check the specifications of the connector to be sure.) That figure can go up substantially if the connectors are covered with dust, or if you shatter the end of the fiber by using the wrong tool for the job. Use a microscope to check the end of the fiber for a clean surface that is devoid of scratches. Once the cable is terminated, the end is protected and there is no risk of shattering of the fiber or scratching of the end of the fiber. From that point on, dust becomes the major concern. Always use dust caps on fiber connectors when they are not connected to a device.

It is extremely difficult to field-terminate angle-polished connectors. For this reason, fusion splicing has become very popular. To perform a fusion splice, cleave the fiber and fusion-splice it to a short "pig-tail" consisting of a connector and a short piece of fiber.

Appropriate backup/redundancy plan

If you are running fiber from one building to another, it would be prudent to pull more than one fiber. The cost of a multifiber cable is almost exactly the same as a single-fiber cable, but the cost of the installation can easily outweigh the cost of the cable itself. And if you have to pull a cable in an emergency (after your only fiber fails), the costs can be very high indeed.

Also, since fiber is more sensitive than copper to being grabbed by a backhoe bucket, you should consider running multiple cables over separate paths between buildings. Terminate all spare fibers, even if you are not using them. It will take less time to terminate the spares while you are doing the initial installation than it will take to go find all the tools, clear out the cobwebs, and terminate the cable months or years later when you have a failure.

There are all sorts of fail-over switches, automatic rerouting technologies and other things available to help you build redundant networks. Also, you might want to consider RF networking technologies or optical networking using free-space optics as a backup for your fiber system. BE

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

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Microphone options

BY GARY ESKOW

Harsh economic conditions are forcing audio recording facilities to make smart purchasing decisions in every area of their business. Fortunately, developments in component technology and increased access to a skilled Asian workforce have led to a proliferation of inexpensive, high-quality microphones.

For example, Studio Projects' B series mics have a one-piece, spun-brass body and a three-micron capsule. Its C series has a dual-cast body and a six-micron capsule. Both series include two FET models and a dual-triode tube model. I recently performed a blind test between Neumann's U87 and the C1 and C3 mics, with the help of longtime U87 owner Joe Cerisano, one of the premiere session singers in New York City. We recorded the same phrase three times, first with the U87 and then with the C1 and C3. On playback, the C3 needed a 2dB boost to match the level of the U87 and C1. Other than that, we were unable to distinguish between the three products.

In a blind test, Studio Projects' C1 and C3 microphones performed favorably against a more expensive microphone.

The company brass attributes the mic's performance to its body design, saying that eliminating highly reflective surfaces inside the mic body helps them avoid a hollow, tinny high end. One design characteristic of the C series that is very different from the U87 is that it uses a solid-state FET design rather than the high-quality Jensen transformer used in the U87. This saves dealers somewhere in the range of $100 to $150 per mic, but some users feel that the FET circuitry is not as stable as a transformer. Will the FET circuitry result in a compromised sound over time? The jury is out on this one, but even if a microphone that costs roughly ten percent of another mic and tests just as well wears out more quickly, then a strong case can be made for it using the old price/performance scale.

Image plays a big part in which mic studio owners choose. High-end clients don't want to see inexpensive equipment in the rooms they use. As a result, companies like Studio Projects are correctly eyeballing the project-studio market. As a result, Studio Projects decided not to manufacture shotgun mics.

Television stations can't afford to experiment with new technology.

Clients for shotgun mics (television stations, primarily) can't afford to experiment with new technology. They prefer the industry's proven leaders, including Sennheiser and Sony. Thus, the strategy of Studio Projects, and perhaps other microphone manufacturers, is to build small-diaphragm mics and a stereo large-diaphragm mic and expand according to market demand.

One day, the field may open up for manufacturers of low-cost microphones. But these days, live applications are handled exclusively with the products that have shown their ability to withstand difficult climatic conditions. Mike Pappas, electronics maintenance engineer for National Mobile Television, considers durability and performance to be critical attributes. For example, NMT uses Sennheiser ME 66 shotgun mics for covering tee and green locations on golf shows. They also use shotguns, typically Sennheiser MKH-70s or MKH-816s, on handheld cameras.

For announcers, headset reliability is at the top of the list. In these mission-critical situations, Sennheiser HMD 25s are typically used.

Recent history has shown that the encroachment of affordable technology cannot be stemmed. The new, affordable mics have found a home in recording studios (both the project variety and those that cater to the wider public) and audio post rooms. However, in all areas of audio production, mission-critical applications have continued to rely on traditional tools. Field applications, for example, are still handled almost exclusively with traditional, high-end gear. Time will tell if budget technology will be able to make inroads in rooms that cater to the upper tier. In the meantime, the continued growth of project studios and offline rooms ensure the success of companies that provide quality tools at affordable prices. BE

Gary Eskow is a composer and journalist who lives in New Jersey. He's held a number of editorial positions in the field of audio journalism, and is currently a contributing editor at Mix *magazine.*

SYSTEMS DESIGN SHOWCASE

Operators work in the master control room at Starz Encore Group headquarters in Denver, monitoring the primary, backup and return signals for 13 channels each on a virtual monitor wall from Barco. A supervisor has the ability to monitor and control any of the signals if required.

Starz Encore Group

BY RAY MILIUS

Starz Encore Group was founded in 1991 with a single channel and has grown to 13 channels with over 500 employees. Recognizing the need to accommodate this growth, the company decided to consolidate the business and post-production operations of the company in one building and create a new broadcast operations center for on-air playback and transmission.

Starz Encore currently broadcasts 13 channels, each with separate digital feeds for east and west coast time zones and a full backup playout. Five analog channel feeds are provided for the backyard C-band dish market.

Starz's technical facility utilizes most of the second floor of its new 300,000-square-foot Denver headquarters.

A decision was also made to upgrade the on-air operation from a semi-automated tape-based playout system to a fully automated, server-based playback and transmission center. The project team chose Omnibus Systems for automation, servers from Pinnacle Systems, Sony Broadcast for archive and Pinzone Engineering for uplink facility design. Beck Associates was chosen as the systems integrator.

Infrastructure for the facility was critically important. The technical center has backup power capabilities including two 1500KVA generators and two 625KVA UPS systems. HVAC is provided by redundant Liebert units in all the equipment rooms. All broadcast equipment wiring, routing and patching is HDTV compliant.

The broadcast operations center is an all-digital, server-based facility. Starz selected Pinnacle Systems MediaStream 700 servers for playback. Each playout server is configured with six ports for channel/feed playback and one for preview of material. The playout servers contain approximately 200 hours of

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storage per channel, and backup servers contain about half that amount. A server can handle up to three channels. Channels were assigned among the servers based on priority, so that no two high-subscriber-count channels share the same server. The backup servers mirror the content and outputs of the primary servers but, as a cost-saving measure, have less disk storage capacity.

Two MediaStream 1600 servers were selected for ingest/encoding. These servers are configured with three input ports for ingest of material and three output ports for preview/QC of material. They are fed from the encoding/ingest room.

Movies and promotional spots are encoded into MPEG-2 files at 15Mb/s into the Pinnacle 1600 server. The MPEG-2 movie files are then transferred to the Sony Petasite robotic data tape archive. Promo files are transferred directly to the playout servers. When a movie file is needed for playback, the automation system transfers the file into the appropriate Pinnacle 700 server.

Kent Wallace, broadcast media manager for Starz, works at an encoding station in the ingest/encode room.

Video processing

Signal flow for the plant is focused on keeping the failure points to a minimum in the playback and transmission chain. So most of the processing of the video and audio takes place during the ingest/encode step. Video is pre-processed and cleaned; V-chip, WebTV and XDS data are encoded; and audio is switched and encoded/decoded to provide the three pairs required. Starz broadcasts Dolby Digital 5.1 on six channels. Spanish SAP is broadcast along with standard English stereo on all channels. Consequently, all movies stored on the servers and archive are encoded with three audio pairs. This permits storage of a single copy of the movie with an audio configuration that will work for any of the channels. All of this signal manipulation takes place during the ingest/encode operation so that fewer

Thirty-six feeds are uplinked from the new facility.

boxes reside in the output chain. This provides the ability to compensate for a failure in any of these areas without affecting air.

An Omnibus Colossus automation system controls ingest and playout of material on all 26 primary feeds and playout on the mirrored backup servers. A total of 52 automation playlists run 24 hours a day to handle all of these feeds. Omnibus' Cache Manager handles the management of material on the servers. It sends commands and requests to the Omnibus Transfer Manager and Avalon software, which handle movement of MPEG-2 files from the archive to the playout servers.

The system also provides the ability to preview material on any of the primary or backup servers via a preview port assigned to each server. Starz has two Colossus engines, a primary and a backup, each running its own independent set of channels and servers.

Master control

In the master control room, two operators each control and monitor 13 channels (13 primary, 13 backup and 13 return signals). A supervisor at a back console has the ability to monitor and control any of the primary and backup channels. The supervisor also has a workstation showing status of the Cache Manager and the file transfer operations. A workstation illustrating status of the satellite encoders and uplink transmitters is located nearby.

Barco provided the virtual monitor wall in the master control room. The wall consists of nine 50-inch projection cubes. Users can define the size and number of windows on the wall. The wall also displays audio monitoring meters for the English and SAP channels in each window, and alarms for loss of audio, closed captioning or video. Each channel is set up with a three-monitor window display: a large window for primary server output, and small windows for backup server output and monitoring of the satellite return signal.

SYSTEMS DESIGN SHOWCASE

Transmission chain

The transmission signal flow is fairly simple. The material is played out of the server port. Effects are added by a Pinnacle DekoCast box when triggered by automation, and the signal then goes directly into the satellite encoder. There it is compressed and fed to the transmitter for uplink to the satellite. The backup path of each channel does not contain any graphics or voice-over capability but goes straight to the transmission router to be switched to the encoder in case of a failure.

The satellite uplink facility contains four nine-meter uplink antennas – three for uplink of the digital and analog feeds, and one as a backup. A one-for-one redundant transmitter is provided for each digital satellite service. A single backup transmitter covers the five analog services for the backyard C-band dish market. In case of a tube failure or other transmitter malfunction, the service is automatically switched to the backup unit. A total of 36 feeds are uplinked from the new facility.

The tape console in Starz's tape dubbing center is used to dub "cross channel" Starz promotions into a variety of formats for playback on other services' channels.

Throughout the project, a high level of cooperation was required and exhibited by all involved in order to meet an extremely tight deadline. The first equipment rack went into the facility in August 2001, and the facility went on air in January 2002. Since the on-air date, the company has logged fewer operational and equipment-related outages than with the previous tape-based system. BE

Ray Milius is vice president of technology for the Starz Encore Group.

Design team

Starz:
Ray Milius, Lonnie Scheele, Jim Porter, Kirk Trost, Ron Hill, Andy Pergeau, Randy Pike, John Ferguson, Kent Wallace, Jonathan Cote, Doug Reither
Omnibus:
Stan Kingett, Ben Frost
Beck:
John Fitzrandolph, Terry Breay, Brad Martens
Pinnacle:
Jerry Stooksbury
Sony:
Randy Brigham
Pinzone:
Basil Pinzone

Equipment list

Omnibus Colossus automation
Avalon Archive Manager
Pinnacle servers and DekoCasts
Sony Petasite archive
NVision routing switcher
Pro-Bel routing switcher
Evertz DAs, A/D-D/A converters
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TV transmitter control systems

BY DON MARKLEY

With the continuing downsizing of the technical staff at many stations, the need for simple control of the transmitting equipment becomes even more critical. Staff members are spread out thinner than ever. Now they have to maintain all of the equipment from past years, as well as install new digital equipment for DTV and operate another transmitter. This means that those pieces of equipment that operate with reasonable stability receive less and less attention. Given that a well-maintained transmitter should show such stability, many transmitters receive scant attention during the broadcast day.

Enter the remote control system. Today's crop can be broken into two general types. First, there is the traditional stand-alone remote control system in which a rack-mounted controller is used to monitor a lengthy list of variables while also performing the control function of providing contact closures on demand. The monitored variables normally are represented by a small DC voltage from sampling units in the transmitter. Each measured voltage is then multiplied by a correction factor entered by the operator to calibrate the equipment. At the remote control point, an indication is available of the actual value of each such parameter.

Many transmitters receive scant attention during the broadcast day or week.

If the equipment is properly calibrated, the operator will have an accurate indication of parameters such as beam current, filament voltage, and forward and reverse power. If the necessary goodies are purchased with the remote control system, the parameters can be shown on a monitor and recorded either to a hard drive or printed out on a paper log. This is the classic type of remote control and should be fairly familiar to all transmitter operators. A large disadvantage of this type of remote control is that it usually requires a really significant number of interface units. The controller itself only looks at a few input voltages for monitoring purposes. At the same time, the control circuits are low voltage/low current contact closures. Placing such contacts directly into the transmitter control circuits is a surefire way to draw arcs and vaporize printed circuit traces.

Expansion modules are purchased for monitoring large numbers of parameters. The sample voltages are wired to the expansion modules, which are switched in and out as needed to make the desired measurements. Happily, switching in the modern units is all electronically controlled by the system controller.

In a similar fashion, those contact closures that are actually provided to the equipment are by relays mounted on external panels. The relays themselves are controlled by the low voltage logic in the controller. These systems have been upgraded with control functions added through improved software.

Now for the second type of system. Most modern television transmitters offer the option of a complete monitoring and control function using software that directly interacts with the transmitter control software. There is no rack full of wires to connect multiple external boxes to the transmitter. One simply plugs in the good old Ethernet plug or a phone line to a modem. The transmitter

FRAME GRAB

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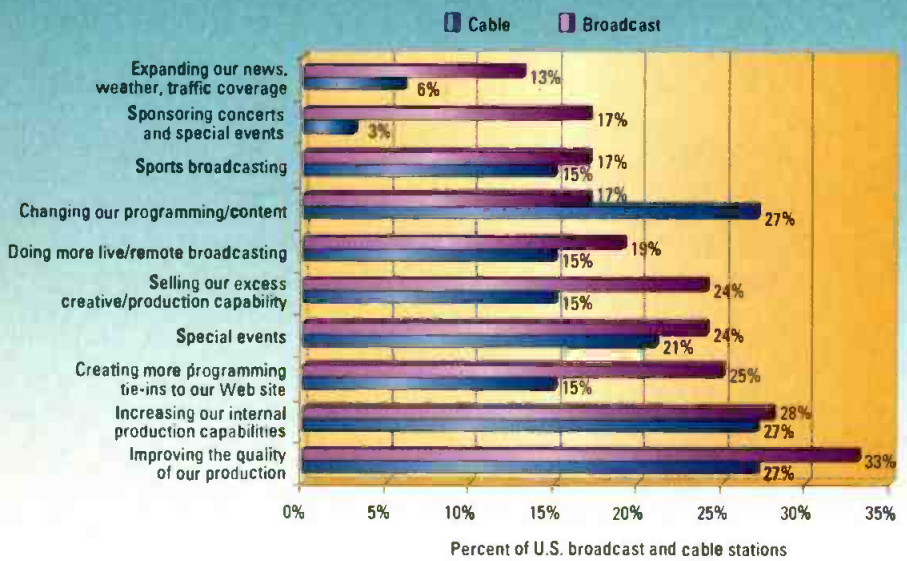

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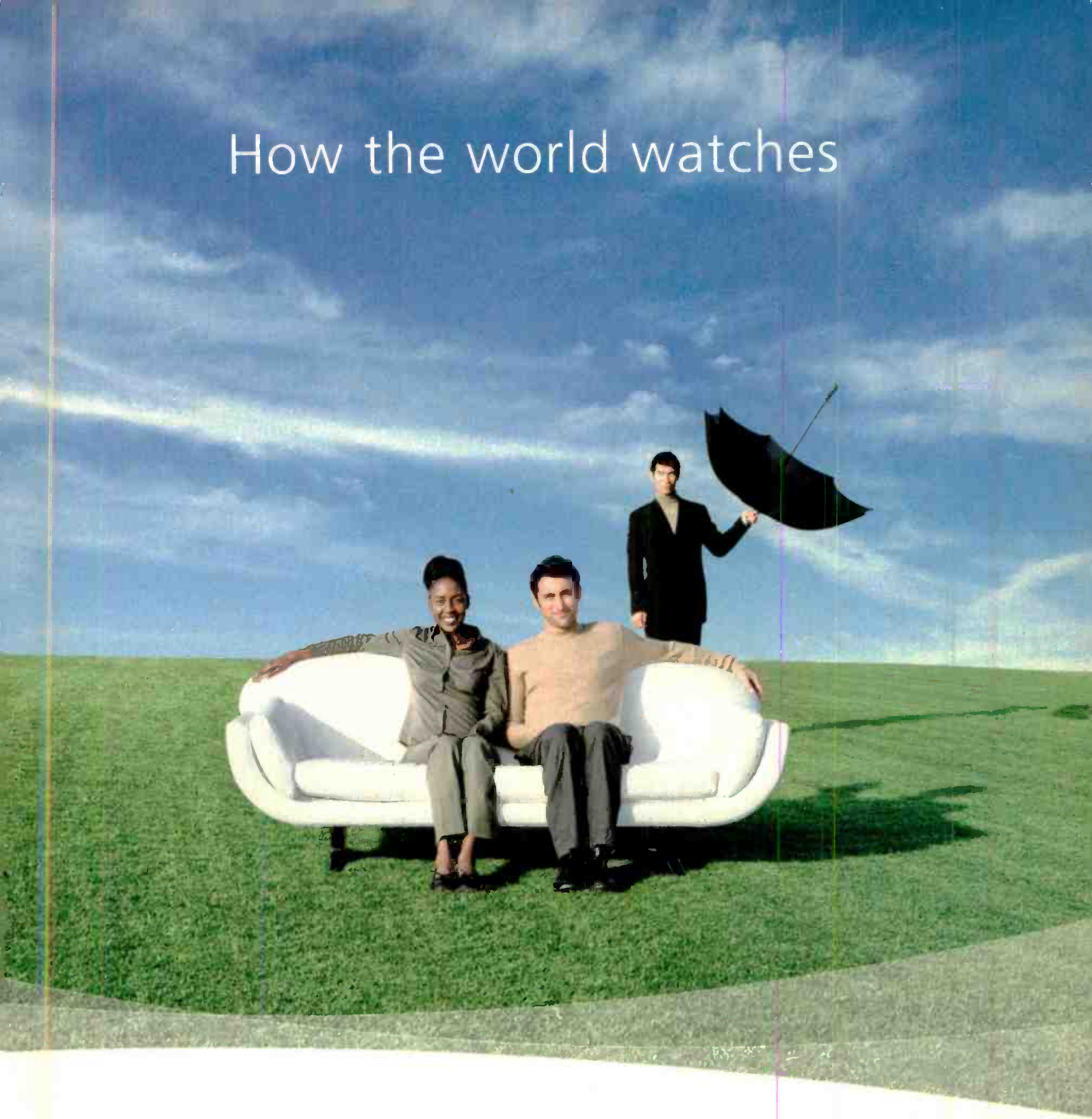

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parameters and controls are then available to anyone with the proper computer software and passwords.

Most of these systems provide remote control of the transmitter itself but do not involve themselves with auxiliary equipment. A small conventional remote control system is often necessary to monitor the STL system, emergency generator, tower lights and building security. Remember, those areas still need attention. The FCC inspector will not be impressed by your ability to adjust the pre-correction circuitry in the exciter remotely if you can't tell if the tower lights are working.

Now, let's move to the real heart of the issue. It can be assumed that the chief engineer does not want to be called every time a storm causes a momentary power break, as long as it can be brought back online simply. In other words, people need to be trained to monitor the remote control readings and control the transmitter.

Today's transmitters are pretty good at protecting the expensive parts if things go wrong. If the operating parameters of an IOT start to go out of acceptable bounds, at least that cabinet will probably be shut down by the transmitter control software. Some accompanying signals should tell the remote control system or the monitor location what the failure mode might be. Often, all this requires is a new application of "ON" to the appropriate control circuit, especially for such problems as momentary power outages. However, this is where training comes into play.

The transmitter doesn't normally know what exactly went wrong, just that a parameter is outside the envelope. But it is not always advisable to keep on trying and trying to bring a system back online after it shuts down. It can be catastrophic in some cases to try again and again to get back on the air.

A prime example of this is a failure in a transmission line or antenna that causes a VSWR trip. If the operator keeps trying again and again to bring the system back online, it is highly likely that the majority, if not all, of the transmission line system may be destroyed.

Finally, an absolute requirement is to regularly check the calibration of the remote control system. It's not hard – just read the meters themselves and compare their indication to that of the remote control system. If this isn't done regularly, the operators slowly but surely lose any idea of exactly how the transmitting system is performing. Remember, it's horrible to get called out of bed to check a problem that turns out to be only a bad calibration. BE

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

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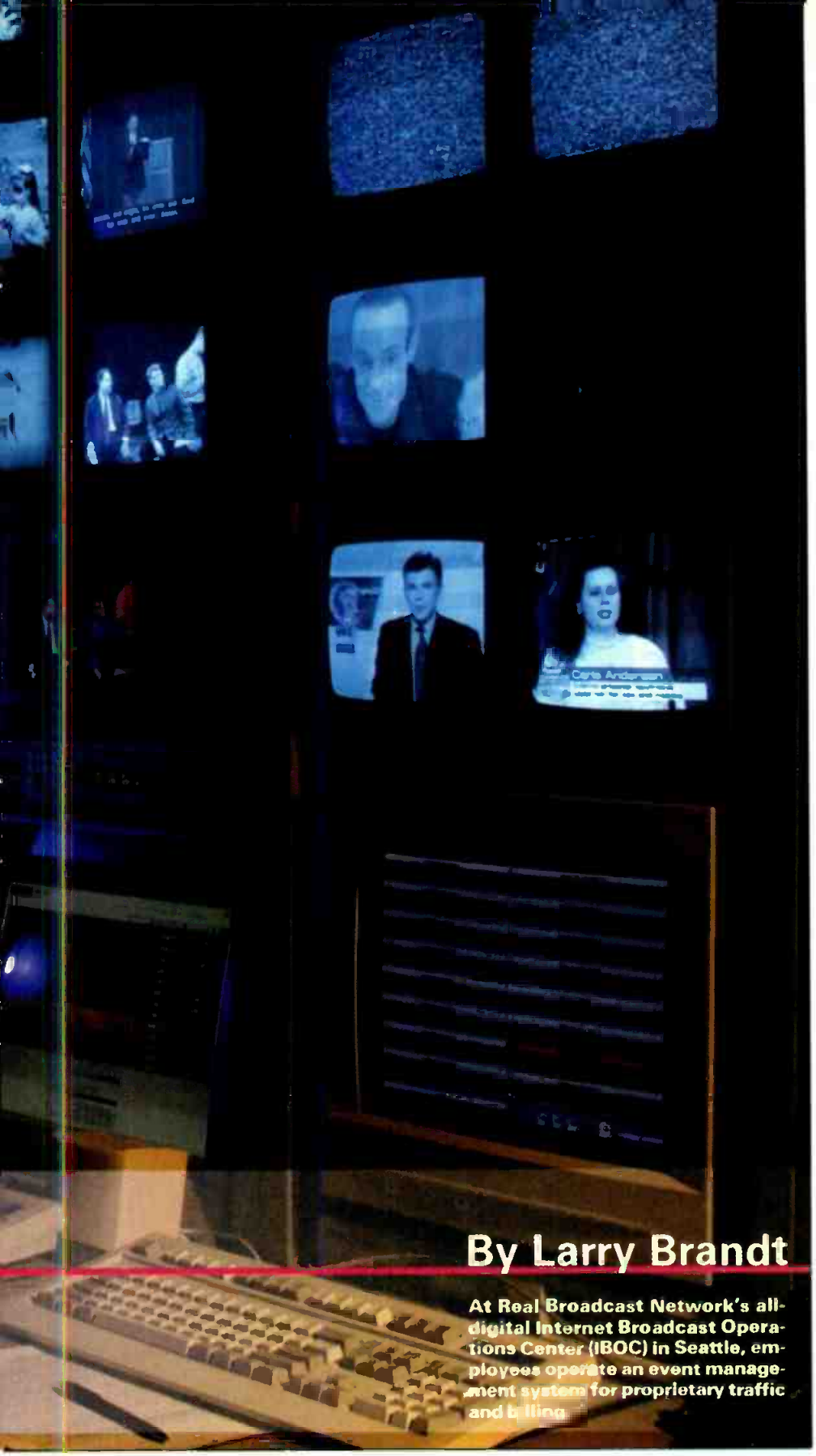
Streamlining broadcast operations

During the first few decades of broadcasting, stations devised the processes, acquired the tools and justified the staffing to deliver programming to the viewer. Television borrowed some methods from the more mature radio industry. But without a mature business model to implement, it followed a more extemporaneous path.

The hardware from those early days has been updated by generations of new technology. But, unfortunately, many of the oldest manual tasks and operational processes from those days have perpetuated and are alive and well in many of today's TV stations.

Automation

Today, program automation is common in many television facilities, primarily to reduce operational costs. But few, if any, broadcast stations



By Larry Brandt

At Real Broadcast Network's all-digital Internet Broadcast Operations Center (IBOC) in Seattle, employees operate an event management system for proprietary traffic and billing.

use automation for its designed purpose: unattended master-control operation. The reasons for this are not fully understood, but there are at least two contributing factors. First, for many decades, FCC rules mandated that someone be present to monitor the transmitter signal. Second, stations have been reticent to leave their playback systems unattended because many manual data processes within the station lack robustness and error checking, and can corrupt the data being delivered to the automation server.

Automated stations still require an operator in master control working as a backup to the system. The operator's primary functions are to perform quality control on the program stream, correct the program playlist and manually switch program elements that are not automated. Finally, the MC operator is there to help prevent catastrophic failure in the program streams.

Another issue with today's automation technology is that functions are still performed repeatedly, often by a different department within the same station. Let's look at two examples.

One primary duty of the MC operator is to provide a quality-control check over video feeds as they are recorded. The operator repeats this function again when the station finally airs the program.

A second, and more labor-wasting, example involves logs. The traffic department creates program logs and then delivers them to master control. The MC operator then changes and corrects the logs to represent the actual as-aired program conditions. Similar procedures are common throughout a typical station's operation. Think of the efficiencies and error reductions the station might enjoy if it automated some of these processes, or at least, handled them only once.

The need to do things differently

Today, stations still perform many operations based on equipment and conditions originated in the 1950s and 1960s. Paper logs are still common. People still handle last-minute changes by telephone or notes passed between traffic and operations or engineering.

Technology has improved, and stations can now manage log data electronically. Yet several station personnel often process the same data, which increases the opportunity for errors. The result is that, for the sake of expediency, stations often improvise impromptu, ad hoc solutions – Band-Aid – to fix operational problems that are systemic in nature. And, after a while, Band-Aids begin to

cover Band-Aids. Occasionally, the process even repeats itself.

Nearly all broadcast stations use the Band-Aid approach. Fortunately, methods exist to cleanse business operations and monitor future modifications. Put another way, there are tools that stations can use to eliminate many of the Band-Aids. These methods and tools are part of a reorganization process that can put the station back on track. Let's take a look at how it works.

Reorganization

First, the reorganization requires that stations identify and eliminate repetitious tasks. Obsolete processes and historical fixes are easy to identify on a flow chart. Unfortunately, replacing a multitask process can be difficult. It might be necessary to hire a consultant to review a station's operations, searching for processes that can be automated or eliminated altogether.

Generally, the goals of such a review are to:

- make the operation as linear as possible
- emphasize electronic data over paper data
- reduce or eliminate multiple data entry
- automate where cost-effective
- eliminate obsolete tasks
- logically reassign task responsibilities to improve data flow and task accuracy

In addition, every proposed change must go through a cost/benefit analysis. The goal is not to replace people with machines but to maximize staff creativity and productivity. Many times, the long-term cost of staff is less than that of an automation system or optical fiber link. Don't enter the process with the idea that you're simply going to replace people with equipment. That's not the solution.

Analyzing broadcast operations

The process of reorganizing station operations is not trivial. In fact, it may take as long as a year. Choosing a person or company to perform the station operational analysis takes careful consideration. Bringing in a third party for a thorough station analysis is a big step, not to be taken lightly. The consultant must possess a thorough working knowledge of operations in traffic, master control, promotion, news, program services and sales. Although in-house staff may be competent in these areas, an outside analyst has the advantage of a fresh perspective. As stations progress into the 21st century, they need to re-examine their workflow with an experienced operations analyst. The goal is to improve operations and efficiently while enabling the staff to be more creative and productive.

The first phase of the consultant's job involves analyzing the current operation and understanding the current business environment. Secondly, the consultant needs to understand the station management's long-range goals. It's important that the consultant know, for example, if the station plans to double the amount of newscasts over two years. If your station doesn't have a long-range plan, you'll have to get one in place before the consultant can effectively begin the process.

The first step in understanding how a station works is to make a thorough audit of the various operational areas. The audit process begins with interviews of both staff and management. It generally takes two to three days to complete this process. A small-market station may require only a single day.

All employees with information about any operational area are interviewed. This includes almost everyone. In large departments, or in those working multiple shifts, the auditors must interview even those employees on different shifts or days of the work week. Often, there are operational differences among day, night and weekend periods, and differences between the duties of full-time and part-time workers.

The general manager, controller and general sales manager need to provide information about labor contracts, niche operations or areas that are important profit centers for the station, policies dictated by ownership that may constrain reorganization, and other market-specific issues the station faces.

While there are several methods the station can use to uncover all this information, two methods are common. The first is to inventory each of the tasks performed by each employee. Supervisors go through a list of employees and catalog all of the tasks each employee performs on a routine basis. They also catalog estimates of employee time spent on each task, volume of output, critical timelines, error rates, tools used, etc. It is important to note the error-detection process or feedback to the employee during task performance. The consultant is critical here as an independent observer. Often, the front-line staff is so familiar with how they work that they will leave out critical steps they perform — omissions that an outsider will catch.

A second approach to the operational analysis is to follow the data paths throughout the station and learn the processes that follow. Data paths are all of the data that pass through a station, such as the ordering process for commercial spots, programming schedules from station management, program timing information, and upcoming news stories being readied for the

Stations often improvise "Band-Aids" to fix operational problems that are systemic in nature.

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newscast's final rundown.

An interviewer asks each department to identify all of the sources of data coming into the department and what forms the data take — paper, electronic, word of mouth, faxes, videotapes, etc.

Using the list of data sources, the interviewer then asks what tasks within the work area use each datastream, what changes are made to the data, and what data leave the department as a result of processing. Information is catalogued relating to who gets the outputted data, what form the data takes, critical timelines, error rates and any feedback loops that exist.

This method is extremely helpful in understanding exactly what people do, who is impacted and whether the process has Band-Aids already in place. This method checks well because the manager can provide information relating to the overall work area while employees can confirm the manager's account and add details not generally known to the manager. Another useful aspect of this method is the ability to track data across department lines.

The data-collection process must be detailed, so it becomes an iterative process, with the analyst graphing operational data, reviewing the data with management, and then correcting the graphical representations before entering the next phase.

Near the end of the data-acquisition process, the analyst assembles the paper data from the station. This would include program logs, satellite-record schedules, spot-dub requests, work schedules, news-assignment logs, graphics requests, promotion-tagging data and other written information commonly sent throughout the station. These data are used to confirm or establish the volumes of workflow.

This is where W-2 information, work schedules and operational budgets are used to analyze the real cost of current operations. Later, the analyst will use this same information to evaluate the costs of various operational models.

The flow chart

Armed with the defined tasks and processes from the interviews and the paper trail from hard copy records, the analyst begins to create a flow chart that describes the whole station operation.

A task flow chart for a typical station should look like a funnel with its large end on the left and the spout on the right. The left side of the chart (the large end of the funnel) represents the input of many diverse streams of data entering the station. These could be spot orders, program information, satellite feeds or news content. To the right, the few lines leaving represent the station's program stream, client billing and FCC reports.

If the station is operationally efficient, it will process this data in a linear manner and the chart will show multiple data streams merging into fewer and fewer data paths as the lines move to the right. Bulges in the chart represent the Band-Aids mentioned earlier. These inefficient operations appear as long paths with numerous tasks and few data lines entering or leaving the path. The number of manual tasks performed on automation input and output data is a measure of the station's automation efficiency.

The goal is not to replace people with machines but to maximize staff creativity and productivity.

The hard part

Now comes the really hard part. The analyst must develop a recommended operating model for the station and a transition plan that ensures a smooth reorganization. The analyst must be extremely careful in making recommendations for reorganization. The proper new model can only be designed if the analyst fully understands the consequences of each and every element of change he recommends. BE

Larry Brandt is a senior broadcast engineer with Digital System Technology.

Some new converters attach to HD cameras to allow on-set monitoring with low-cost SD monitors. Photo courtesy Miranda.

production industries will need reliable, high-quality, affordable conversion solutions that allow them to repurpose content between and among 525/625 and ATSC formats.

The basic techniques for ATSC conversions are no different than those used for 525/625 conversions. But, with ATSC, the number of allowable formats has grown considerably. And the number of possible format conversions has grown tremendously. Figure 1, which shows (the infamous) ATSC document A-53A Table 3 and its accompanying legend, reveals the multitude of allowable digital TV formats.

Note that 1088 lines are actually coded to satisfy the MPEG-2 requirement that the coded vertical size be a multiple of 16 (for progressive scan) or 32 (for interlaced scan).

Vertical size value	Horizontal size value	Aspect ratio information	Frame rate code	Scan mode
1080[1]	1920	1,3	1,2,4,5	1
			4,5	0
720	1280	1,3	1,2,4,5,7,8	1
480	704	2,3	1,2,4,5,7,8	1
			4,5	0
	640	1,2	1,2,4,5,7,8	1
			4,5	0

Legend for MPEG-2 coded values						
Aspect ratio information	1 = square		2 = 4:3 display aspect ratio		3 = 16:9 display aspect ratio	
Frame rate code	1 = 23.976Hz	2 = 24Hz	4 = 29.97Hz	5 = 30Hz	7 = 59.94Hz	8 = 60Hz
Scan mode	0 = interlaced scan		1 = progressive scan			

Figure 1. ATSC document A-53A Table 3 and its accompanying legend reveal the multitude of digital TV formats. (Reproduced courtesy of ATSC.)

Temporal troubles

Field-rate conversion is "a fine kettle of fish." For example, converting film's 24f/s to TV's 30f/s is something with which all of us are familiar. The 3/2 pulldown process involved in the conversion doesn't render motion faithfully. The syncopated rhythm of the 3/2 cadence interrupts motion and, with some scenes, it can become quite annoying. The answer is to perform a motion-compensated interpolation between pairs of frames using knowledge of preceding and subsequent frames to render the motion more smoothly. Similar issues exist when converting between PAL (625/25i) and NTSC (525/30i).

Converting film for TV is simple when compared with some ATSC conversions. Ironically, the most onerous ATSC conversion is the one that, at first glance, seems the easiest. Converting 720p60 to 720p59.94 might appear to be easy because the ratio of the frame rates yields a 0.1 percent difference. We could just skip one frame in a thousand (or repeat one frame in a thousand to convert 720p59.94 to 720p60), but dropping or adding a frame might not meet with the producer's approval. An alternative might be to employ interpolation, perhaps with motion compensation, in the conversion. But in this case, the number of frames the algorithm requires to render the content smoothly can be quite substantial, perhaps eight or more frames in memory for review and processing.

The problems that these examples point out are not restricted to ATSC formats; rather, they highlight the difficulty conversions present in some production situations. To avoid or help alleviate such problems, manufacturers of ATSC converters might have to provide algorithms capable of converting among all ATSC formats. Panasonic, Teranex, Snell & Wilcox, Evertz, Miranda and Sony all make converters, and three of them (Teranex, Panasonic, and Snell & Wilcox) make

standard-definition release of productions, whether on terrestrial broadcast, satellite broadcast, VHS or DVD. The inescapable conclusion is that, for the foreseeable future, the broadcast and

Figure 2. The conversion chart for one of Panasonic's converters shows that it can perform more than 90 bi-directional conversions.

converters for the full range of formats. For example, Figure 2 shows the conversion chart for a Panasonic converter that can perform more than 90 bi-directional conversions.

If spatial and temporal conversions were the only issues with which converter designers had to contend, format conversion would be less problematic. But they must also consider such picture-related parameters as aspect ratio, colorimetry, image content and audio handling.

Aspect ratio

Most of our TV viewing experience has been with NTSC and PAL, which both use the 4:3 (1.333:1) aspect ratio. The ATSC has standardized the aspect ratio of HDTV in North America as 16:9 (1.77:1). Motion pictures on film are shot in a variety of even wider aspect ratios, including 1.85:1 and 2.35:1. Converting content between aspect ratios presents both technical and production issues.

Conversions between aspect ratios have the most noticeable effect on the image. Figure 3 illustrates these effects. For example, downconverting from 16:9 to 4:3 cuts off the sides of the 16:9 image. Most motion pictures are converted for viewing on a 4:3 aspect-ratio screen using the pan-and-scan process. The other choice, favored by many moviemakers, is to employ the letterbox process. This process shrinks the entire image, but preserves the aspect ratio of the original film.

Converting between square-pixel formats and non-square-pixel formats presents technical issues. Non-square pixels complicate the math needed to convert aspect ratios and special resolutions.

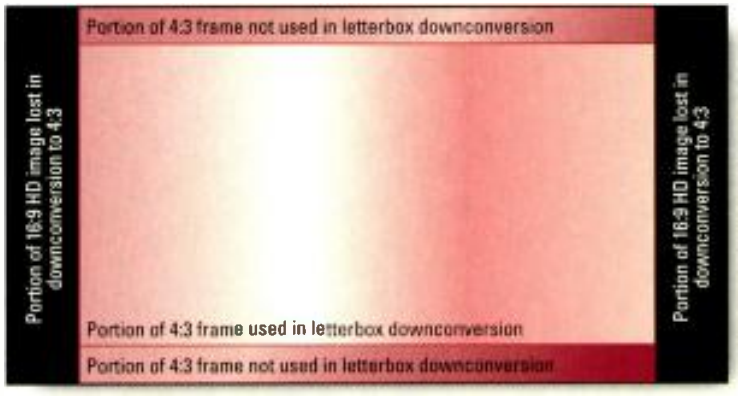

Figure 3. This display shows the effects of aspect-ratio conversions on the image.

Colorimetry

Colorimetry is a parameter that is often overlooked, but is nonetheless critical to converting between SD and HD formats properly. Today, we have three relevant colorimetry standards and, unfortunately, two of them relate to legacy and current HDTV equipment.

Figure 4 shows several TV scanning standards and the luma equations that TV equipment (including converters) should use to maintain correct colorimetry. The early HDTV equipment that had 1035 active lines should conform to SMPTE 240M, while all current systems should be using ITU-R BT.709 colorimetry (often called Rec. 709). A converter may have the smarts to look at the input and output formats and select the correct matrices to transform the color between standards. However, if a 1035i camera is used to produce part of a 1080i program, it may not produce the right colorimetry to match the display format that the converter automatically senses.

Image content

Clearly, an upconversion from 480i or 576i to HDTV cannot generate the detail an HDTV original would produce. But, with high-quality interpolation, it can provide a dramatic improvement over the low-resolution original. Designers of conversion systems must take special care to ensure that their devices do not create spectral energy that causes aliases with the original.

With ATSC, the number of possible format conversions has grown tremendously.

What about sound?

Ideally, converters should be capable of handling all types of audio. This includes analog, discrete AES inputs, and embedded audio. All SD/HD converters will pass and re-embed the signals on the output. It is important that the converter compensates for the latency (electrical delay) of the audio signal(s) as it does for the video signal. Many major manufacturers of conversion devices have implemented only four channels for discrete AES inputs, limiting the

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Television Scanning standard	Luma equation ITU-R BT.601	ITU-R BT.709	Other
SMPTE 170M NTSC	X		
EBU 625 PAL.SECAM	X		
ANSI/SMPTE 293M 525 / 720 x 483 / 59.94 / 1:1	X		
SMPTE 274M 1250 / 1920 x 1080 / multiple rates/ 1:1, 2:1		X	
ANSI/SMPTE 295M 1250 / 1920 x 1080 / 50 / 1:1, 2:1		X	
ANSI/SMPTE 296M 705 / 1280 x 720 / multiple rates/ 1:1		X	
SMPTE 240M 1125 / 1920 x 1035 / 60, 59.94 / 2:1			SMPTE 240M (see note)

NOTE: ANSI/SMPTE 240M uses a luma equation that is similar to ITU-R BT.709, but is not exactly the same. In many applications the difference may be small enough to ignore, but these differences could become significant in critical applications.

Figure 4. SMPTE engineering guideline EG36-2000 shows several TV scanning standards and the luma equations that video equipment (including converters) should use to maintain correct colorimetry.

output to eight of the available 16 channels. Discrete audio for surround sound requires only three AES pairs, though many producers assign L, R, C, L_S, R_S, LFE, and L_T, R_T (Left Total (i.e. consumer surround-sound encoded). So you should use care when considering converters that can handle only two channels.

The new underclass

Additionally, there is a subclass of converters to consider. Several manufacturers (Thomson Grass Valley, Leitch, Miranda, Evertz, Snell & Wilcox, Aja Video and Cobalt Digital, among others) make card-based upconverters and downconverters. The downconverters are available with "monitor only" performance as well as with full 10-bit adaptive conversion. These exciting products allow 525 monitors to monitor high-bandwidth signals, though at lower quality. They can also save large amounts of money if the SD output is employed for non-critical uses only. For instance, you can use a monitoring downconverter to feed a nonlinear editing system at acceptable quality and thus make edit decisions without requiring a higher-cost, full-resolution edit solution. Such a downconverter can also be used to feed low-bit-rate encoders for streaming video in a cost-effective manner. Several manufacturers (Miranda among them) also make converters in a form factor intended to attach to HD cameras to allow low-cost monitors to be used on set. The new Miranda unit even outputs DV on Firewire for input to laptop editors on the set.

Ten years ago, converters cost upwards to $250,000. Today, they can cost well under $10,000. As solutions are committed to silicon, we may soon see conversion embedded in other production devices for little additional money. The flexibility of current converters is bringing us closer to that corner where we can see digital TV. BE

Ideally, converters should be capable of handling all types of audio.

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

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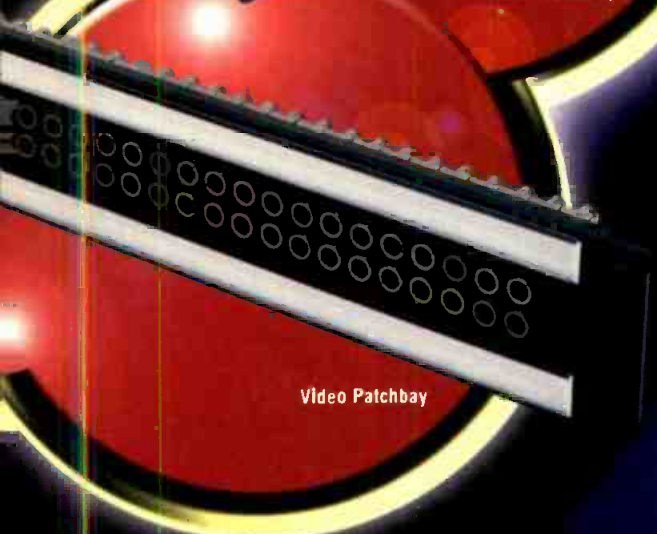

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HD and SD scopes

BY JOHN LUFF

The transition from analog to digital production and transmission technology impacts the tools of our trade in fundamental ways. But manufacturers have done a great job of camouflaging some of these changes. This smoke-and-mirrors act might seem strange at first, but it has a very positive purpose: to ease the transition. From the general-purpose oscilloscope, manufacturers have adapted a specialized version, the "waveform monitor," to simplify its use for video and TV – and now, for digital TV. (See Table 1.)

NTSC can be encoded from any combination of legal RGB values, but only as long as the encoded components remain within the gamut of SMPTE 170M-1999. In legal NTSC colors, the maximum excursion of the subcarrier must fall between –23 and +120 IRE, which is the cutoff of the carrier. Legal RGB colors can, however, create 131IRE excursions. Therefore, it is important to ensure that the component signals cannot create "illegal" encoded signals (even though they are perfectly legal component video). Standard-definition scopes are normally equipped with special modes that easily display such errors, either by an error indicator or a graphical display such as the Tektronix "Arrowhead" display. This specialized display shows gamut errors for composite, RGB or component signals. As a convenience to operators, several manufacturers create a pseudo-composite display by locally encoding the component waveform into an NTSC or PAL signal. This can be especially valuable in easing the transition to a digital system.

Most modern scopes allow both waveform and vector modes, and quite often display other information about the signal. For SD or HD video, it is valuable to know if there are errors in the signal, whether reported by EDH flags or detected by the embedded CRCs in the digital signal (full-field and active-picture CRCs are available). Data screens can also display important information such as the presence of embedded audio, the absence of SAV or EAV data, or scope reference errors. In addition, the analog SMPTE 259 or 292 waveform and the "eye" pattern created by the embedded clock and data often show the health of the digital carrier. The scope may also display jitter waveforms or histograms to provide insight into the overall health of the signal.

Sophisticated combined displays can be created by digitizing the signal and displaying the results on a computer monitor. Photo courtesy Videotek.

In the last decade, waveform displays have evolved to include a class of devices based on digitizing the signal and displaying the results on a computer (or analog video) monitor. These very sophisticated combined displays can show the waveform, vector display, audio signals (from embedded or discrete input sources), and the picture itself subsampled to one-quarter screen. Such monitors also allow the user to bring any of these displays to full screen and show them on large monitors for easy viewing. They include overlaid graticule information that can be very accurate, since the display requires no calibration. Many facilities put such a display on a router bus output and then re-enter the composite signal into the router so the waveform monitor output can be brought up on QC monitors at many locations without buying as many devices. The fact that these displays do not have their own CRTs can offer a long-term savings in maintenance cost. Such a device also does not need to be calibrated as often, though all analog input devices must be calibrated occasionally. Digital display of digital waveforms is inherently accurate and should be more stable.

For the best part of 100 years, the basic tool of the video industry has been the oscilloscope.

HD waveform monitors are little different in the component digital domain, except for the multiplicity of standards that they often must accommodate. The predominant picture formats in North America (1920x1080i and 1280x720p) have been joined by

24-frame progressive variants, as well as 1080psf (progressive segmented frame). All of these, as well as the 60/59.94 variants, are in common use, along with 50-, 25-, 24- and 23.98- (24/1.001 for 525/59.94 compatibility) fps, and all can be mapped into SMPTE 292 at 1.485Gb/s. You may well be able to use a scope with fewer optional formats but, considering the somewhat fuzzy future of our industry, keeping options open at this point in the DTV transition is a wise move. Scopes for HD and SD use may well have to accommodate a total of at least 28 distinct formats, with 625 and 525 variants being only a small subset.

Manufacturers have devised a dizzying array of options. The best way to choose the right scope for your new digital plant is to have a couple

PAL lines/sec:	15,625
NTSC lines/sec:	15,734.26
(2227.5 cycles of subcarrier/line)	
PAL line length:	64.0 µs
NTSC line length:	63.5 µs
PAL color sequence:	8 fields
	160 ms
NTSC color sequence:	4 fields

Table 1. The waveform monitor was adapted from the general-purpose oscilloscope for use as a specialized broadcast tool by restricting it to a vertical calibration of roughly a volt top to bottom and roughly 64 µs.

of manufacturers bring in their product and demonstrate the operating modes, as well as show how it will integrate into your facility. Unfortunately, in making your decision, you will also likely have a thick book to digest. You may decide a handheld unit is all you need, or choose a combination HD/SD unit with separate VGA output for a large screen. All are readily available. BE

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Teranex's Star-up converter

BY BILLY BALDWIN

The current market for 24p in the United States is larger than most people think. It's not just George Lucas and a handful of Hollywood studios. There are numerous documentaries and independent production companies using the medium to their advantage.

PostWorks New York, a post-production facility located in Manhattan, does many projects for theatrical distribution, with film as the end product. The facility handles about one feature-length film per month, and many documentaries. Examples include "A Decade Under the Influence," about the best films of the 1970s, and "The Billabong Odyssey," about a quest to surf the world's largest waves. These and other documentaries often use multiple sources on different film and video formats (interviews shot on 24p and archival footage on every format imaginable). The facility also handles narrative films.

PostWorks uses the Teranex Star-up converter to upconvert content sources from many formats to 24p to put them all on a level playing field.

But no matter what formats its clients use, PostWorks encourages them to start working in a 24p environment as soon as possible so that they have the best idea of what the final product is going to look like.

One of the biggest misconceptions in the post-production industry is that all HD programs are created only from HD sources. The fact is that, more often than not, PostWorks has been faced with the challenge of mixing HD with standard-definition material. To give the final film a consistent look, the facility had been using software-based products. But the rendering times required by these products were excessive. The solution was to use the Teranex Star-up converter to put all the sources on a level playing field.

For "A Decade Under the Influence," all of the interviews were shot on 24p HD, but all the films and archival material were from any number of sources, including DVD. The facility originally had no intention of actually using the DVD as a source in the final film, but the Teranex converter made it possible. Other film transfers came in on various formats, including Digital Betacam, Betacam SP and D1. For "The Billabong Odyssey," which was shot primarily on 35mm film and HD video, the converter expanded the usable footage to include such formats as Digital Betacam and Beta SP. For both projects, the converter was used to get everything over to 24p/HD. One of the features that most impressed the facility was its ability to auto-detect cadence to remove the additional frames introduced in the telecine process, leaving the original 24 frames.

PostWorks chose the converter for several reasons, including its well-thought-out design. The converter also offered the ability to adjust the colorspace or noise reduction filters. The company also took into consideration the re-shaping of time code and working with the audio delay inherent to image processing. Another factor was that the converter had DLP colorspace look-up tables built into it. Its modular hardware and software allows it to be enhanced or upgraded at any time. As digital projectors change, the Teranex can change with them. PostWorks anticipates further developments with the converter, such as dust removal and the DLP codec. The facility also felt that Teranex was very responsive to its needs. **BE**

The current market for 24p in the United States is larger than most people think.

Billy Baldwin is the founder and CEO of PostWorks New York.

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An engineer's holiday

BY PAUL MCGOLDRICK

The holidays are upon us again. The year has been shorter than any I remember, so the adage about time passing quicker as you age seems to be true. But the holidays made me think back to some of the holidays of the past and how they fit into a professional life. The first that came to mind was a snow story, but it was not the most exciting. That would have been my Christmas morning drive...

I was based, at the time, at a high-power TV/FM station in South Wales by the name of Wenvoe (back then there were two VHF television channels, one UHF channel and four FM radio channels on site.) I was working Christmas Eve until television programming closed down at about 3:30 a.m. I drove the 182 miles from Wenvoe to my parents' house in South London in just under two-and-a-half hours. (In those days there were no speed limits and no two- or three-lane motorways.) My faithful Jaguar Mark 7M also took me back that evening for a shift on Dec. 26, but it wasn't the same sharing the roads with holiday celebrants.

My snow story wasn't actually over Christmas, but in the days immediately following – and it went on into the next year. I was doing some installations at a high-power multi-program regional AM station in Yorkshire called Moorside Edge. I finished the job early and was asked to shore up a short crew at a station right on top of the Pennines – high moorland and hills dividing Lancashire and Yorkshire.

In the UK, road numbers increase in digits the worse they get. The station of Holme Moss is on the A6024 at 1750 feet ASL, and on either side of the station are road grades worse than one in six. My first shift was on Dec. 26 with a BBC bus taking me and the day shift up the mountain from the village of Holmfirth. I was scheduled with three others to be there through the close of television programming. But after the day shift left it became obvious that this was not going to be a pleasant night.

When Holme Moss was built in 1951 (and billed as "the most powerful television station in the world"), the 750-foot guyed mast was designed for wind speeds of 125 mph at the top and for half an inch of ice on every part of the structure. The moor is the kind of place that has its own weather, which is often extremely severe. That night it snowed, and there was no way that we were going to get out of there. We left power on the antennas to keep them from freezing, as the snow stopped in the early morning and the temperatures plummeted. By noon the next day the road outside was covered with 15 inches of ice rather than snow. I went on overtime pay sometime during the night, and I remained so for the next 18 days! It alternately snowed and froze throughout that time.

We had no problem with food. The station had a full kitchen, and in the nuclear fallout shelter we had four months of food for 10 people. Power stayed on throughout, we kept programs going out and the shelter had some fairly comfortable bunks. Although we were able to keep the antennas from freezing (watching VSWR numbers was a critical task during the six-hour shifts we scheduled for ourselves), there was nothing we could do about ice on the remainder of the structure, and it was quite scary to see guy wires sag as the weight of ice built up.

We were lucky. A few years later (March 1969) a 1200-foot UHF mast at Emley Moor – visible from Holme Moss on a good day – fell during similar weather. And the original mast at Holme Moss very nearly came down itself in the late '80s when it was being dismantled after a new mast had been installed. As it was, ice blocks crashed through the reinforced concrete roof of the main building, damaging equipment. There was so much fear that something was going to happen, perhaps taking the new structure with it, that the staff had already been evacuated.

I went on overtime pay sometime during the night, and I remained so for the next 18 days!

Fortunately at this writing that chilly transmitter-bound holiday is just a memory. But, even so, I may think twice – and grab an extra sweater – when and if I get the panic call that any of the local FM translators I look after have gone down.

Keep warm, drive carefully and, preferably, get home for the holidays. EOM.

We'll be talking in 2003. BE

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

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

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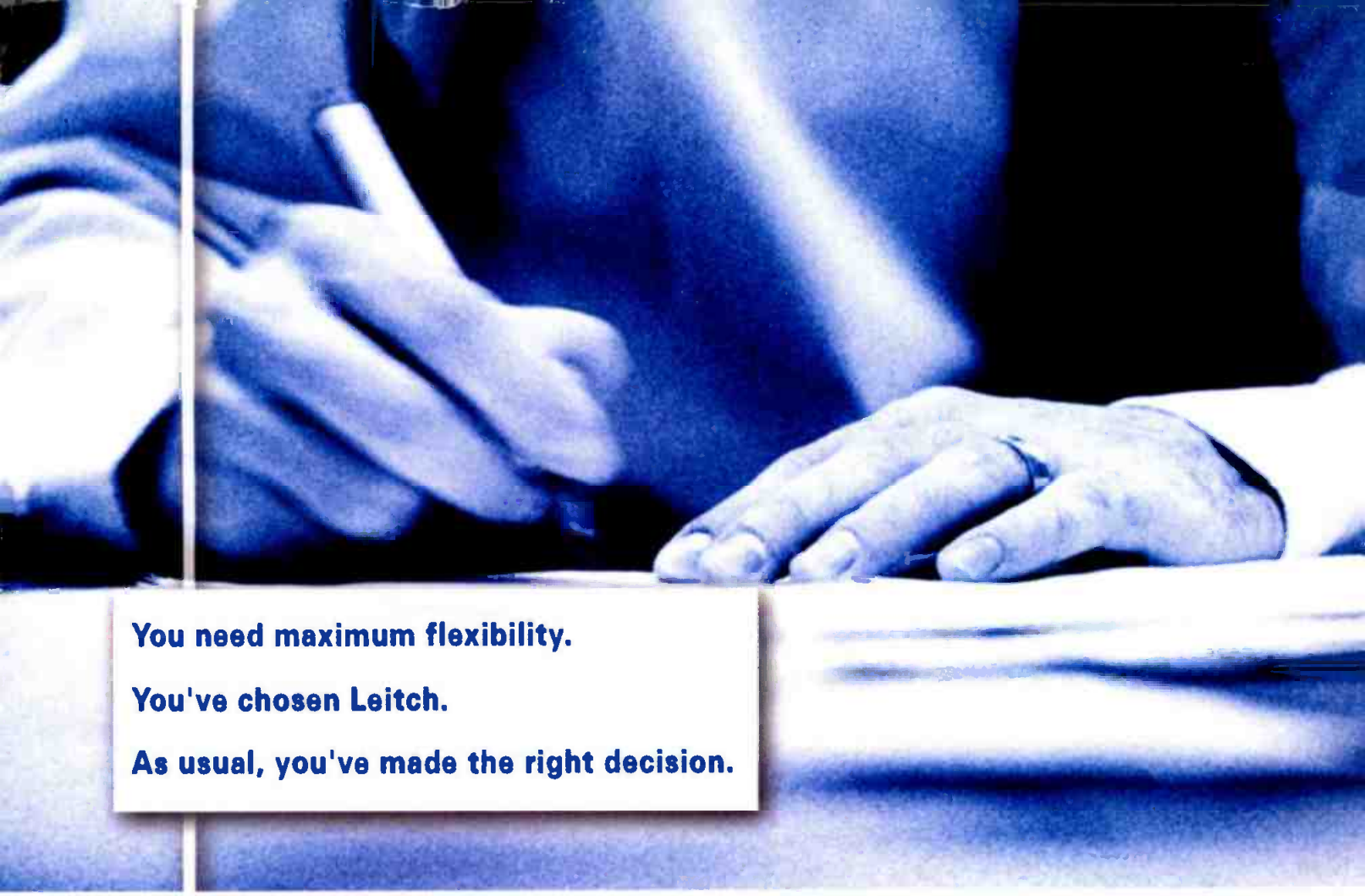

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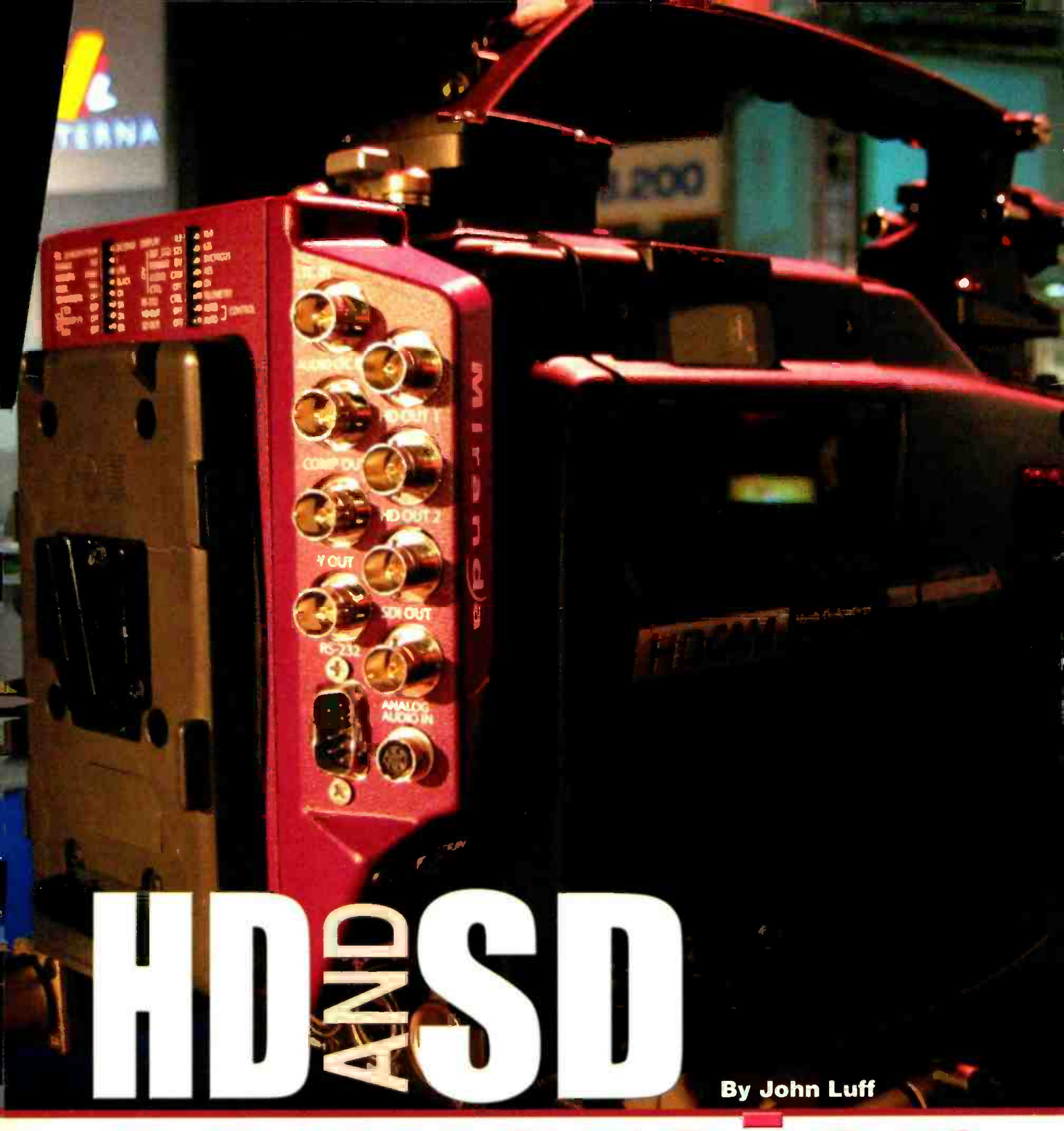

HD AND SD conversion

By John Luff

Since the early '80s, we've been hearing that digital TV is just around the corner. It turns out that the corner was much farther away than we thought. Today, we live in a transitional world. The transition from NTSC to ATSC has begun in earnest, but we still have one foot in the past and one foot in the future.

The United States, Japan and a few other countries exhibit a sense of excitement about ATSC production and distribution. But, today, advertising and licensing revenue still comes almost exclusively from the composite,