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OCTOBER 1999

Broadcast ENGINEERING

THE JOURNAL OF DIGITAL TELEVISION

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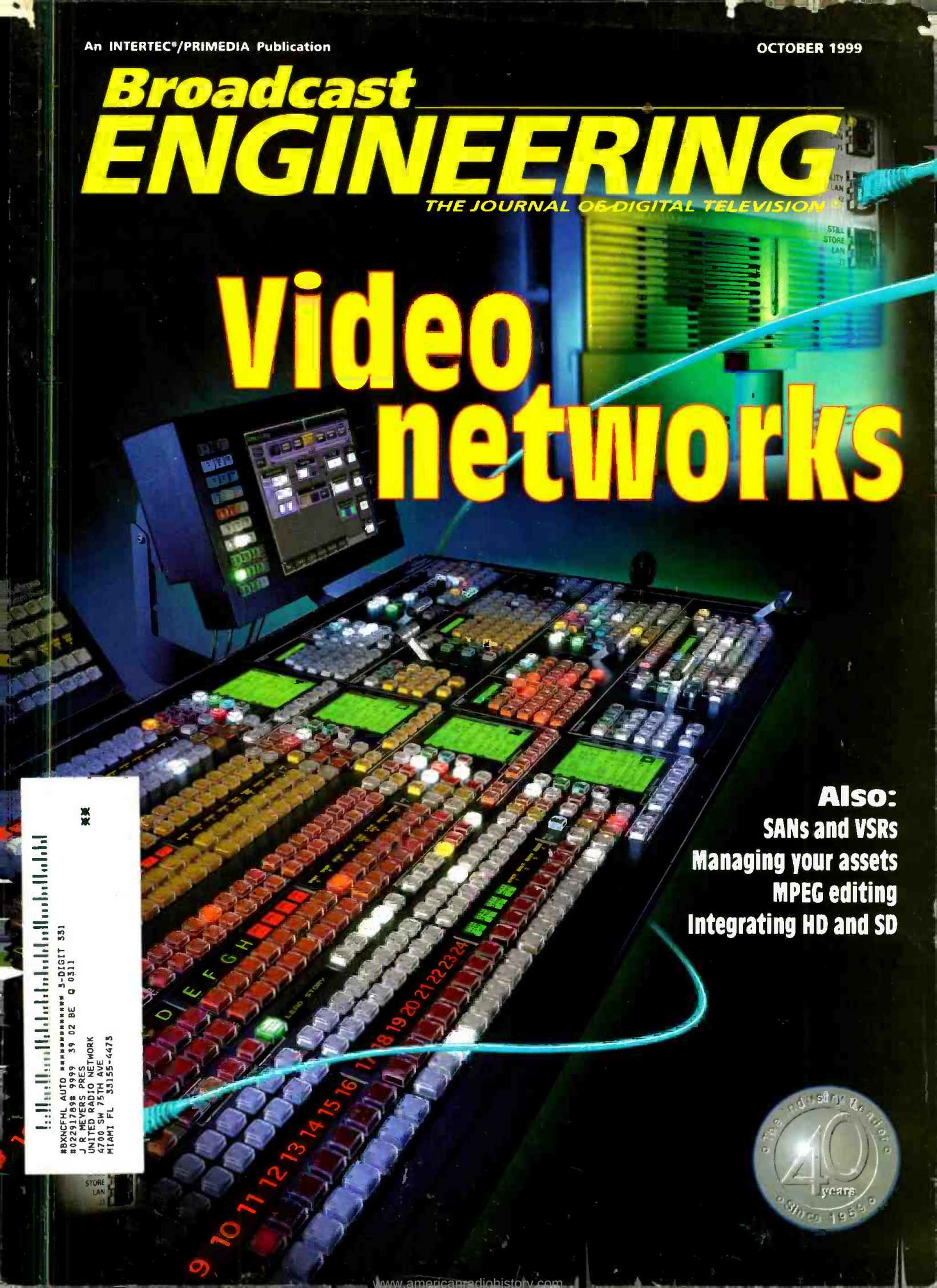

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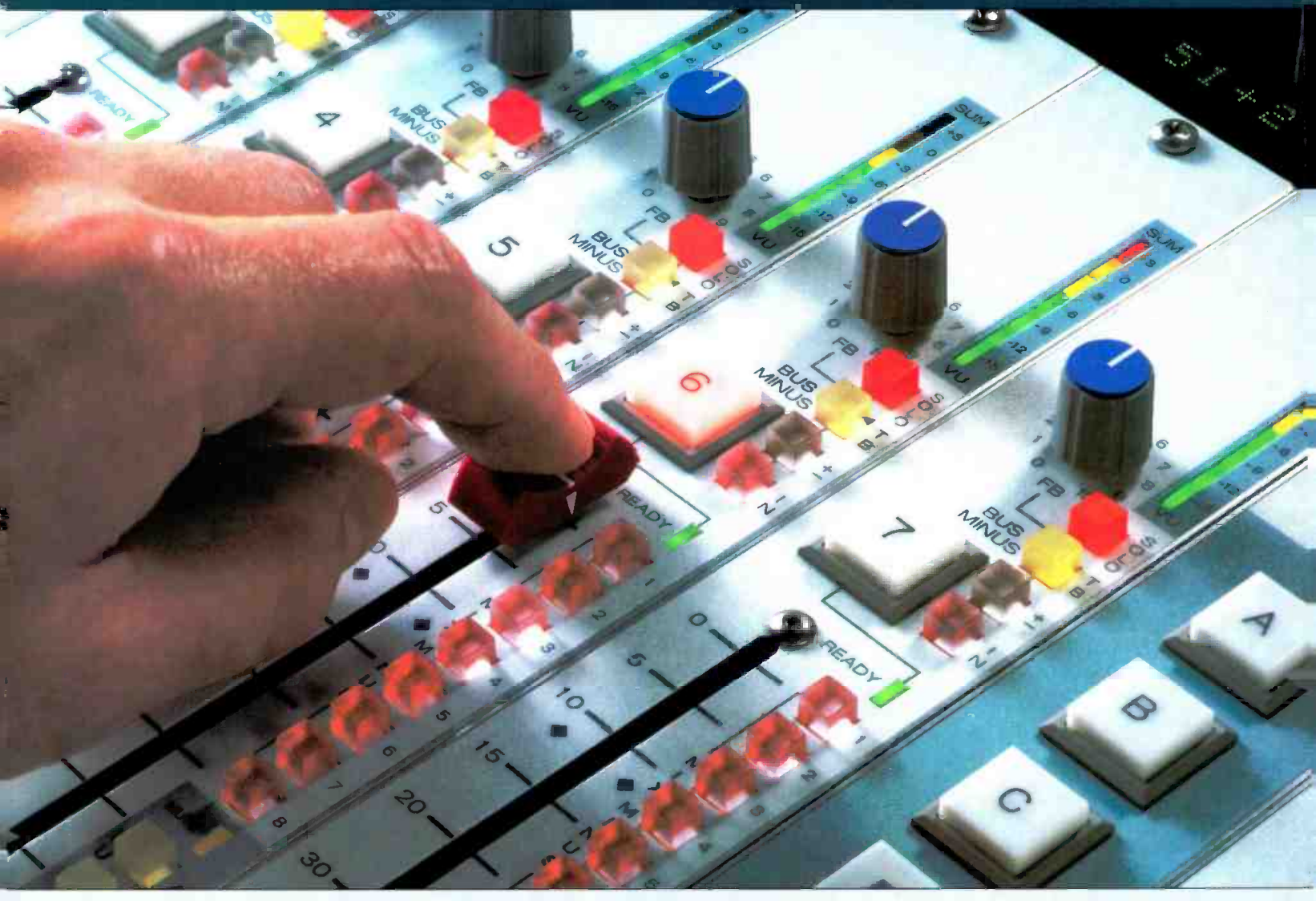

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October 1999
Volume 41
Number 11

Broadcast ENGINEERING
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IN THIS ISSUE

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Beyond the Headlines

Digital Handbook

(continued on page 8)

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FREEZE FRAME

A look at the technology that shaped this industry.

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Editorial

Waiting for HD

Have you ever seen Samuel Beckett's play *Waiting for Godot*? The play revolves around two characters, Vladimir and Estragon, who spend their lives waiting for something that never comes. They think they're waiting for Godot – to them it's just a guy – to arrive. These two laughable and despondent, characters alternate between excitement that Godot is coming and disappointment that he may never show up. At the play's end, they're still waiting. Are you one of the hundreds of stations still waiting for HDTV to show up — or worse, betting your future that it never will?

The implementation of HDTV is proving far more difficult and politically controversial than many of us thought. As our research shows (see page 16), a third of the commercial TV stations have yet to even apply for a DTV construction permit. How's that for noncommittal?

Some stations apparently believe that the FCC's deadline isn't going to hold. Managers and engineers I've talked with say that the Commission can't make the schedule stick. These stations continue to wait, believing that the deadlines are too optimistic and will be extended.

Also, many believe the COFDM controversy has further added to the likelihood that DTV will be delayed. People remember the format battle between Beta and VHS. Station managers and engineers don't want their facilities to be casualties of a similar war.

Finally, CEMA and the set makers, once vocal proponents of HD, have been strangely silent this year with regard to promoting HD. On the other hand, ABC and CBS have just started to promote their HD activities. In my view, if anything's going to make HD take off it's sports, and ABC's Monday Night Football could certainly turn the tide. But is that enough?

I recently asked some industry leaders how they see this situation playing out. The consensus was that DTV is going to happen with or without broadcasters. If stations don't build for DTV, cable and satellite will. Those I talked with didn't see an extension coming from the FCC. The Commission simply isn't going to allow stations to delay the process. If stations don't build, they're going to be out of business.

A venture capitalist recently summed it up this way. Some stations will continue to wait on DTV, hoping they can do what they've always done, play commercials and bill clients. "They're goners," he says. For these stations, he suggests they just sell now, and that there'll be plenty of folks like him who'll be willing to buy those channels and build new facilities. "I'll take every megahertz of spectrum I can get my hands on," he says. Clearly, where some stations see objection, he sees opportunity.

So, as some broadcasters wait for Godot, the DTV clock continues to tick. Be careful though. Playing a waiting game could be a fatal mistake.

Brad Dick

Brad Dick, editor

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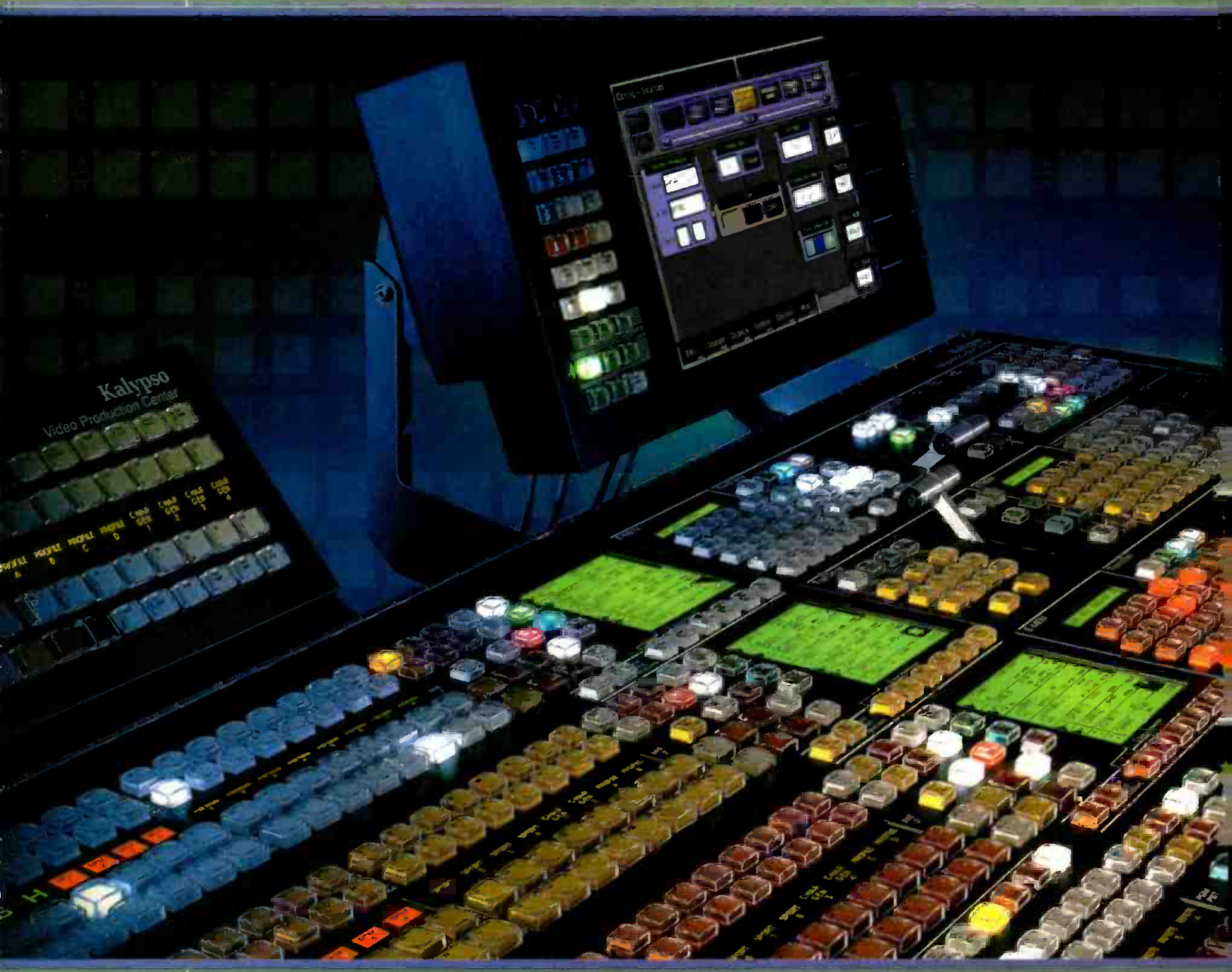

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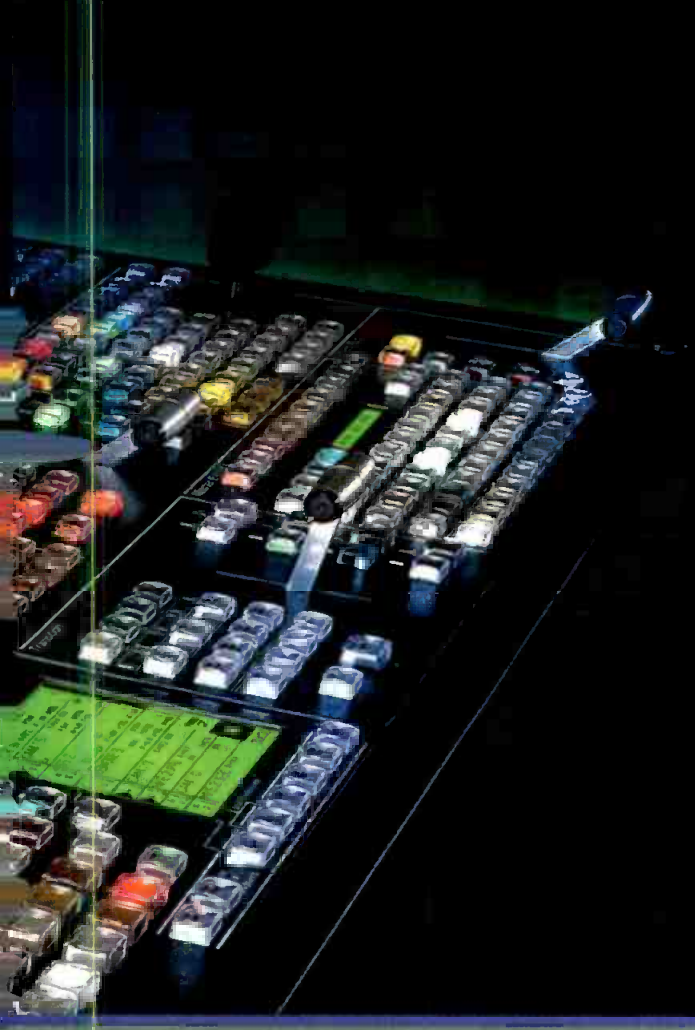

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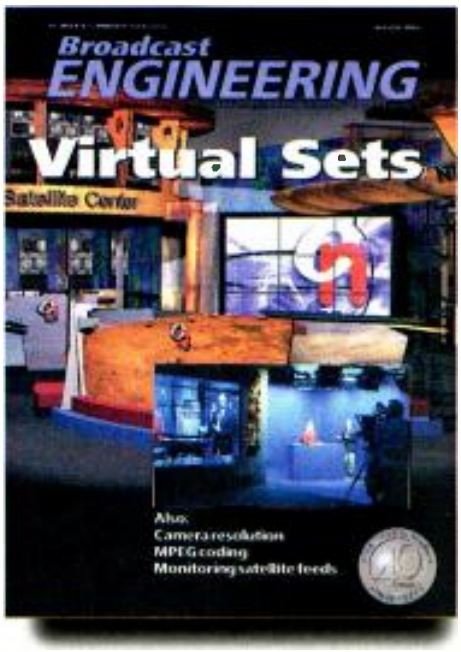
Reader Feedback



Ancillary audio

Dear Mr. Robin,

After reading your article on ancillary audio data in the May issue of Broadcast Engineering magazine, I have several questions.

The original audio/video data has a specific lip-sync relationship. How does this translate into the embedded audio data within the SDV signal?

In Figure 3, the audio data packet is shown consisting of 19 words with an ancillary data space of 268 words. If there are eight total AES/EBU channels that can be contained in this space, then this gives a total of 152 words — leaving a spare capacity for future data. Are there any plans to use this space?

Finally, on p. 46 you mention that subsequent horizontal blanking intervals will accommodate frame 1 of datastreams 1 and 2, etc. I assume that the VANC area does not contain any AES/EBU multiplexed data. Is this correct?

I look forward to hearing from you.

Regards,

David Hargreaves
Freelance Project Manager / Systems Engineer
England

Michael Robin responds:

You raise some interesting questions.

Audio embedders include a delay of the video signal to match the audio signal delay, which is introduced by the formatting of the AES/EBU datastream into embedded audio packets. A similar video delay is used in the de-embedder. No lip-sync problems occur in the embed/de-embed process. It has to be realized that audio embedding works best as a signal distribution (not production) process. De-embedding the audio for additional video and/or audio processing is not recommended as it will generate lip-sync problems that are usually unpredictable and difficult to correct.

The combined VANC and HANC available data space is of the order of 55Mb/s in the 525/60 scanning standard and 57Mb/s in the 625/50 scanning standard. Given that one AES/EBU datastream (two audio channels) equals 3.072Mb/s, it means that eight AES/EBU datastreams (16 audio channels) equal to 24.576Mb/s. Embedding this datastream into a 55Mb/s datastream leaves an unused available data space of about 30Mb/s for other possible uses.

The choice of the type of data to be inserted in the blanking interval is left to the user. The only constraint, other than the presence of an eight-word header and a one-word check sum for each ancillary data packet, is that the ancillary data inserted in the HANC data space does not exceed 255 data words.

The sole requirement is for the decoder to correctly identify the embedded data. There are unfortunate occasions where one manufacturer's de-embedder is incompatible with that of another manufacturer. The decision on the nature of the embedded ancillary data is left to the user. The most popular use is audio embedding, but other types of signals, such as timecode and EDH as well as future user and control data, can be carried in addition to or instead of the audio information.

Finally, the SMPTE standards specify that the ancillary audio data be embedded in the HANC data space with an accuracy of 10 bits per sample. The VANC data space can accept only eight bits per sample in order to match older equipment manufactured before the standards existed. This is one of the reasons why digital audio data are not embedded in the VANC.

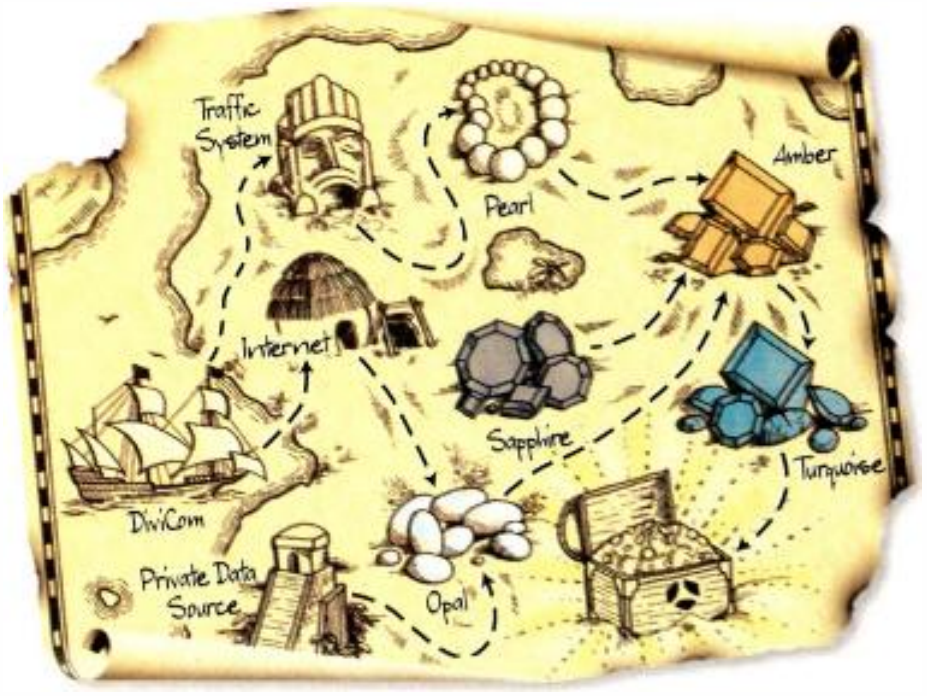
I hope I have answered your queries.

This month's T-shirt winners:

Last month's question on digital tape formats created lots of interest. Here's a partial list of winners:

- Gary Blievernicht, Michigan State University (Congratulations on the most complete answer received.)
- Henry Rue
- John Tonti
- Carlton David, Johnson-Davis Broadcasting
- John Krebs
- Phil Hejtmanek, WTVS-TV
- Dan Large
- Alan Smith, All Occasion Video

Have you won your *Broadcast Engineering* T-shirt? See page 8 for this month's Freezeframe question. Correct entries receive a "digital" *Broadcast Engineering* T-shirt.



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News

DTV deadline looms

BY LARRY BLOOMFIELD

Probably the most pressing date on the "things to do" calendar in the world of television broadcasting is Nov. 1.

This is not just another date on the calendar; it is a significant milestone on which several important events will be observed in the FCC's DTV transition schedule. This is the end of the second phase for commercial stations affiliated with the four largest networks in the top 30 markets to be on the air with their digital signals — 120 stations in total. This is also the deadline for the remainder of commercial stations, approximately 1109, to apply for a DTV transmitter system construction permit.

Network affiliates in the nation's eleventh through thirtieth markets, must be on the air with digital transmitter systems or have a confirmed extension by Nov. 1. Of the nearly 80 engineering managers contacted who are members of this second wave group, most are either on the air or will be by the deadline. But not everyone will make it. About 14 percent reported they are not ready and cited equipment delays, tower work/relocation problems and even some local regulatory issues as major factors in their tardiness. Additionally, several instances of FAA inconsistencies were mentioned.

Many engineering managers have little expectation of doing much more than passing on network feeds in whatever flavor they are received.

The FAA has certain ceiling criterion that must be observed in the erection of structures, which includes towers of any kind. The ceiling criterion excludes existing buildings and does not accommodate the FCC's timetable. John Morgan, the FCC's assistant chief engineer for video, said the FCC and the FAA do not coordinate many of their efforts.

Another instance causing serious delays in some markets are when local governments try to impose local restrictions, as is the case in the Denver market. (See *BE* September 1999, p. 14.)

Other instances of bureaucratic delays include San Diego. KGTV is one of the stations with transmitter facilities on Mount Soladad, near the posh community of La Jolla, north of metropolitan San Diego. The station needed a special power transformer, which was available from a transmitter manufacturer. The transformer is part of a larger, UL-certified unit. However, a local building inspector insisted on UL certification of the individual device even though he knew nothing about its role nor was he qualified to make such an assessment. KGTV, at considerable expense, had the unit certified. This instance of local governmental bureaucracy is typical of several stories uncovered in researching this report.

The Fox affiliate in San Diego makes for an interesting situation in the overall plan of things. Although their studios are located in the U.S., the transmitter, operating on NTSC channel 6, is situated on a hill just south of the U.S./Mexico border. XETV does not have to comply with the U.S. DTV migration schedule. Even so, Bob Taylor, vice president and chief financial officer, said the station is making every effort to voluntarily comply and should be on the air with XETV-DT on or shortly after the U.S. Nov. 1 deadline.

Construction issues can also cause delays. "Biggest of the problems, in and

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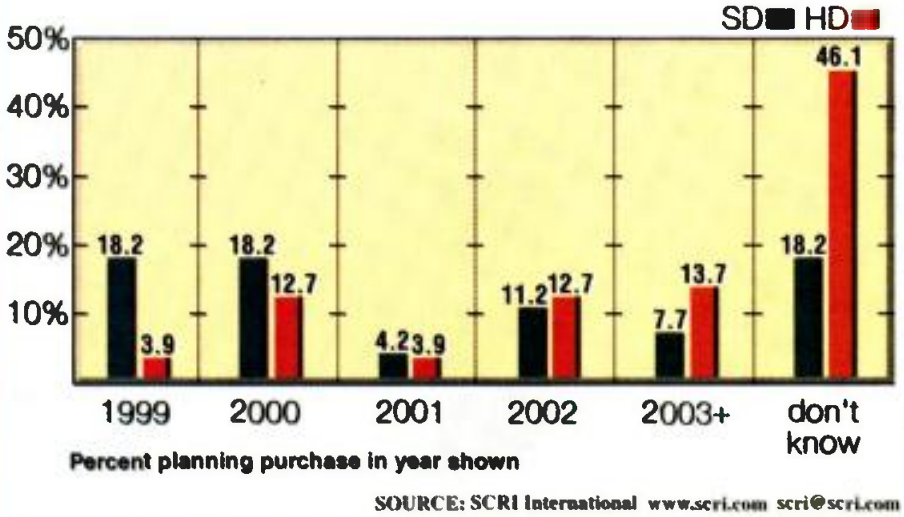

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around the Gulf Coast and Florida, are tower issues," says Frank Torbert, chief engineer at WKMG-TV in Orlando, Fla.

"My biggest challenge is to overcome building a new tower. I believe Orange County, Fla., has probably the most restrictive ordinances in the country when it comes to tower structures. I don't believe any of the stations in our market will meet the Nov. 1 deadline," Torbert said.

Stations face the additional hurdle of construction times and delays, Tobert said. "Tower companies are quoting no less than 300-day schedules to be up and running. Zoning issues must be dealt with," he said. "Once the towers are delivered, with construction time and the unforeseen, the project could extend to well beyond a year; maybe to nearly 18 months."

The FCC's schedule requires 120 stations to be on the air by Nov. 1. Not to be forgotten are the unaffiliated stations who have voluntarily leaped ahead of the overall schedule and braved the digital television waters. The hype out of Washington, D.C., is that these 120 stations in the top 30 markets will reach nearly 80 percent of the viewing public. At face value, that figure appears overly optimistic. Seventy percent of the viewing public currently receives signals through cable; however, many cable companies are unprepared or unable to carry digital signals.

Currently, there are fewer than 100 digital stations on the air. However, after interviews with many of the engineering managers in these top 30 markets, that number will be close to the target by Nov. 1. For those who can't make the deadline, for whatever reason, waivers or extensions must be filed.

What will you transmit?

When asked, many engineering managers have little expectation of doing much more than passing on network feeds in whatever flavor they are received, standard definition, high definition – 720p or 1080i. Locally originated material will be upconverted for broadcast. Few engineering managers contacted were anticipating multichannel transmission in the near future.

ABC and Fox are fairly locked into 720p, and CBS and NBC have chosen the 1080i route. With the exception of Fox, each network plans some regularly scheduled HD programming with "specials" added for spice.

Compared with the first 10 markets, the network-affiliated stations in the next 20 markets, must be on by Nov. 1. Applications for their construction permits were due in at the FCC back on Aug. 3, 1998.

There are a number of stations throughout the 211 markets that do not have to be on the air with a digital signal until May 1, 2002. Some of those have voluntarily stepped into the digital arena. There should be no less than 120 stations in dual operation by November even with those who have filed extensions.

Surprisingly, there are a few full-power commercial NTSC stations that do not have to follow the FCC's transition schedule. The earliest these stations would have to make the change to digital would be by the 2006 cut-off date. The FCC's Morgan explained that new NTSC stations granted construction permit or license on or after the adoption of the Fifth Report and Order on April 3, 1997, have not been granted a second channel for digital use. The FCC was not able to provide the exact number of these stations as the number fluctuates from week to week as new stations come on line and CPs are granted.

For more than 700 full-power commercial television stations who have not filed anything relating to DTV to date, there probably aren't many valid reasons to be in that position. Everything needed is available on the Internet on the FCC's website at www.fcc.gov.

Lauren Colby, an attorney in Frederick, MD, who practices communication law before the FCC, said, "The possible problems are not worth the hassle of not filing on time if the station wishes to stay in the television broadcast business.

"The Communications Act, part 309 is rather clear on what will happen to channel allocations that are not properly maintained or sought after," Colby said. "Things that are spelled out in the Act are rather inflexible such as: 'A television broadcast license that authorizes analog television service may not be renewed to authorize such service for a period that extends beyond December 31, 2006.' With respect to the FCC rules, however, extensions and waivers can be requested providing they don't go beyond the limits of the Act."

The bottom line is this: file. Those stations with valid reasons for not filing on time should submit their applications, then ask for an extension. The people responsible for getting the DTV license filed at these stations should at least file the Checklist, which consists of pages 17, 18 and 19 of FCC form 301, dated May 1999. Go with the best information you have at the time of filing.■

Market	On Air	Construction to be completed by Nov. 1	Requested an extension/ faces regulatory delays
Houston	KHOU	KRIV , KPRC , KTRK	
Seattle-Tacoma	KOMO , KING		KCPQ , KSTW
Cleveland		WEWS, WOIO, WJW, WKYC	
Minneapolis-St. Paul		KSTP, WCCO, KARE	WFTC,
Tampa - St. Petersburg		WFTS, WTSP, WTVT, WFLA	
Miami - Fort Lauderdale		WPLG, WFOR, WSVN, WTVJ	
Phoenix		KNXV, KPHO, KSAZ, KPNX	
Denver	KMGH	KCNC, KDVR, KUSA	
Pittsburgh	WTAE	KDKA, WPXI	WPGH
Sacramento		KOVR, KTXL, KCRA	KXTV
St. Louis		KMOC , KTVI, KSDK	KDNL
Orlando		WFTV , WESH	WKMG , WOFL
Baltimore		WMAR, WJZ,WBAL	WBBF
Portland	KATU	KOIN, KGW	KPDX
Indianapolis	WISH, WTHR	WRTV, WXIN	
San Diego		KGTV , KFMB , KNSD	XETV
Hartford - New Haven	WTNH	WTIC, WVIT	WFSB
Charlotte, SC	WBTV	WSOC, WCCB, WCNC	
Raleigh - Durham	WRAL	WTVD, WNCN , WFLF	
Cincinnati	WLWT	WCPO, WKRC, WXIX	

Table 1. Network affiliates in the eleventh through thirtieth markets are required to begin broadcasting digital by Nov. 1. While few currently offer digital transmissions, approximately 120 stations across the U.S. are expected to be offering DTV by November.

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Rarely, has *one* video tape format inspired *so many* words.

"Our experience with DIGITAL-S has *far exceeded our expectations*—in both quality and reliability"—*Denis J. Roche, Vice President of Engineering and Operations, EABC-TV, Fort Lee, NJ* • "The *durability* of our DIGITAL-S recorders is *unmatched*. One of our recorders has over 10,000 hours on the original heads—*unbelievable!*"—*Ted Small, Director of Engineering, KFXK-TV, Longview-Tyler, TX* • "DIGITAL-S is an *incredible tool* in today's competitive age"—*Robert Baker, Chief Engineer, TCI Media Services, Monterey Bay, CA* • "We purchased DIGITAL-S because it is *perfectly suited* to meet the future demands of DTV"—*Matt Tuter, Station Manager, KFTL-TV, Oakland, CA* • "The *picture quality* of DIGITAL-S *rivals* the most *expensive digital systems*"—*Ken Tofanelli, Chief Engineer, WEEK-TV, Peoria, IL* • "DIGITAL-S provided us with an *easy upgrade path* and has allowed us to achieve extremely high quality digital video at an *affordable price*"—*Robert Sclafani, President, Multi Image Group, Boca Raton, FL*

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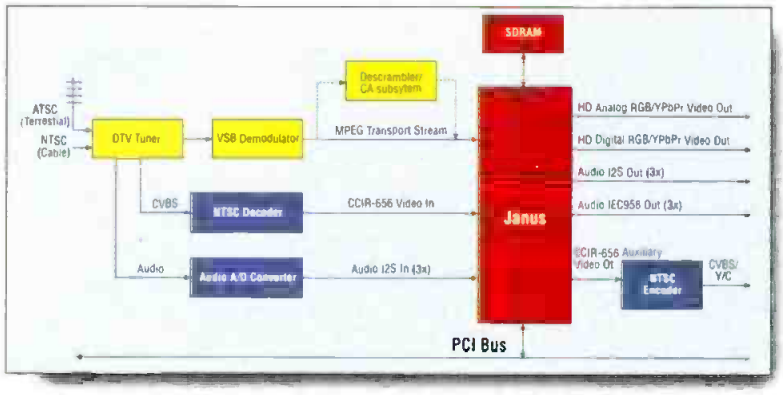
TeraLogic introduces STB chip

TeraLogic has developed a chip which may make it possible to have affordable digital television in time for this year's Christmas shopping season.

The Janus chip will take any of the 18 ATSC formats and deliver the menu-driven selected output, in the format selected, to a PC screen. By using the appropriate auxiliary output on the back plane, the unit is also able to deliver both a bitstream or video to a digital-ready TV set in any of the ATSC formats or downconvert the material so it can be viewed on an NTSC set. In addition to a PC, TeraLogic has demonstrated the output of its device into both a Sony projection system and a Pioneer thin panel plasma display. Although the audio demonstrated was stereo, the company said the device is capable of Dolby Digital AC-3 audio as well.

What makes this technology of particular interest and possible use to broadcast engineers is that this device makes for an inexpensive means of monitoring the output of a digital transmitter plant. Although watching HDTV on a PC may seem like television heresy to some; it could have an application in control room environments where space is limited. When coupled with a tuner and other devices, the device also makes for a low cost piece of test equipment.



Teralogic's Janus chip is capable of converting 18 ATSC formats for viewing with a set-top box or on a PC screen. The chip also contains a line doubler and video scaler that can upconvert NTSC video to HD formats.

TeraLogic is a chip developer and supplier. They are partners with other companies including Hauppauge, MGI Software, Microsoft Corp., NDS, NVIDIA Corp., Philips Semiconductors, Ravisent, S3 Inc., Santa Barbara Software and Videon.

TeraLogic's partners hope to have a set-top box available by next year and a PC card for Windows 98 by Christmas.

TeraLogic has also demonstrated the Janus's on-chip line doubler and video scaler, which they used to show how they can upconvert native NTSC video streams to a HD video format. Native NTSC (such as cable TV) displays 150,000 pixels per frame. The Janus chip can deliver the more than two million pixels available in a 1920x1080 interlaced picture. Most display devices, including a PC are only capable of displaying about half that number. In addition to quality digital pictures, TeraLogic's chip will permit users to utilize any data broadcast applications that may be accompanying the program material.

For more information visit www.TeraLogic-inc.com ■

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Motorola, NxtWave unveil new 8VSB receiver chips

The reliability and performance of 8VSB reception has been among the chief concerns of the transition to DTV. The poor performance of first-generation receivers, particularly with multipath problems, has prompted one broadcast group, Sinclair Broadcasting, to call for a choice in the modulation schemes broadcasters may use.

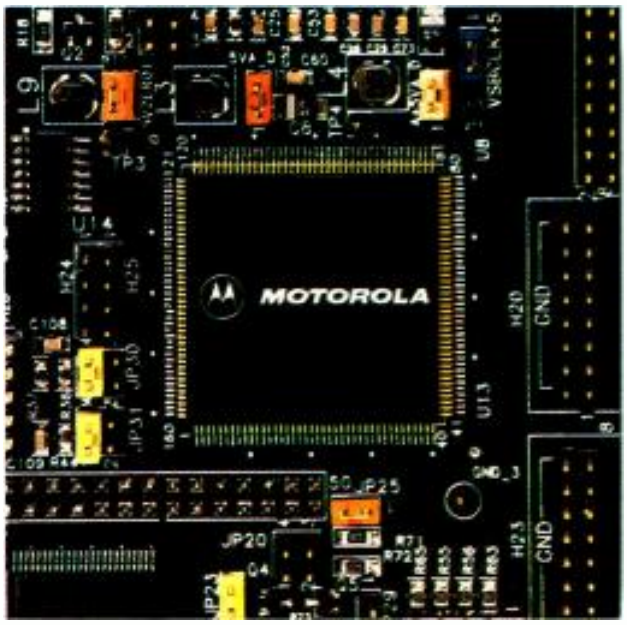
In September, two companies, Motorola and NxtWave, introduced two second-generation 8VSB receivers they claim are more robust and solve the reception problems endemic to the first-generation receivers.

Motorola's Frank Eory, senior principal staff engineer, said his company has developed a new chip that will solve potentially serious digital television reception problems with broadcasts that use the ATSC transmission standard, 8VSB. "This new digital signal processing chip, the MCT2100, is a demodulator and forward error correction (FEC) device," Eory said. "It is designed to deal with the cacophony of multipath errors that have very serious delays. These are the kinds of multipath signals that tend to most seriously impact the 8VSB-ATSC off-air signal. "The chip uses special algorithms in connection with unique equalization architecture to provide clean signal reception in even the most extreme static and dynamic multipath signal conditions," Eory said. "We designed full equalization in this chip from zero out to 44 microseconds and have demonstrated how it can handle signals with up to 41 microseconds of delay."

The Motorola chip does not use sparse equalization techniques, which can adversely affect performance, Eory said. "Our chip can deal with and compensate for a broad range of dynamic echo ensembles with delays out to 41 microseconds that have serious echo amplitudes approaching the level of the desired signal."

Gary Shapiro, president of the Consumer Electronics Manufacturers Association, said, "We have long said the consumer electronics industry is committed to ensuring that all Americans have access to the wonders of digital and high-definition television. Motorola's new demodulation chip helps us reach that goal by directly addressing the digital signal reception challenges presented by urban environments."

NxtWave Communications has developed a broadband communications IC, which is a multimode VSB/QAM receiver chip that they claim will deliver an error-free bitstream when receiving digital broadcast signals in either an indoor or mobile environment. What sets this chip apart is NxtWave's use of On-Chip Advanced Blind Adaptive Equalization. Designated the NXT2000, the chip is a high-performance, multimode integrated circuit that decodes both 8VSB terrestrial and cable signals (such as SCTE DVS-031, ITU-J.83B, and MCNS DOCSIS-compliant 64/256 QAM). This physical layer device will cancel transmission channel impairments such as static and dynamic multipath, phase noise, adjacent or co-channel NTSC interference and impulse noise. The chip includes a direct IF sampling as integrated analog-to-digital converter (A/D) that will enable the chip's direct integration into existing set-top boxes and DTV chassis designs. The programmable symbol rate allows for different VSB/QAM modes without requiring any VCXOs to drive the A/D converter.



Motorola's MCT2100 demodulation chip is a second generation receiver chip designed to correct multipath errors that carry serious delays.

Anyone who has tried to align an antenna for DTV reception knows the built-in "signal quality indicator" available on the NxtWave chip will be an extremely helpful tool. Signal acquisition is 50 milliseconds or less. Because of the speed, the chip will allow for rapid channel changes supporting channel surfing, which has not been possible to date with other digital receiver technologies. Matt Miller, president and chief executive officer of NxtWave Communications, said the chip "will provide robust and dependable demodulation even when the VSB pilot is destroyed due to severe channel conditions. The equalizer range extends from -4.5 microseconds to 44.5 microseconds, ensuring reliable signal recovery in the harshest multipath conditions typical of terrestrial broadcast channels."

"The secret to good digital television reception is in the deployment of error-free digital signals, Miller said. "Since that is nearly impossible, off the air, a device must be present in the receiving unit that will clean-up the signal."

For additional information on the Motorola chip see motsps.com/.

For more information about NxtWave, visit their website at www.nxtwave.com

Sinclair responds

The Sinclair Broadcast Group has been at the forefront of reception tests on ATSC/8VSB. Sinclair had ready a petition for submission to the FCC requesting that the Commission allow COFDM be an alternative transmission standard available to broadcasters along with 8VSB, but it has put the petition project on hold. On the brink of implementing plans to distribute this petition among broadcasters, Nat Ostroff, vice president of New Technology at the Sinclair Broadcast Group, said, "These announcements, coming from non-consumer set makers, need to be taken into consideration and evaluated before any further steps are taken with the FCC. The fact that the work has been inspired by background intellectual property from The Sarnoff Corporation lends a degree of credibility to the issue that

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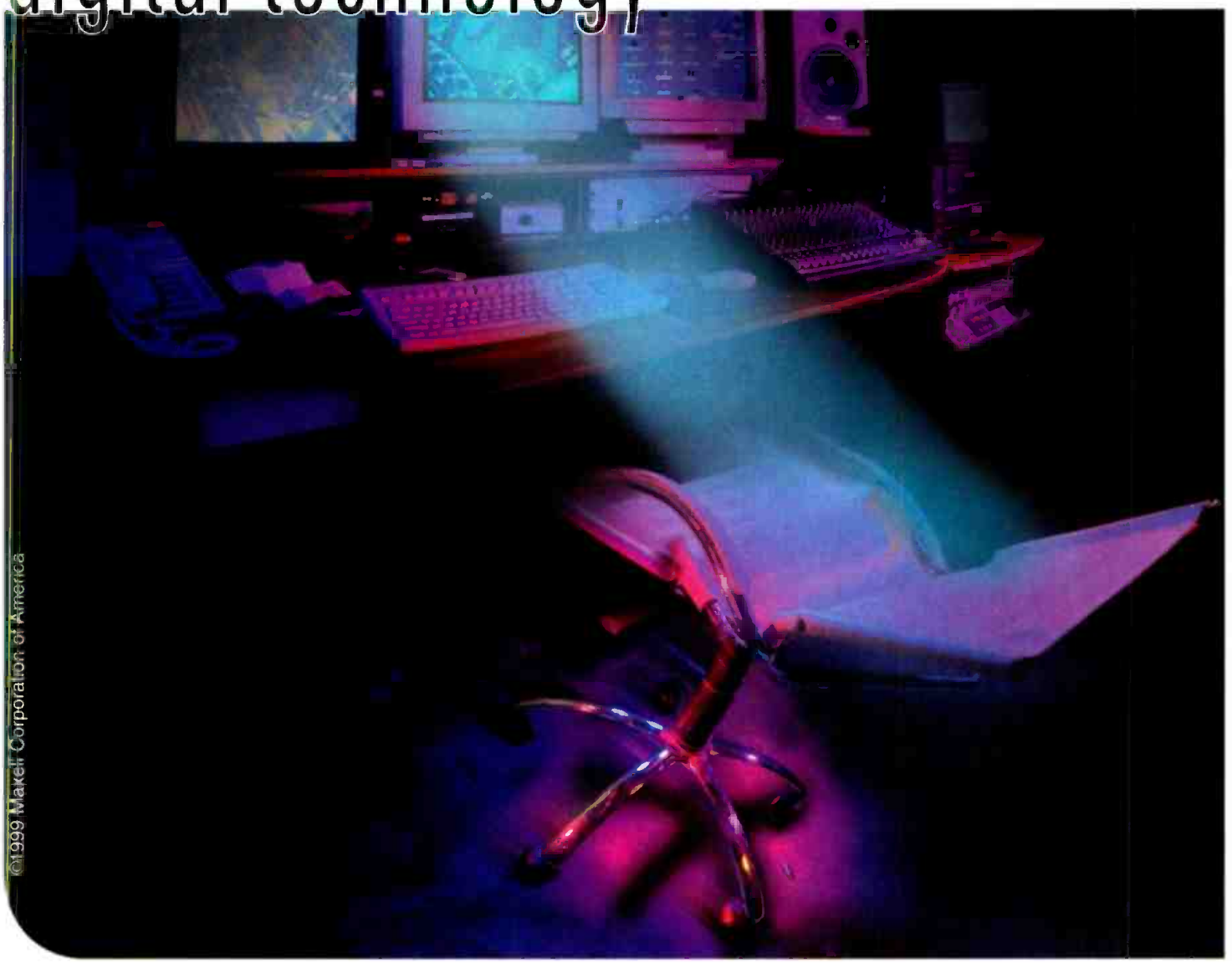

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must be recognized.

"Sinclair has therefore decided to temporarily hold the FCC petition and instead has invited the chip making companies to come to Baltimore and demonstrate their achievements using our facilities and the calibrated locations available in Baltimore," Ostroff said. "If the tests bear out the claims already made for this technology then there may not be a reason to file the current version of our petition with the FCC."

Ostroff is "cautiously optimistic that these companies have found the code to crack the most difficult aspect of the reception of the 8VSB standard. If they can demonstrate their achievement, we want to be among the first to say congratulations." Ostroff says that his and Sinclair's objective throughout this entire process was to insure that broadcasters ended up with a robust over-the-air delivery service. ■

Networks eye the Internet, interactivity

As more media services vie for viewer time and attention, television networks, software manufacturers and a few local broadcasters are finding new ways to capture viewers' attention through interactive services and the Internet.

Would-be subscribers to the world of interactive television are enticed with ideas of being able to chat and play games with other viewers, look up statistics on athletes or bios about actors, shop for related merchandise, and lots more.

Interactive or enhanced television is nothing more than extra content that's sent along with a particular network show. Syndicated and local programming have yet to realize the impact of such technology as it is currently available only at selected "beta sites." Interactivity on the local level isn't too far away. The Columbia TriStar TV Group began offering "Wheel of Fortune-Interactive" and "Jeopardy! - Interactive" earlier this month to WebTV Plus users. The interactivity aspect of the feed allows viewers to provide answers while watching the shows. The Game Show Network could see similar interactive programming this winter.

Local stations are in a unique position to provide interactive overlays on standard 30-second spots and process the responses. National advertisers are doing this now and handling their own response processing even though it is very hard to implement. The biggest problem is getting the data all the way through the network chain. Local broadcasters have a valuable datastream in analog TV, as we speak, that will only become more valuable with DTV.

Many local broadcasters have websites to cross-promote various programs and supplemental services, paying for it with banners and click-through deals. There are even a few who broadcast 24-hour web interfaces for the million or so viewers who can see them on set top boxes or PCs. In the future, millions of subscribers to AT&T, EchoStar, Time-Warner, Falcon, DirecTV, Wink and WebTV with set-top boxes and a few TV sets will receive the web interface in the ATVEF format.

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Intel and NBC announced during NAB99 a multiyear project to create and provide enhanced multiplatform DTV programming that will premier this fall season. Jonathan Boltax, director of NBC's Enhanced Broadcast Group, indicated that regardless of whether viewer's use a DTV-enabled PC, digital television set or "powerful" set-top box, they will be able to watch NBC digital television programming and receive interactive content.

NBC leads the pack with alternative or supplemental viewing with services such as MSNBC and CNBC. In addition to this, they have a website and actively seek to bring in participants to their ongoing interactive offerings.

In the future, millions of subscribers to AT&T, EchoStar, Time-Warner, Falcon, DirecTV, Wink, WebTV with set-top boxes and a few TV sets will receive the web interface in the ATVEF format.

NBC is currently working with the Advanced Television Enhancement Forum (ATVEF), an industry group led by Intel and Microsoft. The ATVEF bills itself as a cross-industry alliance of companies from the broadcast and cable networks, television transports, consumer electronics and PC industries. This group has developed protocols for HTML-based enhanced television, which allow content creators to deliver enhanced programming over all forms of transport (analog, digital, cable, and satellite) to any intelligent receivers. ATVEF is committed to accelerating the creation and distribution of enhanced television programs so consumers can receive enhanced television programs in the least expensive and most convenient way possible.

NBC offers several paths for Internet, cable and other media service. It holds equity stakes in Snap.com, CNET, Launch Media, Talk City, iVillage, Telescan and ValueVision International, maintain NBC.com, operate NBC Interactive Neighborhood, a localized Internet community guide service customized for over 100 local NBC stations and owns VideoSeeker, an on-demand Internet video service operated with InterVU Inc. With Microsoft, NBC owns and operates MSNBC, an Internet news service at www.msnbc.com. Also, together with Microsoft and Dow Jones, NBC operates CNBC/Dow Jones Business Video.

Other new media innovations from NBC include interactive television initiatives with Intel for NBC Intercast, Microsoft WebTV for Windows and WebTV Plus, Wink-enhanced programming with Wink Communications, electronic program guides with Gemstar and on-demand video services with Intertainer.

Microsoft has entered into a joint venture with Thomson Multimedia to launch an interactive TV platform and associated services for broadcasters and TV set manufacturers. The venture, called TAK will offer such services as enhanced TV programming, e-mail and Internet access on a CE based platform, compatible with ATVEF specifications. But it won't be available here in the U.S. until the second quarter of next year under the name eTV.

The TAK enhanced programming service will utilize the vertical blanking interval (VBI) as well as newer digital technology for delivery. By providing broadcasters with special broadcast servers that synchronize the TAK in-house developed interactive services with TV broadcast programming and will utilize their own online servers for delivering HTML-based applications. The start-up will also operate as a dedicated services company. According to a Thomson spokesperson, the service will be offered by a collection of U.S. broadcasters rather than by TAK itself.

CBS is also purchasing chunks of Internet companies with advertising airtime. To make itself a player in the Internet arena, CBS has bartered almost $800 million in advertising time over the next seven years for a piece of nine sites.

Closer to the entertainment media is the expansion of a deal made earlier this year with Big Entertainment. The new expanded deal will give CBS a nearly one-third ownership in Big. Big's claim to fame is the Internet site Hollywood.com. CBS joins Gannett and Times Mirror as shareholders of Big Entertainment.

Big Entertainment owns, in addition to Hollywood.com, bigE.com, and CinemaSource, a combination of movie-related Internet businesses that are being combined under the "Hollywood.com" name. Big Entertainment is also negotiating an agreement to acquire pkbaseline.com, a comprehensive online film database. ■

Send questions and comments to:
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Seidel to deliver keynote address at DTV99

Robert P. Seidel, vice president of engineering at CBS, will deliver the keynote address at the Digital Television 99 conference, Dec. 1-3 at the Hyatt Regency O'Hare in Rosemont, Ill.

Seidel's address, titled "DTV — The Global View," will be delivered at 8:30 a.m. Dec. 2. The three-day DTV99 conference will focus on four conference topics: Interactive television, DTV infrastructure, Building the Digital Studio and Building the RF plant.

The conference will also host a series of high-definition production workshops for producers, directors and post-production managers. Production session topics include a HD cameras, HD production tools and formats and HD Business Opportunities: Real or Imagined? The production workshop series is sponsored by *Video Systems* and *Millimeter* magazines.

DTV99 is sponsored by *Broadcast Engineering* and Intertec Exhibitions.

For more information on the DTV99 conference, call 1-800-288-8606 or 1-303-741-2901 or email trade_shows@intertec.com. Information is also available at www.dtvconference.com.

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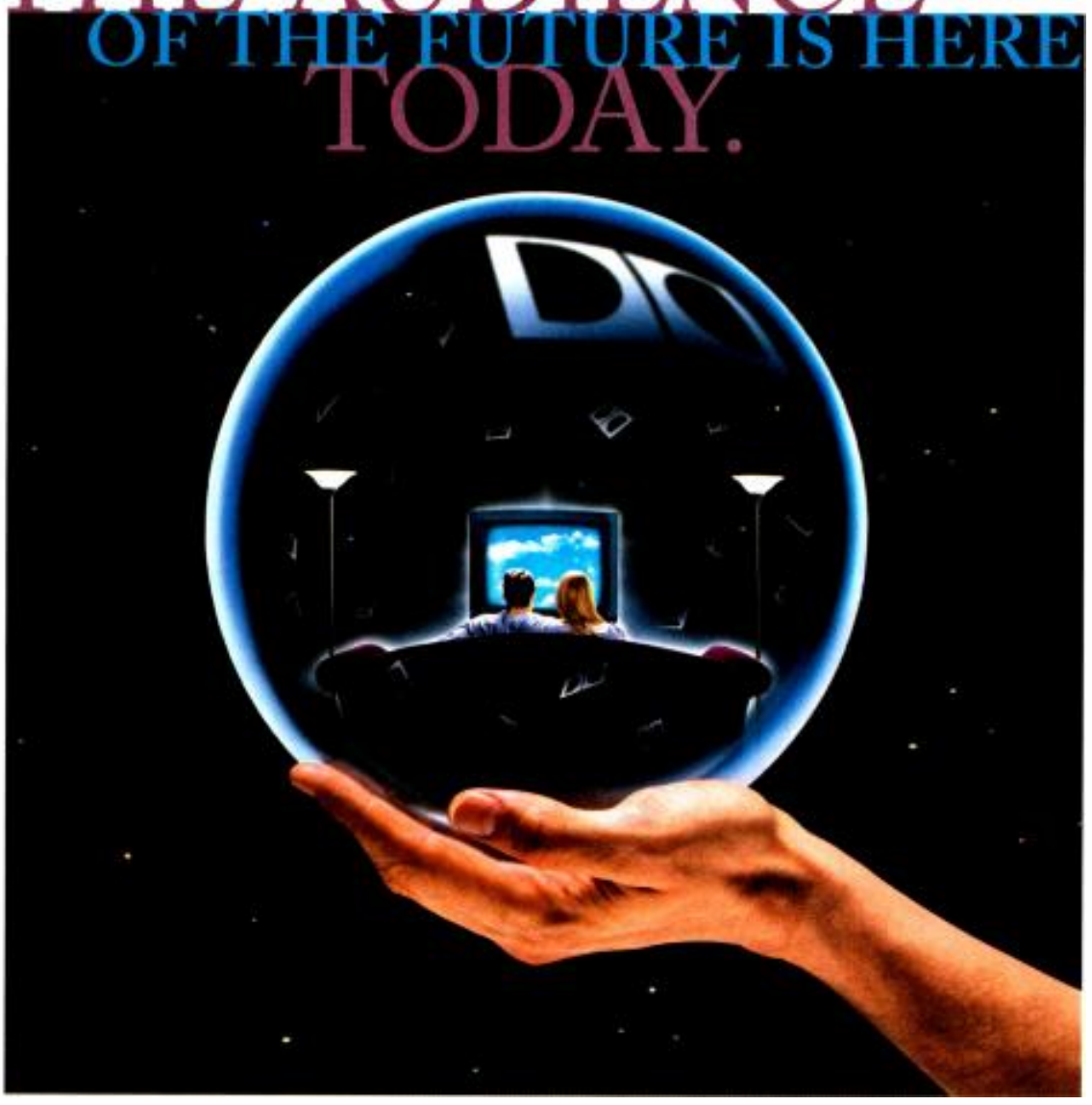

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FCC Update

DTV closed captioning standards

BY HARRY MARTIN

Technical standards for closed captioning on digital television sets are coming. A 1990 statute requires the FCC to mandate closed captioning on all television sets with picture screens 13 inches or larger, regardless of the broadcast technology used. Rules for closed captioning on analog TV have been on the books since 1991. With the introduction of DTV, the FCC must now update its rules to stay in compliance with the statute.

The DTV transmission standard adopted by the FCC in 1996 reserved a datastream for closed-captioning information, but it did not provide standards for implementation. The Electronics Industries Alliance (EIA) has since adopted the needed standards in its EIA-708-A. The FCC now proposes to incorporate the relevant sections of the EIA standards into its rules.

The standards offer a number of features that are currently not available in analog closed captioning. The on-screen characters are larger, for example. Viewers will be able to change the font, spacing, color and screen position of the captioned text. Programmers can also distribute captions at different reading levels or in different languages concurrently.

The FCC has sought comment on whether it should require only the minimum recommendations of the EIA standards, making full implementation optional for each manufacturer, or, alternatively, whether it should mandate the full standards in the rules. The FCC also wants help in determining what picture sizes should trigger a captioning requirement. Because of DTV's wider screen proportions, a 13-inch diagonal DTV screen will have a smaller area than a 13-inch analog set, and only 60 percent of the analog's screen height.

During the transition period to DTV, stations will transmit in both formats. The first few generations of DTV receivers are expected to operate in a dual mode, receiving both DTV and analog broadcasts. The FCC has proposed requiring that these receivers provide closed captioning in accordance with current rules when operating in the analog mode, but use the EIA standard in the digital mode. Digital converters for analog sets similarly must handle both kinds of captioning appropriately.

These provisions would enable consumers to benefit from the additional features of the EIA standard during the transition period, although they might add to the cost of consumer equipment.

Dateline

Television stations in the following states (commercial and noncommercial) must file their biennial ownership reports on new Form 323 (or Form 323-E for NCE-TV) on or before December 1: Alabama, Colorado, Connecticut, Georgia, Maine, Massachusetts, Minnesota, Montana, New Hampshire, North Dakota, Rhode Island, South Dakota and Vermont.

Private cable at 12GHz

Feeling cramped at 18GHz, a private cable operator petitioned the FCC to use 12GHz frequencies for video service to subscribers. Private cable offers multichannel video service, similar to that of cable systems, to subscribers who are generally concentrated in multiunit buildings. The operator typically relays signals from its head-end offices via microwave signals in the 18- or 23GHz bands. Both bands are heavily shared with other services, and atmospheric attenuation limits their useful range to a few miles.

The FCC seeks comment on whether it should permit private cable operators to operate in the 12GHz band. Currently designated for Cable Television Relay Service (CARS), 12GHz is used for cable system distribution backbones and certain broadcast relay operations. The private cable operator requesting the change argues this band is less crowded than 18GHz and offers more than three times the range. The proposed rules would open the 12GHz band to private cable and to open video service providers and other video programming system providers for CARS-type backbone services and direct transmission to subscribers' buildings.

Uplink streamlining

The FCC announced its most recent initiative to streamline licensing for certain satellite uplinks, with a promise of more improvements to come.

First, the FCC will automatically grant routine Ku-band earth station applications that propose to use U.S.-licensed satellites for service within the United States. Applications meeting these restrictions will be considered granted 35 days after the application appears on public notice, unless the FCC says otherwise. This means a grant roughly 55 days after filing, an improvement over the present 75 days. Also, the FCC has reduced the number of emission designators required in applications for digital systems. Applicants now need specify only the emission designators for the lowest and highest bandwidth for each class of modulation. The licensee will then be authorized to operate at any bandwidth within these limits, without the need to file modification applications.

Possible future changes under discussion include post card renewals, mandatory electronic filing, longer license terms, conditional grants to operate as soon as an application is filed and certification of satellite earth station equipment. ■

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

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Expert's Corner/Vendor Views

DTV receiver update

JERRY WHITAKER, BE CONFERENCE CONSULTANT

With nearly 100 DTV stations now on the air, the challenge of the aggressive DTV rollout is shifting from broadcast stations to consumer receivers. The stage is now appropriately set to introduce consumers to — and interest them in — digital television in general and high definition in particular. How well the new DTV receivers perform is critical to acceptance by the public, even more so than the price. They will invest in leading-edge television sets if they perform up to their advertised capabilities.

Early reports are mixed on the performance of DTV receivers. The obvious fallout of first-generation receiver performance was the Sinclair demonstrations of COFDM and 8VSB. Now that second-generation receivers are making their way to consumer electronics showrooms, better results are expected. Indeed, within the past month, new DTV receiver chip sets have been announced that offer improved performance, particularly with regard to the troublesome issue of multipath.

What do next-generation receivers have in store for DTV viewers? In this month's column, we hear two perspectives: George Hanover, vice president of technology and standards, Consumer Electronics Manufacturers Association, and Jim Boston, project engineer for Scripps Howard. ■

Send questions and comments to:
jerry_whitaker@intertec.com

VENDOR

George Hanover, vice president, Technology and Standards, Consumer Electronics Manufacturers Association

The success of DTV requires close cooperation among several different industries in a transition that impacts every broadcaster, cable operator, satellite provider, technology manufacturer, programmer and nearly every household in America. The consumer electronics industry and CEMA have worked together with representatives from these other industries during the last year to resolve several outstanding issues affecting the implementation of DTV.

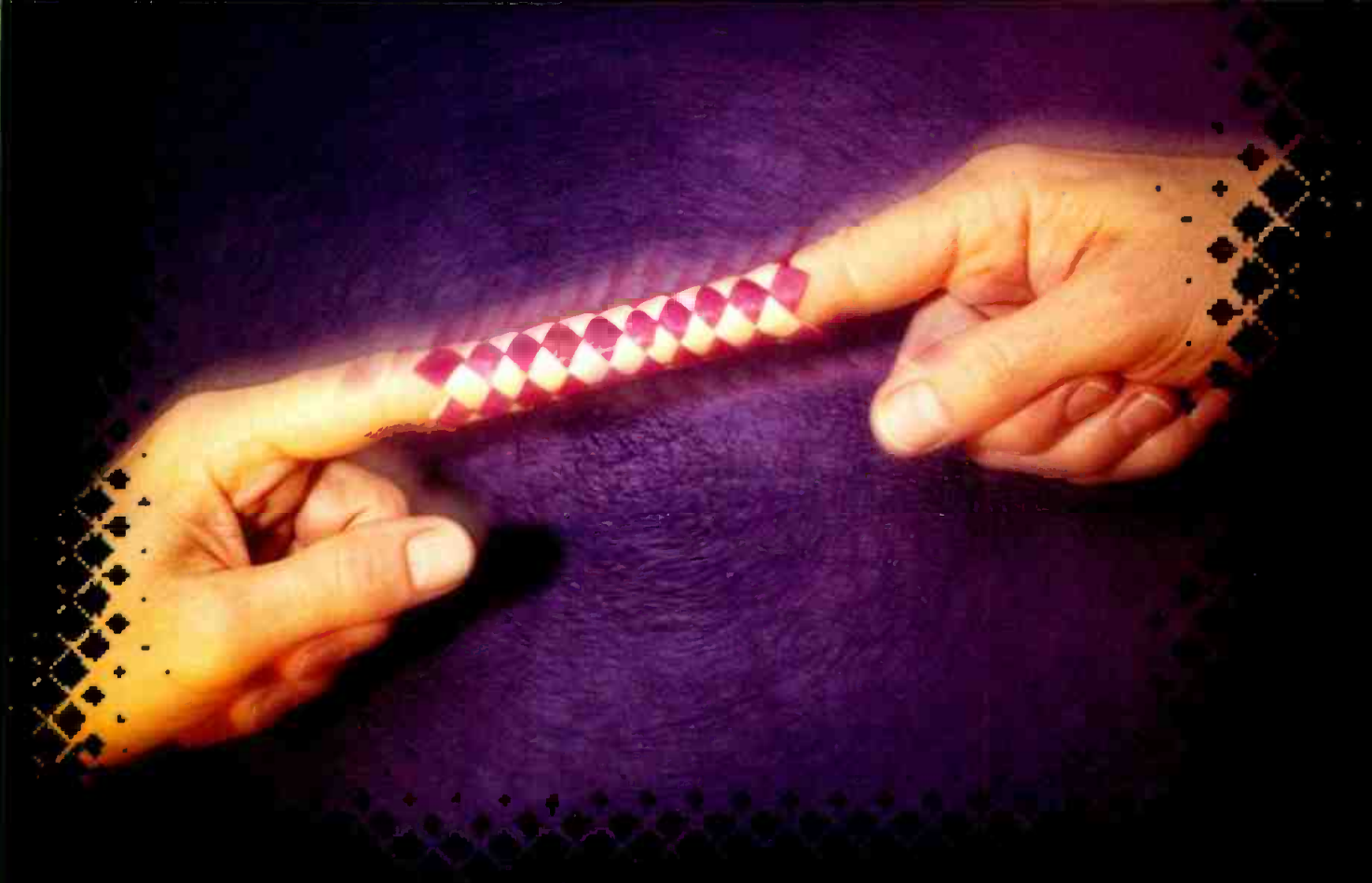
Nearly two-thirds of all U.S. households receive TV programming through cable. For this reason, it is critical to ensure that the full benefits of digital television reach cable subscribers. This requires technical solutions that link cable set-top boxes and digital television sets. CEMA and the National Cable Television Association (NCTA) are working together to define the interfaces needed to link cable systems directly to digital receivers, thus diminishing or eliminating the need for set-top boxes. Joint standards and guidelines will define cable/receiver specifications to support the basic and premium programming services as well as emergency messaging, electronic program guides, closed captioning and other program-related services.

Under Cable Labs' Open Cable Project, the industries have also been working to establish guidelines for manufacturing digital set-top boxes capable of providing consumers — no matter where they live — with a number of advanced features. These features could include high-speed, cable-based connections to the Internet, interactive TV, phone service and PC-like features such as e-mail and e-commerce. Thus, in the future, a consumer could purchase a set-top box and have access to all these features anywhere in the country.

It is critical to ensure that the full benefits of digital television reach cable subscribers.

CEMA has also developed four technical solutions for connecting cable and other set-top boxes to TV receivers: an IEEE 1394 interface, the RF remodulator interface, a component video interface and the National Renewable Security Standard (NRSS) interface. These four interfaces provide consumers and manufacturers with a wide range of choice for connecting digital TVs to cable systems:

- 1394 Interface: This standard (EIA-775) creates a two-way digital bus architecture that allows several digital devices to be daisy-chained together, such as digital versatile disc (DVD) players, digital VHS players, Dolby Digital surround sound processors/receivers, digital converter boxes as well as set-top boxes.
- RF Remodulator Interface: EIA-762 links one digital device (such as a digital cable set-top box) to a digital TV receiver, via a one-way, point-to-point RF connection. The interface can support one-way digital copy protection schemes.
- Component Video Interface: This standard has been published as a three-part document under EIA-770. The component video interface can link a cable set-top box to a TV receiver, using a one-way, point-to-point analog connection. The interface can support analog copy protection technology.
- National Renewable Security Standard (NRSS) Interface: This standard, which has been published as EIA-679, applies to digital cable-ready TV receivers and set-top boxes. In the NRSS interface model, a smart card or PCM-



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Over-the-air reception

With the transition to DTV underway, consumers may only have access to digital TV content via their local broadcaster. CEMA has introduced the TV Antenna Selector Map Program, a new campaign aimed at making antenna sales easy for consumers. Using color-coded maps that match antenna performance, CEMA's new program will help consumers select the appropriate type of antenna for their television reception location, taking the guesswork out of antenna purchases.

At least two companies have developed solutions to potential multipath problems with urban reception of DTV. A new digital equalizer technology from Motorola, in cooperation with Sarnoff Corporation, promises to provide "excellent signal reception, even under difficult ghost signal conditions found in urban areas," according to a company representative. Nxtwave Communications Inc. has also reportedly developed a chip solution to the multipath issue.

As advances continue to be made in the basic chipsets that go into DTV receivers, further improvements in the ultimate performance of receiver systems can be expected. ■

EXPERT

Jim Boston is a project engineer at Scripps Howard, Cincinnati, OH.

Like the old adage says, the resulting display on a DTV receiver is usually only as good as the input. Many in and out of our industry think DTV is the total transformation to digital of the process from image capture to home reception. As most of us know, all that is really mandated and, in many instances, implemented are modulation techniques that allows carriage of digital data. In fact, the argument over modulation techniques continues. But this engineer believes that 8VSB's higher bit payload per given bandwidth and lower peak to average power than COFDM will carry the day. COFDM is often mentioned as more robust in multipath scenarios than 8VSB. But this author has seen numerous instances where multipath will render NTSC unuseable while a co-located 8VSB signal of much lower signal strength was recovered OK and with very early demod and demultiplex chip sets with multipath energy half that of the direct signal. Current receiver chipsets can use DSP techniques and the resulting coefficients (what is commonly referred to as tap energy) to produce usable demodulated transport streams. Above the 50 percent level, inadvertent noise amplification (white noise enhancement) in the correction process swamps recovery efforts in the current set of receivers. Advancements should soon allow lower ratios of direct to indirect signals to be recovered. Already, at least one vendor is offering a chipset that can dynamically change tap values at a very fast rate. This will allow future generations of receivers to handle dynamic multipath (thus muting the main virtue of COFDM).

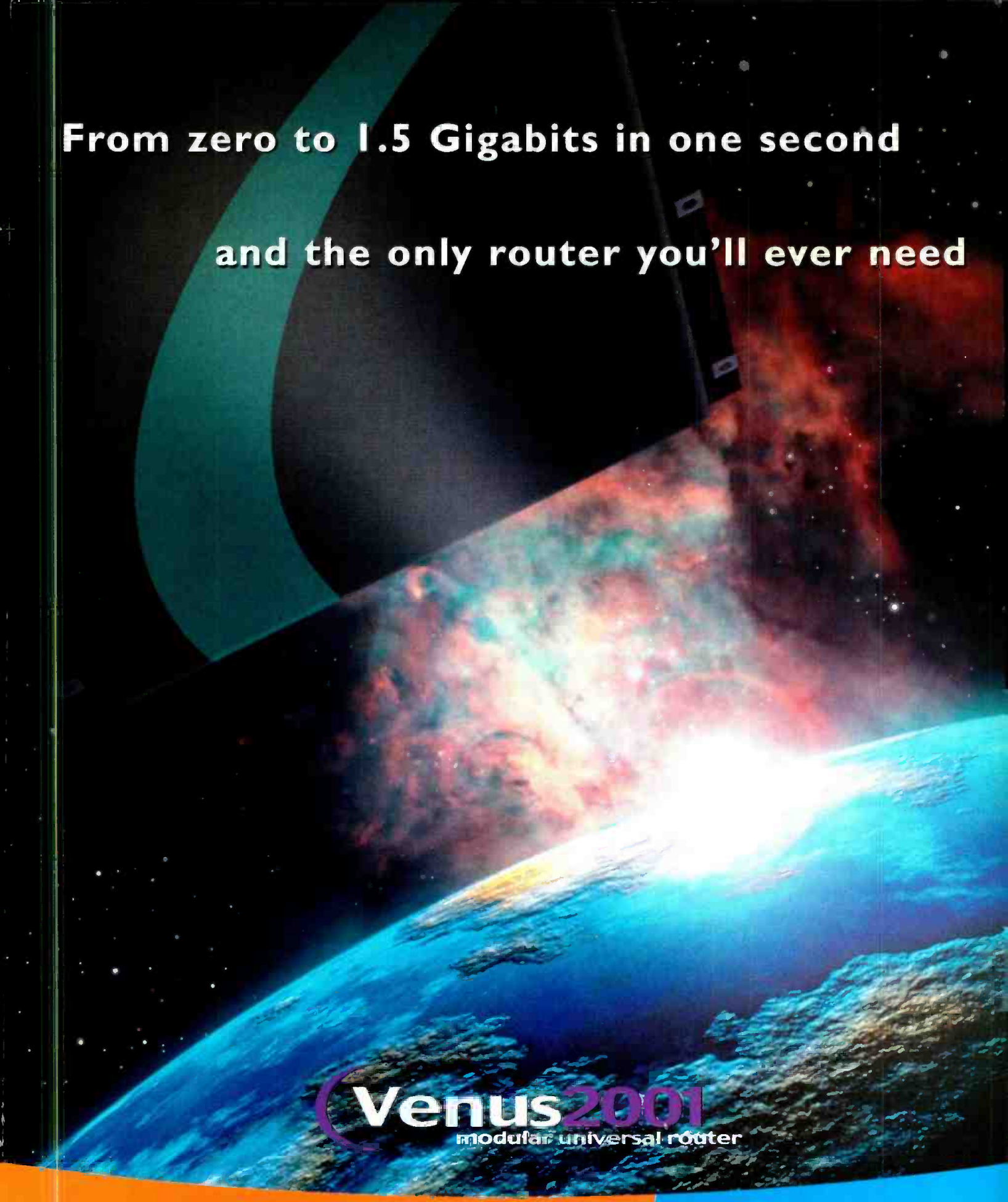
Back to the garbage in/garbage out inference. A lot, not all, but a lot of what is displayed by DTV receivers are artifacts that are directly attributable to the broadcaster. NTSC upconverted to any of the HD formats can look bad. Most of what I have witnessed is the trade of one set of artifacts for another. Impulse noise, white noise, and reflections are not displayed. But cross-modulation effects of composite video, as well as compression artifacts are usually visible. Broadcasters who build component digital paths through their facilities with the proper pre-processing in front of the ATSC encoder (future generation encoders will likely include the necessary pre-processing) will deliver the best looking SD signals. No Virginia, all DTV video will not look alike. Digital component HD, especially live (minimal compression concatenations), still dazzles this viewer.

A lot of what is displayed by DTV receivers are artifacts that are directly attributable to the broadcaster.

Thankfully and astutely on the part of vendors, almost all DTV receivers consist of a box that demods/demuxes/decodes the ATSC signal and a separate display or monitor. Not all of these set-top boxes (STB) are alike. You will find boxes that have different noise floors (8VSB is recoverable with up to SNR of 15dB). The higher the STBs noise floor the higher the required signal strength to watch a particular channel. Different boxes require different minimal video and audio data rates. Some early STBs are rumored to not use time stamps in the MPEG packets. Casual observation seems to bear this out. But again the broadcaster can cause problems in this area by not engineering the proper distribution of timing reference signals to the encoders/muxes. A rule of thumb, if your box has a spigot for a reference signal, supply it with what it asks.

Another interesting source of STB confusion surrounds PSIP. This table embedded in the transport stream is only now starting to assume the importance to DTV that was originally envisioned. PSIP is supposed to tell the receiver of all the virtual programs or channels that comprise a channel's transport stream. It is also to identify the DTV channel that the transport stream occupies and pair it with its NTSC parent. Early DTV receivers react differently to a lack of PSIP table data. There are some models that will only tune to channels with PSIP data if any channel in the market is transmitting PSIP. Without receiving PSIP, receivers might display channels incorrectly with regards to virtual channels. The author has even heard of PSIP tables of one DTV broadcaster interfering with a DTV receivers ability to decode another DTV broadcaster (we used to have frequency interference, can we now have table interference?). Part of this confusion is due to the fact that, as a standard, PSIP was in flux. Only now are PSIP generators becoming available that will allow PSIP tables to be handled dynamically and therefore more correctly.

Overall, first generation receivers have performed fairly well when given the chance to. What most of us didn't realize was that just like good old NTSC, the receivers will work best when broadcasters provide the best "data" they can. ■



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PHILIPS

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Transition to Digital

Understanding standards

BY MICHAEL ROBIN

Standards can best be described as an agreement between several parties. Consequently, standards become a compromise restraining the freedom of the participants. Agreement to a standard indicates that the parties involved have certain perceived advantages that offset the limitations of freedom of choice. In the professional audio/video world the key word is *interoperability*. Interoperability is best defined as the capability to achieve communication between devices. There are two interrelated aspects to the concept of interoperability, these are:

•*Audio/video communication:* The transmission of audio/video data (the message) through a transmission path (the medium) across time and/or space in a manner that is intelligible to the receiving device and human beings.

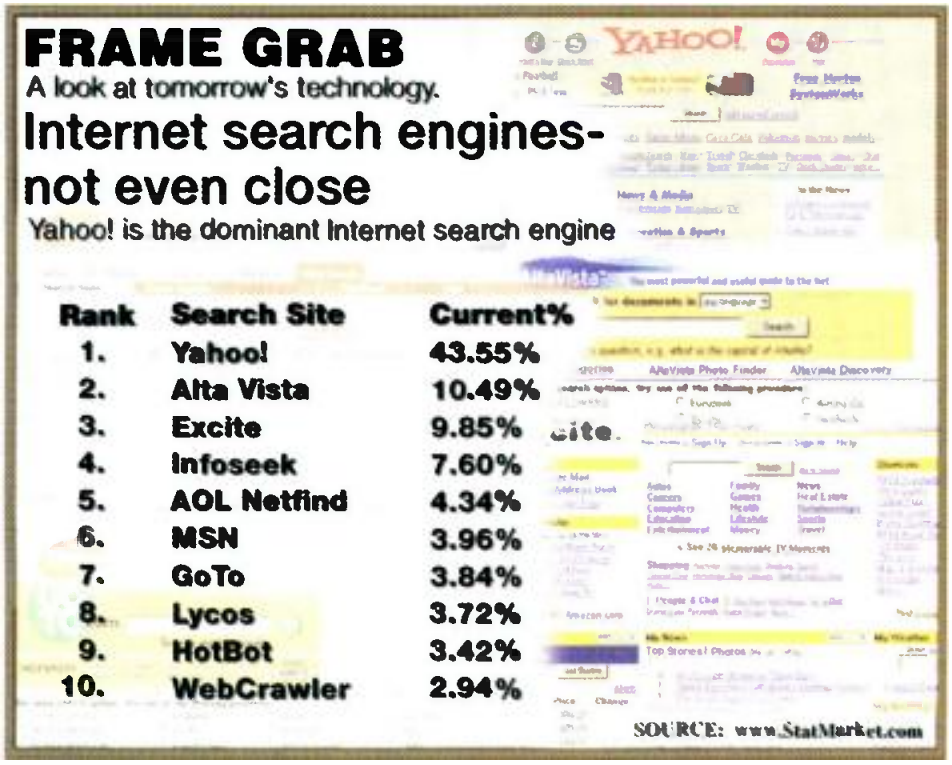
•*Audio/video standardization:* The specification of devices, codes and parameter values aimed at achieving compatibility between devices.

Many companies within the telecommunications and broadcast industries operate and prosper thanks to the existence and acceptance of worldwide (or sometimes regional) standards. They traditionally participate in standards bodies, usually assigning their best personnel to help achieve uniform standards. In so doing, they are driven by their assumed role of public service providers. Invariably, governments also play a major role in the development of standards for telegraphy, telephone, radio and television.

By the early 1960s there were no less than three scanning standards and seven incompatible transmission standards in Europe.

The standards bodies – a bit of history

The first International Telegraph Convention was signed in 1865 and harmonized the different systems used. In 1885, the Telegraph Union started to draw up international rules for telephony. The first Radiotelegraph Convention was signed in 1906. The International Telephone Consultative Committee (CCIF) was set up in 1924. The International Telegraph Consultative Committee (CCIT) was set up in 1925 and the International Radio Consultative Committee (CCIR) set up in 1927. These three bodies, the CCIF, CCIT and CCIR were made responsible for drawing up international standards. In 1927 the Telegraph Union allocated frequency bands to the various existing radio services such as fixed, maritime and aeronautical, broadcasting, amateur and experimental. In 1934 the International Telegraph Convention of 1865 and the International Radiotelegraph Convention of 1906 were merged to become the International Telecommunication Union (ITU). In 1956, the CCIT and the CCIF were amalgamated to give rise to the International Telephone and Telegraph Consultative Committee (CCITT). Today the CCITT is called ITU-T and the CCIR is called ITU-R. All these bodies are operating under the umbrella of the United Nations. Other internationally recognized regional standards bodies include the EBU (the European Broadcasting Union) and the SMPTE (Society of Motion Picture and Television Engineers). Transmission standards are regulated and enforced in the U.S. by the FCC and in Canada by the Departments of Communications (DOC). Similar organizations exist in other countries.



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Failures of standardization

In 1941, the U.S. National Television System Committee (NTSC) developed the 525/60 NTSC television system embodying such revolutionary concepts as negative video modulation, vestigial sideband transmission, FM sound and a multichannel frequency allocation. The original VHF channel allocation, with the exception of the removal of channel 1, has withstood the test of time. In the 1950s UHF channels were added. In 1953 the second NTSC committee developed the NTSC compatible color television system—a revolutionary application of time division multiplexing of chrominance and luminance information.

After WWII, most of Europe adopted the 625/50 scanning standard. France adopted in 1948 a high-definition 819/50 scanning standard shared by Belgium, Monaco, Algeria and Morocco. England retained the prewar 405/50 scanning standard. Both France and England

Standards documents

Standards documents are necessary to define the details of complex systems and ensure stable and reliable operation. Listed below are standards documents from professional organizations that may be helpful in defining and describing TV audio and video systems.

AES standards:

- AES3-1992 (ANSI S4.40-1992). Transmission of two-channels periodically sampled and uniformly quantized audio signals on a single twisted pair cable. User and interface-related data may also be transmitted. This is a revision of the original 1985 document.
- AES-3id-1995. This information document (id) describes transmission of AES3-formatted data over unbalanced coaxial cable.
- AES10-1991 (ANSI S4.43-1991). Serial Multichannel Audio Digital Interface (MADI). This standard is for transmitting multiple AES3 channels over a 75V coaxial cable or optical fiber. This interface is becoming popular with digital console and multitrack recorder systems. Up to 56 channels can be transmitted.
- AES14-1992 (ANSI S4.48-1991). XLR-type connector gender and polarity. This standard specifies a common scheme for wiring XLR connectors in audio systems.
- AES17-1991 (ANSI S4.50-1991). Measurement of digital audio equipment. This standard specifies methods for verifying the performance of digital equipment. Many tests are almost identical to those used when testing analog equipment. Because of the requirements of digital audio equipment, additional tests are included. This document is currently under revision.
- AES26-1995. Conservation of polarity of audio systems. This standard specifies the polarity of the signal at the different interface points in the audio chain, particularly for the acoustical, electrical and magnetic aspects.

SMPTE issues different kinds of standards documents. These include "standards," "recommended practices" (RP) and "engineering guidelines" (EG). Some of the relevant documents for analog and digital systems include:

- SMPTE 170M-1994 NTSC for studio systems;
- EG 1-1990 alignment color-bar signal (SMPTE bars);
- SMPTE 259M-1993 bit-serial 4:2:2 interface;
- SMPTE 125M-1995 bit-parallel 4:2:2 interface;
- SMPTE 244M-1995 bit-parallel NTSC composite interface;
- RP 165-1994 error detection check words and data flags (EDH);
- RP 184-1996 jitter specification;
- RP 192-1996 jitter measurement;
- EG-33 jitter characteristics and measurement;
- SMPTE 276M-1994 AES/EBU audio over coaxial cable (similar to AES-3id);
- EG 32-1996 AES/EBU emphasis and preferred sample rate;
- SMPTE 292M-1996 bit-serial 4:2:2 high-definition interface;
- SMPTE 240M-1995 analog HDTV production system 1125/60;
- SMPTE 260M-1992 digital HDTV production system 1125/60;
- SMPTE 274M-1994 1,920x1,080 HDTV scanning 60Hz; and
- SMPTE 296M 1,280x720 scanning 60Hz (this document has not been finalized);
- ANSI/EIA/TIA 250-C-1989 Electrical Performance Standard For Television Transmission Systems. This is the standard that all common carriers and most TV networks must comply with. Although there is no digital performance specification that is analogous to 250-C, this standard is often applied to the analog I/O of digital systems.

Standards documents are available from:

Society of Motion Picture & Television Engineers
Standards Department
595 W. Hartsdale Avenue, White Plains, NY 10607-1824
Phone: 914-761-1100; Fax: 914-761-3115
eng@smpte.org
http://www.smpte.org

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later adopted the 625/50 scanning standard while retaining the alternate standards for the benefit of older TV set owners. In addition to several line standards there were numerous transmission standards in Europe, which created a nightmare of channel allocations. While the U.S. and other countries of the American continent recognized the need to have identical transmission standards and VHF/UHF channel allocations all the way from Alaska to Chile, Europe did not feel the need to have either a common scanning standard or a common transmission standard. By the early 1960s there were no less than three scanning standards and seven incompatible transmission standards in Europe.

With the advent of color television the national choices multiplied dramatically. With the exception of Brazil, NTSC was chosen by 525/60 countries. PAL was adopted by the majority of 625/50 countries. SECAM was chosen by France, most of the East European (communist) countries (with the exception of Romania, the former Yugoslavia and Albania), some Middle Eastern countries such as Egypt, Lebanon and Iran as well as former or remaining French overseas territories. By the early 1980s the French transmissions in 819/50 and the British transmissions in 405/50 were phased out. Currently Europe shares a single scanning standard (625/50), two color standards (PAL and SECAM) and only four incompatible transmission standards, a marked improvement. CCIR Report 624-4 uses 33 pages to describe all these television standards

Other industries, particularly the consumer electronics and the computer industries have in the past taken a different attitude. They define standards either as individual companies or as groups of companies and offer them to the market place for use. Typical examples are the competing Betamax and VHS consumer VCR formats and the non-compatible and non-standard component video signal levels of Betacam and MII as marketed in North America. Occasionally these non-standards are offered to a standards body for ratification. Among the standards developed by the manufacturers and submitted to standards bodies for ratification are the D2 and D3 composite digital (4fsc) standards.

A success story: CCIR recommendation 601

In the early 1980s there evolved an interest in the standardization of studio digital signals. The first successful internationally accepted digital television approach was Recommendation 601 of the then CCIR. This concept uses time-division multiplexing of three digital component video signals: Y, C_R, C_B for parallel or serial distribution. The result was a component digital sampling family known as 4:4:4, 4:2:2 and 4:1:1 with common sampling frequencies in the two SD scanning standards (625/50 and 525/60). The dominant format is 4:2:2. The SMPTE 259 standard defines the characteristics of the bit-serial interface for 4:2:2 digital signals with a bit rate of 270Mb/s. A host of SMPTE standards relating to the new component digital technologies were subsequently developed.

Among the main failings of the ATSC standard is the lack of a coordinated approach to digital transmission.

The late 1980s witnessed the development of a new concept: compression of 270Mb/s signals by a factor of 15 to 20 while preserving the majority of the original picture quality. The result was the MPEG standards. The majority of MPEG levels and profiles start with a 4:2:2 component digital signal. Further processes reduce the bit-rate by using such methods as downsampling to 4:2:0, discrete cosine transform (DCT), requantizing, variable length coding (VLC), run length coding (RLC) and buffering to achieve a constant bit rate. This resulted in the appearance on the market of various digital video and audio compression schemes, allowing a proliferation of compressed digital VTRs and video servers.

In tandem with the MPEG developments there evolved a number of advanced digital modulation techniques. These resulted in superior bandwidth saving methods of digital audio and video transmission.

The near future

Digital signal emission followed a different path in North America and the rest of the World. In North America we adopted the ATSC standard, which sets the rules for over-the-air digital television transmissions with a total bit-rate of 19.4Mb/s using a standard 6MHz channel and 8VSB modulation. The choice of the scanning standard is left to the broadcaster. Initially, the ATSC suggested a 16VSB modulation technique for CATV. This was rejected by the CATV community, which is developing alternate and incompatible modulation techniques. The ATSC standard has gained a limited number of allies, mainly in contiguous countries such as Canada and Mexico. Among the main failings of the ATSC standard is the lack of a coordinated approach to digital transmission and the concentration on the terrestrial transmission and a hotly contested 8VSB modulation scheme.

In contrast with the erratic development of the analog television standards in the late 1940s, the Europeans have developed a highly coordinated and structured transition towards DVB (Digital Video Broadcasting) resulting in a family of standards:

- *DVB-S:* Digital satellite transmission system using quadrature phase shift keying modulation (QPSK).
- *DVB-C:* Digital cable delivery system using quadrature amplitude modulation (QAM) with a choice of 16-QAM, 32-QAM, 64-QAM, 128-QAM and 256-QAM.
- *DVB-T:* Digital terrestrial transmission system using coded orthogonal frequency division multiplexing (COFDM).
- *DVB (M)MDS:* Digital (microwave) multipoint distribution systems. DVB-MC is based on the DVB-C delivery system and uses frequencies above 10GHz. DVB-MS is based on the DVB-S delivery system and uses frequencies below 10GHz.

This structured approach has, for the first time in television history, resulted in common standards for all European countries. In addition, it is gaining recognition in other areas of the world. ■

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

Send questions and comments to: michael_robin@intertec.com

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Feeding the Web: Behind the scenes at CNN Interactive

BY BRAD GILMER

If you already had more than 3500 news specialists in 34 bureaus along with 800 broadcast affiliates working worldwide to collect and present news 24 hours a day, you would be in a great position to start your own website. That is what CNN did when it launched CNN Interactive with 20 people on Aug. 30, 1995. Since then, CNN Interactive (CNNin) has grown to become one of the Web's most popular sites. By just about any measure, the CNN websites are among the largest in the world. CNNin is now staffed by more than 170 people. The eight websites run by CNNin have run up some impressive viewership indicators: over four billion page impressions for the first eight months of 1999, 642 million page impressions in the month of April, and in a single day, when the Starr Report was released online, 34,265,595 page impressions. So far this year, it has had four days over 30 million.

With the completion of deals with Cable & Wireless and Quest, the sites will be supported by over 1GB/s of connectivity from six different carriers. There are 50 computers waiting for you to type in one of the CNNin URLs. The logging systems are supported by over 1TB of mirrored disk storage. This month's column takes a look behind the scenes to see how this massive collection of people and systems produce one of the best sites on the Web.

Production and serving

From a technical perspective, CNNin is organized along two major lines – production and serving. The production side has all the aspects of a normal newsroom but also includes tasks specific to producing for the Web. The serving side, while very different from the typical broadcast facility, faces many of the same challenges we do – staying on-the-air (so to speak), dealing with equipment upgrades while staying online and working with all the other challenges presented by being up 24 hours a day. Of course, there is one important difference, when CNNin has a peak in viewership, it directly impacts the technical infrastructure. More servers, more bandwidth, and generally more of everything is required to meet the demand. This is especially important for CNN, where demand on the website is driven by world events.

Much of the content found on the CNNin website is edited and prepared in the CNNin newsroom located in the CNN Center, Atlanta.

One major difference between conventional broadcasting and webcasting is that Web technology, especially hyperlinking, allows stories to be presented as more than just a stand-alone event.

The production process consists of three major areas – news gathering, content creation and distribution. The news gathering process is similar to that of any broadcast news organization. CNN reporters cover some stories, while breaking news may be reported across the news wires. CNN also receives significant contributions from its news affiliates worldwide. Once the initial information about the story is collected, the story moves into the content creation process.

The producer picks a story from a list of many possible candidates and assigns a writer. The writer works with an associate producer to collect all relevant information about the news event. While the writer is writing the copy for the story, the associate producer is looking for information that can be used to put the story into context. One major difference between conventional broadcasting and webcasting is that Web technology, especially hyperlinking, allows stories to be presented as more than just a stand-alone event. CNNin looks for related stories, creates supporting video captures, related websites, and, if warranted, may even start a new thread on the CNNin message boards. CNNin also verifies the information contained in any story it publishes, as unverified stories have been an issue in the Internet community.

Once the writer is finished, the story goes to a copy editor and then goes to Web editing. There the story, along with links to related stories, sites, and supporting material, is formatted for publication according to standards and practices established by CNN. When the story is formatted and ready for publication, the producer takes a final look before approving the story for publica-

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tion. If the story is important enough to warrant the creation of a new thread within the message board, or perhaps a live online chat, an online coordinator provides these services.

Once the story is released, it is ready for distribution. In conventional websites, the publication process consists of FTP-ing the completed page to your Web server. While CNNin does the equivalent of this, it also distributes the completed story to a number of other sources as well. In addition to posting a story to the appropriate CNN website, the story also needs to be posted to CNN mirror sites worldwide. Additionally, the story is formatted for cobranding in association with affiliates and other partners. It is formatted for distribution to Netcast, IDG, WebMD and Hong Kong Telephone for use in their advanced telephone system. Stories may also be distributed to cell phones, pagers and other personal electronic devices. Formatting stories for all these different distribution mediums is a key strength of CNN.

One of the many computer systems currently used to serve Web info, along with its associated storage. The entire system is built with redundancy and fault tolerance as a priority.

Serving up CNN Interactive

Of the 150 or so servers supporting CNNin, about 50 of those are front-end listeners, waiting for someone to type in a CNNin URL or web address. Content is stored on large NFS servers. Twelve machines serve ads, and another six stream video. Of the remaining systems, some handle data and some are running databases for logging and fantasy sports leagues on the CNNSI site. By and large, the sites run Netscape on Sun Ultra dual-processor servers with Solaris as the operating system. Oracle is used for databases, and NetGravity is used for ads. Live video is encoded at CNN Center, but it is provided on the Internet by InterVU.

CNN's connectivity to the Internet is impressive. The company has two OC-3 circuits to UUNet, one OC-3 to Sprint, one OC-3 to AT&T, and a DS-3 to GTE. Furthermore, the company has plans to install an OC-3 to Cable & Wireless, and another OC-3 to Quest. All totaled, CNN's Web farm is served by about 1GB/s of connectivity. Cisco routers handle network routing.

CNN is one of a handful of companies that has designed its Web farm from the ground up for redundancy and fault tolerance. Web infrastructure is located at CNN Center in Atlanta, which consists of two towers. The Web infrastructure is split between these two towers. Each tower is served by separate cable entry paths to reduce the likelihood of a "backhoe fade" affecting all of CNN's data lines at once. The two towers are on separate generators and UPS systems. As an additional precaution, some of the most critical computers in the Web farm are protected by their own freestanding UPS systems. Of course, the system includes redundant servers and the ability to route around equipment and path failures.

Currently, the CNN websites run at about 40 percent to 50 percent utilization; 30 percent would be better, because CNN cannot predict when its peak demands will occur. All peak demand is handled with existing equipment. Therefore, the infrastructure must be capable of handling CNN's heaviest days. Most of the time, this is taken care of through excess capacity. On the heaviest days, the size of the home page may be reduced. Also, some listener servers may be redirected from one website to another to improve response times. Generally these peak times only last an hour or so, so changes are only temporary.

With thousands of hours of broadcast-quality video in its archive and several CNN-branded networks originating in Atlanta, it is a natural question to ask when this full-bandwidth material will be used on the Internet. As of now, there are two barriers that must be removed. First, there is the bandwidth issue. Not much will happen until broadcast quality streams can be comfortably originated and streamed to the home at reasonable prices. Second, the users must be connected to this high-bandwidth pipe and be multicast enabled. One of the problems inherent in point-to-point streaming is that every time a viewer joins your broadcast, that person requires a unique stream. Add several thousand viewers, and you need to generate several thousand streams. Throw in a Gulf War or some other large news event, and it is easy to exceed the capacity of even the largest streaming server when the bandwidth of the streams is, itself, large. This is where multicast comes in. In a multicast, the program provider originates a single stream. Just as in conventional broadcasting, viewers may join or leave the stream at will without having any impact on the loading of the streaming source. For large-scale, high-bandwidth streams, multicasting is the only practical way to go. At the moment, very few places have these sorts of networks in place; those that do are mostly businesses. It will be some time before this infrastructure is in place at the home. When such technology is rolled out to the home, the Internet as we know it may or may not be the distribution mechanism for such broadcasts. We will have to wait and see what develops. ■

Of the 150 or so servers supporting CNN interactive, about 50 of those are front-end listeners, waiting for someone to type in a CNN interactive URL or Web address.

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

Send questions and comments to: brad_gilmer@intertec.com

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Producing for the web: MPEG-1 or MPEG-2?

BY STEVE EPSTEIN, TECHNICAL EDITOR

I am doing research for a client. They are planning to make sports highlight packages available for fans to download on the Internet. Currently, we are producing demo tapes and compressing them using MPEG-1. Would MPEG-2 work any better?

At present, we are taking raw older Betacam and BetacamSP masters, digitizing them and editing them on an Avid system. However, we really do not use any of the Avid's nonlinear features. Once edited, the footage is compressed using MPEG-1. Can an MPEG bitstream be edited? We will also be acquiring new footage using digital cameras in the near future. Plans are to locate or build a facility to do this. Is there a better approach?

Marc Fleisher
Freelance video producer

That is quite a few questions. First, let's step back and look at this. The goal is to edit Betacam masters (and, in the future, some digital masters) for distribution on the Web. Under the current scenario, analog video is digitized into an Avid, compressed using Avid's AVR compression scheme, edited, output as either digital or analog and recompressed to MPEG-1 for distribution.

First of all, the original signal is going through several conversions. For best quality, conversions need to be kept to a minimum. Second, compression encoding/decoding cycles also need to be considered. Most of today's digital acquisition formats use compression, and, for the most part, the most popular scheme is DV—not AVR or MPEG. The problem of concatenating compression schemes has been blown out of proportion, but it does exist and must be considered. Also, because you are not using the Avid's nonlinear features, have you considered a linear suite? Why do a signal conversion/compression if you do not need to?

Consider this: Drop a BetacamSP into a traditional (uncompressed) component digital suite and do a linear edit, thus avoiding the AVR compression encode/decode cycle. Do a high-quality A/D from the Betacam deck and everything happens in the digital domain, avoiding any artifacts caused by multiple analog generations. Newer 4:2:2 digital footage (50Mb/s DV or 18Mb/s MPEG-2) can easily be integrated into this environment without any serious problems. When you are finished, you will have a high-quality digital master that can be used for a variety of purposes.

Then, take that component digital master, run it through a high-quality compression preprocessor and compress it using MPEG-1. One difference between MPEG-1 and MPEG-2 is the data rates these systems are designed for. MPEG-1 is designed for lower data rates and can actually produce better-looking pictures at lower data rates than MPEG-2. Because this is going on the Web, data rates and file sizes need to be kept as low as possible. Yes, there will be higher data rates available soon for the Internet, but I remember when the PCI bus (at 132Mb/s) was going to solve all the problems of moving video through a PC. Just like PCs, as the Internet's capacity increases, so too will the applications running on it.

As far as editing compressed MPEG streams, yes it is possible, but the technology is in its infancy and I would avoid it for an application such as this. One of the first implementations of bitstream editing technology will likely be in some type of (HD) master control application. Good luck and let me know how it turns out.

What solutions are you looking for? Send any comments, questions or concerns to drdigital@compuserve.com ■

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SYSTEMS DESIGN SHOWCASE

ABC brings HD to

Panasonic employed numerous flat panel monitors, including two PT42P1 42-inch progressive scan plasma displays, in ABC One's digital production truck. Photo courtesy Panasonic.

Monday Night Football

By John A. Luff

It's Tuesday, August 31st, and the ABC crew that spent Monday in Oakland, CA, doing *NFL Monday Night Football* is on its way home before heading out again for *Monday Night Football's* regular season game between the Miami Dolphins and Denver Broncos in Mile High Stadium in September. Ordinarily, there are three trucks involved in the *Monday Night Football (MNF)* broadcast.

ABC

But this year, a newcomer augmented the rhythm. The interloper produced a unique piece of history-making television: *NFL Monday Night Football* in HD, the first regularly scheduled progressive scan sports broadcast. Panasonic assembled a crew of design engineers, factory personnel and technicians to support the challenge in the incredibly short time period of 137 days since the concept was hatched just before NAB.

ABC's broadcast engineering and operations president, Preston Davis, and Panasonic Broadcast & Television Systems' president, Warren Allgyer, concluded a key agreement in April that could well shape part of the future of HD in the U.S. ABC wanted to produce programming in HD that would excite the public. Panasonic wanted to showcase its HD solutions, including advanced HD production equipment and DTV receivers for consumers.

Davis and Allgyer met in early April and challenged each other to develop a unique public viewing experience and to deliver a system up to the demands of *MNF* in HD. In what Allgyer laughingly said could be a "career-defining move," ABC and Panasonic agreed that live major sports provided the best platform to demonstrate the benefits of HD. Allgyer enlisted Synergistic Technologies Inc. (STI) in Pittsburgh to deliver the significant challenge.

Panasonic completed development of the AQ-7200 720P studio HD camera and its companion, AQ-720 720P hand-held camera and delivered them for integration in early August. At the same time, STI worked with other manufacturers to line up the rest of the systems. They asked Snell & Wilcox, Pluto Technologies, NVision, Tiernan, Dolby, Tektronix and others to supply key equipment. VTRs were Panasonic's AJ-HD2700s and their AJ-UFC1800 Universal Format Converters would convert TV signals between video formats. The truck would send the 45Mb MPEG signal to New York along with Dolby Digital AC-3 audio at 640Kb for full 5.1-channel sound.

On a fast track, Gerling and Associates was selected to build the truck body. Gerling delivered the nearly 58-foot (open) truck a scant ten weeks later, with a 40-foot by 5-foot expansion on one side, an 18-foot by 18-inch expansion for the monitor wall and a two-foot extension at the rear of the truck to expand audio.

STI decided to make a statement about the future of production vehicles and build an all-HD monitor wall using flat panel LCDs and plasma displays.

In June, even before the design was final, STI began construction of the system in skeleton racks built to mimic the exact dimensions of the incomplete truck. In mid-July, the company took delivery of the truck and began a scheduled five and one half week assembly of more than $6 million worth of truck and hardware. Panasonic supplied the truck with two digital WR-DA7 digital audio mixers in a master/slave configuration to expand the input digital audio capabilities. Even Panasonic's office equipment company was part of the project.

STI's installation crew, under the di-

Above Left: Panasonic HD-D5 VTRs replays using Lance controllers. Above: Camera personnel use one of 12 cameras from ABC One to zoom in on Denver's Mile High Stadium. Photos courtesy John Luff.

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ABC

rection of Marty Skoff, executed the designs of the project's lead design engineer, Jim Naughton. Everyone knew the September 1 delivery date was immovable. That would give ABC just ten days to experiment with producing a HD version of *Monday Night Football*.

In early August, ABC requested that the truck be finished early enough to use it on the last *MNF* preseason game in Oakland as a HD rehearsal. A design and fabrication review was held on the first Saturday in August and then developed a new schedule. The truck would leave eight days ahead of schedule to make the Oakland broadcast possible. Panasonic engineers delivered the new native 720P cameras later that week.

ABC One deploys Panasonic AQ-72 cameras on fiber optic cable, allowing flexibitlity at field level. Photo courtesy John Luff.

STI decided to make a statement about the future of production vehicles and build an all-HD monitor wall using flat panel LCDs and plasma displays. Up until now, all HD trucks used less costly NTSC monitors for production monitoring. At NAB the team had decided the new SGI 1600 SW widescreen 17-inch color LCD might well be a better answer to the problem, saving precious weight and power consumption. A total of 34 LCDs surrounding two Panasonic PT42P1 42-inch progressive scan gas plasma displays were installed in the truck. The completed truck left on schedule from STI's shop bound for Oakland.

In Oakland, nervous STI personnel turned on the finished systems and ABC's staff saw for the first time a fully functional HD production system, started just over 130 days earlier. The system included seven 720P cameras with eight replays and two channels of DVE. On Monday the rehearsal looked less like a debugging session and more like a routine use of proven system. ABC chose to keep the "experiment" a rehearsal, ensuring that viewers' first experience with *Monday Night Football* in HD would be the "full up" production from Denver.

After the game, the truck returned to Pittsburgh for the finishing touches, including a billboard-sized logo.

The new ABC truck system is a *tour de force* in replicating the customary tools while moving considerably upscale. The truck is wired for 12 cameras, 10 AJ-HD2700 D-5 HD VTRs, two DVCPRO HD VTRs and eight single-channel servers (all recording devices are wired for eight-channel audio using Dolby E encoding). This winter, when a larger Calrec Alpha 100 digital audio production console with additional channels is finished, it will replace the Panasonic Ramsa DA7 audio consoles installed in the interim.

Two weeks after the rehearsal, the first live broadcast was produced by the ABC production team under the direction of Norm Sammet. It heralded the arrival of live sports in 720p HD. ■

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

Design team:

Warren Allgyer, Panasonic
John Luff, project manager, STI
Jim Naughton, lead designer, STI
Kevin Clifford, designer
Marty Skoff, installation manager
Bill Sturcke, Panasonic 720P camera system

Equipment list:

Size closed: 8 1/2" x 53' (plus air conditioning depth of 30")
Size open: 15' by 55'; curb side expansion 5' x 39'10"; street side expansion 18" x 18'
Weight: 74,900 lb. (with tractor)
Height: 13'6"
Manufacturer: Gerling and Associates, Sunbury, OH

Production: Snell & Wilcox HD1024 production switcher: 1 1/2 ME; 2 DVE channels and 4 still stores
2 Panasonic PT42P1 plasma displays, 480p 852x480
10 Panasonic BT-S915DA 9" color monitors, switchable 4:3 or 16:9
34 SGI 1600SW 17" HD LCD displays, 1600x1024 resolution
Genelec 1030/1031/1092 self-powered audio monitoring, 5.1 channel surround sound

Video: Panasonic Native 720P DSP HDTV cameras
3 AQ-72 hand-held cameras
4 AQ-7200 studio/field cameras
3 Fujinon HA66X9.5BESM HD lenses
1 Fujinon HA66X13.5BESM HD lens
2 Canon HA20X7.5BEVM HH HD lenses
1 Canon HJ9X5.5B wide angle lens for hand-held cameras

VTR: 6 Panasonic AJ-HD2700 HD-D5 multiformat HD VTR, wired for 10 VTRs
4 Pluto HyperSpace HD video servers
Panasonic AJ-HD510 HD-D5 interfaces

Transmission: NVision Envoy 6128 64 In 128 Out 1.5 Gb HD router
Tektronix GVG SMS-7000 64x64 SDI/NTSC/stereo audio
Tektronix GVG SMS-7500 256x256 synchronous AES router
3 Panasonic UFC-1800 universal format converters
5 Leitch Juno HDU-3800 upconverters

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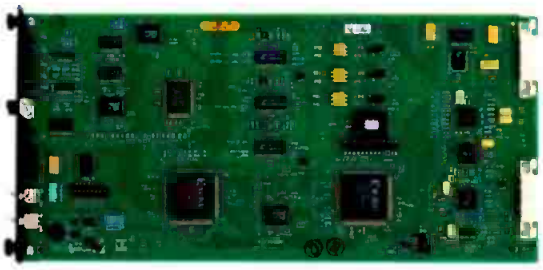

SD4150
AES Embedder

Embedding Problems

Component SDI video has always offered the ability to embed up to 16 channels of audio in a video stream. There are, however, associated problems. When a switch is made between two video sources that contain embedded audio data, it is difficult to obtain a clean audio transition at the receiving end.

Then there are multi-channel difficulties. When more than four channels are required, the normal technique is to cascade embedders. Cascading embedders is expensive and the more channels inserted, the more difficult it becomes to determine channel location at the receiving end. Plus, with the advent of surround sound in general usage, phase alignment becomes all but impossible with cascading.

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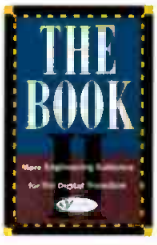
- NVISION's modules allow selectable group assignment for easy channel identification and location. This resolves all data allocation problems.
- NVISION has developed proprietary reframing ASICs that provide sample alignment across groups. Surround sound is reliable and real!
- A further feature of the disembedder is the built-in monitoring quality D to A converter and mini headphone jack, for convenient channel pair locating and subsequent output group assignment.



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Transmission & Distribution

Proof-of-performance measurements

BY DON MARKLEY

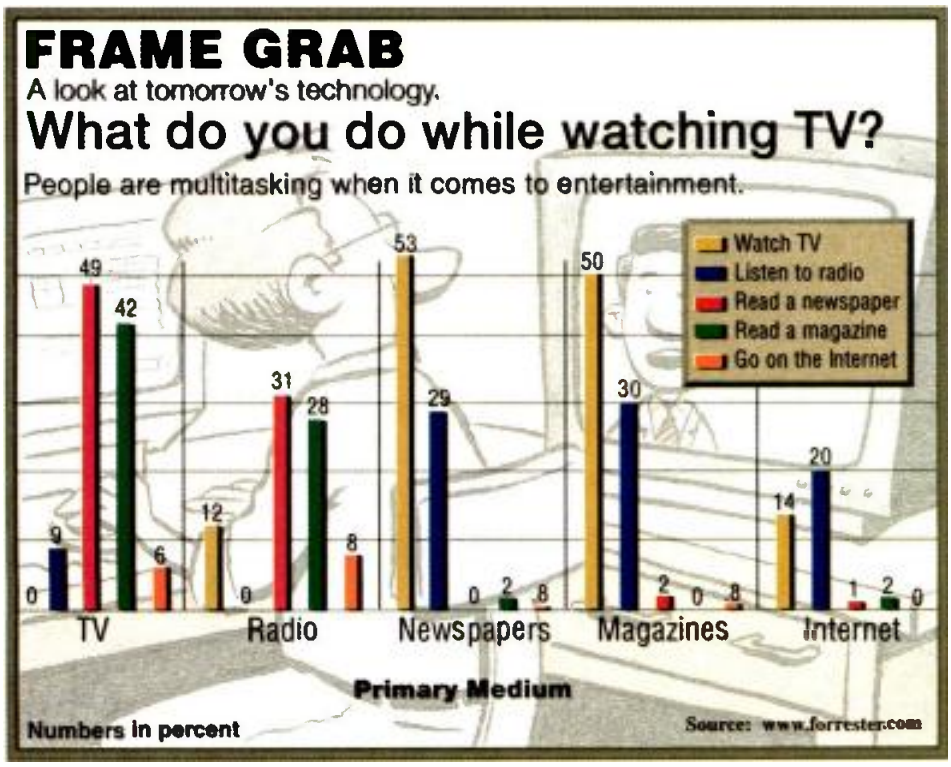
Most of us are acquainted with the requirements for a television proof of performance on analog NTSC transmitter systems. The rules are fairly straightforward concerning those measurements and plenty of examples can be found in a variety of literature. Nevertheless, a quick review follows.

Analog proofs

NTSC measurements normally include frequency response measurements, calibration of the power meters, spectrum analysis data to show both in-band and out-of-band signals, aural distortion and carrier frequency measurements. A problem area was the measurement of envelope delay in the visual signal. Including a vague reference to the fact that it had been measured at the factory traditionally solved this. In recent years, that clever bit of side-stepping has been eliminated by the availability of relatively inexpensive equipment capable of easily measuring envelope delay. Years ago, sideband characteristics were measured with response measuring equipment that left something to be desired. It seemed at the time that you simply tuned slowly until the waveform looked familiar or like the one in the literature. Then, you took a picture quickly before it went away. Thankfully, things have changed.

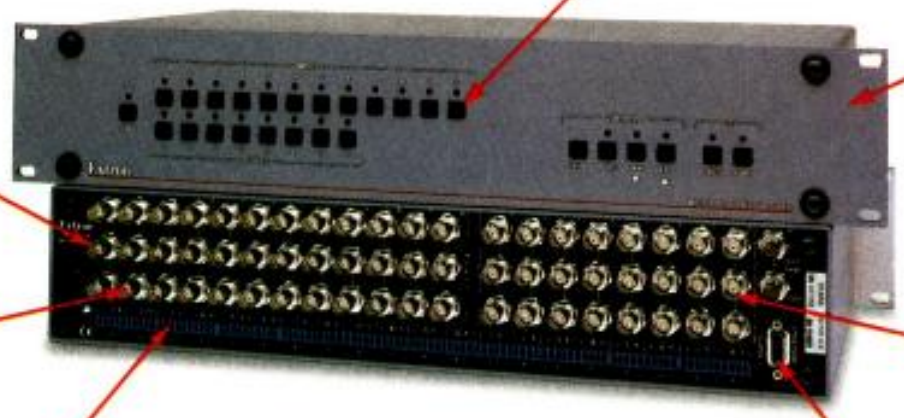
The standard tool for frequency response measurements then became the Tektronix model 1405 Sideband Adapter along with one of their spectrum analyzers. That is still a very effective way of measuring NTSC sideband response. With the newer spectrum analyzers, hard copy of the measured results is easy to obtain. Somewhat sadly, the scope camera with the Polaroid film pack is becoming a thing of the past. Newer Tektronix spectrum adapters require an optional local oscillator output to drive the 1405. Tektronix' friendly competitor Hewlett-Packard will also provide a connection to the 1405 for their spectrum analyzers if you so request. Differential phase and gain measurements have now become a one-button test with printed readout. In fact, reasonably priced instruments are readily available to easily measure almost everything you need for a proof of performance. It becomes more and more difficult to fudge a little bit and maintain your sense of integrity. When you were reading an old fashioned meter, you could employ a little Kentucky windage by leaning to one side before you took a reading. It was often possible to improve frequency response by a decibel or so in that fashion. You can't do that with a digital readout.

The Commission's rules lead directly to the ATSC standard.



The digital side

Now we are moving into a new era in television testing. It is becoming necessary to perform proof-of-performance measurements on digital television transmitters. Of course, we are assuming such a thing exists. A review of the FCC Rules and Regulations will leave one frustrated—nothing seems to be mentioned. Everything concerning equipment performance discusses only NTSC analog systems with the additions of subcarriers, stereo, vertical interval information and subscription services. No DTV. That same problem carries over into a review of the fourth, fifth and sixth Report and Orders along with their associated reconsiderations, further explanations, et al. Only one requirement was found in a diligent (30



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minute) search by the author. Section 73.682(d) of the Rules and Regulations states that the transmission of DTV signals shall comply with the standards for such transmissions set forth in Advanced Television Systems Committee (ATSC) Doc. A/52 and A/53. Those standards are available at www.atsc.org and should yield many fascinating hours of reading.

Station engineers have thought mainly in the frequency domain ... now they need to start thinking in the time domain and worrying about such things as symbol rate tolerance, carrier phase noise and error vector magnitude.

Nowhere in the FCC Rules and Regulations is there any requirement that specifies exactly how the DTV transmitter is to be operated. Even the power measurement instructions only refer to analog systems. However, the reference to the ATSC standards does lead to a set of performance requirements that should at least be taken as a guideline. Another of the ATSC standards is identified as "Transmission Measurement And Compliance For Digital Television" (Doc. A/64). Again, that can be quickly downloaded from their Web page. It specifies those values that should be met for proper operation of a DTV transmitting system. That document should be a must for every chief engineer of a DTV station. While the FCC Rules and Regulations do not directly fix the standards, it could reasonably be argued that Doc. A/64 becomes a *de facto* rule. Look at it this way – Sec. 73.682(d) says that DTV stations must comply with the standards in A/52 and A/53. Then A/64 tells what the limits should be to meet A/52 and A/53. Therefore, the Commission's rules lead directly to the ATSC standard. While a station might not be cited for not complying with A/64, it still is a realistic set of values for station operation.

The general agreement seems to be that simple power and frequency measurements are reasonable and still should be made. Power should be measured with a calorimeter but there is no correction to peak power. Remember that we are dealing with average power now. ATSC also recommends that the power variation be limited to ±5% to stabilize the number of receivers that can regularly receive viewable pictures at significant distances from the transmitter. After that, the big thing seems to be to adjust the system for correct error vector magnitude (EVM) or S/N (signal to noise ratio) and to confirm that the operation is within the DTV emissions mask. Since you probably can't do anything about the emissions mask, we will discuss it first.

The current mask was defined in the Memorandum Opinion and Order on Reconsideration of the Sixth Report and Order, FCC 98-24. In particular, refer to paragraph 92 of that document. The station's compliance with the limi-

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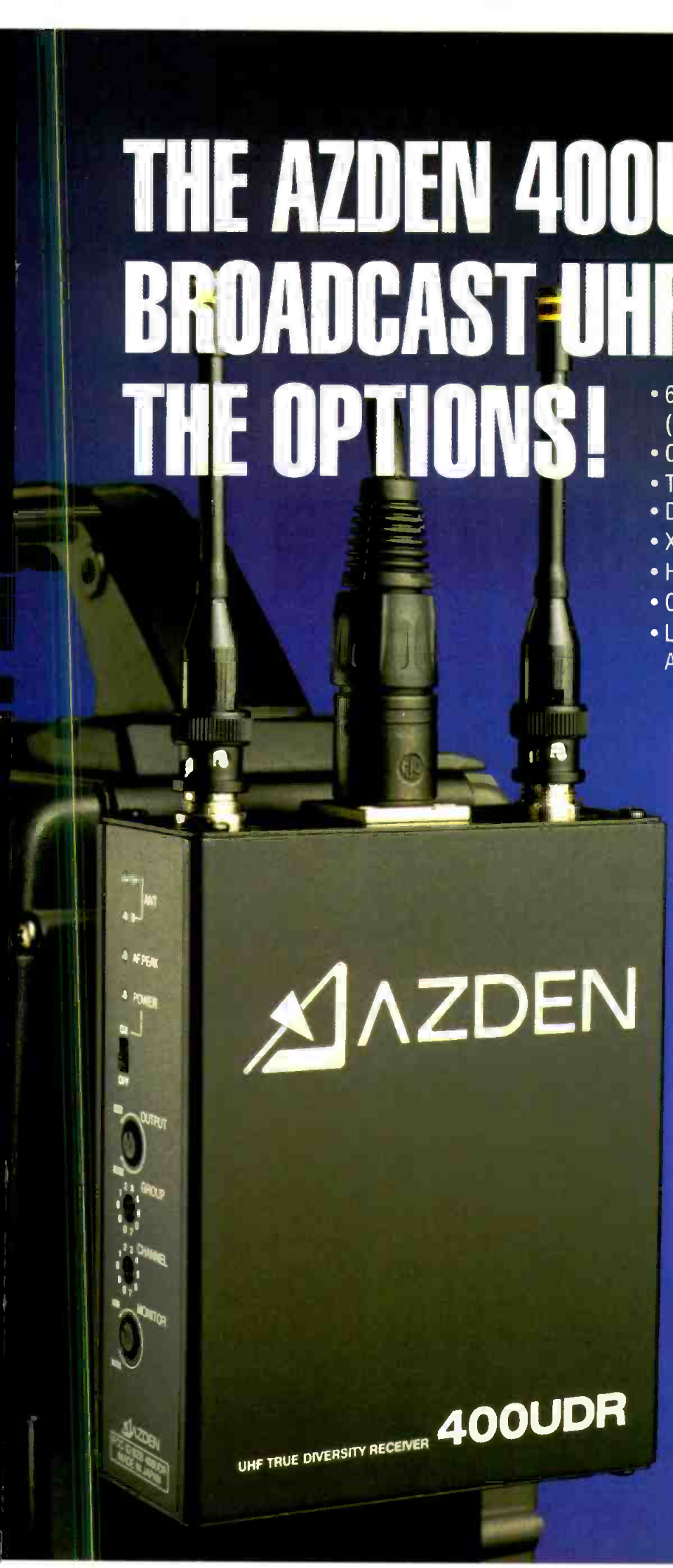

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tation of the mask can be checked with any reasonably good spectrum analyzer within a reasonable tolerance. A good discussion of that can be found in a paper by Dr. Paul D. Smith titled "Understanding the FCC's DTV Emissions Requirement." That paper is identified as Report #6157 by Micro Communications Inc. Another great paper dealing with the mask and the overall performance of a DTV transmitter is "Measuring The DTV Signal" by Henry Fries and Brett Jenkins of Thomcast Communications Inc., Comark Division. That paper was presented at the fall symposium of the IEEE Broadcast Technical Society. You may obtain a copy of that paper from the authors at Comark or soon via the BTS page found under Societies on www.ieee.org. You should also look at "Digital Television Transmission Parameters – Analysis and Discussion" by Carl Eilers and Gary Sgrignoli of Zenith. You should be able to find it on that same Web page.

Your author hereby apologizes for not including all of the information in this article that would be needed to analyze the performance of a DTV transmitter. Such an inclusion would extend this column to a series. That is why the reference has been made to the papers listed above. For those who need such information, it would be better provided by directly obtaining the papers than by using a synopsis from this column. At least we have told you where to go – something that has often been done to the author.

The Comark paper also discusses other measurements on the DTV transmitter. Unfortunately, everything other than looking at the radiated signal requires rather expensive test equipment. Two commonly discussed items are the Tektronix Model RFA 300 analyzer and Hewlett Packard 89441 Vector Signal Analyzer. Unfortunately, these are a bit pricey. For example, the HP 89441 currently goes for more than $60,000 when equipped with the nicer options. Therefore, the manufacturer's representative will generally do the measurements performed for a complete proof at the time of installation.

The biggest problem for most station engineers will be changing their mode of thinking. Those of us with gray (if still existing) hair had to go through the change from vacuum tube technology to discrete solid-state devices. Then we moved from those components to integrated circuits. For all of that technology, station engineers thought mainly in the frequency domain in terms of frequency response, phase and group delay. Now, you need to change to thinking in the time domain and worrying about such things as symbol rate tolerance, carrier phase noise and error vector magnitude.

Fortunately, some manufacturers are providing the ability to measure some of those parameters via their exciters and proprietary software. Such systems act as an excellent backup once the transmitters are initially adjusted in conjunction with the antenna and transmission line systems. Individual stations won't really need systems such as the big signal analyzers unless major changes are made or massive failures occur. On the other hand, rumor has it that less expensive equipment is being designed that will allow the individual station to keep a fairly close watch on transmitter performance.

Unfortunately, the times are changing. DTV systems can't be operated by simply using the techniques perfected in NTSC systems. As bad as it sounds, station engineers are going to have learn new tricks or prepare to make way for new dogs. ■

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

Send questions and comments to:
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Audio metering devices

BY KENNETH HUNOLD

Audio meters are a poor, misunderstood lot. In many pieces of equipment they are included seemingly as an afterthought, as a signal presence indicator or just "something to go by" rather than as a true measurement device.

For offline setting of levels (with sine waves), almost any kind of meter will suffice, especially if the meter is built into the device you are setting. "Turn it up until the third LED lights" will still result in a repeatable, if only an arbitrary, level. If you are setting up the gain structure of a device, you are often using (relatively) pure sine waves as opposed to a complex signal, such as program material. In that case, the meter indication is relatively easy to read and is reasonably repeatable. It can be tempting to use these metering devices that have reasonable accuracy but unknown frequency response, depending on the application. The use of sine waves, or pure tones for set up allows the use of lower-quality meters or digital multimeters without true RMS algorithms to be used. Inexpensive digital meters often read the average value of a signal, but if they assume that the signal is a sine wave (sometimes not a correct assumption), the display can be scaled to "read" RMS values.

Metering, both for calibration and operation (gain riding), is an area where multiple standards coexist. The traditional method of metering/monitoring audio signals was the VU meter. Learning how to "ride" an audio level is very much an acquired skill. It is sometimes difficult to interpret the movement of a VU meter, and instructing operators how to set program levels based on its "readings" can give greatly varying results. If there is a VU meter somewhere in the room, many operators will, almost subconsciously, glance at it occasionally as a sort of "reality check" during a session or show. More often than not, this is due to the lack of faith in the meter that the operator is looking at.

We have come a long way from the days of the VU meter with an LED to indicate "peak" level. There are metering implementations that give us much more information about the signal than the old VU meter ever could. The trick is to figure out a way to show the most information without the display being cluttered or hard to read and interpret.

As broadcasters work with an expanding number of audio channels (first mono, then stereo, and now even more) it becomes challenging to try to come up with a method to meter and display all of this information in a format that is meaningful, yet still easy to comprehend.

Most audio mixers and engineers are familiar with using a Lissajous, or X-Y display for two-channel systems. But as the number of channels grows to four, five, six, eight or even more, how can that many channels be comprehensively or intuitively monitored? A number of manufacturers have developed displays that can broadly be referred to as "fish finder" displays. This is because of the resemblance of these displays, at least at first glance, to a sonar-type display used by boaters and anglers to find fish and the depth of the water.

There are metering implementations that give us much more information about the signal than the old VU meter ever could.

The look, as well as the technology, of these displays varies widely and many designers are trying to come up with the best way to accomplish this task. Measurement devices resembling audio meters have been developed for video signals, and any such approach is fair game for development and approval by the marketplace. It will most likely come down to users forming a consensus on the most useful of these displays. The waveform monitor and vectorscope evolved into the *de facto* standard measurement devices for monitoring video signals.

Many manufacturers are looking for the best way to monitor multichannel audio signals. If you can, the best way to evaluate these meters is to give them a try. Talk it over with your colleagues and see what they think. If you have the opportunity, visit the manufacturer at trade shows or dealer showrooms.

Digital meters mean different things to different people. Because digital audio assigns a value to every audio sample, it is theoretically possible to build a meter that could indicate every single audio sample. Of course, it would take over 65,000 LEDs to build such a meter, and it wouldn't be all that useful. These meters can also have ballistics programmed into the device, so they can be changed from VU to PPM to "true peak" at the programmer's option (and be selected by the operator.) Peak hold is also an option.

Digital meters can be made with different resolutions. An eight-segment LED meter has more resolution than a four-segment LED meter, and less resolution than a 64-segment meter. It is important to remember that these statements alone do not describe the accuracy of the meter at all.

Audio meters are really scientific instruments. But in order for them to be useful in a production environment, they must be easy to use and provide the desired information without the need for time-consuming interpretation. The merger of science and art continues to evolve. Equipment manufacturers are now offering solutions, but they need to have feedback to develop these designs into truly useful tools that broadcasters use in their day-to-day operations. ■

Kenneth Hunold is a broadcast applications engineer for Dolby Laboratories Inc., New York.

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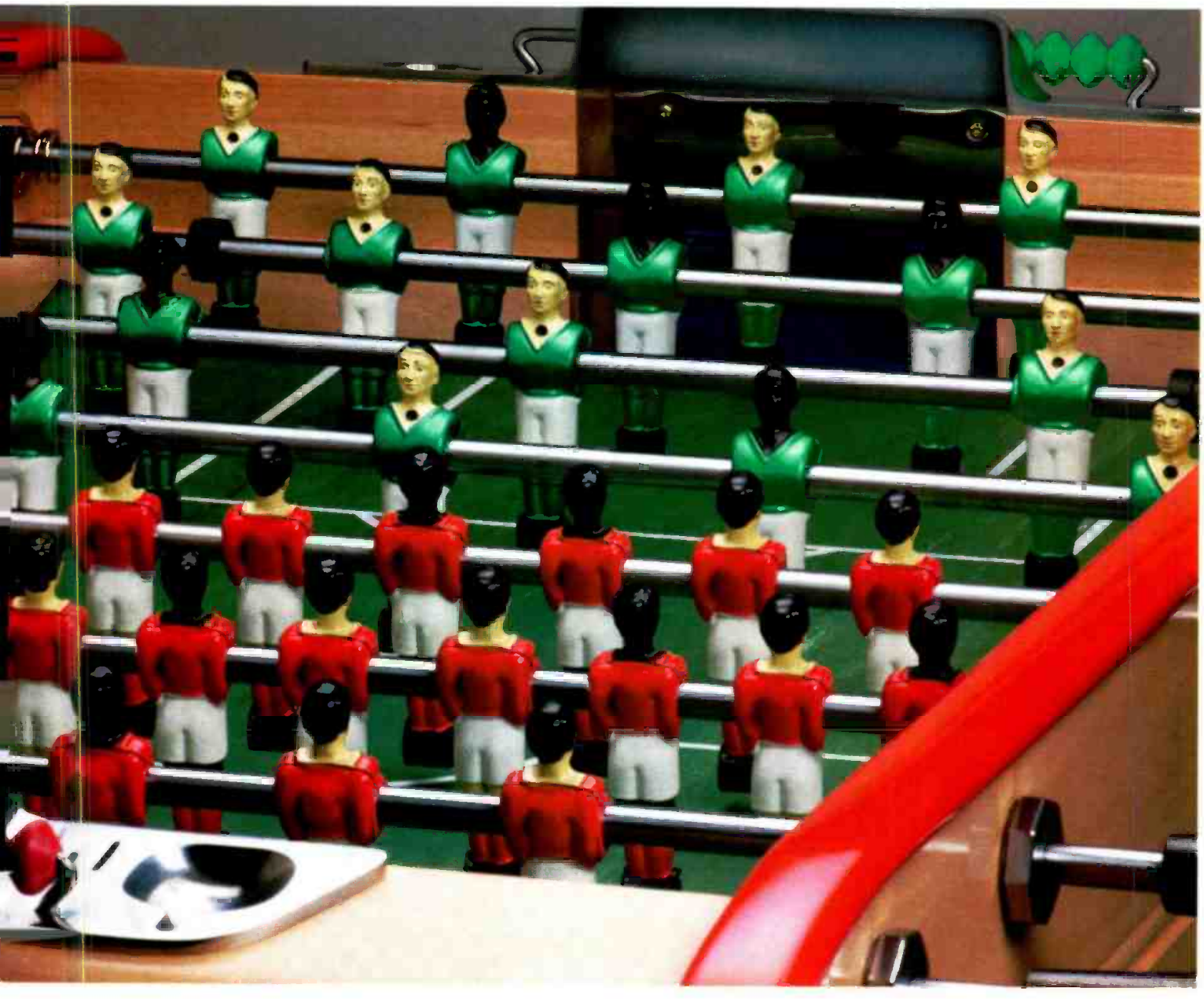

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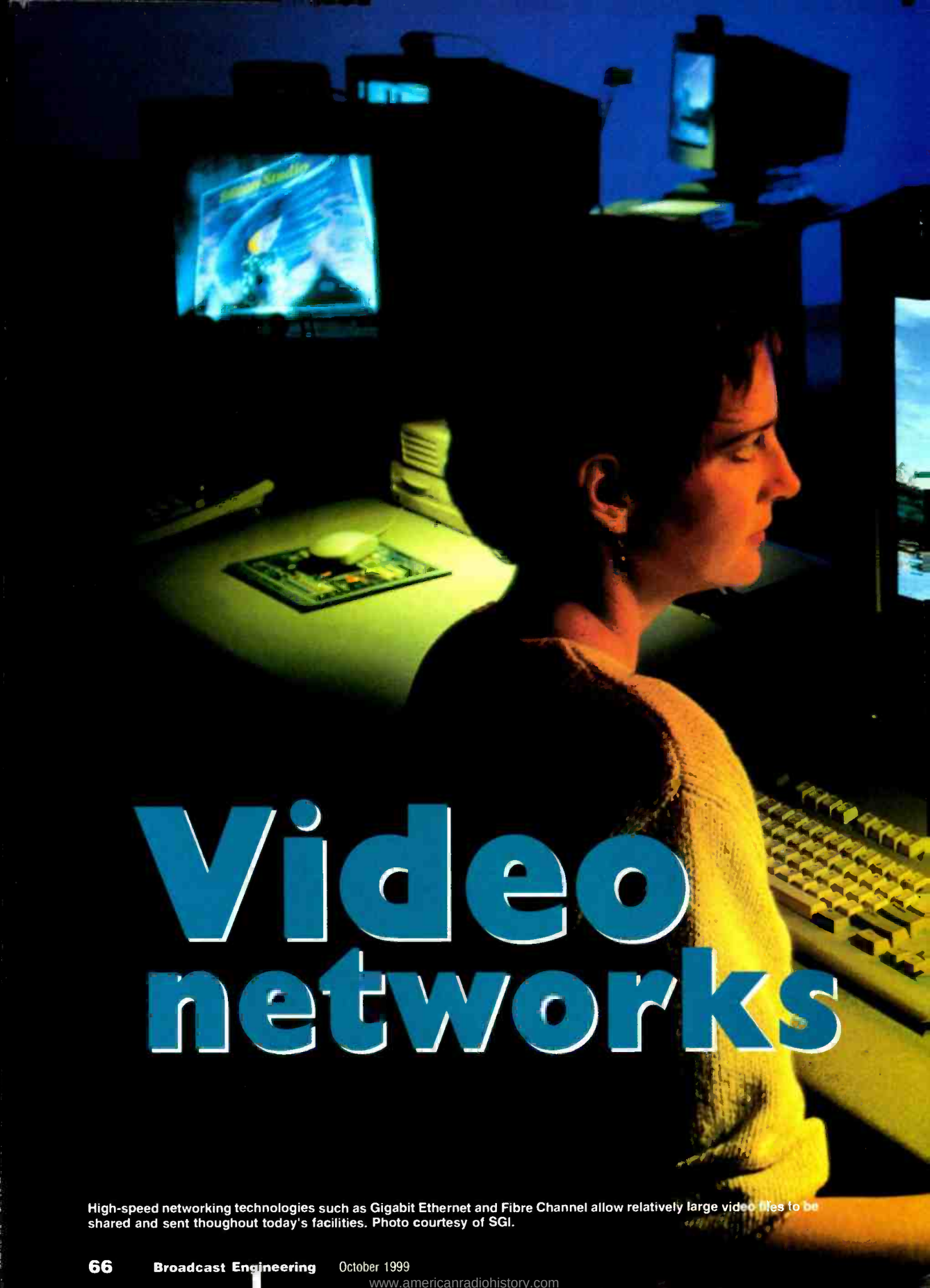
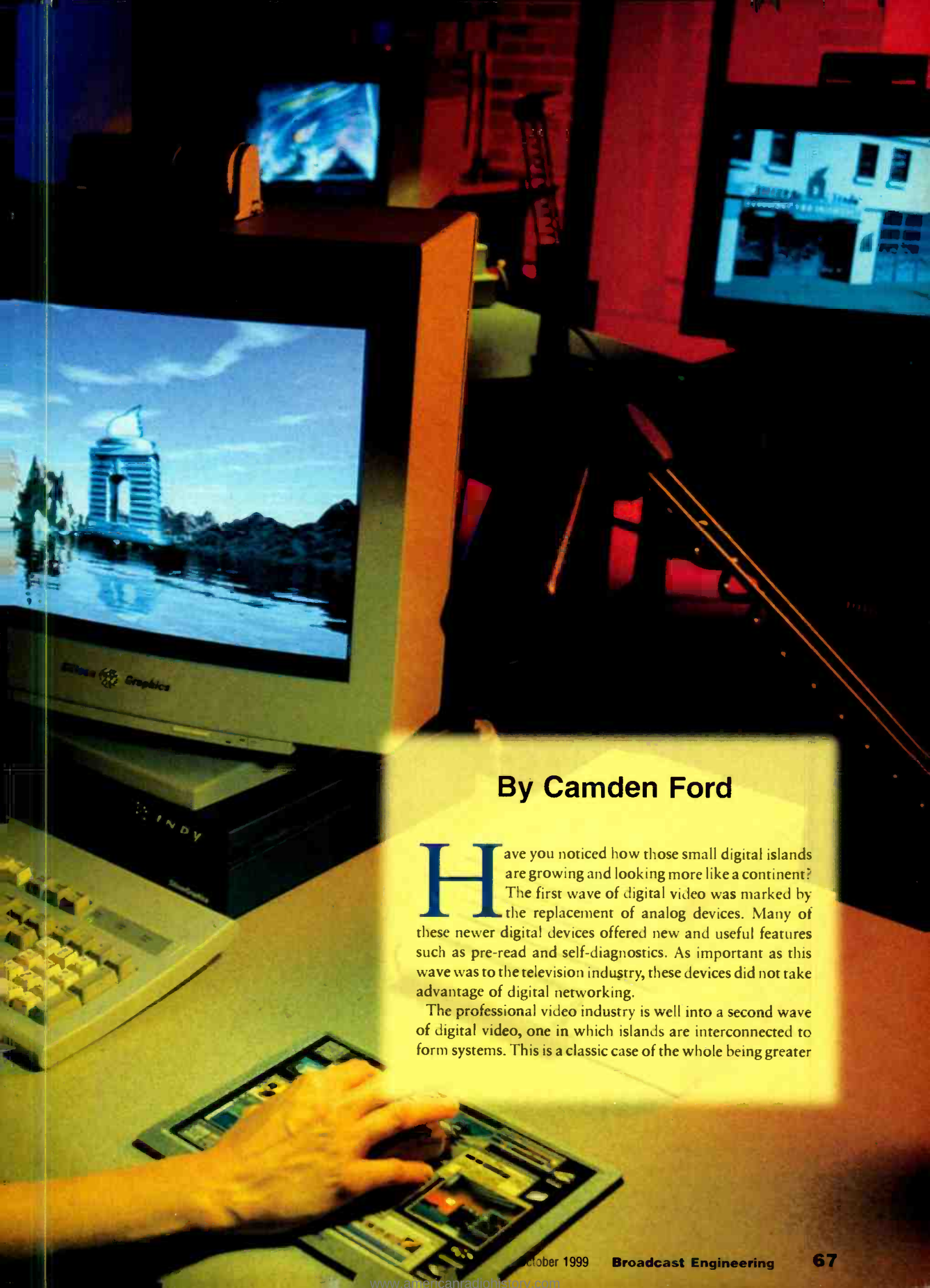


Video networks

High-speed networking technologies such as Gigabit Ethernet and Fibre Channel allow relatively large video files to be shared and sent thoughout today's facilities. Photo courtesy of SGI.



By Camden Ford

Have you noticed how those small digital islands are growing and looking more like a continent? The first wave of digital video was marked by the replacement of analog devices. Many of these newer digital devices offered new and useful features such as pre-read and self-diagnostics. As important as this wave was to the television industry, these devices did not take advantage of digital networking.

The professional video industry is well into a second wave of digital video, one in which islands are interconnected to form systems. This is a classic case of the whole being greater

Video networks

than the sum of its parts. With the convergence of video and computer technology now reaching a critical mass, networking can be the next big step to facility efficiency. Choosing the right technology for a given application is the key to performance and — equally important — expandability.

Converging technologies

One of the first instances of convergence in broadcasting was in the form of nonlinear editing systems. Most of these systems were standalone or, at best, part of a simple network. The concept of workgroups was advanced based on the idea that all of the elements of content creation needed to be linked to enhance productivity. What developed were networks linking graphic artists and audio workstations with the nonlinear editing workstation. Artists and editors could exchange materials electronically, reducing errors and eliminating the costs of and need to care for floppy disks, tapes and other physical transfer media.

Success in this area naturally led to the implementation of shared storage systems where multiple editing workstations could have access to needed material. At the same time, computerization had already penetrated management functions, such as on-air programming databases, schedules, automation systems and other station functions. One factor limiting routine network implementation has been the size of video files. Early networking technology was slow and did not take into account the real-time needs of video. Because of this, early networks were relegated to data transactions and control functions.

Today, however, network technology has reached a reasonable performance level with respect to moving video files. It is time to consider the question of effectively networking an entire facility. The typical goal would be to move content throughout a broadcast facility electronically, without using videotape. To consider effective network strategies for broadcast facilities, a primer in network technology choices is in order.

Basic choices

As broadcasters integrate more digital systems into their facilities, reliance on different types of video compression increases. In many cases, compression technology makes digital systems cost-effective. Different compression techniques (such as MPEG, DV, M-JPEG, etc.) are used in different applications based on their characteristics. As compression technologies improve, and network performance increases, many of these devices will integrate networking technologies to extend the size of these digital islands.

Some common networking technologies and topologies that are gaining acceptance in today's broadcast facility include Fibre Channel networks, Storage Area Networks (SANs), Ethernet, and ATM. SDI/SDTI technology is used as a replacement for analog video routing systems. Although not a true networking technology, SDI/SDTI is used to connect standard video devices such as VTRs, switchers, mixers, video servers, video monitors, etc. through a central router. Advantages of SDI/SDTI are that it can carry uncompressed ITU-R 601 video as well as compressed formats such as DV, MPEG, HDCAM and D5-HD, and of course, most broadcast manufacturers support SDI/SDTI as a standard interface on their products.

One factor limiting routine network implementation has been the size of video files.

Fibre Channel (FC) networks are being installed to link multiple video servers together for transferring files at high speeds. FC itself runs at gigabit speeds, but due to packetization and protocol overhead, the actual data throughput is closer to 600Mb/s. While FC networks are growing in size due to the recent advent of intelligent FC switches, the protocols used in many cases are still proprietary. Typically, video servers that utilize FC networking for file transfers cannot transfer files in and out of the network or interoperate with non-FC devices. FC does not currently support isochronous streaming and can only be used as an asynchronous data transport. Due to this, FC networks are often utilized within a single manufacturer's product family. To get video or data into or out of these networks, typically requires the video or data to pass through one of these devices via some other interface (usually SDI for video or Ethernet for data).

Storage area networks are a fast growing technology, especially for the data industry. Storage area networks (SANs) also use FC networking, but instead of connecting one device to another, they connect devices to a storage system. Devices connected to a SAN can share video and data files by using disc storage as a central data repository. The acceptance of this networking topology in the nonlinear production and post-production markets is growing. A SAN allows multiple nonlinear workstations to access a common pool of shared storage. Unlike the FC networks, SANs use standard FC protocols for accessing FC disc storage (typically SCSI on FC). Storage can be shared by connecting multiple workstations directly to the FC storage through a FC hub or switch. The difficulty with these networks is that to control access to the shared storage, complex, proprietary file systems and file management software may be required. In many implementations, software drivers must run on every workstation tied to the network. In addition, an external workstation may be used to synchronize access to the material stored. To attach external devices to the SAN, these devices must be capable of running this proprietary software. Typically this limits network access to workstations only. As in the FC networks previously described, moving video or data into or out of this network means the video and data must pass through one of these workstations.

Ethernet networks are mature and relatively inexpensive. They have been

used extensively in broadcast facilities for years as data and control networks. Most broadcast facilities have internal IS networks for general application and file sharing. Most automated traffic systems have Ethernet connectivity for local access. Many also have connectivity over wide area networks (WANs) to a centralized traffic and program scheduling system. Many automation systems use Ethernet networks for connectivity to central media databases and to distributed control computers. However, many times, these similar networks remain islands. Typically, these networks are not used for transferring video files, and most are standard 10Base-T or 100Base-T.

The bigger brother to Fast Ethernet (100Base-T) is Gigabit Ethernet. This relatively new technology is limited to fiber optic connections. Fiber optic connections are not yet standard on PCs; however, new NICs are available that offer these connections as standard I/O. Because Gigabit Ethernet uses the same protocols as other implementations of Ethernet, it is therefore automatically compatible with existing application software. The increased bandwidth makes Gigabit Ethernet feasible for high-speed transfer of video files between devices. Broadcasters are already starting to see implementations of Gigabit Ethernet used instead of Fibre Channel for interconnecting video servers. The data rates for file transfers are relatively similar and Gigabit Ethernet is a widely accepted standard. Not only that, but it is easy to connect to other devices such as nonlinear editing workstations, automation systems, traffic systems, etc. One disadvantage of Gigabit Ethernet is that it does not support isochronous channels, which can be used for video streaming. Because of this, bandwidth or timing cannot be guaranteed.

The acceptance of SAN networking in the nonlinear production and post-production markets is growing.

ATM was originally designed to handle both data and voice traffic. To do this, there is a mechanism for specifying class of service. Users can specify data priorities such that bandwidth can be guaranteed for voice (or video) applications. These come at the expense of lower class of service data such as TCP/IP data. Because this technology was designed to handle many types of data and up to five different classes of service, it can be fairly expensive to implement. It is a highly flexible and highly scalable technology that is most often used for long-haul data backbone networks such as the Internet backbone and telephone networks. Many broadcasters have used ATM on wide area networks for both data and video applications, but it is not often used for internal network operations due to its complexity and cost.

Planning for the future

The dilemma facing broadcast facility owners and operators today is how to install a full-featured network without constraining opportunities for later growth, and — naturally — to stay within reasonable budget limitations. There is an overriding need for flexibility, both in the size of the network and the ability to handle video data from an ever-changing mix of input and output formats. This need for format independence also encompasses

Video networking will provide even traditional applications, like the A/B-Roll Edit Room at Globecast America, with new ways of completing projects. Photo courtesy Globecast America.

Video networks

broadcasters' requirements to get full use and value from the equipment currently in their facilities while addressing new equipment reaching the market each year.

A number of solutions have been proposed and implemented. Some are more effective than others are. As always, such decisions come down to a series of trade-offs; typically cost vs. features vs. flexibility.

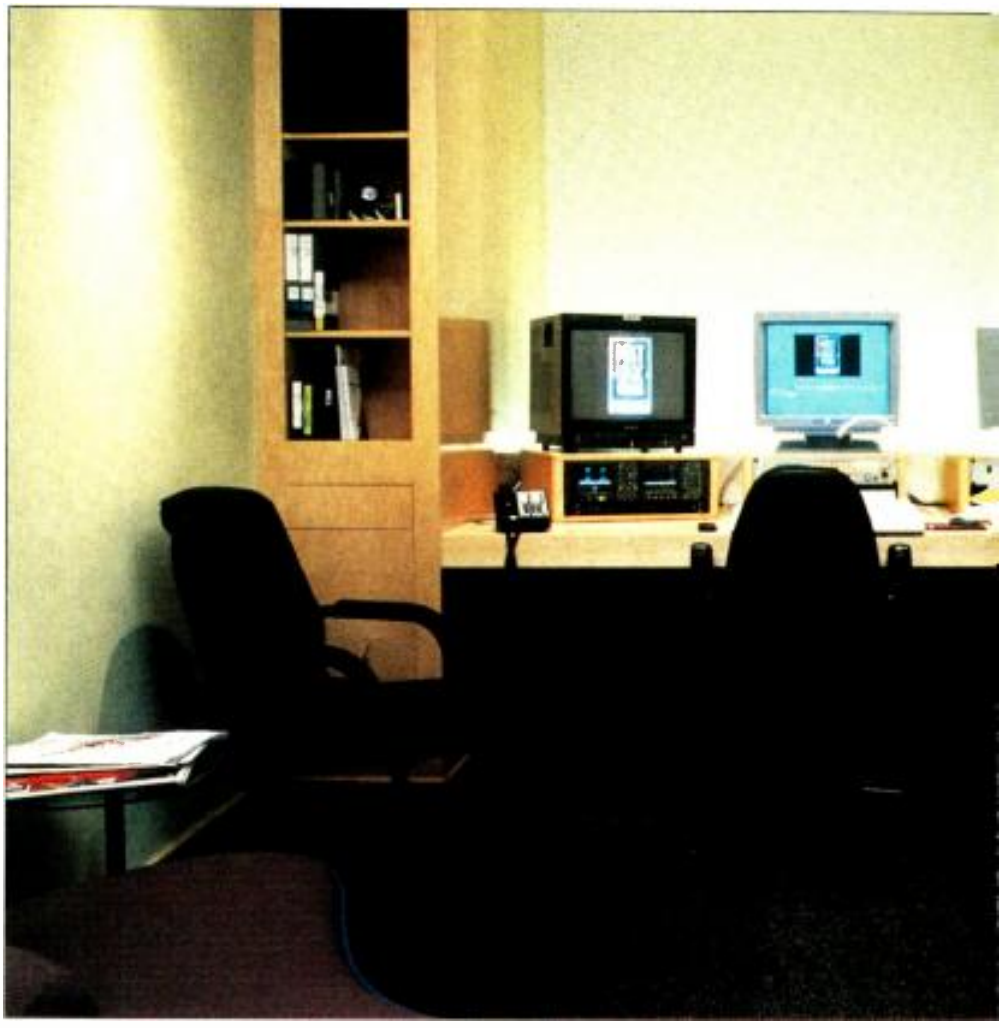
Computer networks are designed to handle data; but not all video content reaches a facility as data. However, not all networking technologies have these limitations. IEEE 1394 offers the ability to route data in both an asynchronous and isochronous manner. Many people think of IEEE 1394 as a simple consumer technology used for connecting digital camcorders to PCs. Digging deeper into the IEEE 1394 specification, one finds that it is a good networking technology for use in video-intensive environments.

The current commercial implementation is IEEE 1394a. This specification is complete. Products that meet this specification have been shipping for over a year. IEEE 1394a specifies link distances of 4.5m (15 feet) with standard cables and up to 10m (35 feet) with high-quality cables. Bus speeds up to 400Mb/s are allowed. One may ask how an effective network can be built with cable distances of only 4.5m. The answer is that 4.5m link distance does not make a very good network. However, IEEE 1394 proponents are forging ahead with a new specification known as IEEE 1394b. The new specification allows IEEE 1394 devices to incorporate glass optical fiber (GOF), plastic optical fiber (POF), and unshielded twisted pair (UTP Category 5) for distances up to 500m, depending on media type. This new specification increases bus bandwidth to 800Mb/s and beyond. The IEEE 1394b specification actually specifies link bandwidths of 800Mb/s, 1600Mb/s and 3200Mb/s. This new specification will be complete shortly. Prototype devices running at 800Mb/s are already operating at industry trade shows.

With Gigabit Ethernet and Fibre Channel already on the market and running at gigabit speeds, what makes IEEE 1394 different from the other networking technologies? IEEE 1394 provides fixed, low latency end-to-end delivery for high bandwidth streams. Designed specifically as a multimedia technology for carrying audio, video, control, and data, 1394 provides two Classes of Service, isochronous (guaranteed bandwidth) service and asynchronous service. Its most attractive feature is that it provides the ability to allocate discrete bandwidth channels for delivery of isochronous datastreams such as video and audio. This means that a device can reserve 25Mb/s of bandwidth for streaming DV25 video. Regardless of other traffic on the network, the reserved data channel is never interrupted or reduced.

The increased bandwidth makes Gigabit Ethernet feasible for high-speed transfer of video files between devices.

Another interesting capability of this technology is that it can support up to 64 individual isochronous channels on a single link. This means that up to 64 different MPEG-2 videostreams can be simultaneously carried on a single link. In addition to the isochronous data



Today's technologies allow video networks to move beyond data transactions and control functions and on to providing effective access to video files. While not yet tapeless, the future for online suites, like this Inferno bay at Post Logic Studios, Hollywood, is to move content entirely through the use of networking technology. Photo courtesy Spelling Communications.

channels, any bandwidth not reserved can be used for asynchronous traffic. There are already several commercial implementations of TCP/IP on IEEE 1394. To guarantee at least some asynchronous packet transport on the link, up to 80 percent of the available bandwidth can be reserved for isochronous data channels. The remaining bandwidth carries asynchronous packets. On a 400Mb/s link, this equates to 320Mb/s for isochronous traffic (such as video and audio), and 80Mb/s for asynchronous packets (such as TCP/IP). Using IEEE 1394b at 800Mb/s, this means that up to 640Mb/s can be used for video, leaving 160Mb/s for asynchronous packets. These numbers are a maximum for isochronous bandwidth. If less bandwidth is required for isochronous channels, any remaining bandwidth can be used for asynchronous packets (up to 50 percent of the link bandwidth). For example, using 800Mb/s IEEE 1394b with only 40 MPEG-2 streams (10Mb/s per stream), 400Mb/s of bandwidth is available for asynchronous traffic (IP traffic). This is four times the raw bandwidth of Fast Ethernet.

Connectivity

For the most part, current networking technologies used in video applications do not provide an easy connection to video and audio devices. Video servers, for example, may have physical connectors for SDI video, AES audio, LTC timecode, RS-422 control, Ethernet and Fibre Channel. The SDI, AES, and LTC connections are all different data formats carried at different bit rates; but they are all serial and isochronous. The RS-422, Ethernet and Fibre Channel connections are asynchronous, also with different formats. Getting data into and out of this server requires a multitude of connections. IEEE 1394 can simplify this because it can carry all of the isochronous information and asynchronous information on the same cable. A simple example can be seen in the consumer market. For a nonlinear editing workstation to record video for editing, the workstation needs an SDI (or composite or S-video) input, and AES (or analog) audio input, a timecode reader (optional), and RS-422 (or RS-232) for control of the VTR. With these connections and the appropriate software, the nonlinear workstation can then control a professional VTR. On the consumer side, a PC with an IEEE 1394 card and a 1394-capable digital camcorder can accomplish all of the above with a single IEEE 1394 connection.

Many devices are adding IEEE 1394 ports as standard connections. Apple and Sony computers have them, as do some Compaq and NEC computers. Many lower-end digital camcorders have them, and they are even appearing on some higher-end equipment. IEEE 1394 has been specified as the preferred method of connecting set-top boxes to digital television sets, and some new HD VCRs now include 1394 connectors. Additionally, there are a multitude of scanners, digital still cameras, and even disk drives that are implementing IEEE 1394. While most devices are generally consumer or industrial grade, the high volume of these devices has driven the cost of IEEE 1394 down to very low levels, reducing the implementation costs.

IEEE 1394 offers the ability to route data in both an asynchronous and isochronous manner.

The advent of high-performance IEEE 1394b technology, with its capacity for long distance links on fiber and copper cables, combined with IEEE 1394 switching and mass storage technology, makes 1394's future as a video networking technology.

There is a next generation networking and storage solution for professional broadcaster based on IEEE 1394. The recently introduced Video Area Network has the capability of recording and playing back video, audio, and data in a variety of formats, both compressed and non-compressed. This network infrastructure was built to encompass the many devices on the market today with IEEE 1394 interfaces, as well as those without. The system includes a set of network interfaces that will connect the IEEE 1394 network to SDI, AES, LTC, RS-422, Ethernet, ATM, DVB-ASI and other standard interfaces. Implementation of effective video network topologies can begin to connect those many and varied digital islands found in broadcast facilities today. The net result will be technical centers poised to take full advantage of the future and to serve their customers. ■

Camden Ford is the product marketing manager for Omneon Video Networks, Campbell, CA.

Storage Area Networks and Video SAN Recorders

Large facilities with high storage demands, such as Post Logic Studios in Hollywood, could find it efficient to install a storage area network (SAN). SANs rely on direct disk connections across the network for accessing all digitized content. Photo courtesy Spelling Communications.

By Dimitri Chernyshov

Whether you like the trend or not, computers will continue to invade the world of broadcast television.

For the past decade, video equipment manufacturers have found it increasingly attractive to use off-the-shelf computers, operating systems, and file systems as the platform for their products. This reliance has allowed video equipment manufacturers to focus their efforts on adding value through increasingly refined software that enables the creation and manipulation of video in ways that were unimagined a decade ago.

So far, two major technologies from the computer industry have found broad acceptance at video facilities around the world, disk-based video storage as implemented in video servers, and off-the-shelf computers running application-specific video and audio creation and manipulation software (editing, graphics, animation, etc.), generically called "video workstations."

Video servers and video workstations have become a part of most video facilities because they both provide distinct advantages over the older methods – instant random access, less maintenance, more creativity, higher reliability and lower costs – all while providing a better looking final product on air. As much as we applaud the computer industry's help on the creative side of video, and as close as we've embraced disk drives for recording and playing back video, most of us have just started looking at the way computers route and share data and how it might help us.

How do computers distribute data?

While computers deal best with files – self-contained objects that are accessed in discrete chunks – video equipment deals with "streams," slippery flowing data that resists being bottled up as an objects. The big-picture view of the storage, distribution and manipulation of video within facilities over the past 40 years could be summed up as "expensive intelligent video storage devices blindly pumping video through a pipe to passive video manipulation and viewing devices." This is exactly the opposite of the computer industry's methods of storing, distributing and manipulating data, which could be summed up as "inexpensive, dumb data storage devices responding to requests via a pipe from intelligent data manipulation and viewing devices."

As disparate as the ways of handling data distribution might be, computer people might just be on to something good. Treating video as computer data and distributing it via computer networking can provide all of the same benefits we've seen the computer industry give us with video servers and video workstations. But can computer networks handle video?

Will LANs work for video?

The concerns most of us share about computer networks for video centers around speed. A 100Mb/s LAN, like 100baseT Ethernet, should theoretically provide more than enough bandwidth for 25- and 50Mb/s compressed video. But 100BaseT usually yields well less than 100Mb/s, usually not enough to reliably handle even 25Mb/s video.

The next level of speed, Gigabit Ethernet, is billed at a billion bits per second. But it too provides much less than that in real-world implementations. While easily able to provide enough bandwidth for 25-50Mb/s video or even 2:1 MJPEG compressed video, Gigabit Ethernet makes apparent a basic problem with standard computer networking – processing overhead.

Computer LANs using IP or other protocols require many CPU cycles to process each packet of network data. As faster Ethernet brings in more packets per second, the CPU must dedicate more of its processing power

to handle those packets. While Gigabit Ethernet may be able to provide 200Mb/s to any single computer, it takes more than half of the processing power of a 300MHz Pentium processor to handle all that data. So while you may have video on your computer desktop, you don't have enough processing power left to even move your mouse smoothly across the display.

What's a SAN?

When compared to LAN technologies, the disk transport technologies used in Storage Area Networks (SANs) are fast and efficient. Ultra SCSI reliably channels 300Mb/s of data between computer and disk. Fibre Channel consistently provides more than 600Mb/s using the same SCSI protocol. And the SCSI protocol is two orders of magnitude more efficient in its use of processing power – typically using no more than three percent of a even a slow Pentium's processing power to provide hundreds of megabits per second of bandwidth.

Unfortunately, SCSI cables can be only a few feet long before their signals degrade. Even low-voltage differential SCSI goes only a few dozen feet. Fibre Channel can be thought of as "serial SCSI" designed to overcome the distance limitation of parallel SCSI. It can be run about 50 feet over special Fibre Channel copper cables (essentially two very well shielded twisted pair). If using glass optical cable, Fibre Channel can go as far as one, 10, or nearly 100 miles depending on which color and power of laser is used.

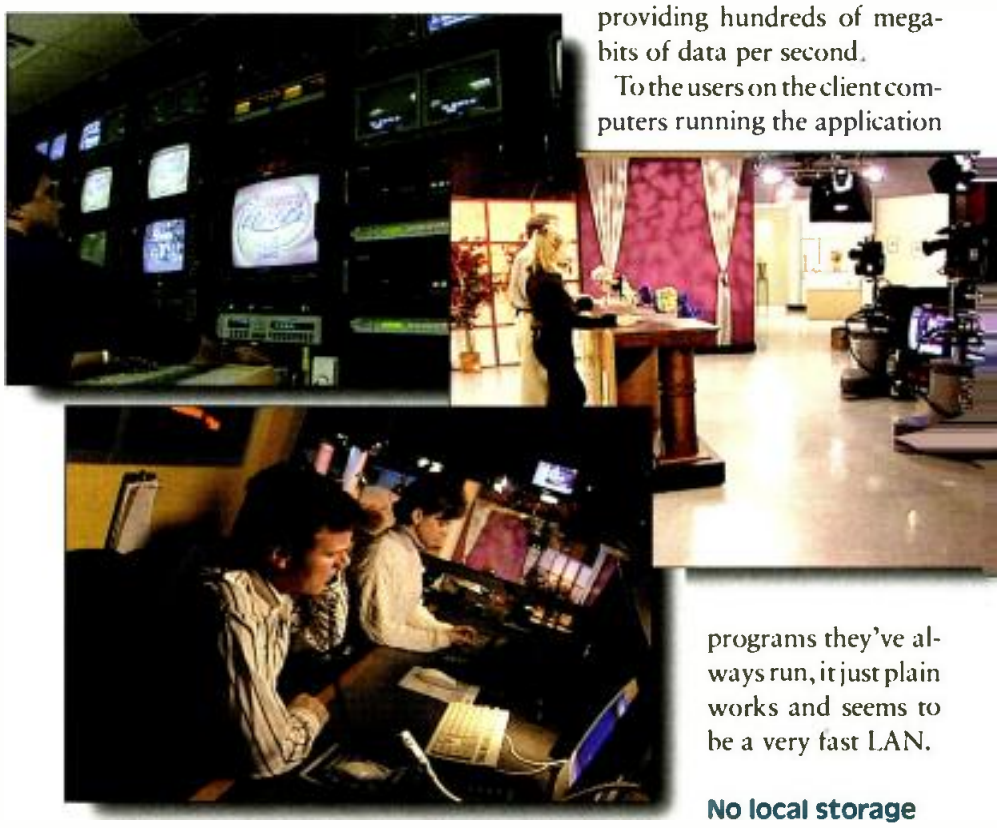
Only SCSI and Fibre Channel can make direct connections between storage and computers, so one or the other (or some combination of the two) must be used to build the SAN. Now that some Fibre Channel network interface cards (NIC) can handle both SCSI protocol (the normal protocol of Fibre Channel) and IP protocol, it is possible to build a SAN using only Fibre Channel connections with no LAN in parallel.

Storage area network operating systems (SAN O/S) similar to Novell's network operating system (NOS) of a decade ago, work with existing operating systems, file systems, and application programs to allow computers to copy, move, and share files across a hybrid SAN/LAN. Just like the Windows NT network that it utilizes, a SAN O/S allows Windows NT, Mac and a variety of UNIX flavors to share the same disks on the same hybrid SAN/LAN. A SAN O/S will typically utilize one Windows NT computer as the metadata controller (MDC) – essentially a file-server that serves not files but metadata.

By using a storage transport like Fibre Channel to connect multiple computers together, a SAN can provide all the bandwidth most video applications would ever need with minimal processing overhead. The trick is to make this new kind of network work as well as the old kind of network.

While all the computers running the SAN O/S are connected to both the SAN and the LAN, only the MDC actually mounts the disks connected to the SAN. The other clients see the MDC as if it were a standard Windows NT server and the storage across the SAN as if it were storage connected to the server. Because the clients don't mount the disks, they don't know they have a direct connection to that storage. When these client computers want to use a file from a disk that appears to be connected to the MDC, they send a file request across the LAN to the MDC. Using standard Windows NT networking methodology, the MDC negotiates with the clients to make sure they have permission to use the requested files, that no other clients have locked the files for exclusive use, and any of a number of other little tidbits of data negotiation in the networking software. If everything with the requesting client is proper, the MDC does not provide the data the client requested, just the file-pointers – the low-level cluster and block information about where the file resides on the disk – back to the client. Armed with the file-pointer data, the SAN O/S running on the client workstation allows the client to directly access the disk via its direct SAN connection, a connection providing hundreds of megabits of data per second.

To the users on the client computers running the application programs they've always run, it just plain works and seems to be a very fast LAN.



VSRs employ a storage area network operating system (SAN O/S) allowing computers, including DAWs and workstations for animation and nonlinear editing, to move and share data efficiently and quickly across a SAN. Because VSRs can store data to RAID arrays, there is a high level of system flexibility and fault tolerance. Photos courtesy Shop At Home Network.

No local storage

When your network connection is faster than your workstation's local disk connection, you have to wonder whether it's necessary to even have local disks. Like network computers that rely on disks across the network to operate, video workstations with a SAN can rely on the disks across the SAN to hold all their digitized video and audio materials. Because the SAN (and the disks connected to it) can provide more than enough bandwidth for any video application, multiple computers can use the

same disks at the same time as if they were just local disks.

In the situation where a facility might have more than one graphics workstation, nonlinear editor, 3D animation system, or digital audio workstation, all these workstations could use the same fast disk array or RAID to hold digitized media files for all the workstations. With a SAN O/S, the applications running on those workstations see the storage across the SAN as if it were just storage behind the file server on the LAN. So any application that can use data from a LAN can use the data from the disks on the SAN. Because the data is available at hundreds of megabits per second, no local disk storage is needed at each workstation.

There are a number of advantages that come with having no local disk storage at each workstation:

- Increased storage efficiency: With centralized-shared storage possible with a SAN, each workstation can use as much storage as needed for each job. With more than enough gigabytes shared between a few workstations, everyone has all the storage they need and nobody has leftover storage being wasted.
- Improved visual quality: Video is digitized and/or captured only once to the shared storage for everyone to use.
- No more sneaker-net: Since all the computers are connected together, moving data over the network is easier than disconnecting a disk drive and carrying it across the building.
- Sharing: Since every workstation can get to the same storage at the same time, files do not need to be copied between workstations.
- Increased reliability: Fault-tolerant RAIDs guarantee that if a single disk in the RAID fails none of the data is lost. Also, since multiple computers are similar or identical, if one workstation fails, the job it was doing can be continued from any other workstation on the network.
- Increased application flexibility: If the latest and greatest application happens to run only on Windows NT, files can still be shared between it and all the existing Mac and SGI workstations.
- Productivity: The gains enabled by a SAN allow people to collaborate more easily to create better projects or to reduce the time a single project takes to complete.

Will a SAN/LAN work on my video servers?

Now that we have a computer network that's fast enough for video and provides several new benefits, why not connect our video servers also? Unfortunately, most of the video servers that have been sold over the last few years are not based on standard off-the-shelf computers using standard operating systems and file systems. Networking them together would require more proprietary networking software development.

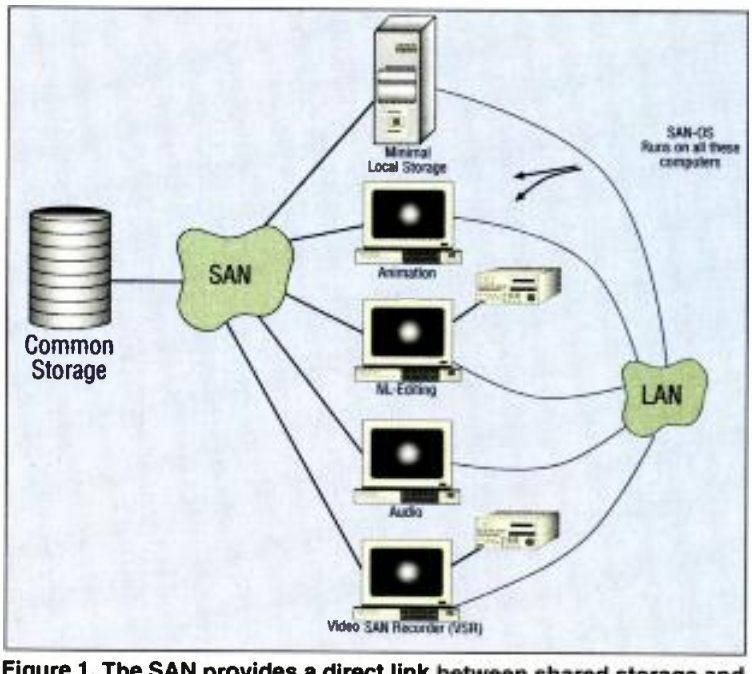


Figure 1. The SAN provides a direct link between shared storage and every video workstation and VSR in the facility, allowing everyone to use the same disks at the same time.

However, at NAB99, six companies showed video servers based on off-the-shelf computers, operating systems and files systems that connect to SANs as easily as any other video workstation. Because of the benefits afforded by connecting to a SAN/LAN, this new generation of video server is so different it deserves a new name – video SAN recorders, or VSRs. VSRs provide advantages over the previous generation of proprietary hardware and software video servers. But the most important advantage to broadcasters may be just the much lower cost of VSRs over video servers. Using standard computer parts and operating system software removes one of the biggest costs of building VSRs. With lower overall parts and development costs, a new low price point per VSR is reached, potentially allowing a broadcaster to replace many old VCRs with new VSRs and gain all the benefits that SANs provide. The best example of how this could work is in news editing and airing.

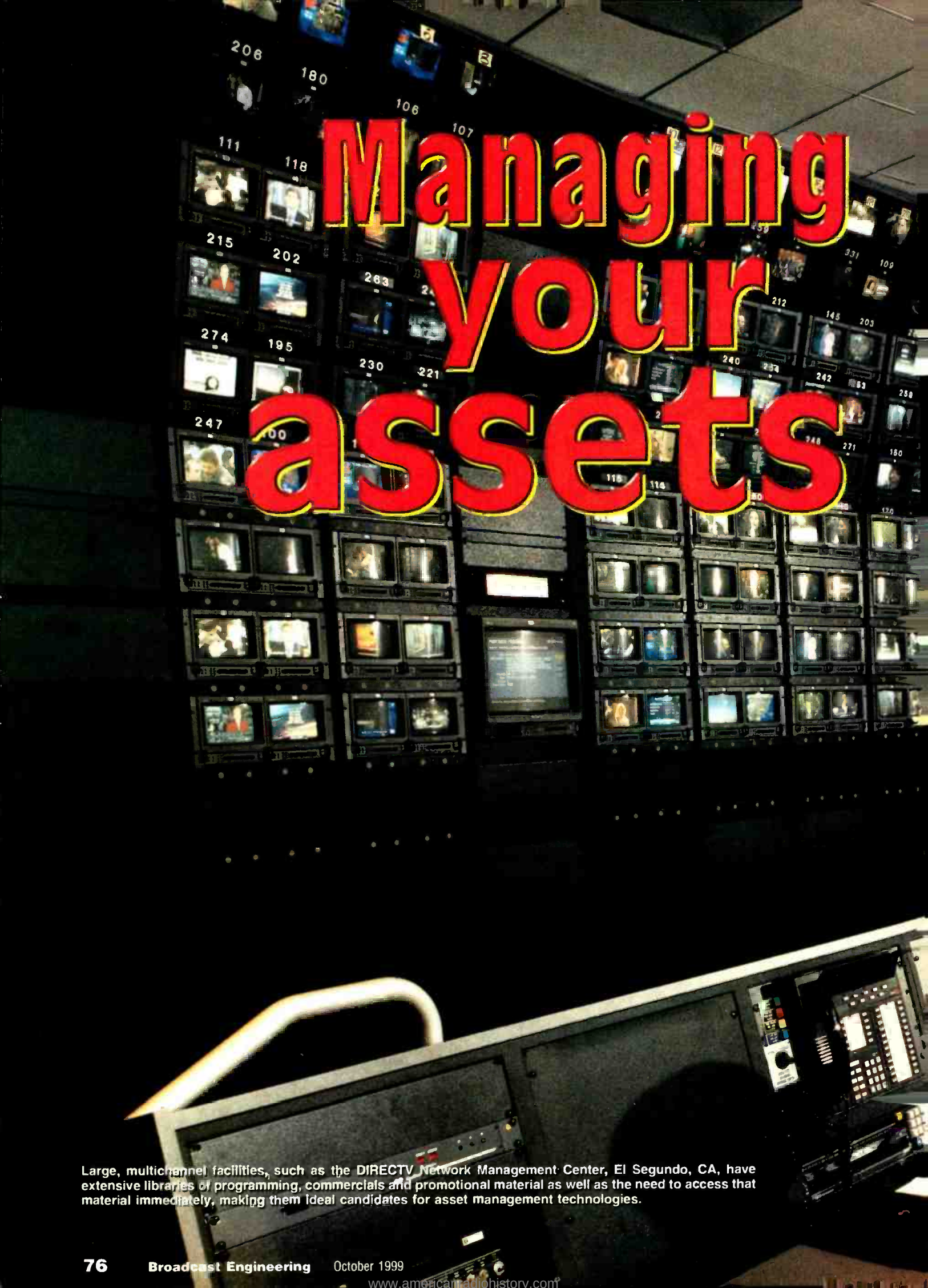
With multiple VSRs sprinkled throughout a news facility, freshly shot news can be cuts-only edited from a VCR directly into a VSR and recorded to the SAN's storage. The instant footage is on the common SAN storage, any other VSR in the facility can play that video back. Contrast that with editing from one tape to another and then hand-carrying that tape somewhere else in the building to be played back from another VCR to air. A few VSRs connected via a SAN can save many minutes in the production of every news story and much frustration over lost tapes and missed deadlines.

Recording network feeds through a VSR directly to the SAN's shared storage can yield similar time savings. The newly recorded feed can be viewed instantly and edited from any VSR in the building even while it is still recording to disk. Because of the SAN/LAN connection, no VSR ever has to copy or move files to use them. Instead, all VSRs are able to share the same footage on the same disks at the same time.

Video servers and video workstations have become a part of most video facilities because they both provide distinct advantages over the older methods of doing things all while providing a better looking final product on air. With the latest generation of video servers, or VSRs, and the addition of the SAN that connects them together, a melding of video servers and video workstations can occur that provides the final benefits the computer industry has been offering to us in the video world. ■

Dimitri Chernyshov is entertainment marketing manager for the Shared Storage Business Unit of Mercury Computer Systems Inc., Chelmsford, MA. For additional information, visit www.SANergy.com.

Managing your assets



Large, multichannel facilities, such as the DIRECTV Network Management Center, El Segundo, CA, have extensive libraries of programming, commercials and promotional material as well as the need to access that material immediately, making them ideal candidates for asset management technologies.

By Stephen J. Smedberg

Within television facilities, there are numerous assets. These include a variety of familiar items such as office furniture, broadcast equipment, computers, etc. Lately, many have realized that on-air programming is also an asset. Unfortunately this particular asset comes in a variety of shapes, sizes and formats, and over the years has grown immensely.

Not only is past programming something that must be dealt with, but new material arrives every day. In a broadcast facility, programs, news stories and promos regularly arrive at the last minute before air. There is also an around-the-clock requirement to load the playback system. Even though the on-air playback system is automated, it still demands daily feeding. In most environments, this means someone with a cart full of tapes and some paperwork is responsible for constantly loading tapes into the belly of the playback beast.

Digital enters the picture

In the 1980s, the business of making television pictures took a digital turn.

At about the same time, the first computer applications emerged enabling the frame-by-frame rendering of special effects, which could be recorded onto videotape via early implementations of RS232 and RS422 control. Eventually, these systems could render directly to disks and play back from them in real time.

Through this evolution, analog master tapes, field footage, slides and artwork piled up in libraries, vaults, closets and file cabinets in television studios around the world. OK, enough nostalgia. The GM has just appeared in your office with an idea; he thinks a little more revenue could be squeezed out of the Sunday morning line-up if those old bowling shows

bandwidth of the connection, not the real-time run length of the file itself.

It is also possible to put the server between the on-air playback device(s) and a tape-based, near-line or deep archiving system. The asset manager could be configured to load material onto the server without interfering with on-air playback. That server could contain enough storage to accommodate up to seven days of programming, while the smaller, dedicated playback DDRs might hold only one day's material.

A more direct method of playback uses the server's video I/O ports along with its ability to be controlled serially by another device. In this case, the video with either embedded audio or independent audio tracks can be cued, played and manipulated as though the server were a VTR or conventional DDR. This control can be integrated into a complete workflow environment, such as a digital newsroom automation system, or simply used as the source machine for a dubbing station.

A fully automated workflow solution depends on seamless use of materials between editors and on-air control systems. A story edited using material on the server should be available for playback the instant it is finished editing. In fact, because of a true server's ability to simultaneously play back to multiple ports, a news producer wishing to live on the edge should be able to begin airing a story even before the last b-roll is laid down. The risk is that the story will get to the missing b-roll before the editor does, but such are the legends of getting the scoop.

Where do we go from here?

With a good background on the technical capabilities of an asset management solution and the go-ahead from station management to begin the transition, it is time to decide how to deploy such a system within your facility. It is not practical to overhaul your entire facility in one fell swoop, due to issues such as budget constraints, user acceptance and workflow issues, as well as potentially significant technology ramp-up requirements.

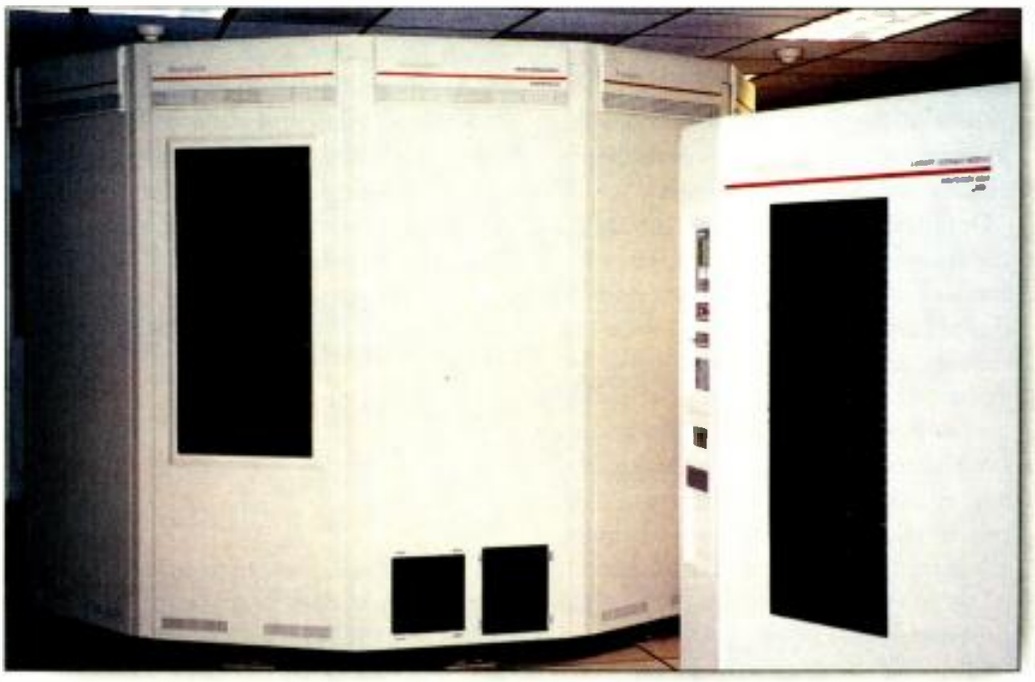
Those who have successfully deployed such a system suggest that you start with the paper version of your workflow to define the system's requirements. It will also serve as a benchmark with which you can compare the new workflow to the legacy one to ensure acceptance and compliance by the staff. It bears repeating that the solution will succeed only if it is easier and more efficient for the users.

When correctly implemented, changing to an asset management system simply means that the technology beneath the workflow now looks a lot more like a computer network.

The backbone of any complete asset management solution is the IT infrastructure being used to move the video, audio and metadata. Different elements in the solution will have different bandwidth requirements. Some parts of the solution demand guaranteed rate I/O, while others are not as sensitive to interrupts on a network or bus. Make sure the solution deployed does not pose a risk of bandwidth bottleneck.

The best solutions scale to any size without a decrease in performance and use standard storage. The economics of these two issues are clear. If you start with a solution of limited scalability, you must decide that that solution is disposable once it is outgrown. Using conventional storage allows you to expand your system in line with the storage economies at that time and prevents you from being stuck with legacy storage devices, available only at premium prices. We all remember how expensive formatted eight-inch floppies were, and many of us were buying them long after they had been enshrined in the storage technology museum.

The final consideration should be the strength of your IT staff. Many television stations do not have a system administrator on staff. In these situations, success depends on the vendor or integrator taking ownership of the IT demands of the solution. The best solution providers will help develop and deploy the proper architecture and, provide ongoing system administration and support through a long-term contract. For those facilities with an on-staff IT expert, gaining that person's buy-in is the single best thing you can do to ensure the success of the solution.



An effective asset management system makes use of longtime archival storage, one of the keys to repurposing content. StorageTek Powderhorn 9310 and Wolfcreek 9360 library storage units at KGO-TV in San Francisco. Photo credit Noreen Lovol.

Collect all those binders and card catalogs then figure out how the work gets done today. Decide where you can get the most immediate benefit from an asset management system, then get out a notebook and start plotting the solution. Make sure you consider the way the system will look in a few years and get started. The next time the GM shows up, in a matter of a few mouse clicks, you can watch bowling together, on your desktop. After that, if he still thinks it is a good idea to rerun it, at least you will know where to find the master. ■

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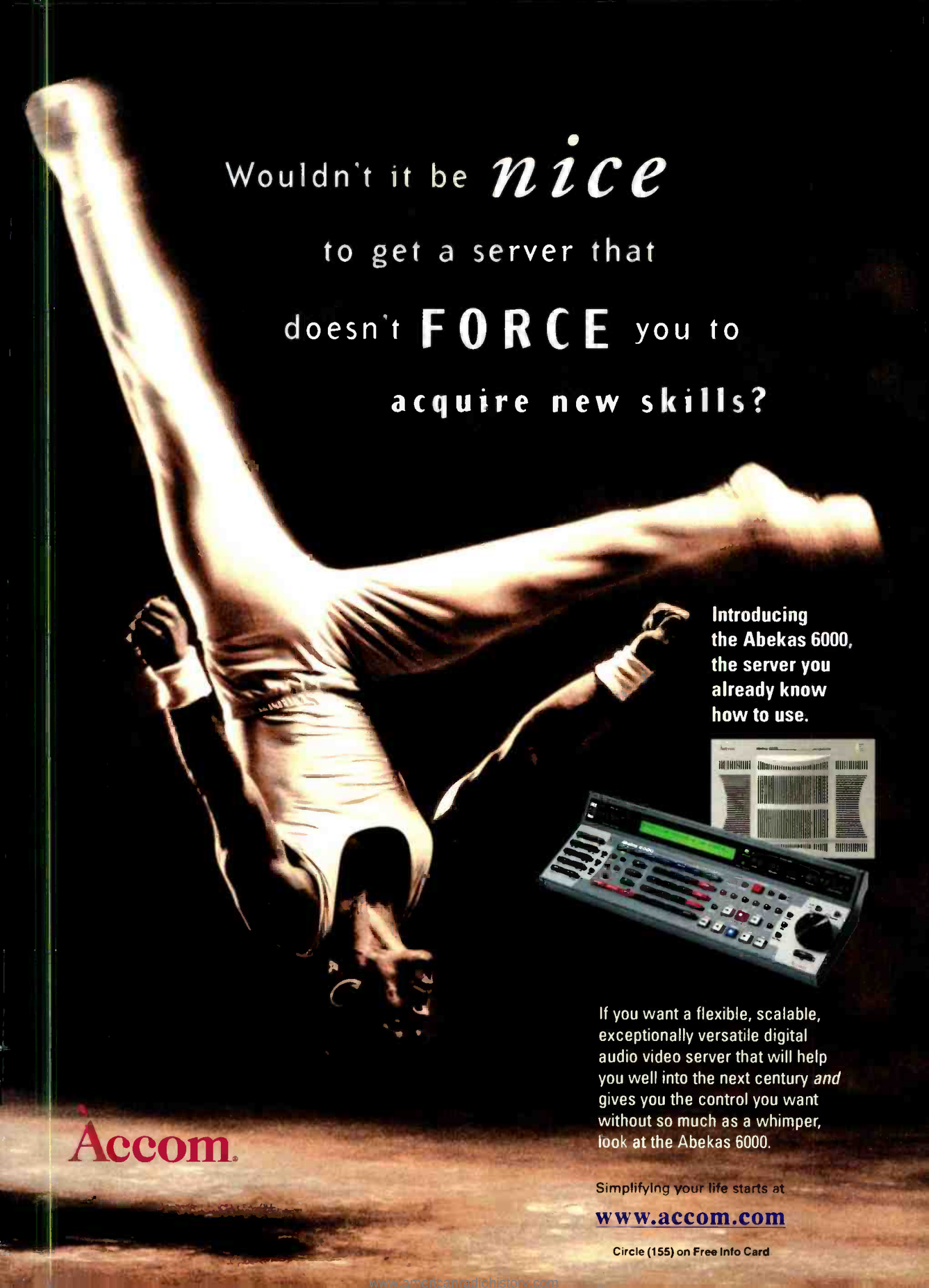

Integrating HD and SD images

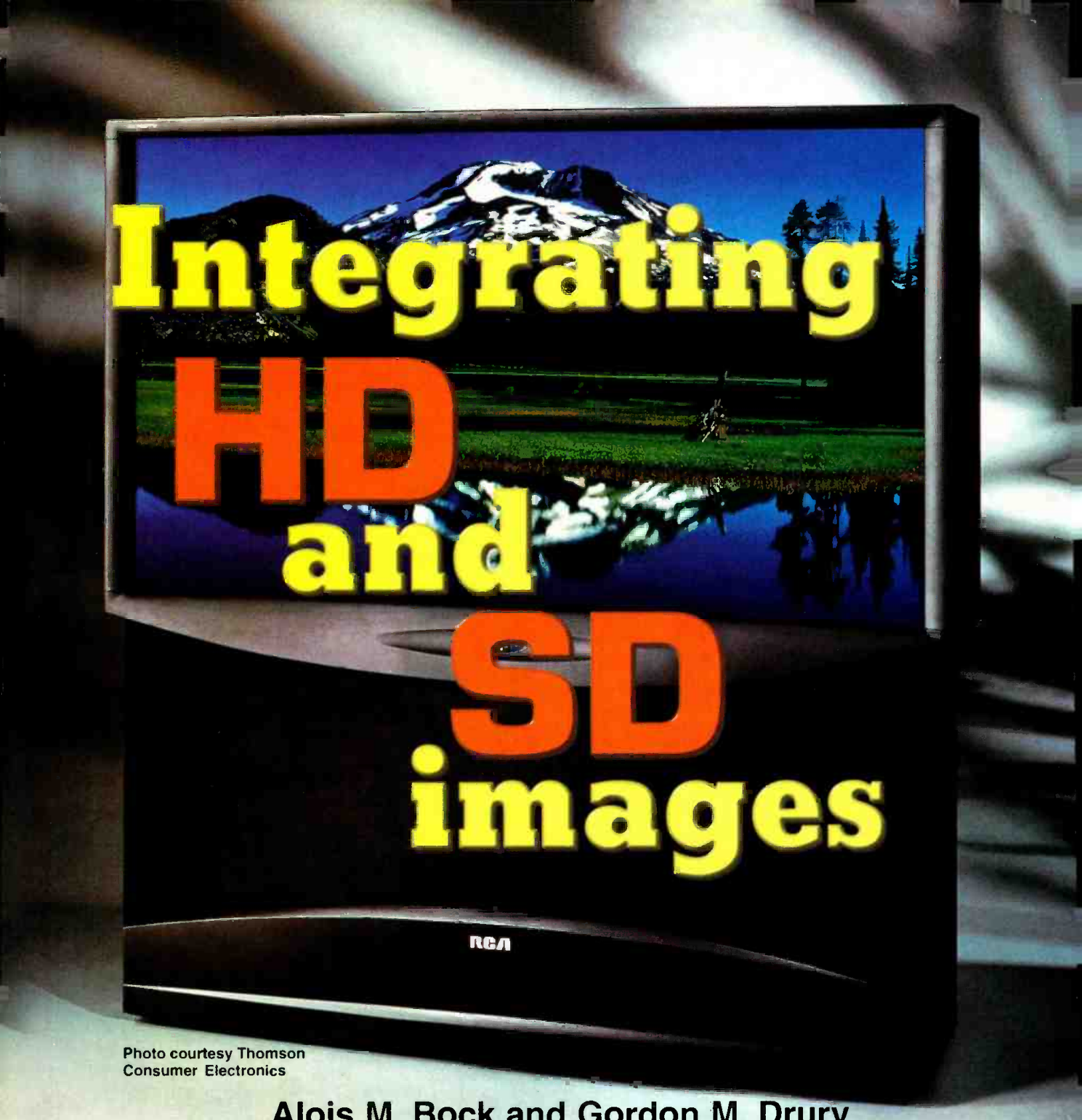

Photo courtesy Thomson Consumer Electronics

Alois M. Bock and Gordon M. Drury

There are a number of ways in which the drive towards better picture quality in the home can be achieved. The main difference between the proposals currently under discussion is the point in time at which it will be appropriate to begin transmission of true HDTV; while highly impressive and desirable, high definition is likely to be very costly, both for producer and viewer. This prompts a search for alternative approaches, which, perhaps in the early stages of digital TV broadcasting, will suffice to meet viewers expectations and might pave the way, if commercial factors are appropriate, for true HDTV. The beneficial use of scan conversion techniques, both at the studio and in the receiver, has long been known to broadcasters and has been proven in experiments performed over a period of more than two decades. This article discusses the merits of different scan conversion techniques and offers views on how the transition from existing television technology to higher quality could be made in a cost effective manner.

Electronic digital standard definition video production is now widespread using the agreed ITU-R worldwide standard formats, but a production standard for HD has only recently been agreed upon and, although some

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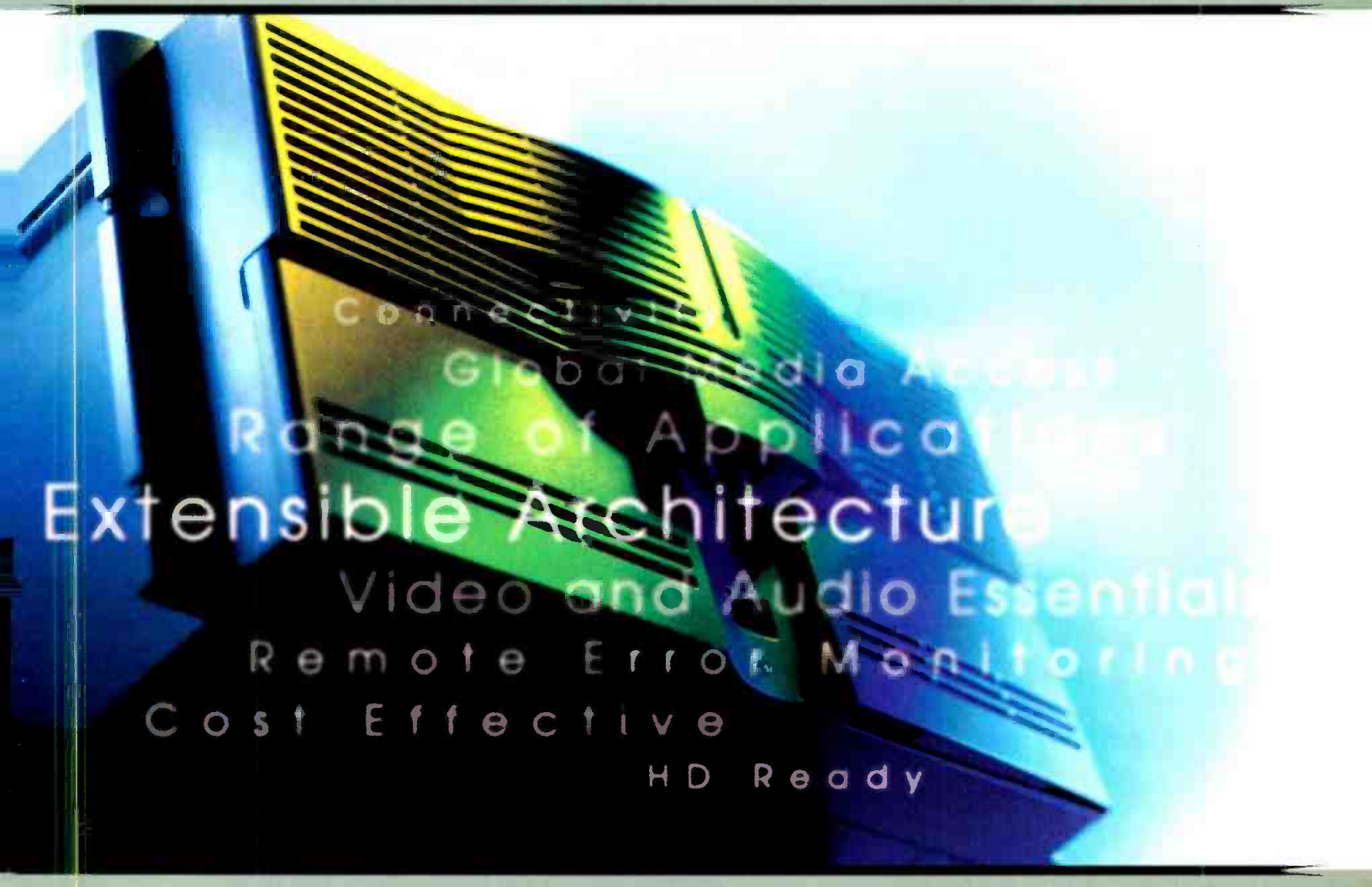

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equipment is available for its support, no widespread use is likely for some time for economic reasons alone. Some scan conversion to enable the importation of existing electronically acquired material, possibly in composite format, into some HD format is therefore implied in the production environment. Similarly HD material will need to be converted for use in an SD environment. The best possible format conversion and composite decoding will be necessary if the quality of the final viewed image is to be the optimum. Transmissions in the new HD format will, like color over four decades ago, not be the norm across the country for some time and some SD material will also be transmitted simultaneously. The new receivers will be required to present this material to the viewer in such a way that the best quality possible is extracted given the resources available at that receiver. The difference between the resultant picture quality and that of the "true" HD transmissions should be minimized, otherwise viewers and program sponsors alike could react adversely to this quality variation. Conversely, if HDTV receivers are to achieve rapid acceptance by the viewer, there must be some differentiation in service quality to justify any additional cost; this presents a considerable dilemma to the broadcaster that cannot be resolved by technical means alone. Remember that viewers may receive their experiences of HDTV from several alternate media and so there will be a range of "HDTV" pictures that may vary in quality, thus confusing the public.

HD requires the use of a wider aspect ratio than SD. Conversion between the formats will require the management of this both during HD production (to protect the possible later reduction to 4:3 SD) and during the injection of 4:3 archive SD material into a 16:9 program. This is not a trivial production task and needs the processes and tools to be refined.

The introduction of HDTV services can readily be achieved by direct scanning of film; 35mm, 16mm and, more recently, Super 16, have been in widespread use in program acquisition. However, it is debatable whether any film format less than 35mm will be adequate to deserve the "HDTV" label because resolution reduction, noise and grain etc. are visible on such sources even in current analog systems and will adversely affect the performance of the digital compression process. Only approximately 18Mb/s is available to carry a video signal worthy of the "HDTV" label, as seen by the viewer on a consumer display rather than an expensive high-quality demonstration system. It is therefore crucial to provide the compression process with the highest possible source quality if visible defects are to be avoided. Professional precompression processing equipment and high-quality composite decoders are available to deal with some of these defects wherever high performance is required. Some MPEG coding equipment features built-in means of dealing with some of these issues.

DTV signal processing allows the decoupling of the signal formats used in studio, transmission and display and so there is a range of scanning options allowed under the ATSC standard and broadcasters are free to choose among them. However, such freedom of choice requires the receiver to deal with all processing to match the several possible incoming video formats to one suitable for the display device available. Multiple format scan conversion has to be good enough to deliver high-quality pictures consistent with the expectations generated by the label "HDTV." Much of the cost and complexity of this conversion could be avoided by rationalizing the formats in use for production, transmission and display. It is clear that there is a need for high-quality scan conversion both in studios and in consumer display drivers. Whereas for the former, there are already proven solutions from well known suppliers (e.g. Snell & Wilcox HD 5050), the latter poses a new and significant challenge to the consumer electronics industry since the matching of the high performance devices used in production should, given the fidelity of good compression, be matched at the display driver. The limit of the quality perceived by the viewer could be that of the driver.

The separation of the display issues from those of the receiver electronics allows choice by the viewer of the picture quality required. For example, a larger screen of sufficient capability in resolution, brightness, contrast, colorimetry, etc. will undoubtedly improve the impact of the HD services. But it will also give similar benefits to scan-converted standard definition services so this does not in itself resolve the dilemma of differentiation among service qualities on any given screen and thus support a strong case for true HDTV. The "HDTV" experience is closely associated with the large (and bright) screen experience and smaller screens do not favor

Format	4:2:0		4:2:0		4:2:2		4:2:0		4:2:0	
Picture	352x576		720x576		720x576		720x576		1920x1080	
structure	x25		x25		x25		x50		x25	
Pixel rate	7.6 Mp/s		15.55 Mp/s		20.74 Mp/s		31.1 Mp/s		77.76 Mp/s	
Sequence	Mb/s	B/p	Mb/s	B/p	Mb/s	B/p	Mb/s	B/p	Mb/s	B/p
Women	2.25	0.296	5.22	0.336	6.37	0.307	8.75	0.281	17.39	0.224
Dance	1.13	0.149	1.37	0.088	1.89	0.091	2.69	0.086	6.23	0.080
Football	3.17	0.417	5.55	0.357	6.25	0.301	7.65	0.246	16.97	0.218
H.Racing	2.43	0.320	5.49	0.353	8.19	0.395	10.15	0.326	20.69	0.266
Horses	0.98	0.129	3.32	0.214	3.97	0.191	5.53	0.178	11.25	0.145
Juggler	2.99	0.393	6.47	0.416	7.37	0.355	9.67	0.311	22.87	0.294
Soccer	4.77	0.628	8.19	0.527	8.65	0.417	12.86	0.414	26.67	0.343
Susie	1.14	0.150	1.96	0.126	2.14	0.103	2.69	0.086	8.19	0.105
Walk	1.25	0.164	2.09	0.134	2.29	0.110	3.37	0.108	7.54	0.097
XCL	2.14	0.282	6.48	0.417	6.87	0.331	9.77	0.314	19.77	0.254
Average	2.23	0.293	4.61	0.297	5.4	0.26	7.31	0.235	15.76	0.203

Mp/s = 10^6 pixels per second
Mb/s = 10^6 bits per second
B/p = bits per pixel

Table 1. Results of simulations carried out to determine the required data rate for a number of different picture formats. Note that the required data rate is roughly proportional to the transmitted pixel rate.

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HD and SD

HDTV. No broadcaster can be content with poor pictures on any screen, regardless of how they arrived, and so any conscious degradation of SD services or scan conversion in order to show the benefit of true HDTV seems a very dangerous policy. One solution is to avoid any SD services at all, but that approach has its own demerits.

Quality issues

The idea of HDTV is as old as television itself; the early pioneers had set themselves targets of performance that tested the technologies of the day to their limits. They also developed much of the relevant theory that is still sound and applicable today, as those who have come lately to HDTV have discovered, especially the relation between interlace and progressive raster scanning. The development of television technology in Europe and the U.S. during the 1930s led to the adoption in the U.K. of an electronic monochrome 405-line system (later to become CCIR System A, that was only discontinued in 1985 after almost 50 years of use); at the time, this was considered a HD system. The later CCIR System E, used in France and based on 819 lines, would, respectively, have to be classified as an "Even Higher Definition" system. The moving technological base upon which these systems were built clearly considered that more lines was synonymous with better quality.

However, for entertainment television, picture quality is a complex issue, bound up primarily in content and artistic matters but also affected by technical factors. This can be illustrated by the introduction of color TV that was, in several respects, a step backwards in the quest for higher resolution. This was for the simple reason that the early display Direct View Cathode Ray Tube (DVCRT) devices were less bright and had significantly reduced resolution because of the shadow mask, the phosphor dot pitch and density and the problems of scan registration. Additional noise brought to the screen by the combination of chrominance and luminance channel noise was also a factor. A further example is the experience of the 1980s where millions of people would happily pay a small rental fee to watch VHS tapes of movies otherwise unavailable via the free public service broadcast channels. This was and remains a clear indication that, provided the material was interesting, technical quality for its own sake was not important. This phenomenon simply illustrates that the technical factors are not the main motivators for viewers and that, as in the case of color, the benefit has to be obvious rather than obscure.

Sequence	SNR (dB) of Signal A	SNR (dB) of Signal B
Women	33.5	33.79
Dance	39.28	42.11
Football	33.5	33.82
Horse Racing	30.93	33.55
Horses	33.93	35.6
Juggler	27.6	28.66
Soccer	27.37	27.49
Susie	38.23	42.11
Walk	37.49	40.44
XCL	27.57	31.62
Average	32.94	34.92

Table 2. Simulation results of the comparison of SD with upconversion, compression and downconversion.

What is HDTV?

In a commercial environment, the introduction of any new TV system claiming to be high definition must be clearly and demonstrably better than what is already available; after all, high definition is still television and has to do all the things that ordinary television does except with higher resolution. The viewer must be able to differentiate the benefits of HDTV if it is to succeed.

There are, however, signs that some aspects of this situation may change as a generation of viewers, brought up on high-quality computer-generated graphics used in games etc., enter the marketplace. In computer-generated still images there are no defects due to transmission impairments such as noise and no compromises for compatibility when color coding into a restricted bandwidth (i.e. cross color). As a result the images are cleaner and generally watched from closer viewing distances, typically one picture height, where any defect is soon noticed because of the dominance in this case of foveal vision. The close viewing distance is unlikely to change for practical reasons and because the involvement factor in a video game or interactive application requires the player to be as close as possible to fill the field of view. The viewing of these new images is not the same experience as watching normal television.

High definition, relative to standard definition, is characterized by many factors, including:

- Better spatial and temporal resolution;
- Wider aspect ratio; 16:9 rather than 4:3;
- Improved video S/N ratio, i.e. low bit error rate and compression artifacts;
- Better sound quality;
- Ready conversion to/from existing video scanning standards;
- Awareness of convergence of technologies e.g. computer industry;
- Realistic introduction scenarios; and,
- Spectrum efficiency.

The achievement of some of these objectives depends upon good engineering and the picture quality question can be answered in ways that are more cost effective and more readily achieved in the short term than a direct move to a completely new system. There is much potential remaining in the existing scanning systems that has not been fully exploited in a consumer context and that could be just as effective in producing the high picture quality and enhanced viewing experience sought in HDTV. There is signal processing potential, both in the studio and in the consumer's equipment, to better match signal formats to the application in ways which are both cost effective and efficient in the use of spectrum. The following describes some of the applicable techniques.

Introduction of HD production equipment

Despite the fact that HD production equipment has now been available for some time, its uptake, outside of Japan, has been rather sluggish. Instead, many studios seem to be converting straight from composite to digital standard definition. The reasons behind this are not only cost, but also the lack of ready availability of low-cost sophisticated production equipment for HD. Furthermore, under all but the most favorable production conditions, the picture quality of digital SDTV may even be better than HDTV due to the lower level of noise. With the increased use of digital effects processing in the production of television programs

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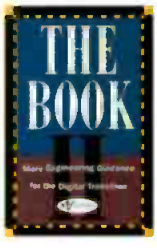

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and increasingly also in film post production, ready availability of Serial Digital Interface (SDI) infrastructure and connectivity on a single coaxial cable is another reason for moving to digital SD rather than analog or digital HD.

Upconversion to HD at the output of the studio

Because the bulk of television production will remain at standard resolution for some time, today's HDTV transmissions use upconversion at the output of the studio immediately prior to compression encoding for the majority of time. This scheme enables the start of early transmissions in HD and accelerates the introduction of the HD transmission standard. There are, however, a number of technical reasons that indicate that this method is not only rather wasteful in transmission bandwidth but also leads to inferior picture quality at the consumer display.

Required data rate of upconverted HD signal

Simulations determined the required data rate for a number of different picture formats. Picture quality, in terms of MPEG coding, was held constant at a relatively high level by fixing the quantization parameter. The picture formats considered were half resolution 4:2:0 as is currently used in many SD satellite services, full-resolution 4:2:0 (MP@ML), full-resolution MPEG-2 professional profile (4:2:2P@ML), full-resolution 4:2:0 with 50Hz progressive scanning and MPEG-2 MP@HL. The 50Hz progressive and 1080-line interlaced sequences were generated by state-of-the-art motion-adaptive upconversion prior to compression.

It can be seen from the bit-per-pixel values given in Table 1 that the required data rate is roughly proportional to the transmitted pixel rate. Therefore, if the number of pixels is increased by a certain factor, the required data rate increases by almost the same ratio despite the fact that no new information has been added. This means that, theoretically, the transmission of HD signals requires almost five times the transmission bandwidth of standard resolution (using a 1080-line interlaced format with 1920 pixels per line).

In practice, the ratio is somewhat lower due to the fact that MPEG artifacts on HD pictures are generally less noticeable than the same artifacts in standard definition. This is due to the spatially smaller block sizes in high definition, which lead to smaller, less noticeable DCT artifacts.

Note that the absolute data rates given in Table 1 should not be taken as typical. The sequences were chosen to give a wide spread of material, not necessarily to be representative of real broadcast material.

Tests with real-time equipment have shown that, in practice, upconversion to progressive scanning formats has advantages over upconversion to 1080-line interlace. Due to its orthogonal spatio-temporal sampling structure, progressive material is easier to compress. Furthermore, progressive pictures provide a better basis for further scan-conversion processes in the receiver. With progressive transmission formats, simple scan-conversion processes in the receiver are less likely to introduce additional picture artifacts than with interlaced formats.

Picture quality with upconversion and downconversion

It is expected that for a significant period of time a large number of viewers will not have access to a HDTV display. If the transmitted signal consists of upconverted SD, these viewers will be watching a video signal that has undergone two scan-conversion processes. Simulations were carried out to determine the picture quality under those circumstances.

The results are shown in Table 2. It can be seen that the picture quality of the HD signal in combination with up- and down-conversion processes is much lower than that of the SD system, despite the fact that the HD signal was coded at the same bit-per-pixel value as the SD signal.

The combination of MPEG compression and scan-conversion has been examined. Because there are complex interactions between these two processes taking place (compression of up-conversion artifacts or upconversion of compression artifacts) the order in which these processes are carried out is important. From the point of view of image quality in any given transmission bandwidth, compression should be followed by scan-conversion and not vice versa. This has the added advantage that the upconversion process can be closely matched to the display format so as to achieve the highest picture quality for any given scanning format. ■

Alois Bock is a senior member of the technical staff and Gordon Drury is vice president, technology, for NDS Ltd, U.K.

(i) Upconversion should take place immediately prior to the display process to make sure that the number of scan-conversion processes is kept to a minimum. If upconversion, say to 1080-line interlace, is done at the output of the studio, displaying it on, say, a 720-line progressive monitor involves two scan-conversion processes both of which have adverse effects on picture quality.

(ii) The upconversion process itself should be matched to the display process. This is the only way in which the full potential of the display hardware can be exploited. Due to the diversity in displays, there is currently no preferred scanning rate which could be chosen as the best format for the transmission.

(iii) Scan-conversion processes inevitably lead to some picture artifacts. Even if these artifacts can be kept at an absolute minimum through the use of high quality professional equipment, the appearance of the artifacts may get enhanced in the compression process. Experiments have shown that upconversion to 1080-line interlace, in particular, carried out prior to compression, leads to a disproportionate increase in bit rate demand. By comparison, progressive scanning formats are less demanding. However, in terms of overall picture quality on a range of display equipment it is still preferable to do the compression first and scan-conversion afterwards.

(iv) The upconverted video signal needs significantly more bits to code than SD signals, particularly 1080-line interlaced. Therefore the compression of the HD signal is likely to require higher compression ratios than that of SD signals. Higher compression factors, however, also lead to more coding artifacts.

(v) If the consumer display is not capable of handling HDTV rates, the signal has to be down-converted again to SD. The cascade of two scan-conversion processes with intermediate compression leads to a significant degradation in picture quality.

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Passive men and wild, wild women

BY KARE ANDERSON

Dr. Pierre Mornell had a hunch that he'd hit a raw nerve when he gave a lecture at our local community college here in Marin County on why he thought men and women were foundering in their relationships with each other. His hunch was confirmed the next day when he was deluged with excited calls from journalists and others around the world. That was back in 1978, and journalists still contact him about what he once called "modern man's main secret."

To this day I think about Dr. Mornell's theory at least once a week, especially if I am speaking at a conference filled with technically oriented men or observing an arguing couple. So here is Mornell's "troublesome" theory about men and women and arguing.

I promise you that following even some of the apparently simple suggestions in this column are going to be difficult as we have deeply ingrained habits as experienced adults. Yet they can make your relationships with the opposite sex in all parts of your life less stressful and more satisfying.

Do I have your attention?

Well, frankly that last comment is a central part of the problem, at least as women see it.

To begin with, the most recurring, rage-raising phenomena, according to Dr. Mornell, is "In our own homes, most of us 'men' — we would-be emperors — have no clothes. We are passive and that drives our women crazy."

The problem? "We have met the enemy and he is us." — Pogo

Webster's defines these two words as follows:

Passive: Inactive, yielding, taking no part, submissive, acted upon without acting in return.

Wild: Not easily restrained, angry, vexed, crazed, in a state of disorder, disarrangement, confusion.

The rules now? Whatever he does is now never enough. Right or wrong, he is always wrong. And so is she. Unfortunately, this pattern may continue to be their script. Except one day when one of them may "suddenly" walk from the relationship.

A variation of this same theme occurs in work situations between men and women, just in a milder, lower gear level where there is a thin veneer of apparent civility barely covering the passivity and the intensity in interactions. The stain of scripts and expectations and retaliations gets set there too. We are ready to prove the other person wrong, even knowing what that person has done in the past in response to our actions. There's the endless ferris wheel of increasing futility that we both step onto and seem unable to step off, because we both keep it moving.

Some peace-keeping suggestions for women and men

Know that showing appreciation and attention, especially when you least want to show them and the other person most needs them, will always bring you closer than asking for them.

First look to the other person's positive intent as you hear what is said.

Making and keeping an agreement usually helps the other person feel more safe, respected and cared for in the relationship.

First try to act in a different and positive way before you verbally ask for a change in someone else.

Don't interrupt, especially when you most want to.

First answer the other person's question. Answer it directly, without preface, qualifiers, countering, second-guessing, answering questions she or he did not ask or raising other points first.

Do not answer a question with a question, including questioning that person's question of you.

Find out whether the other person feels you've answered her or his question or otherwise responded adequately before you move on to your question or another point or topic.

Showing resentment and resistance will most likely escalate the hardening of sides between you.

Rather than describing what you don't like, ask for a specific change.

Be willing to make a change before asking for one.

Don't ask for more than one change at a time, unless you want them all ignored.

Use factual language and few words to describe what you want changed.

Use emotion-laden language, and more words, to describe what you like in the other person.

In the middle of your hottest moments of discussion, remember what you most like in the other person and take the time to express it. Of course all these wise pieces of advice are much easier to offer than to live by. ■

Kare Anderson is a speaker and author.

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Applied Technology

THOMSON's Multi-Service Encoder: Multicasting HD and SD in DTV

CHRISTOPHER B. BRECHIN

Today, more than 35 U.S. cities have at least one HD service, with others coming on air every month. Many of these cities did not anticipate this early start when the Federal Communications Commission announced its first rulings in 1998. By the end of the year, more than 55 percent of American households will be able to see a DTV broadcast using a home-mounted antenna.

Getting the most out of your video

With the need for flexibility in formats and applications, many manufacturers have taken different paths to the same goal. Typically, a system will employ separate encoders and multiplexers (Figure 1). This architecture allows multiple services with each additional unit supporting one program. Thus, to broadcast three SD programs and then switch to a HD broadcast, a broadcaster would need a minimum of two SD encoders and one HD encoder. In this scenario, a HD encoder is used to support one of the SD services. In contrast, THOMSON chose to create an encoder architecture that will support up to six SD (480i) services with the same HD hardware. This flexibility will allow the support of daytime switching between formats as announced by a number of U.S. broadcasters.

THOMSON Broadcast System's Multi-Service Encoder supports both HD and SD encoding applications.

The Public Broadcast Service announced the intention to use both HD and SD formats — HD at night and SD during the day. By using statistical multiplexing between channels, PBS can broadcast six different video/audio services to classrooms during the day. In the evening, PBS stations can then switch over to HD programming, which will use most of the bandwidth of their 6MHz channel. In this scenario, a typical encoder architecture will need a minimum of five SD encoders and one HD/SD encoder to support this daily operation; however, with THOMSON's Multi-Service Encoder, an operator would employ the same hardware for either application. The advantages include cost effectiveness and the inherent flexibility of using the same system to support multiple applications like HD and SD services. The use of dual formats raises the issue of how to switch smoothly between the different formats.

With a typical architecture, to switch between two different formats, the broadcaster needs only support running two programs (i.e., a HD and SD program) in the same mutiplex for just an instant. Using THOMSON's still picture mode with the encoder, a broadcaster could "hold" a channel with as little as 500Kb/s to display a 480i slide of the station's logo or other type of picture.

An alternate scenario to handle format transitions is to continue using the same channel and simply switch Program IDs and the associated PSIP tables, moving viewers from one source to another. The advantage of this scenario is that it keeps viewers on the same channel without asking them to change, which introduces the risk of selecting another broadcaster's programming. The disadvantage is that this quick switch is not easy for a consumer decoder and may take a moment to realize the change. Thus, using frames of black or a simple slide might also allow a smoother transition.

To support either transition strategy, the Multi-Service Encoder would employ a standard SDI, 270Mb/s router. As Figure 2 shows, the user can select to feed the encoder with a HD signal (which is divided into six panels) or with several SD signals. In the example, three SD

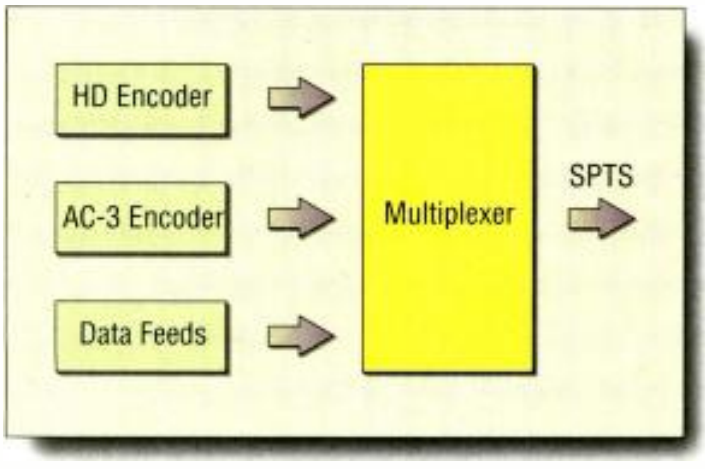

Figure 1. Typical ATSC encoder - multiplexer architecture.

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sources are represented, but in practice, six SD programs can be supported by the same hardware with the option to add three more, for a total of nine SD encoders. Again, the Multi-Service Encoder allows the broadcaster to avoid buying separate units for the two different applications.

Just as the current satellite-based encoder systems have improved in compression performance, it is clear that it will soon be possible to fit both HD and multi-SD services in the same bandwidth. A typical architecture will support this arrangement by simply adding additional units. THOMSON's Multi-Service Encoder allows adding additional SD encoders and supports running HD and SD programs concurrently in the same chassis, limited only by the unit's 21 slots. Statistical multiplexing may be used among the SD programs and may include the HD program as well. Operational experience will determine the best method to use.

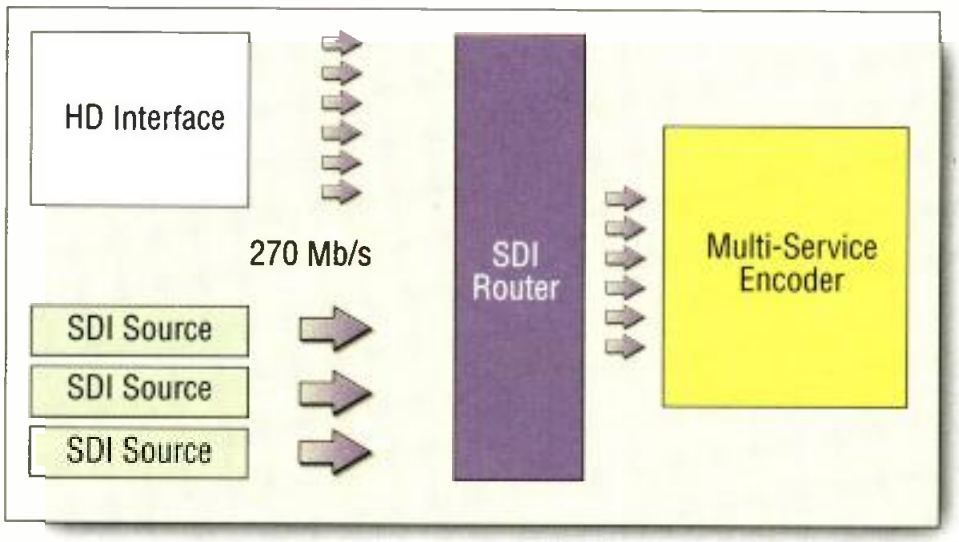

Figure 2. Switching between one HD and three SD programs with the Multi-Service Encoder.

Getting the most out of your audio

Dolby Digital, otherwise known as AC-3, is the ATSC audio standard. As it stands today, Dolby Laboratories will license the stereo version of AC-3 but continue to support the use of 5.1 channel through its own separate audio encoder, the DP569, for broadcast applications. The introduction of the new contribution audio standard, Dolby E, will place some requirements on the broadcast encoder, including the use of metadata, to help guide the AC-3 encoder when making its encoding decisions. Needless to say, it is best to use an encoding system that manages the separate Dolby unit, or in some cases, uses a Dolby-licensed internal stereo encoder to support redundancy and other system management.

Several broadcasting options are apparent when considering audio. One is the use of multiple audio tracks to support different languages with a single video service. Another option might be an audio-only service supporting radio-type entertainment. A typical encoding system might be restricted in the number or type of audio services that it might support. However, in the case of THOMSON's Multi-Service Encoder, its modular design supports adding additional audio boards which direct and receive the external Dolby encoder input. When combined with the still-picture mode, a music service might display the album cover of the current music as well as the phone number for ordering it. Thus, for less than 1Mb/s of bandwidth and the cost of two Multi-Service Encoder boards, a broadcaster could add a revenue-generating service to the current programming offer.

As bandwidth efficiency improves, especially with respect to HD video encoding, broadcasters will search for ways to use the open capacity to support other types of services.

Getting the most out of your data

Multiplexers in a typical architecture support different types of data inputs such as Ethernet, serial data and DVB ASI allowing the passage of several hundred kilobits, up to the full bandwidth of the channel. Typically, these are constant bit rate. However, with the limited bandwidth available in the 6MHz channel (i.e., 19.4Mb/s) in ATSC, the use of opportunistic data is very interesting.

Most in the industry define opportunistic data as the capability of replacing null packets at the encoding system output before modulation. Typically, these packets represent less than four percent of the bandwidth. But when combined with variable bit rate encoding, which allows data to replace bandwidth normally reserved for video, this portion of the available bandwidth for data approaches 15 to 20 percent. Consequently, a broadcaster can support a HD program while also broadcasting data when the video is less complex and null packets appear in the encoded stream. To support opportunistic data, the Multi-Service Encoder uses 50Mb of multiplexer memory to replace null packets with useful data. In fact, the system will support rebroadcasting cyclical data, allowing the system to update only portions that need to be renewed.

As bandwidth efficiency improves, especially with respect to HD video encoding, broadcasters will search for ways to use the open capacity to support other types of services. THOMSON's Multi-Service Encoder allows reuse of the same hardware in a single chassis architecture to support the different formats, redundancy, additional audio and data. ■

For more information on THOMSON's Multi-Service Encoder, circle (451) on the Free Info Card.

Christopher B. Brechin is marketing manager, North America, THOMSON Broadcast Systems

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Applied Technology

Panasonic's DVCPRO-HD family

BY MASATAKA HIGUCHI, NORIAKI UGO AND PHILIP LIVINGSTON

With the advent of DTV, DVCPRO is synonymous with news gathering and cost-effective digital video. The current DVCPRO product line comprises some two dozen different models in both the 25- and 50Mb formats, albeit all of them standard-definition.

The introduction of DVCPRO-HD brings a VTR format that has the picture quality required for HD, the audio channels needed for DTV and the economics required to be the solution for local broadcasters. DVCPRO-HD has backward compatibility with the digital DVCPRO and DVCPRO 50 equipment that is already present in many stations. The same videotapes used for DVCPRO and DVCPRO 50 can be used for DVCPRO-HD, allowing for easy co-existence. DVCPRO-HD provides internal space for an optional up or downconverter. This allows the VTR itself to convert existing material from standard-definition to high-definition, eliminating concerns about archival material and system design integration.

Panasonic's AJ-HD150 DVCPRO-HD VTR can playback both DVCPRO and DVCPRO 50 recorded tapes.

DVCPRO family concept

DV compression technology, originally developed for consumer digital video, was adopted as the compression algorithm for DVCPRO to create a high performance, cost-effective ENG system. DVCPRO, a nonproprietary format standardized as SMPTE D-7, has been widely adopted domestically and internationally. Last year the family expanded to incorporate DVCPRO 50. This upwardly compatible, 50Mb/s format provides the wider chroma bandwidth and transparent minimal compression required for EFP production purposes.

DVCPRO-HD uses newly developed technology based on the DVCPRO algorithm to expand the video data rate to 100Mb/s, maintaining upward compatibility into high-definition in the same fashion as DVCPRO 50.

Compression

DVCPRO, DVCPRO 50, and DVCPRO-HD use a symmetrical feedforward intraframe compression design that minimizes the picture degradation when the video signal is dubbed. This compression algorithm is precisely defined and is ideally suited for either a linear recording system (such as a VTR) or disk-based systems (such as a server or NLE system).

It is the frame-bound 5:1 compression that makes DVCPRO excel and this is accomplished by the use of a technique called chroma subsampling that reduces the amount of video data to be compressed. The overall amount of digits in the color signal is constrained prior to compression, which results in better performance than the traditional NTSC or PAL with which broadcasters are well accustomed. However, less compression is better, and many users are accustomed to the ITU-R Rec. 601 4:2:2 signal structure and believe that it is an important factor in image quality. In that light, DVCPRO was extended to DVCPRO 50 with full 4:2:2 detail while still using the same algorithm to create the lower and effectively lossless 3.3:1 compression ratio. DVCPRO 50 uses dual compression chip sets operating in parallel, each processing a 2:1:1 stream to generate the 4:2:2 signal. DVCPRO-HD uses newly developed LSI devices with the same core algorithm to reduce the data to 385 bytes, yielding a 6.7:1 compression ratio.

Decompression

The decompression process is simply the reverse of compression. Unlike MPEG-2, the DVCPRO-HD codec is symmetrical and the same LSI devices are used for compression and decompression. In the case of digital broadcast transmission, asymmetry is not a problem. The complex and expensive encoder in the broadcast station allows for simple and inexpensive decoders in the home.

Digital transfer

Digital transfer techniques mean that the original image quality can now be preserved as material moves through the production process and between equipment of many types, bringing the freedom from degradation inherent with digital recording. Since DVCPRO is suitable for either file or stream transfer to move signals among systems transparently, Panasonic is working on multiple developments for broadcast infrastructures. In addition, with more than 20 companies participating in the Pana-

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sonic DVCPRO Partners Program, the user has a wide selection of features, cost/performance points and vendors from which to select equipment capable of digital transfers.

SDTI transmission

While serial digital SDI (colloquially known as 601 or 259) is well known and widely used, it is a video signal transfer. SDTI, standardized as SMPTE 305M, allows the transfer of the compressed data without any decode or encode process. Panasonic actively participated in the SMPTE SDTI harmonization effort that generated a multilayer SDTI standard including SMPTE 305M, thus protecting the users' investment in SDI routers and other infrastructure elements. The DVCPRO-HD signal will be standardized as a part of the SMPTE 305M.

File transfer protocol

One can expect file transfer protocol to impact television system design in the near future in both real-time and non-real-time file transmission, and DVCPRO-HD data easily fits in the emerging high-speed network technology like Fibre Channel and gigabit Ethernet.

DVCPRO and DVCPRO 50 compatibility

DVCPRO is extensible from 25Mb/s to 100Mb/s and beyond, in multiple image formats, 480i 4:1:1 sampled, 480i 4:2:2 sampled, 480p 4:2:0 sampled and 1080i. DVCPRO 50 480p 16:9 will allow cost-effective field gathering of images with attributes and quality approaching HD for those applications not requiring field recording of real high-definition images. While officially classed as standard-definition, 480p produces spectacular extended definition images that are easy to either upconvert or integrate with other 480p production equipment.

Because DVCPRO-HD has been developed based on the DVCPRO family, the AJ-HD1500 DVCPRO-HD VTR can playback both DVCPRO and DVCPRO 50 recorded tapes. In addition, an optional format converter card will be available for the studio VTR. A derivative of the Panasonic universal format converter (AJ-UFC1800), this optional internal device can upconvert 480i or 480p signals to 1080/60i or 720p signals, or it can perform downconversion from 1080/60i to 480i. Now a broadcast station can integrate SD video clips and HD video clips seamlessly.

Initial DVCPRO HD equipment

Prototypes of two camcorders (one with three 1 million pixel CCDs and one with 2.2 million pixel devices) and a companion studio editing VTR have been displayed. These are expected to be finished products later this year. Although the 100Mb/s DVCPRO HD products are still under development, the prototypes show that considerable progress has already been made and that DVCPRO HD will allow breakthrough, cost-effective equipment for HD acquisition. Panasonic will also launch the DVCPRO-HD laptop editor, video server and nonlinear editing system just as it has with DVCPRO to complete this product line.

For more information on Panasonic's DVCPRO-HD family of products, circle (452) on the Free Info Card.

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Tektronix PQM300 Picture Quality Analysis Systems

Tektronix has introduced a real-time, continuous monitoring solution for ensuring the quality of compressed digital video. The PQM300 program quality of service (QoS) monitor gives providers of compressed digital video an effective approach for managing image quality and efficiently allocating bandwidth. The PQM300 addresses DTV dynamics by allowing users to quickly identify the most common visual impairments, including blockiness, frozen and repeated frames, loss of service, and Gaussian noise, before they become customer complaints.

The PQM300 monitors all pixels and all fields continuously. In-service, continuous monitoring by the PQM300 assures that the most annoying picture defects are intercepted and logged for all monitored programs. When the PQM300 identifies an image defect or impairment, it will signal an alarm, identifying the channel on which the problem resides. The PQM300 allows users to establish quality histories and defect logs for all simultaneously monitored programs. In contrast to today's technology, the PQM300 provides users a systematic and quantifiable method for assigning bit rates to individual channels. Helping users efficiently allocate their transmission bandwidth maximizes service capacity by reducing the number of bits required per program, while maintaining acceptable levels of picture quality.

The flexible and extensive nature of the PQM300 architecture allows the number of channels to increase.

AMS Neve Capricorn Options

AMS Neve has introduced new options to Capricorn, the company's leading, fully automated and instantly resettable music console. New Capricorn software provides a number of new features to help operators control large mix projects. These include automated routing, which enables multitrack outputs to be used for additional effects sends, and support for VCA groups in automated mixes.

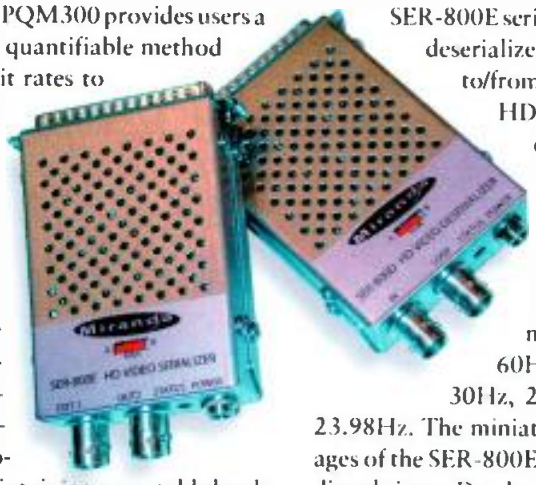
Capricorn's bank layout also has been extended. Banks work the way the operator thinks, allowing the desk layout to change as the mixer focuses on specific elements of the mix. A new path swap feature allows users to move any channel to a new position on the console surface on the fly, enabling any combination of channels to be controlled from the monitoring sweet spot.

Capricorn supports mixing in all major surround formats, including LCRS, 5.1, 6.1/Dolby EX, 7.1, and Imax. The console's flexible layout enables surround panning to be controlled directly from each channel strip, in the sweet spot from the central channel strip (AFU), or from optional automated joysticks.

The new CXS digital surround monitoring system option enables up to six different versions of the mix to be created and compared, and also allows the stereo compatibility of surround mixes to be checked.

Miranda HDTV Serializer and Deserializer

Users of SGI's Onyx2 HD modules and the Philips DataCine now have a cost-effective way to convert the parallel-only inputs and outputs of these systems to SMPTE 292M serial HD. The Miranda SER-800E serializer and SER-800D deserializer convert parallel HD to/from SMPTE-292M serial HD video. Both converters automatically detect the incoming signal format and support 480p, 720p, 1035i, 1080i, and 1080p image formats at scan rates of 60Hz, 59.94Hz, 50Hz, 30Hz, 29.97Hz, 24Hz, and 23.98Hz. The miniaturized, in-line packages of the SER-800E and SER-800D plug directly into a D-sub connector, eliminating the need for frame or parallel cabling. Either unit can be powered from an individual wall plug-in power supply or a centralized, rackmount power supply.



Tiernan TATM-8 MPEG-2 Over ATM

Tiernan Communications has introduced its new TATM-8 MPEG-2 over ATM multiplexer/demultiplexer. The TATM-8 provides a simple and efficient method of transmitting multiple MPEG-2 transport streams over ATM networks. The TATM-8 supports up to eight MPEG-2 virtual circuit pairs on a single OC-3/STM1 or DS-3/E-3 physical layer connection. The TATM-8 can be configured and controlled from the front panel or through a separate network management system.

Tektronix Real-Time MPEG-2 Monitoring System

Tektronix has introduced a cost-effective, full-featured system for real-time, remote monitoring of MPEG-2 transport streams. The MTM300 Series provides MPEG protocol monitoring at a low cost per transport stream by continuously monitoring multiple transport streams in a single chassis. The modular and extensible nature of the MTM300 Series protocol monitoring system offers flexibility to broadcasters and telecommunications providers involved in the transport of compressed digital video. The MTM300 Series includes full-featured analysis, user customization, and the flexibility to integrate the product into existing monitoring and control networks.

Designed to serve the needs of system integrators who are building network monitoring systems, the modular MTM300 Series is a one-stop solution for continuous, remote monitoring of multiple MPEG-2, DVB, and ATSC transport streams.

The MTM300 Series conforms to industry-standard tests and interfaces, which helps identify synchronization, decoding, and metadata problems. Modular inputs/outputs (I/Os) — including asynchronous serial input (ASI) for DVB and SMPTE 310M for ATSC — give users the flexibility to select the I/O they require.

Testing includes dynamic graphical views of all timing diagrams, including program clock reference (PCR), presentation time stamp/decode time stamp (PTS/DTS), and section rate analysis. These features make possible the easy analysis of packet timing parameters. The MTM300 Series also allows users to better manage and minimize the data being monitored by grouping various feeds into so-called bouquets, which are represented on the screen by icons.

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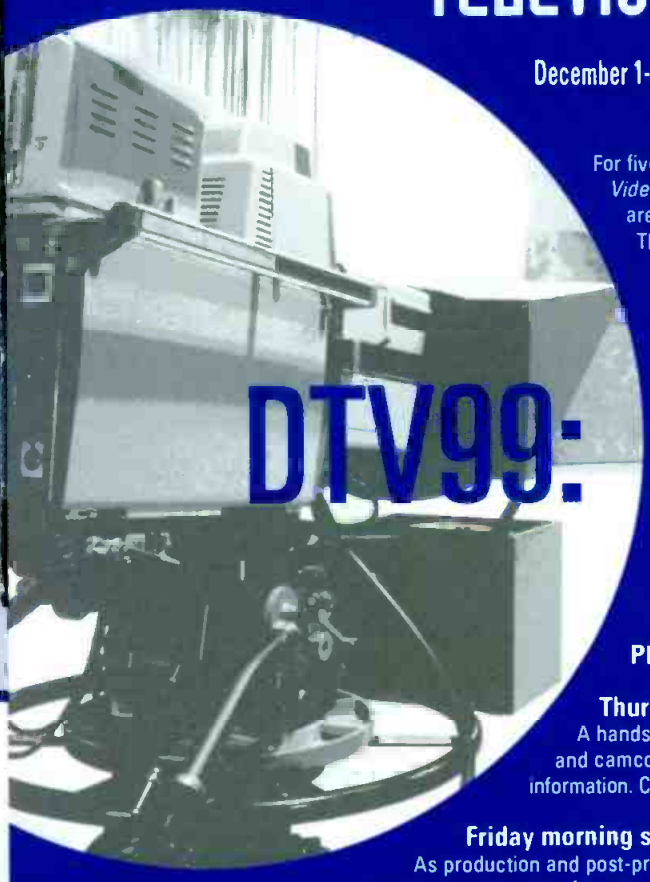

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Friday afternoon sessions: HD Business Opportunities: Real or Imagined?
The media hype about HDTV is running hot and heavy. But what are the real opportunities for those working in production and post-production? Is this a time to move ahead aggressively or to hold back and see what happens? What kind of HDTV work is actually being done, and who's paying for it? These and other questions are addressed by a panel of ad agencies, post facilities, commercial producers and documentarians who have already begun to explore the world beyond NTSC.

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sihilities would he to use the bit stream available in digital terrestrial or satellite bruadcasting to deliver to the public a certain numher of digitally compressed conventional TV programs instead of a single conventional, enhanced, or high-definition program. These digitally compressed TV signals would be accompanied by digital high-quality sound, coded conditional access information, and ancillary data channels. And, the same approach could be implemented in the transmission of multiprogram signals over existing digital satellite or terrestrial links or cable TV networks.

Despite the intrinsic merits of the HDTV-6-7-8 system, it was quickly superseded hy the Digital Video Broadcasting project in Europe and the Grand Alliance project in the United States.

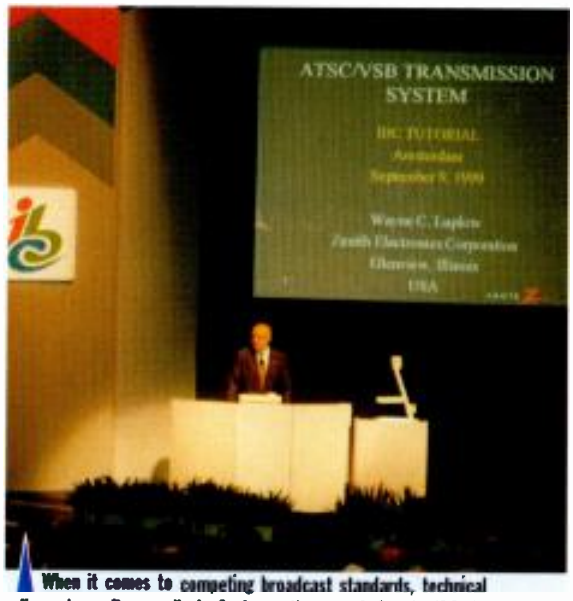
Standardization issues

Video standards have a complex structure. They pruvide a detailed description uf video signals compatible with an intended receiver. Strictly speaking, a *broadcast TV standard* is a set of technical specifications defining the method of on-air radio-frequency transmission of a picture with accompanying sound. However, in the video production envirunment, the RF parameters are usually irrelevant and sound can be handled in several ways. For this reason, the term *video standard* is more apprupriate.

It is possible, and many times useful, to divide a video standard into five component parts, as follows:

- The scanning standard, which determines how the picture is sampled in space and in time . Only the conversion of video signals between different scanning standards, for example NTSC to PAL, can truly be called *standards conversion*.
- Color information representation, which determines how color information is conveyed. Color formats are divided into twu basic categories: Component (primarily for production) and composite (traditionally for conventional TV broadcasting).
- Aspect ratio, which describes how the picture fits into a screen of a particular proportion.
- Signal levels, which determine how a receiver will interpret a video waveform in the voltage domain. In the digital domain, it is necessary to standardize the relationship between analog voltages and the digital codes they signify.
- Format, which is an agreed way of packaging the picture information for transmission or recording.

Historically, the most significant boundary in the TV world was the one hetween different frame rates. At the dawn of hlack-and-white television, it was reasonable to link the field repetition rate with the frequency of the ac power line. This prevented slow scroll of the horizontal hum bar on the received picture. When the color era began, this link became irrelevant. The only justifiable reason for preserving the relationship was to reduce the visibility of unpleasant low-frequency beating between studio lighting and the video camera field rate. Unfortunately, the economic necessity for backward compatibility didn't permit significant changes to field and frame rates.



When it comes to competing broadcast standards, technical discussions often are lively. Such was the case during the IBC show on virtually any paper or panel devoted to DTV and/or DVB.

There are a number of organizations responsible for standardization at global, regional, and national levels. In the broadcast TV field, one of the most prominent is the former CCIR. CCIR was a branch of the International Telecommunication Union (ITU), which is part of the United Nations Organization. In 1993, the CCIR was renamed as ITU-R (the Radiocommunication Sector of the ITU). Television is a main topic for ITU-R Study Group 11. The crucial documents issued by ITU-R are Recommendations and Reports. They contain explicit information, but in reasonably general form, often leaving room for different variants in practical implementation.

Digital TV system model

One key milestone in the development of digital television was the ITU's adoption of a series of Recommendations (standards) defining a *digital terrestrial television broadcasting* (DTTB) system. The set of Recommendations and associated descriptive Reports represented a four-year effort by ITU Task Group 11/3. The Task Group began with the premise that it should establish an infrastructure that enabled a communication environment in which a continuum of television and other data services could be brought to the consumer via wire, recorded media, and through the air. Terrestrial broadcasting presents the most challenging set of constraints of all media forms. Therefore, a system that works well in the terrestrial broadcasting environment should suffice for other media. The first step in harmonizing the delivery of these services was the development of a suitable service model.

The Task Group work was based in many ways on the work of and the philosophy behind the MPEG-2 standard. The MPEG-2 document provides a set of tools that can be used to describe a system. The set of Recommendations developed by Task Group 11/3 defined a constrained set of tools that can be used to provide a DTTB service. This set of tools provides for a single, low-cost decoder that can deliver ATSC- and DVB-coded images and sound.

Task Group 11/3 established a harmonized subset of MPEG-2 allowing for a single decoder that can translate the service multiplex and transport layer, and decode the audio and video compression and coding layers for any system that conforms to the DTTB set of Recommendations.

The set of harmonized Recommendations fully meets the request of the World Broadcasting Union for unique global broadcasting systems leading to single universal consumer appliances.

Measurable progress

There has been tremendous progress in the standardization of digital television. The international HDTV scene has evolved into a range of tool sets that can be applied to a variety of requirements. The accomplishments of the SMPTE in the area of production-oriented issues is considerable. Since the ATSC DTV standard was approved by the FCC two years ago, SMPTE standardization committees have made enormous progress in developing documents relating to the production and interchange aspects of digital television.

This process will certainly continue as the broadcast, post-production, and business/industrial sectors move forward into the digital era. The lessons of the past tell us that open standards are ones that will stand the test of time.

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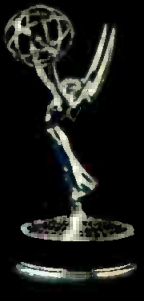

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can meet the particular requirements or priorities of each country, as well as other non-technical (but critical) factors, such as geographical, economical, and political connections with surrounding countries and regions. Each country needs to clearly establish its needs, then investigate the available information on the performances of different systems to make the best choice."

There is considerable hope at this juncture that the problems identified by Sinclair in its real-world tests will be solved by better receiver designs. Indeed, as the tests were being conducted, several companies reported new improvements in their second-generation receiver chip sets that would essentially eliminate the indoor reception problems that were demonstrated in Baltimore.

With this situation as a backdrop, it is appropriate to step back and examine the long road to HDTV standardization on an international scale, a saga that will likely continue to evolve for several years.

HDTV production technology was seen from the beginning as an opportunity to simplify program exchange. The concept of a single production standard that could serve all regions of the world and have application in the film community would provide benefits to broadcasting organizations and program producers. All participants stated a preference for a single worldwide standard for HDTV studio production and international program exchange.

The work conducted in the field of studio standards showed that the task of creating a recommendation for HDTV studio production and international program exchange was made more difficult by the diversity of objectives foreseen for HDTV in different parts of the world. There were differences in approach in terms of technology, support systems, and compatibility. It became clear that, for some, the use of HDTV for production of motion pictures and their distribution via satellites was the most immediate need. For others, there was a greater emphasis on satellite broadcasting, with a diversity of opinion on the scale of time for service introduction and the frequency bands to be used. For still others, the dominant consideration was terrestrial broadcasting services.

The proposal for a draft recommendation for an HDTV studio standard based on a 60Hz field rate was submitted to the CCIR in 1985 and the follow-up proposal for a draft recommendation for an HDTV studio standard based on a 50Hz field rate was submitted in 1987. Unfortunately, neither draft brought a consensus within the CCIR as a single worldwide standard. However, both had sufficient support for practical use in specific areas to encourage manufacturers to produce equipment.

Despite the lack of an agreement on HDTV, a lot of progress was made in the area of an HDTV source standard. The specific parameters agreed upon included a picture aspect ratio of 16:9, color rendition, and an equation for luminance.

IBC sessions this year focused almost exclusively on the implementation of digital television.

Thus, for the first time in television's history, all countries of the world agreed on the technical definition of a basic tristimulus color system for display devices. Also agreed upon, in principle, were the digital HDTV bit-rate values for the studio interface signal, which was important in determining both the interface for HDTV transmission and the use of digital recording. All of these agreements culminated in Recommendation 709, adopted by the XVII Plenary Assembly of the CCIR in 1990 in Dusseldorf, Germany.

Digital systems emerge

By mid-1991, reports showed that bit-rate reduction schemes on the order of 60:1 could be applied successfully to HDTV source images. The results imply that HDTV-image sequences could be transmitted in a relatively narrowband channel in the range of 15Mbits/s to 25Mbits/s. Using standard, proven modulation technologies, it would be possible to transmit an HDTV program within the existing 6MHz, 7MHz, and/or 8MHz channel bandwidths provided for in the existing VHF- and UHF-TV bands.

One outgrowth of this development was the initiation of studies into how, if at all, the existing divergent broadcasting systems could be included under a single unifying cover. Thus the HDTV-6-7-8 program was born. HDTV-6-7-8 was based on the following set of assumptions:

- First, the differences between the bandwidths of the 6MHz, 7MHz, and 8MHz channels might give rise to the development of three separate HDTV scenarios that would fully utilize the bandwidth of the assigned channels. It was assumed that the 6MHz implementation would have the potential to provide pictures of sufficiently high quality to satisfy viewers' wishes for a "new viewing experience." The addition of a 1MHz or 2MHz increment in the bandwidth, therefore, would not be critical for further improvement for domestic reception. On this basis, there was a possibility of adopting, as a core system, a single 6MHz scheme to provide a minimum service consisting of video, two multichannel sound services, and appropriate support data channels for conditional access, and, where appropriate, closed captioning, program identification, and other user-oriented services.
- Second, given the previous assumption, the 1MHz or 2MHz channel bandwidth that could be saved in several countries might be used for transmission of a variety of additional information services, either within a 7MHz or 8MHz composite digital signal or on new carriers in the band above the HDTV-6 signal. Such additional information might include narrowband TV signals that provide for an HDTV stereoscopic service, enhanced TV services, multiprogram TV broadcasting, additional sound services, and/or additional data services.
- Third, it would be practical to combine audio and video signals, additional information (data), and new control/test signals into a single HDTV-6-7-8 signal, in order to avoid using a secondary audio transmitter. In combination with an appropriate header/descriptor protocol and appropriate signal processing, the number of frequency channels could be increased, and protection ratio requirements would be reduced. This could lead to a review of frequency plans at the national and international levels for terrestrial TV transmission networks and cable television. This scheme could go a long ways toward meeting the growing demand for frequency assignments.

This digital TV system offered the prospect of considerably improved sound and image quality, while appreciably improving spectrum utilization (as compared to the current analog services). It was theorized that one way of exploiting these pos-

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Standards: Where do we go From Here?

The '99 IBC Convention provided a fascinating glimpse of the state of DTV standards.

Jerry Whitaker, *editorial consultant*

The IBC Convention, held in Amsterdam, Netherlands on September 10-14, provided the opportunity to assess how far the video industry has come in its efforts to harmonize divergent interests through the standardization process.

It was described as "The Baltimore Tea Party," the ongoing battle over the suggestion by Sinclair Broadcasting that the modulation system chosen by the Advanced Television Systems Committee (ATSC) should be re-evaluated. Sinclair raised the subject at NAB in April and promised field trials (in Baltimore) designed to evaluate the performance of the 8-VSB system under multipath conditions typically experienced by viewers in urban areas. The issue here is a significant one, to be sure. No one in the technical community could seriously criticize Sinclair for being concerned about the performance of the ATSC system with first-generation receivers. It was the timing, however, that caused many in the technical community to cry foul.

Raising such a fundamental question now, with nearly a hundred stations already on-the-air and after receivers are in the hands of consumers (admittedly, a very small number of receivers), was roundly criticized. Still, Sinclair continued its campaign and held tests during the summer to demonstrate the weakness of 8-VSB in an urban-receiving environment, and the relative strength of the COFDM system used by the European DVB system. Most everybody agrees that the DTV system, as approved by the FCC, performs quite well in rural areas that are not subject to multipath reflections, which are commonly experienced in urban centers because of high-rise building and other obstructions. Most everybody also agrees that urban reception of ATSC DTV is good with an external (rooftop) antenna. Of course, few consumers still have antennas on their roofs — indeed many are prohibited from doing so because of housing restrictions. Therein lies the rub.

So, fast forward to IBC '99. IBC has become the favorite forum for European vs. Japanese/United States jousting over which TV system is better. Not just DTV, but HDTV (NHK's 1125/60 system) before it, and even color television before that. A decade ago, the battle lines were drawn between the European Eureka 95 project and the Japanese/U.S. HDTV efforts. Although considerable progress has been made to bring the camps together, it was clear from several of the technical sessions at IBC that the battle continues, albeit on a less combative stance, publicly at least. It was into this techno-political brew that the Sinclair proposal was added.

Supporters of the European DVB standard were thrilled at the dissention among the American ranks. Supporters of the ATSC standard were, of course, aghast. The Sinclair presence in the various technical sessions at the show was clear and vocal — its right, certainly. Were any minds changed? Probably not. Did it make for interesting sessions? Yes, without question.

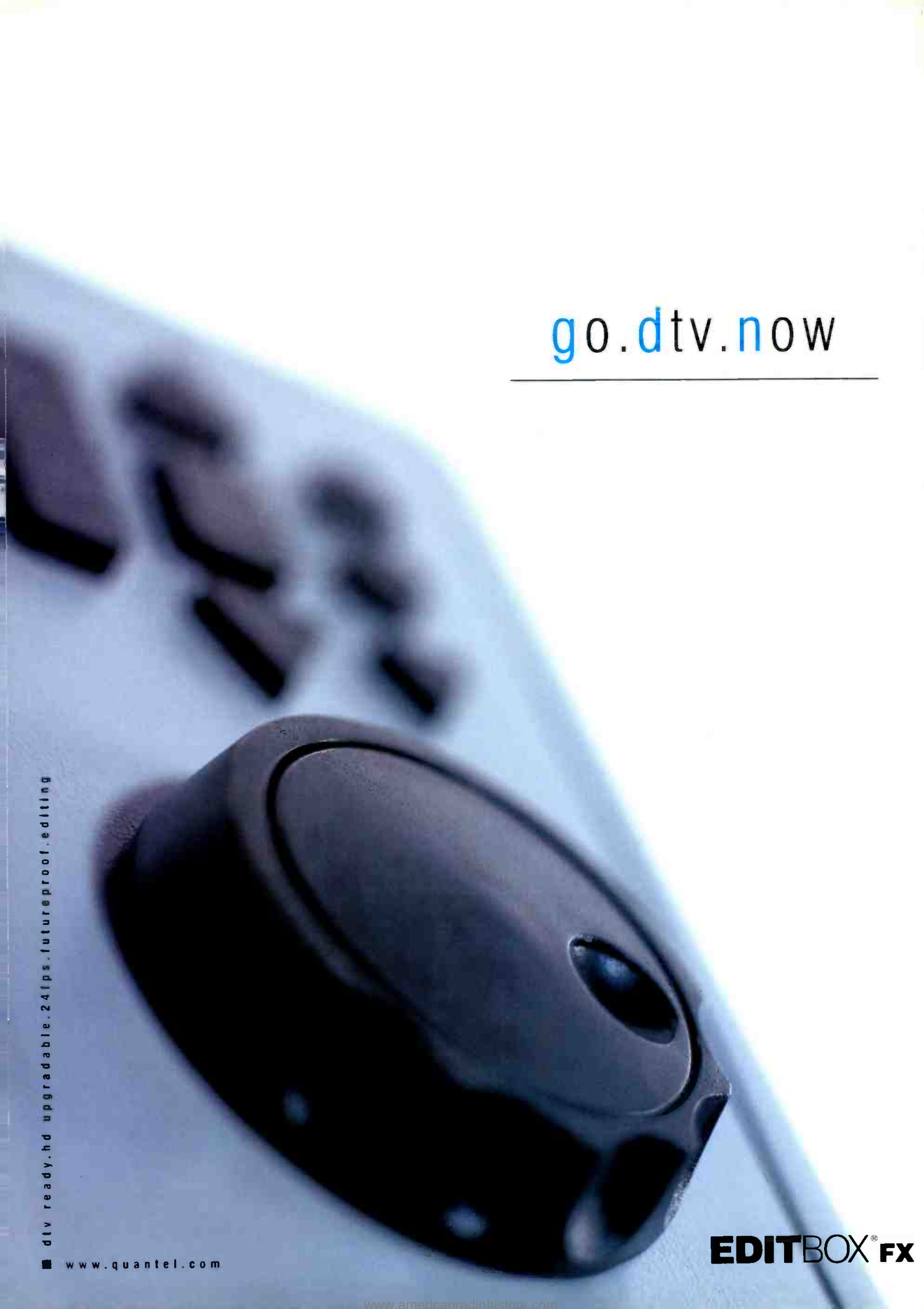
Well before IBC, the ATSC made its position on the Sinclair tests crystal clear, calling the effort "unwarranted and irresponsible." The statement continues, "It is unwarranted because a growing body of evidence supports the performance of the VSB transmission system, and there is no clear evidence that COFDM is better. It is irresponsible because it seriously understates the impact of a change." The position statement concludes that, "Any decision to revisit the transmission standard would cause years of delay."

The ITU also found itself being drawn into the modulation wars of Summer 1999. A report issued by an ITU Radiocommunication Study Group presented an objective, scientifically valid comparison of the modulation schemes under a variety of conditions. The report, *Guide for the Use of Digital Television Terrestrial Broadcasting Systems Based on Performance Comparison of ATSC 8-VSB and DVB-T COFDM Transmission Systems*, provided considerable detail of the relative merits of each system. The COFDM and 8-VSB camps use the report to support their positions.

In essence, the report concludes that each system was found to have unique advantages and disadvantages.

The ITU report concludes, "DTV implementation is still in its early stage. The first few generations of receivers might not function as well as anticipated. However, with the technical advances, both systems will accomplish performance improvements and provide a much improved TV service.

"The final choice of a DTV modulation system is based on how well the two systems



Lucasfilm Ltd. is moving into 24-frame production to supplement and, in some cases, replace film in major motion-picture releases. (*Courtesy of Lucasfilm Ltd.*)

Last year, the station used HD camcorders to shoot an HDTV segment for its popular travel magazine, *Bay Area Backroads*.

New HD center at Staples Arena

To capitalize on the benefits of covering sporting events in high-definition, Staples Arena in Los Angeles has undertaken a major HD build-up. Scheduled for completion this month, the facility will feature live-production and post-production capabilities, as well as 24-bit, 5.1 surround sound digital audio. The project will give Staples the ability to produce 226 live events already scheduled for the year 2000, including professional basketball and live entertainment in high-definition and standard-definition simultaneously. Staples Arena hosts a number of leading professional sports organizations, including the Los Angeles Lakers, Los Angeles Clippers, and Los Angeles Kings.

Equipment for the project includes a Sony HDS-7100 high-definition production switcher, HDME-7000 digital multi-effects, HDM series high-definition monitors, HDC-700A, and HDC-750A high-definition studio cameras, and HKPF series of conversion and distribution equipment for HD production. The SDTV edit suite consists of a DVS-7350 digital production switcher, DME-7000 digital multi-effects, and a BE-9100 edit controller. The audio mixing room, featuring the Sony OXF-R3 Oxford digital console, is key to the project.

The force of HD

Lucasfilm Ltd. has launched a collaborative project with Panavision and Sony to bring high-definition imaging into the realm of major motion-picture production. The Lucas companies pioneered digital technology in movie post production, most notably in the *Star Wars* series. The recent advent of cost-effective HD products spurred a new interest within Lucasfilm for use of digital electronic cinematography as an alternative to motion-picture film.

Driven by a desire to control escalating costs of producing major movies and to extend creative flexibilities to the shooting stage, Lucasfilm has, since 1996, explored the possibilities of developing a 24-frame progressive scan digital HD production system. The 24-frame electronic cinematography project is now in full swing. The first prototype camcorders are being delivered to Lucasfilm this Fall for testing with the Panavision lenses.

In 1998, Lucasfilm instituted a series of extensive tests to explore lens criteria for an HD motion-picture camera, and to evaluate total system performance from the original electronic shoot to the final transfer to 35mm film. A series of scenes for *Star Wars:* Episode I *The Phantom Menace* were shot on stage in London with Sony's HDC-750 high-definition camera (in the 1920x1035/60i format). Digital recordings were made on the HDCAM format and the baseband HDD-1000 VTR. Evaluations were subsequently made of both recording formats transferred to 35mm film. Some scenes were then incorporated into the movie, constituting a real-world test of the technology, as well as creating a prelude to the planned use of the 24-frame progressive HD system in shooting *Star Wars:* Episode II, which begins in Spring 2000.

Success story

Viewed now, from the vantage point of nearly one year's experience with DTV, the rollout from the professional video industry of HD programs to on-air digital transmitters is impressive. In fact, it exceeds most, if not all, predictions for HD program availability to consumers. Next, as receivers make their way from factories to showrooms and, finally, to living rooms, the real benefits of high-definition programming will be realized. At that point, the transition from conventional television to decidedly unconventional high-definition imaging will likely become a stampede.

broadcast in 720p, ABC's selected HDTV format. The HD telecasts are produced and transmitted independent of *MNF* on the traditional analog network.

The production truck was used for a rehearsal exercise during the last preseason *MNF* game in Oakland, California, on August 30, and then it traveled to Denver for the first of 17 live broadcasts of *MNF* games, one wild card playoff game on January 8, 2000, and Super Bowl XXXIV on January 30, 2000.

The production truck's 720p HDTV broadcast system is equipped with a wide variety of HDTV products, including:

- Four AQ-7200P 720p full-featured studio cameras and three AQ-720P handheld cameras — used for acquisition of the game.
- Four AJ-HD2700 1080i/720p D-5 HD VTRs — used for recording, slow-motion replays, as well as playback of prerecorded elements.
- Four AJ-HDP510 720p HDTV processors — allowed the truck's Pluto HyperSpace HD digital disk recorder to record the 720p signal for use in slow-motion replays.
- AJ-UFC1800 Universal Format Converters — made it possible to convert TV signals between video formats recognized under the U.S. ATSC-DTV standard.
- Two PT-42P1 42-in. gas plasma displays — the centerpiece of the truck's main monitor wall (the first HD flat-panel monitor wall ever assembled in a mobile production) and a third 42-in. plasma display is utilized in the announcers' booth.
- Two WR-DA7V digital audio mixers — linked together in the truck's audio suite to mix up to 64 inputs of 5.1 channel surround sound.
- More than 40 BT-S915DA 9-in. monitors, capable of either 4:3 or 16:9 display — used throughout the video and audio departments in the truck.

The *MNF* programs have played to good reviews from both the technical community and viewers. ABC stations broadcasting the *MNF* games in HDTV include WCPO (Cincinnati), KABC (Los Angeles), WCVB (Boston), KATU (Portland, OR), WEWS (Cleveland), KGO (San Francisco), WFAA (Dallas), KGTV (San Diego), WKOW, (Madison, WI), KITV (Honolulu), WMUR (Manchester, NH), KMGH (Denver), WPLG (Miami), KOMO (Seattle), WPVI (Philadelphia), KXLY (Spokane, WA), WRTV (Indianapolis), KTRK (Houston), WSB (Atlanta), WSOC (Charlotte, NC), WTAE (Pittsburgh), WTNH (New Haven, CT), WTVD (Raleigh/Durham, NC), and WXYZ (Detroit).

CBS Television City build-up

CBS Hollywood is using five new Hitachi HD SK-3000P high-definition cameras to launch high-definition production at its Television City facility. The cameras initially will be installed on Stage 36 but will be moved to other stages as productions require. CBS Television City serves as the production facility for such programs as *The Young and the Restless*, *The Bold and the Beautiful*, *Politically Incorrect with Bill Maher*, *Dennis Miller Live*, *The Price is Right*, *Hollywood Squares*, *The Late Late Show with Craig Kilborn*, and *Family Feud*.

For the current season, CBS is offering an extensive lineup of HD programming for DTV-capable-owned stations and affiliates. The CBS Fall HDTV lineup includes *Touched by an Angel* on Sundays; *King of Queens*, *Everybody Loves Raymond*, *and Becker* on Mondays; *JAG* and *Judging Amy* on Tuesdays; *Work With Me* on Wednesdays; *Diagnosis Murder*, and *Chicago Hope* on Thursdays; *Love or Money* and *Nash Bridges* on Fridays; and *Early Edition* and *Martial Law* on Saturdays.

In addition, five movies have been presented in HD on CBS so far this season.

KTLA Dodgers baseball in HD

Continuing its tradition of technological firsts, KTLA television has launched the broadcast of Los Angeles Dodgers baseball games in high-definition on KTLA-DT (Channel 31). The games were the first broadcasts of a local sports event originated by a Los Angeles TV station. The Dodgers faced the New York Mets in HDTV from Dodger Stadium on Friday and Saturday, September 10 and 11.

KTLA was the first station in Los Angeles to sign on its digital Channel 31 with the historic broadcast of John Glenn's Shuttle launch in October 1998. On January 1, KTLA's HDTV cameras captured the vibrant colors, panoramic scenery, and digital sound of its signature broadcast event, the Tournament of Roses Parade.

For the Dodgers broadcasts, KTLA utilized state-of-the-art digital equipment, including National Mobile Television's digital HD mobile unit and Sony's HDC-700 and HDC-750 cameras. The games were simulcast in HDTV and NTSC. KTLA uses the 1080-line interlace format.

KTLA was the first commercial TV station in Los Angeles when it signed on the air in 1947. Since that milestone 52 years ago, the history of KTLA has become the history of Los Angeles broadcasting. The station has enjoyed a long list of technological firsts, including pioneering work in the field of remote broadcasting and stereo/multilanguage programming. KTLA (Channel 5) is the WB affiliate in Los Angeles and a Tribune Broadcasting station.

Tall Ships arrive in style

The arrival of the Tall Ships to San Francisco Bay marked the 150th anniversary of the California Gold Rush, and San Francisco station KRON-TV captured the once-in-a-lifetime event with HD camcorders. Photographer David Koehn was aboard one of the vessels as it sailed under the Golden Gate Bridge while another crew shot the arrival from several different locations on land. According to KRON director of operations and HDTV coordinator Larry Shenosky, "The results were stunning, despite the wide range of lighting conditions and the challenge of handheld shooting aboard a ship."

San Francisco station KRON used high-definition cameras to capture the once-in-a-lifetime arrival of the Tall Ships into San Francisco Bay. (*Courtesy of Sony.*)

HDTV: moving into High Gear

Jerry Whitaker, *editorial consultant*

The Space Shuttle Columbia swoops out of the darkness onto runway 33 at the Shuttle Landing Facility in Florida. The landing was only the 12th night landing in Shuttle program history. *(Courtesy of NASA.)*

Liftoff of Space Shuttle Columbia occurred at 12:31 a.m. (EDT) on July 22. The primary objective of the five-day mission was the release of the Chandra X-ray Observatory. *(Courtesy of NASA.)*

If you have any doubts about the interest in network-delivered HDTV, look no further than the Big Three's Fall lineups. Led by CBS, the network's high-definition programs are considerable. Highlights include HD offerings each night in the forms of episodic shows and big-screen releases. For ABC, considerable attention is being paid to *Monday Night Football* in HD, capitalizing on what many believe to be the ultimate calling of improved imaging, sports programming. At NBC, the *Tonight Show with Jay Leno* continues to blaze trails in live-entertainment programming.

The rapid launch of HD-based production speaks volumes to the behind-the-scenes efforts at all networks, which have been underway for months, and even years. As the number of DTV stations on the air increases, the next milestone in the aggressive DTV rollout that was mandated by the FCC belongs to the consumer electronics industry. Broadcasters and program producers have answered half of the *chick-and-egg* question of DTV. It is now up to receiver manufacturers to provide improved, lower-cost sets to consumers. How soon this will happen is the only question. From the standpoint of the professional video industry, it can't happen quickly enough.

NASA studies use of HD

In another first for the U.S. space program, the summer flight of the Space Shuttle Columbia (STS-93) included trial use of high-definition imaging on the mission. Using the Sony HDW-700A, NASA is studying the potential applications for HD imaging in a number of areas. The value of HD imaging was, in fact, demonstrated clearly during the launch of the John Glenn Shuttle flight last year. Cameras covering the event for live HD broadcasts captured the loss of a parachute deployment door upon liftoff. Among the high-resolution footage taken on Shuttle mission STS-93 was the deployment of the Chandra X-ray Observatory.

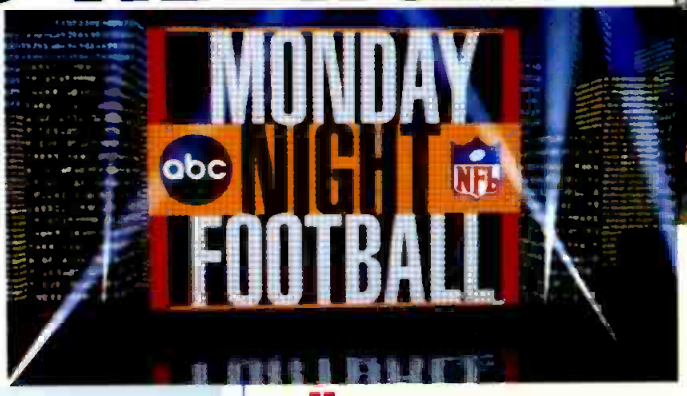
The NASA effort is designed to produce side-by-side simultaneous comparisons of HDTV and NTSC formats during Shuttle missions from which NASA can make post-mission color and clarity assessments and to provide NASA with HDTV source material for broadcast distribution that meets FCC DTV standards.

STS-93 was the 26th mission of the Space Shuttle Columbia and the 95th Space Shuttle mission. The miss on lasted five days. The HDW-700A camcorder is scheduled for additional research in a number of future Space Shuttle missions, which could include recording and documenting the building of the International Space Station.

MNF on the air in HD

ABC's ambitious effort to bring its premier sports program, *Monday Night Football*, to viewers in HDTV is now off the ground and on the air. The 58-ft. truck intended to carry out that assignment, built by Synergistic Technologies (STI) and Panasonic, is now on the road. Following the announcement earlier this year that ABC and Panasonic would team up to broadcast the 1999/2000 season of ABC's *NFL Monday Night Football* (*MNF*) and Super Bowl XXXIV live in HD, work began on the truck. It was completed just 129 days later. The 1999/2000 season of *MNF* is the first live, regularly scheduled HDTV sporting event in primetime, and is being

The HD Train Rolls On



Producing for HDTV
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Having just returned from the IBC show in Amsterdam, Netherlands, it is clear that the pace of development on digital video equipment continues to accelerate. Work on high-definition products, likewise, continues to enjoy rapid development and deployment. As products make their way from concept to field use, the lessons learned by the early adopters are translated into practical product improvements and valuable peer advice on how to make the best use of these new technologies.

There were a number of excellent technical sessions and several production-oriented sessions and workshops at the IBC show that discussed new tools of high-quality electronic imaging. Beyond the more obvious issues of widescreen shooting are important production considerations, including:

- Composing scenes for various aspect ratios. This issue is far more complex than it might seem. With the multitude of potential media outlets — from standard- and high-definition television to streaming video via the Internet — scene composition is critical to gaining maximum use out of each frame shot.
- Image storage and retrieval. Within the past few years, the number of options for storing video have grown. From conventional videotape to distributed servers, the choices are numerous, dictated by the particular requirements of a given application.
- Image processing. The options for manipulating captured images are truly staggering. With each major trade show, new ways of improving and modifying video are unveiled. Progress in this area has continued, essentially unabated, for nearly a decade now. And there's no end in sight.

So it was another successful outing for the major European video community at IBC '99. Without doubt, the pace of digital video development is continuing to gain speed, and all of us are the benefactors of this progress.

In this issue of *Producing for HDTV* special supplement, we examine:

HDTV: Moving Into High Gear — The Fall season is here, and HDTV has moved squarely into primetime.

Standards: Where Do We Go From Here? — The IBC Convention provided a fascinating glimpse of the state of DTV standards.

HDTV New Products

As always, your comments are welcomed. Additional background information on HDTV can be found at *www.technicalpress.com*.

Jerry C. Whitaker
Editorial consultant

On the Cover: High-profile events have captured the interest and imagination of TV producers nationwide. The scenes on the cover are from the San Francisco Chinese New Year celebration earlier this year, covered in HDTV by KTVU, Oakland, California. The production, using the National Mobile Television HD-2 truck, fed three separate TV outlets in the Bay Area. *(Photos courtesy of Sony.)*

In this issue...

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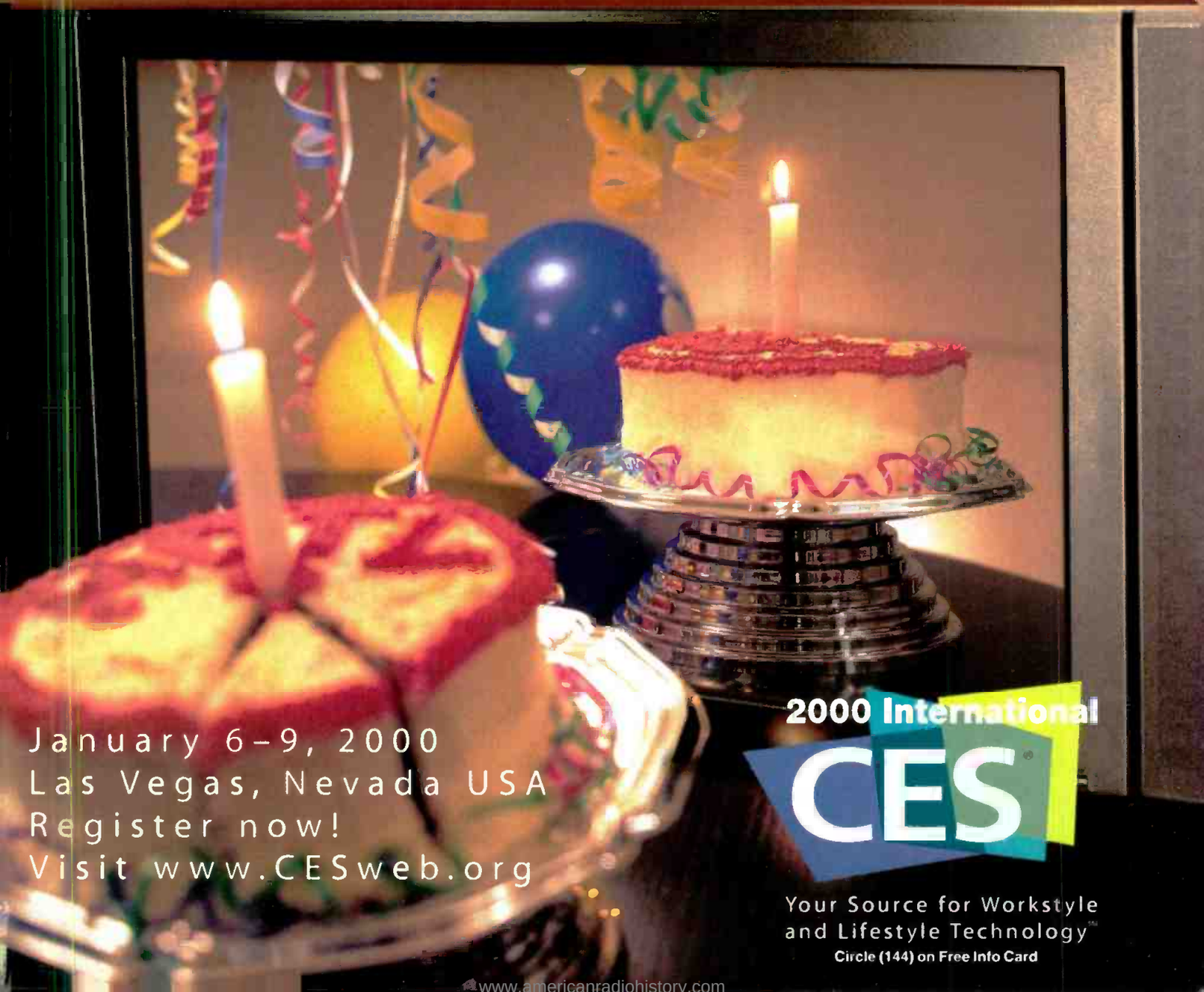

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Video servers

BY JIM BOSTON

Video servers and DTV are a lot alike. Both terms mean different things to different people. Does DTV mean high definition or multichannel standard definition? The same applies to video servers. Some servers use their available bandwidth to serve a single HD record/playback channel, while most divide that bandwidth to simultaneously serve multiple I/O channels. Some claim DTV will speed the eventual pervasiveness of video servers in place of tape-based systems. In simplest terms, video servers can be thought of as digital disk recorders that mimic the operation of the VTRs they replace. This is the most basic application of the video server. But many devices in a television facility today operate as part of a larger system. Video servers are leading that trend. Servers allow new flexibility and power to be brought to bear to increase the efficiency of your facility.

Implementing a system of servers usually requires additional infrastructure throughout the facility and improvements to operating procedure in today's TV facility.

Servers are brought together to produce replacements of VTR-based spot/program playback systems, time shifting systems and complete news acquisition, editing and play-to-air systems. Off-the-shelf RS-232/422 edit controllers can control some servers. Their use in newsrooms points to another source of confusion when describing video servers. Editors used in the newsroom system might have the same attributes of a video server, but are often referred to as nonlinear editors because they have different functionality than a server. Most disk-based storage systems are generically referred to as servers, except when they perform editing duties.

Some servers saddled with editing chores have integrated effects capability that allows a stand-alone server to act as a VTR, switcher and DVE/DME. Implementing a system of servers usually requires additional infrastructure throughout the facility and improvements to operating procedure in today's TV facility. A router is usually required by a server's system controller to move content from one part of the system to another.

The overall bit rate, or throughput, of a server determines the number of SD I/O channels or whether high definition can be accommodated. Because digital creates an explosion in the usage of bandwidth, compression is almost always employed. Compression stretches the available bandwidth to allow the use of additional I/O channels or the acceptance of high definition where the servers' internal bandwidth would not allow it. Servers with backplane speeds pushing a gigabit per second are now possible. The big bottleneck in server throughput comes from disk I/O. The number of bits coming through the I/O channels is a limiting factor in recording and recovering information from the disk. Common disk interfaces are IDE, SCSI, Fibre Channel, and now Firewire (P1394). Data rates of these interfaces can range from well under 10MB/s to over 50MB/s. IDE provides I/O at the low end, while Fibre Channel and Firewire provide I/O at the high end. SCSI is still the predominant interface with a throughput in the middle of the range. Multiple drives are necessary to provide the throughput rates of 10- to 50MB/s. Throughput is increased as drives are added — to a point. A point of diminishing returns is reached with more than four drives. To get around this limitation the drives are grouped using RAID techniques. In addition to the data protection ability of RAID, it also uses separate I/O for each drive, boosting disk throughput. Technology is also moving forward to solve the disk throughput problem by creating drives that will soon allow data I/O of more than 50MB/s.

RAID 3 and 5 are the techniques usually applied to video servers. RAID 3 stripes data across all disks in the group or array one byte at a time. There is a drive dedicated to storing ECC (parity). RAID 3 is good for applications that transfer large amounts of sequentially stored data such as video and audio. This method allows for higher data rates because the data transfer of each disk is available in parallel. RAID 5 stripes entire blocks of data across disks in an array. One block is stored on one disk; the next block is stored on the next disk. This arrangement is good for randomly distributed data such as might be found in a database. In RAID 5, access to individual data blocks is much quicker, but large data burst transfer rates are lower than RAID 3. The use of data striping used in RAID implementation is what allows for multiple I/O streams out of a single array, as data can be quickly read out and cached so reads for another stream can commence. Depending on data rates, which are dependent on compression ratios, a single RAID is generally able to support around four I/O channels. Some vendors are starting to RAID their RAIDs. This inner and outer protection scheme allows entire RAIDs to

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be lost, while the data they create is still accessible.

With over 20 vendors offering servers today, many are starting to realize that to survive in the marketplace they will need to make their systems as "bulletproof" as possible. Many now are offering systems that allow all parts to be replaced without having to derack the unit. While individual components can and will fail, the overall system cannot go down. With entry-level systems starting at $35,000 and easily exceeding $250,000, you must make sure that not only the system performs as needed but that it does not fail in ways that create career-limiting scenarios. ■

Jim Boston is a project engineer for Scripps Howard in Cincinnati.

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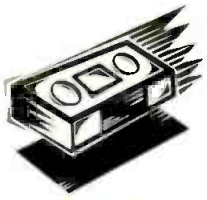
First Television Broadcast

1954

First Color Broadcast

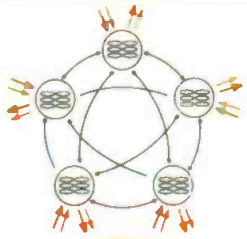


1956

Video Tape Introduced

1962

First Satellite Transmission



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Eight-channel DVCPRO server
PANASONIC AV-SS500

compact, eight-channel DVCPRO server that operates as a multichannel disk recorder/player; unit can record and play eight videostreams concurrently; each of the eight I/O channels has a conventional RS-422 control port and accepts or delivers SDI (SMPRE259 video); allows the creation of a multichannel hybrid tape/disk editing system.

800-528-8601; 323-436-3500; fax: 323-436-3660; www.panasonic.com/broadcast

Circle (364) on Free Info Card

Video routing switchers
NVISION INC ENVOY7256

frame occupies 18 rack units and can be populated from 16x16 up to 256x256; by adding additional frames it can be expanded to 1024x1024 without the need for DAS.

800-719-1900; 530-265-1000; fax: 530-265-1010; www.nvision1.com

Circle (365) on Free Info Card

Protocol analyzer
XYRATEX FIBRE CHANNEL INVESTIGATOR

includes full speed capture of up to 288Mb of on-board RAM, a protocol editor and "C" API for post capture analysis; features remote access via Internet, LAN, parallel port or serial port; the protocol editor allows the user to add vendor-unique protocol support.

+44 1705 486363; fax: +44 (0) 1705 453611; www.xyratex.com

Circle (366) on Free Info Card

On-line newsroom system
OMNIBUS GAMMA

suite of applications that allows broadcasters to provide access to current and archive media to users via an Internet connection.

801-975-9799; fax: 801-975-0970; www.omnibus.co.uk

Circle (368) on Free Info Card

Fiber optic system
TELECAST FIBER SYSTEMS VIPER II

accommodates up to 16 transmitter or receiver modules in a 3RU, 19-inch frame with several power options (12 VDC source, 48 VDC single or dual redundant supplies, 90-240 VAC, auto-sensing single or dual supplies, AC power with alarmed UPS).

508-754-4858; fax: 508-752-1520; www.telecast-fiber.com

Circle (369) on Free Info Card

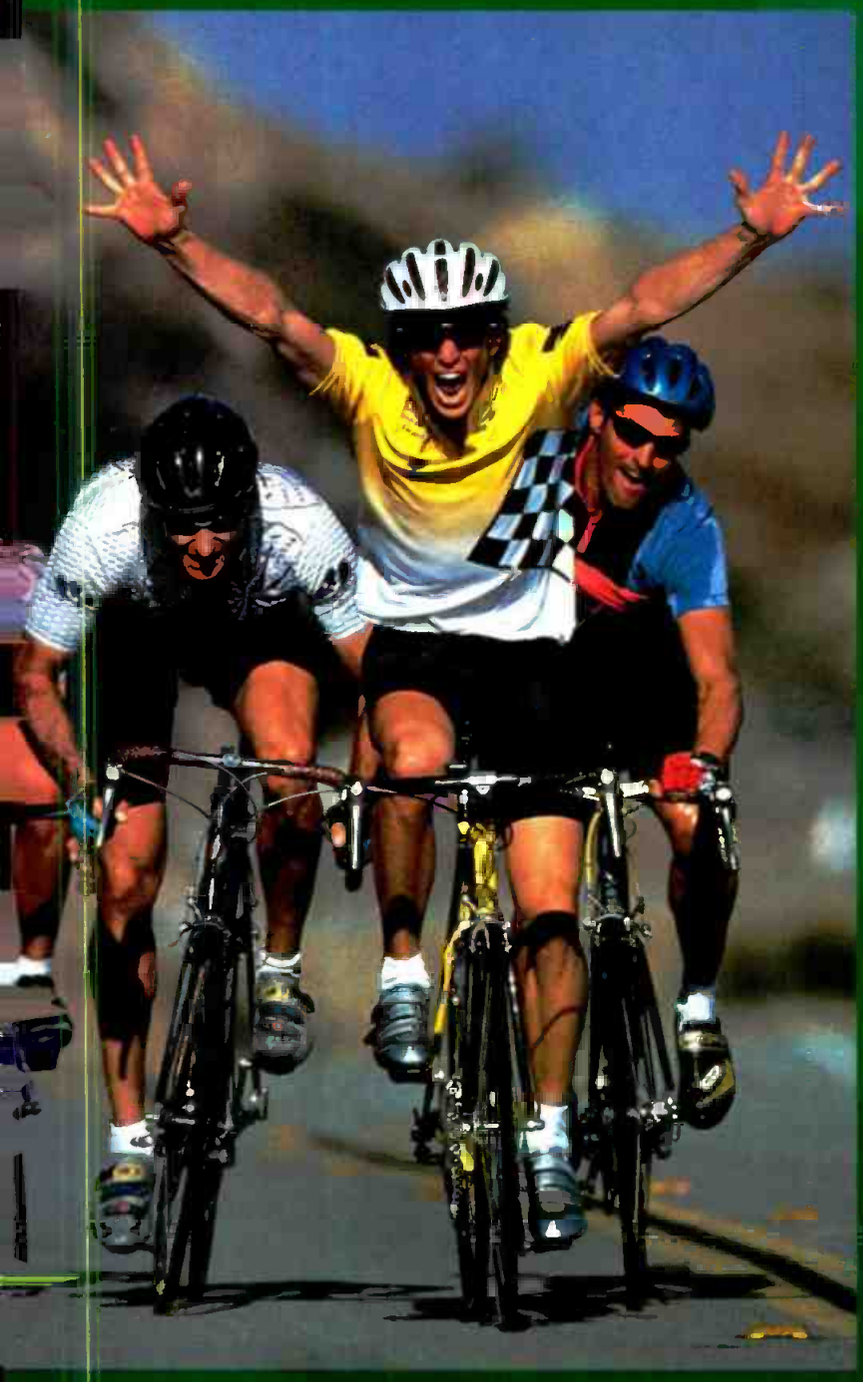
MPEG Streamer
HEWLETT-PACKARD MPEGSCROPE STREAMER

designed for continuous recording and playout of MPEG-2, DVC, ATSC and ISDB transport streams; applications include production test of digital TVs and set-top boxes and demonstration of digital TV products; also can be used as a standby source of digital TV signals in the studio environment.

800-452-4844; fax: 408-553-6248; www.hp.com/go/broadcast

Circle (370) on Free Info Card

Tour de force.



There is a new force in the world of digital electronic news gathering and live sports coverage. A highly mobile system that lets you cover all the action—even when you're on the move. Without the need to raise a 40-foot mast.

No more missed shots, no more competitors taking the only transmission spot. How? NDS has combined state-of-the-art encoding technology with its market leading COFDM modulation. The result is crystal clear images without the ghosting or multipath interference.

In conjunction with NDS Business Partners Adaptive Broadband™ and Wolf Coach,™ NDS' digital ENG has proven itself around the country, from Los Angeles to New York, Boston to Chicago.

Be first in the race for news and ratings with the NDS digital ENG—the system that captures stories on the move or in the heart of downtown. Call us, or visit one of our web sites today.

Compare the difference!
NDS digital ENG vs conventional ENG systems

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WORLD LEADER • WORLD VISION
www.ndsworld.com

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508.791.1950
www.wolfcoach.com

ADAPTIVE BROADBAND
978.671.5700
www.adaptivebroadband.com

Circle (152) on Free Info Card

HD upconverter
CHYRON DUAL CHANNEL HDTV UPCONVERTER

is the first two-channel HD upconverter that converts standard-definition digital signals in real time to 1080i or 1035i serial digital high-definition signals; is especially suited for use with the iNFiNiT! family of graphics generators; its dual channels can process video and key or two channels of video.

516-845-3871; fax: 516-845-3888; www.chyron.com
Circle (371) on Free Info Card

Digital routing system
CHYRON ECLIPSE

a large-scale digital routing system, offering HD and true field expansion in a package for digital video, ASI, SDH STM-1 and PDH E4 routing; each Eclipse router is made up of input and output frames providing 128 inputs and 128 dual outputs respectively.

516-845-3871; fax: 516-845-3888; www.chyron.com
Circle (372) on Free Info Card

Newsroom computing system
AVSTAR SYSTEMS MEDIA BROWSE 2.0

allows immediate and simultaneous accessibility of material to multiple users who can browse and edit footage while feeds are concurrently recorded; records video feeds directly to a central server, allowing the entire news team to browse and work with select video on the same workstations they use to script stories and manage rundowns; creations can be published as an EDL or an OMF file.

608-274-8686; fax: 608-273-5876; www.avstarnews.com
Circle (395) on Free Info Card

MPEG analysis tools
INTERRA SYNCHECK

a software application designed to view and measure the synchronization of video and audio data in MPEG bitstreams; is designed to measure the accuracy of lip sync in the compressed domain and helps MPEG developers and users of coding devices to test, fine tune and troubleshoot synchronization-related issues and problems.

408-573-1400; fax: 408-573-1430; www.interrainc.com
Circle (373) on Free Info Card

Proxy video browsing system
PHILIPS SURF

a proxy video browsing system that allows video residing on Media Pool servers to be located and reviewed from any computer on a facility's computer network; as video is loaded or modified on Media Pool, Surf automatically creates a low-resolution MPEG copy and storyboard that can be viewed using standard web browser technology.

800-962-4287; 801-977-1577fax: 801-972-0837;
www.broadcast.philips.com
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- Browsing of video and audio over your network and the Internet
- Fast retrieval, viewing, and trimming of clips, using a standard PC or Laptop
- Built-in asset management system for efficient operation
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So shed the weight of those obsolete solutions. Call 1-800-4PINNACLE or visit www.pinnaclesys.com and find out how Thunder can get your facility in shape, today. There is a better way.

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www.pinnaclesys.com

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Digital video broadcasting equipment
SKYSTREAM DBN-26 INTEGRATOR

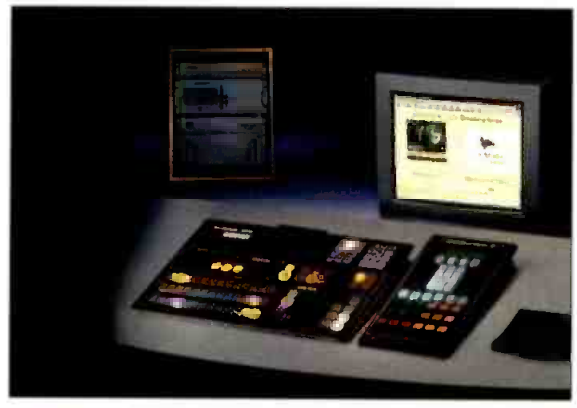
incorporates SkyStream's patent-pending Null Packet Optimization (NPO) technology; NPO feature allows broadcasters to insert Internet and web-cached data content into the null packets of a DVB transport broadcast stream at no bandwidth cost to the source video; can inject DVB-Simulcrypt CA scrambling into an incoming MPEG video/audio stream; DVB-Simulcrypt interface allows any third party CAS vendor to integrate their scrambling and subscriber management solution with any DVB-compliant encoder or multiplexer, making for a completely open broadcast networking solution.

650-390-8800; fax: 650-390-8990; www.skystream.com
Circle (375) on Free Info Card

Conditional access systems
PHILIPS CRYPTOWORKS

capabilities extended towards the protection of IP data offering the same performance and security as in the pay TV environment.

800-962-4287; 801-977-1577; fax: 801-972-0837;
www.broadcast.phillips.com
Circle (376) on Free Info Card



Integrated video production studio
ECHOLAB E-STUDIO

includes an ECHOlab 5000 digital video SuperSwitcher with integrated NT workstation; adds the ability to broadcast on the Internet with an integrated RealNetworks G2 server, audio and e-Studio software; its web viewer is enriched with video, audio, graphics and chat in an intuitive interface.

781-273-1512; fax: 781-273-3275; www.echolab.com
Circle (377) on Free Info Card

Feed browsing technology
AVS GRAPHICS MULTIBROWSE

a means of browsing audio and video feed in real-time from a desktop PC; allows up to 25 users to concurrently view four lines of both audio and video feed; as the media is viewed, selections of in and out can be made and a list of shots compiled.

801-975-9799; fax: 801-975-0970;
www.avsg.co.uk
Circle (378) on Free Info Card

ATM network interface
TIERNAN COMMUNICATIONS TATM8

ATM network interface, supporting up to eight MPEG-2 transport streams over ATM networks; can be configured and controlled by the front panel or through a network management system.

800-323-0252; 619-587-0252; fax: 619-587-0257;
www.tiernan.com
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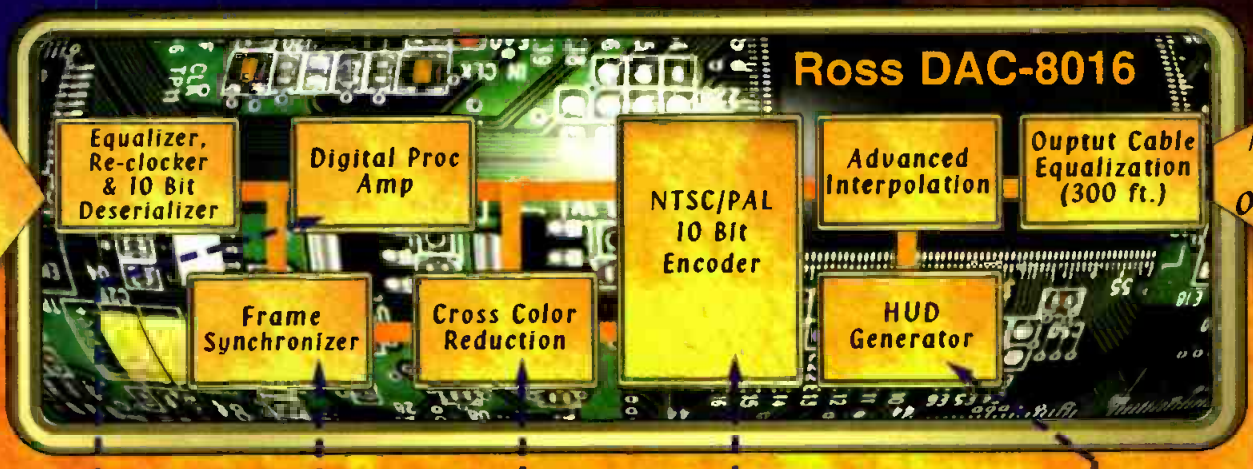

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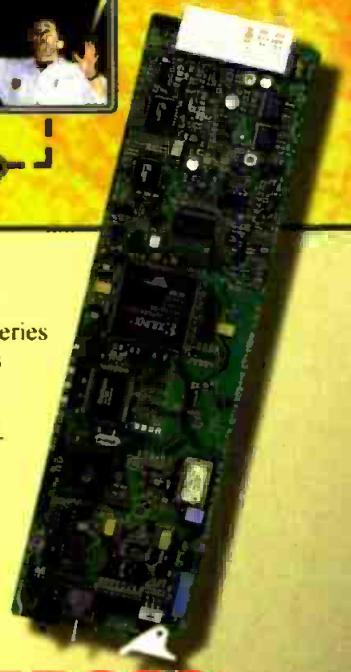

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Web browser control
TELESTREAM CLIPMAIL WEB BROWSER

web browser control for ClipMail video/audio deliver systems; ClipMail Pro and ProView systems are now available in a choice of configurations — the standard configuration that includes a touchscreen control panel and a newly available network configuration with web browser that extends product capability by allowing remote access and control of ClipMail while lowering ownership cost.

530-470-1300; fax: 530-470-1301; www.telestream.net
Circle (380) on Free Info Card

Speaker stations
CLEAR-COM SYSTEMS KB-211 AND KB-211GM

two-channel, full-duplex speaker stations, permitting the user to select between two channels of party-line communications with the ability to talk and/or listen on the selected channel; mountable in a standard U.S. 4-gang box; microprocessor-controlled stations feature visual and audible call signaling, balanced program input and standard or four-wire connection with optional daughter board.

510-496-6666; fax: 510-496-6699; www.clearcom.com
Circle (381) on Free Info Card

Encoder
DIVICOM MV45

includes ClearMotion integrated noise reduction; uses a number of advanced filtering techniques to reduce video noise and helps to prevent blurring effects caused by fast movements in video pictures.

877-348-4266; 408-490-6700; fax: 408-490-6999; www.divi.com
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As Advanced As The Equipment It Ties Together.

Now that you've made the decision to move up to new serial digital video equipment, you're ready for the advanced fiber optic transmission system that ties it all together. The Math Fiber Optics™ SDI Video Link is specially designed to enhance even the most demanding environment with new levels of reliability, flexibility and performance excellence. It's also designed to save you money, with single-mode and multimode versions that are compatible with any fiber optic cables you may already have in place.

SDI Video Link transmits your video signals—with or without embedded audio—with absolutely no signal degradation and is immune to electrical and environmental interference. Equalized cable input at the transmitter and two re-clocked outputs at the receiver virtually eliminate jitter and assure the highest performance. SDI Video Link supports SMPTE 259M, 294M and 305M standards at data rates up to 360 mb/s. It's easy to operate, requires no adjustments and is as affordable as it is advanced.

The best part is, it's engineered by the company you already depend on for award-wining video products like the Scan Do® family of scan converters. So step right up to the SDI fiber optic link system for reliable, high performance SDI transmission at extended distances.

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650-843-3665; fax: 650-843-3666; www.louth.com
Circle (383) on Free Info Card

News automation system
AVSTAR SYSTEMS NEWSROOM COMPUTER SYSTEM, VERSION 1.3
features an adaptive user interface technology that allows the system manager to configure workspaces and manage users configurations centrally; title entry tool that allows journalists to create character generator pages and preview them on the newsroom workstation.

608-274-8686; fax: 608-273-5876; www.avstarnews.com
Circle (384) on Free Info Card

Media network
AVID TECHNOLOGY UNITY MEDIANET 1.1
is a set of open networking and central storage technologies based on an advanced media file system that enables real time, concurrent sharing of high-bandwidth media; features Windows NT support that allows direct connection of all of Avid's professional editing applications.

800-949-AVID; 978-640-6789; fax: 978-851-0418; www.avid.com
Circle (385) on Free Info Card

3-D animation functions
AVID TECHNOLOGY SOFTIMAGE VERSION DS 3.0
features expanded 3-D integration, DVE and Tracker F-curve editing, effects tree and mix and match compositing.

800-949-AVID; 978-640-6789; fax: 978-851-0418; www.avid.com
Circle (386) on Free Info Card

Statistical re-multiplexer
IMEDIA CHERRYPICKER 7000
provides cable, terrestrial and satellite operators with upgradeable hardware for maximizing bandwidth capacity; can handle six DVB-ASI and two DHEI multichannel transport feeds and deliver up to 18:1 video service outputs in a single MPEG-2 video stream.

415-975-8000; fax: 415-975-8008; www.imedia.com
Circle (387) on Free Info Card

Video server
SONY MEDIACASTER
format-independent, allowing MHEG, HTML, JAVA and DVB-MHP applications as well as other datatypes to be incorporated into standard MPEG-2 transport streams; applications include delivery of interactive data services, electronic program guides and software downloads to consumer receivers.

800-635-SONY; 408-432-1600; fax: 408-955-5111; www.sony.com/professional
Circle (388) on Free Info Card

Now Shipping

Digital audio console
EUPHONIX SYSTEM 5
features an audio processing core; a large format console that offers a traditional-style user interface with 24-bit/96kHz digital audio and 5.1 surround sound processing.

818-766-1666; fax: 818-766-3401; www.euphonix.com
Circle (389) on Free Info Card

Software for DA7
PANASONIC MAX
allows the incorporation of a Macintosh computer into any recording environment using a Panasonic DA7 digital mixer; the complete MAX package includes two separate software pieces: the MAX software itself and a librarian program that enables storage/recall of the mixer's internal memories (including Channel, EQ, Dynamics and Scene libraries).

800-528-8601; 323-436-3500; fax: 323-436-3660; www.panasonic.com/broadcast
Circle (390) on Free Info Card

Video and audio converter
ENSEMBLE DESIGNS AVENUE SYSTEM
is a collaborative effort between Ensemble Designs and Graham-Patten; provides a full complement of conversion for video and audio, along with distribution amplifiers and synchronization; the 3RU mounting tray accommodates up to 10 modules and includes provisions for the sophisticated networkable remote control system

530-478-1830; fax: 530-478-1832; www.ensembledesigns.com
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Newscasters face a daunting set of technology choices as they approach the end of the century. Not only is there an ever-increasing need for production speed and quality, but the digital deadline looms large on the horizon. Avid NewsCutter® Effects is here now, and you can immediately reap the benefits of the first nonlinear Windows NT®-based editing system designed specifically for news. Because NewsCutter Effects provides instant random access to audio and video, the system is faster and easier to use than tape-based systems. And it's not just for editing! The Avid NewsCutter Effects system allows you to add special effects without tying up the control room or post-production suite. It's like getting two systems in one. Whether you need a standalone editing system, a DV-native workgroup system, or a complete client/server video production system, Avid has a fast, flexible news solution for your PC-based environment.

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Business Wire

Business highlights from broadcast and production

BY SANDRA FERGUSON, EDITORIAL ASSISTANT

Ron Rose Productions Ltd. recently completed a significant facility-wide upgrade, purchasing one AMS Neve Logic 2 audio console, upgrading all three of its Logic 1 consoles and upgrading nine of their stand-alone AudioFile editors.

KOMO-TV in Seattle recently purchased over $1 million of Omnibus Systems' station media and asset management and master control automation equipment.

Philips announced that KCOP-TV in Los Angeles acquired a seven-workstation EditStream networked news editing system.

Omneon Video Networks integrated its Video Area Network with the Associated Press' ENPS by adopting the MOS protocol. Drake Automation and Omneon announced a partnership agreement to integrate Omneon's networking and storage system with Drake's range of broadcast automation and transmission systems.

NBTel selected Leitch as its video routing and distribution supplier for the network's digital interactive TV service. Leitch made a five-year agreement with Hearst-Argyle, including being named as its principle supplier of SD digital interface products.

Vibrint and Avstar announced that the two companies completed integration of Vibrint's NewsEdit. Vibrint and the Broadcast Technology Group of the Associated Press announced completion of the first phase testing efforts to integrate Vibrint's NewsEdit and AP's Electronic News Production System. Vibrint's NewsEdit's next release will support file transfer media compatibility with the Grass Valley Group's PDR300 MPEG video server.

CNBC signed an agreement with Avstar to install its Newsroom Computer System at CNBC's 24-hour business news facility in London.

American Media Productions recently purchased three Hitachi Z-3000W digital, switchable portable cameras.

Complete Post in Hollywood is the first post house to place an order with Panasonic for six AJ-HD3000 D-5 HD mastering VTRs. WHO-TV in Des Moines converted its news editing to Panasonic's newsBYTE and DVEDIT nonlinear systems.

WNBC-TV in New York purchased a THOMCAST Ultimate Model solid state transmitter.

WBGU-TV in Bowling Green is now using Ikegami's HDK-79D HD camera. WNDU-TV in South Bend recently purchased four Ikegami HDK-790D studio/field cameras.

DirecTV purchased Tektronix's PQM300 Program of Quality of Service monitor.

USA Broadcasting installed Louth automation equipment in its new Ontario, CA, facility.

HDTV Productions recently purchased one Fujinon HA10x5.2 EVM/ERD and one HA20x7.5 EVM/ERD lens for its Sony HD camera.

SeaChange International announced that Europe's ASTRA is using its Broadcast MediaCluster video server system.

KXLT-TV in Rochester, MN, and WOFL-TV in Orlando purchased ParkerVision's PVTV Studio News.

Acrodyne announced that Sinclair Broadcast Group ordered four 5kW broadband UHF DTV transmitters and that Community Television Inc. signed a $350,000 contract for an Au60D, 60kW visual, 6kW aural power output UHF TV transmitter for WATC-TV 57 in Atlanta.

Turner Broadcasting ordered Wegener ENVOY encoders/modulators, UNITY4422 IRDs and Divicom digital video encoders.

Digital Projection announced that Imax Corporation purchased all of the outstanding shares of DPI, making Digital Projection a wholly owned subsidiary of Imax Corporation.

BBP Recording Studios recently expanded its West Los Angeles facility to include a new state-of-the-art post room featuring a Euphonix high performance mixing system.

Complete Sound in Los Angeles installed two Solid State Logic Avant digital consoles.

RT-SET's virtual studio technology was recognized by the Academy of Television Arts and Sciences with an Emmy nomination for CBS News/*Time* 100 "People of the Century: Leaders and Revolutionaries."

The PESA Tiger is quickly becoming the router of choice for studio and mobile broadcasting around the world. It's no wonder the competition is nervous!

The PESA Tiger size advantage is undeniable - a 144x144 video switcher requires only 12RU, while the audio switcher packs two channels of analog or AES audio into a scant 8RU. And there's plenty of muscle behind those good looks. Both Tiger switchers support mixed analog and digital matrices in the same frame.

The Tiger delivers absolutely unbeatable packaging, bullet-proof performance, and the flexibility to take on new challenges. It's a killer combination.

It's a jungle out there...and it's full of Tigers. Anything less is just lunch.

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25th Anniversary PESA Switching Systems, Inc.

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People

Tiernan Communications recently made the following appointments: Steve Bonica was appointed as chief executive officer and George Mancuso was appointed vice president of sales.


Steve Bonica


George Mancuso

Lifetime Studios named Neal Edwards as studio engineer.


Neal Edwards

Harris announced the appointment of Charles Sotto as television systems account manager.

Ikegami appointed John Chow as vice president of sales and marketing.


John Chow


David Strachan

Evertz appointed David Strachan as its director of sales.

Jerome Cohen was recently appointed as Vinten's director of product marketing.

Omneon Video Networks named John (Jay) A. Kidd as vice president of marketing. Dr. William I. Nowicki will now serve as the company's principal engineer for a new line of networking and storage products.


John (Jay) A. Kidd

SeaChange International made the following appointments: John Pittas is vice president of broadcast products. Craig Taylor is vice president of worldwide broadcast sales. ■

Screen Shot

NBC takes trial run at the IAAF Championships in Seville with Sony's video disk recorders

NBC used Sony's MAV-555 multichannel video disk recorders during its broadcast of the seventh edition of the IAAF World Championships in Athletics in Seville, Spain. NBC used two MAV-555 recorders in the mobile edit rooms, along with a BE-9100 editor, a DVS-2000 switcher, a DME-7000 effects, DVW-500 Digital Betacam VTRs and a host of Evergreen-series monitors. A third MAV-555 was used in the control room for live replay.

Sony's high-definition video cameras give Major League Baseball a new point of view

Baseball fans will be able to see higher-quality images from a variety of perspectives, including an umpire's point of view, when games from Yankee and Shea stadiums are broadcast by MSG Network and Fox Sports Net NY. Chicago-based Fletcher Inc. purchased and installed five Sony HD DXC-H10 color video cameras in these New York area stadiums for point-of-view image capture.

Two of the cameras are installed at Yankee Stadium and three at Shea Stadium. Currently, the cameras are used for isolated coverage of a particular player, instant replay shots, images of the New York metropolitan area and footage of home plate.

Clarification

Keeping the numbers straight.

Because of some confusion in the use of terms, the July article, "Transmission line for DTV," may have caused some readers to question their calculators. The differences between *peak-of-sync* power and *average* power were not consistent in the article. Let's re-examine the calculation of proper power rating for transmission lines.

Assume an ERP of 1750kW, antenna gain of 25, 800 feet of 6 1/8-inch line, with an efficiency of 80%. By dividing the numbers, the input power to the antenna becomes 70kW peak-of-sync. The transmitter, therefore, must output 87kW peak-of-sync to the line.

Peak NTSC power is therefore 152kW.

$$\text{NTSC Peak Power} = \left(\sqrt{\text{Peak-of-sync-power}} + \sqrt{10\% \times \text{Peak-of-sync-power}}\right)^2$$

Average NTSC power is based on a picture power level with black screen of 60% peak-of-sync power and an aural power level of 10% peak-of-sync power. NTSC average power equals 61kW.

NTSC average power is:

$$\text{NTSC Average Power} = (60\% \times \text{Peak Power}) + (10\% \times \text{Peak power})$$

Corrected equation: NTSC Average Power = (60% x peak-of-sync) + (10% x peak-of-sync)

The DTV calculations don't change and the DTV peak power in this example is 50kW. It's calculated by using a 7dB ratio between peak DTV power and average DTV power.

$$\text{DTV Peak Power} = 5 \times \text{DTV Average Power}$$

To calculate the peak power for the combined NTSC and DTV channels, add each channel's voltage units and square the sum. This results in peak power for the NTSC/DTV transmission of 376kW, which is well below the 6 1/8-inch maximum peak rating of 1500kW for this line.

$$\text{Combined Peak Power} = \left(\sqrt{\text{NTSC Peak Power}} + \sqrt{\text{DTV Peak Power}}\right)^2$$

Now, isn't that more clear?

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FINALLY! The cool thing about Magni's Serial Digital Monitor is how much it does for everyone across the whole technical range. In a word, this box is a no-brainer. Graphic designers and video operators find it a snap to check video and audio signal levels and gamut compliance. Video engineers use it for complete qualitative and quantitative signal measurement. And depending on the configuration you choose, the SDM delivers everything that's useful from simple status monitoring to complete quantitative measurements. **EASILY.**

It shows right now what you need to know to eliminate illegal color, weak signal or missing audio surprises. It monitors signal strength, gamut and EDH, jitter, audio levels, and ancillary data presence. It also decodes the signal into component and composite formats and can monitor all the key analog parameters. Its pop-up icons and bar graph displays show you any out-of-limit conditions. And it works where you work – right on your color picture monitor.

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Waste no time getting yours.

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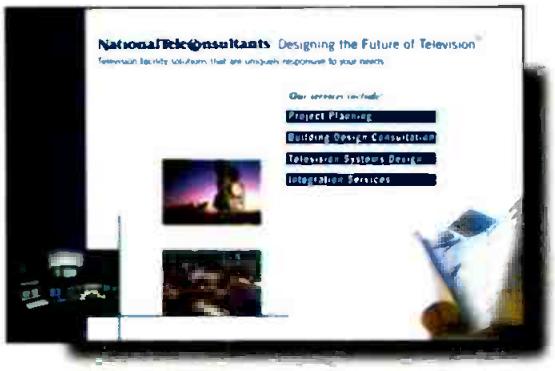
The GALLERY

Windows to the Web



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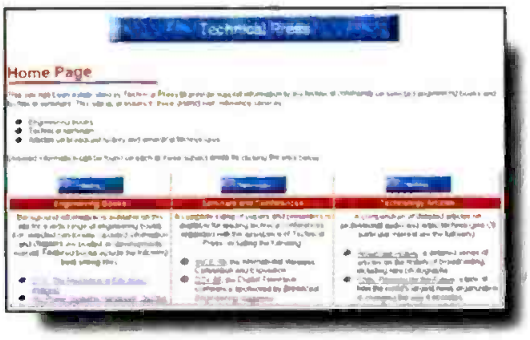
National TeleConsultants: National TeleConsultants is the largest independent television facility design and system integration company in the world. NTC is known for building creative and cost effective multichannel network facilities, production studios and television stations. Call us at 818-265-4400 and let us put our 19 years of experience to work for you.



www.technicalpress.com

Technical Press is a web-based reference site that supports more than a dozen video engineering books, including *DTV: The Revolution in Electronic Imaging*. Also available are articles on digital video technologies and applications, and a detailed series on the history of broadcast engineering.

www.winsted.com

Winsted Corporation: Winsted offers a full line of modular consoles, rack cabinets, file server workstations, tape storage, and editing desks. The most complete line of accessories in the industry complement this extensive offering. Winsted's 164-page fully illustrated catalog includes an easy-to-understand modular components section that allows you to design your own console, or you can receive a free consultation with a Winsted's system design engineer. To receive a free catalog or learn more about Winsted at their website www.winsted.com or call toll free at 800-447-2257.

www.sennheiserusa.com

Sennheiser: Established in 1945 in Wedemark, Germany, Sennheiser is an Oscar and Emmy award-winning leader in microphone technology, RF-wireless and infrared sound transmission, headphone transducer technology, and most recently in the development of active noise-cancellation. The company is driven by an innovative and pioneering spirit and is committed to ongoing research, precision engineering and meticulous manufacturing standards.

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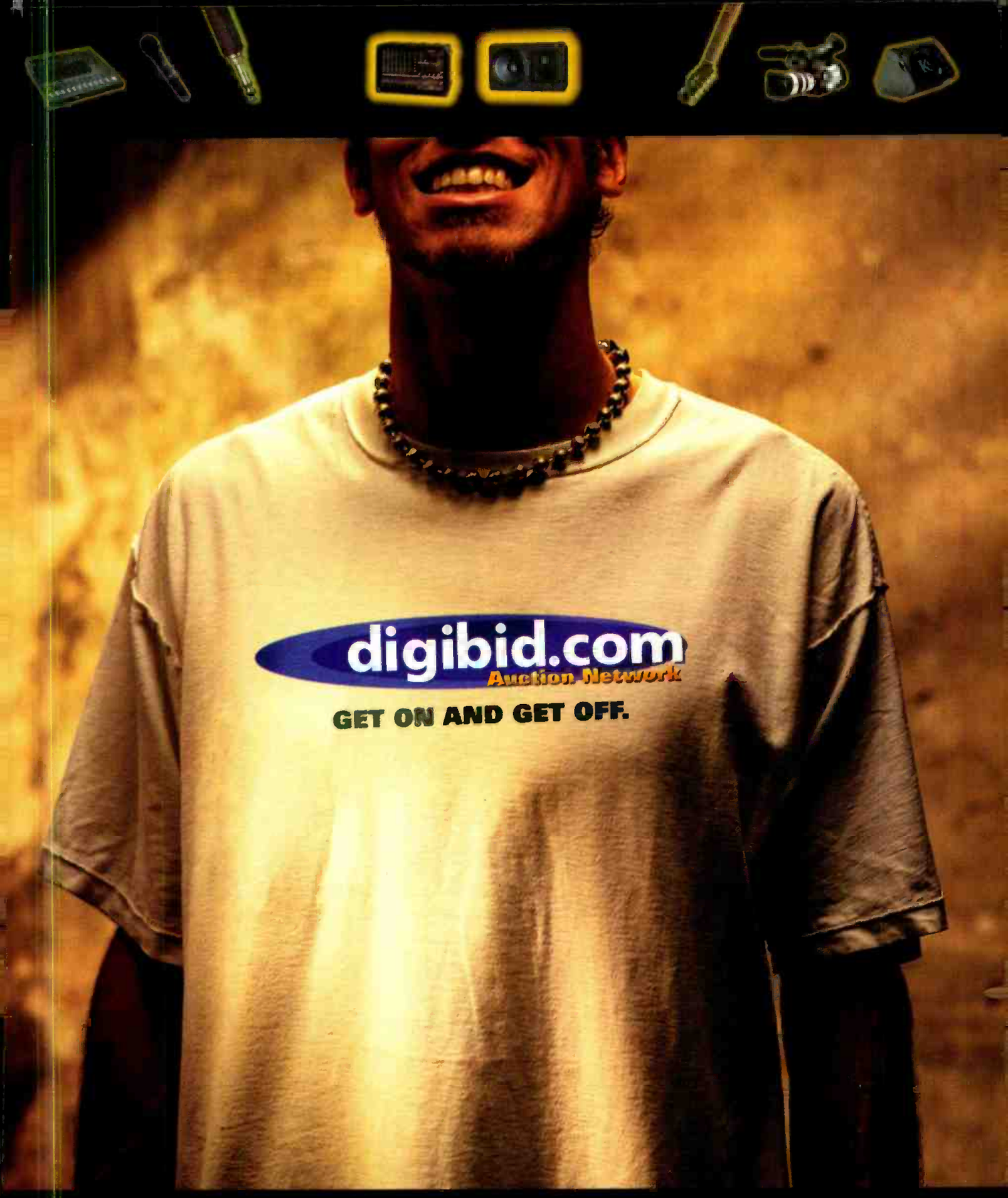
Broadcast Engineering: *Broadcast Engineering* is the only technology-driven online magazine in the industry. Its editorial environment delivers practical, informative articles on digital technology, systems integration, management, how-to installation, and systems and equipment maintenance. It is a package geared toward TV stations, cable/telcom, production, post-production, business TV, satellite and interactive television.



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FUJINON ENG LENSES

While ENG camera technology evolves faster and faster, delivering ever higher performance in ever small bodies, it has been increasingly difficult for lens manufacturers to improve quality while keeping size and weight to a minimum until recently. With Aspheric Technology (At2) Fujinon has succeeded in manufacturing superior quality lenses that are both smaller and lighter than lenses of conventional spherical design. From the widest angle to the highest telephoto, Fujinon's broadcast hand-held style lenses offer unparalleled features and performance. In fact, they are so advanced and so optically superb they will reshape your thinking about how well a lens can perform.

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

A15X8EVM Standard Zoom Lens

A versatile performer in a compact package, offers AT2, inner focus, Quick Zoom and the "V-Grip" 6495.95

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

CHYRON PC-CODI & PC Scribe

Text and Graphics Generator and Video Titling Software

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

PC-CODI Hardware:

- Fully-antialiased displays • Display and non-display buffers
- Less than 10 nanosecond effective pixel resolution
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- Board addressability for multi-channel applications
- Auto display sequencing • Local message/page memory
- Preview output with safe-title/cursor/menu overlay
- Composite and S-video input with auto-genlock select

PC-Scribe Software:

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

PC-CODI and PC-Scribe Bundle 2995.00

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Professional Video Production Workstation

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

TARGA 1000 Features:

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

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

MCXpress Features:

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

TARGA 1000/MCXpress Turnkey Systems:

- 300-watt, 6-Bay Full Tower ATX Chassis
- Pentium ATX Motherboard with 512K Cache
- Pentium II- 300 MHz Processor
- Matrox Millenium II AGP 4MB WRAM Display Card
- 64MB 10ns 168-Pin (DIMM) S-DRAM
- Quantum Fireball 6.4GB IDE System Drive
- Seagate Barracuda External 9.1GB SCSI-3 Ultra Wide Capture Drive
- Adaptec AHA-2940UW Ultra Wide SCSI-3 Controller Card
- Teac CD-532e 32X EIDE Internal CD-ROM Drive • 3.5" Floppy Drive
- Altec-Lansing ACS-48 3-Piece Deluxe Speaker System
- Viewsonic G771 17-Inch (1280 x 1024) Monitor (0.27mm dot pitch)
- Focus 2001A Keyboard • Microsoft MS Mouse
- Windows NT 4.0 Operating System Software
- Avid MCXpress for Windows NT
- Truevision TARGA 1000 or 1000 Pro Video Capture Card

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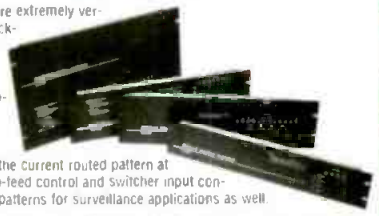
With TARGA 1000 Pro (component input/output) $6495.00

KNOX VIDEO

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

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



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

LEADER

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

5860C
WAVEFORM MONITOR

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

5850C
VECTORSCOPE

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

5100 4-Channel Component / Composite WAVEFORM

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

5100D Digital Waveform/Vectorscope

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

5870 Waveform/Vectorscope w/SCH and Line Select

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

5872A Combination Waveform/Vectorscope

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

5864A Waveform Monitor

A two-input waveform monitor that offers full monitoring facilities for cameras, VCRs and video transmission links. The 5864A offers front panel selection of A or B inputs, the choice of 2H or 2V display with sweep magnification, and flat frequency response or the insertion of an IRE filter. In addition, a switchable gain boost of X4 magnifies setup to 30 IRE units, and a dashed graticule line at 30 units on screen facilitates easy setting of master pedestal. Intensity and focus are fixed and automatic for optimum display. Supplied with an instruction manual and DC power cable.

5854 Vectorscope

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

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

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I. GVG-7000 Router 64x64 frame with 32x32 Analog Video and Analog Stereo Audio. Four XY control panels, four dedicated control panels. Duel power Supply and 7.0 W95 software. Manufactured 6/98. All parts in perfect condition.

II. 8TS-Saturn Router 96x96 frome with 96x96 Analog Video and Analog Stereo Audio. Twenty XY control panels, Duel power supply and latest software. Can be configured for Digital and HDTV. All parts in perfect condition.

Contact Cory Benson 1-517-558-1986 for details and photos of equipment.

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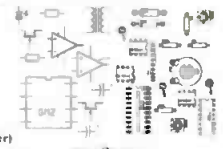

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Classifieds Help Wanted

COMMUNICATION ENGINEER: Supervise RF systems for analog and digital transmitters analog and digital microwave systems, ITFS systems and translators and repeaters to guarantee proper broadcast operation. Responsible for maintenance of LAN and WAN as relating to broadcast applications. Facilitate repair of technical equipment, maintain tower FCC/FAA compliance and implement on-going tests and measurements. Candidates should have AAS degree in radio, television or electrical engineering and five years of VHF and UHF television transmitter mgmt experience. SBE certification is preferred. Salary range 40-60K. Please send 2 copies each of resume and references to Margaret Feige at KCTS Television, 401 Mercer St. Seattle, WA. Attn: Communications Engineer. No faxes or phone calls please.

MAINTENANCE ENGINEER: Tired of 2nd and 3rd shift? Get out before winter begins-again! Move to one of the most attractive cities in the country!!! Audio Video Resources in Phoenix, AZ has an immediate opening for the right engineer with the right attitude. and skill sets for the repair, maintenance, and integration/installation of broadcast cameras, VTR's and related equipment. We are looking for 4-5 years experience in a broadcast environment with a proven track record on Sony, JVC, and Panasonic broadcast equipment. Generous salaries and full benefit package including 401K. EOE. Drug test required. Fax info/resumes Attn. J.L. at 602-274-7416.

TRANSMITTER SUPERVISOR: KMAX TV has an immediate opening for a Transmitter Supervisor. Great place to live and work. If you have High Power UHF, Microwave and Translator experience, this is a wonderful opportunity. Please send your resume to Personnel JD 9-1; KMAX TV; 500 Media Place; Sacramento, CA 95815. EOE

MAINTENANCE ENGINEER: Multi-channel broadcast operation seeks qualified technician with Associates Degree and three to five years experience repairing and installing broadcast equipment. Candidate must have a solid electronics background with component level repair skills, including analog and digital equipment and all aspects of ENG maintenance. Candidate must also be skilled in computer systems and networks. Panasonic DVCPRTO experience a plus. KXAN-TV/LIN Television is an Equal Opportunity Employer. Send resume to: Assistant Chief Engineer *KXAN-TV * PO Box 490 * Austin, TX * 78767 * Fax (512) 482-0330

ASSISTANT CHIEF ENGINEER, in So. California. Station expanding into DTV seeks hands-on broadcast engineer to assist in day to day operations. Applicant must be able to repair audio and video equipment, including VCRs to component level, w/ EE, SBE or equiv. We are seeking engineer with a minimum 5 years experience with high-power transmitters, studio equipment, and station automation. Successful candidate will help install, document, and maintain both analog and new digital systems. FCC Rules and Computer experience a must. Send resume and salary history to HR, KDOC-TV, 18021 Cowan, Irvine, California 92614. EOE

CHIEF ENGINEER needed for telemundo affil., RF exp. essential, townsend XMTR. Must be prepared to lead station through digital transition. Send resume to Gen. Manager. KFWD-TV, 3000 W. Story rd., Irving, TX 75038. An EEOE.

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EIC/Uplink & Maintenance Engineers

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

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TELEVISION MAINTENANCE ENGINEER, WPTV CHANNEL 5 (NBC) WEST PALM BEACH, FLORIDA. Knowledge of TV studio equipment maintenance, including routine maintenance and repair of DVCPro, MII and 1" video tape cameras, DVE's still stores, computer graphics, character generator systems, switchers, audio, editing systems. RF and transmitter experience a plus. Knowledge of Windows NT and computer networking also helpful. Minimum of an Associate EE Degree and/or 3-5 years of studio and transmitter maintenance experience. Digital facilities experience a plus. FCC general class license or SBE Certification desired. EOE. Deadline: Open Salary: Open Application: Cover letter, resume and salary requirements to David McKinley, Assistant Engineering Manager, WPTV Channel 5, 622 N. Flagler Drive, West Palm Beach, FL 33401 FAX: 561-653-5657

TRANSMITTER ENGINEER: Northwest Arkansas television station is seeking a transmitter engineer. Must be a self-motivated individual with experience in UHF transmitters. Repair and upkeep on all RF and microwave equipment and two UHF transmitters about 50 miles apart. Send resume to KPOM/KFAA. Attention Charles Hoing P.O. Box 4610, Fort Smith, Arkansas 72914. EOE

FOX 35
WOFL · ORLANDO

TV BROADCAST MAINTENANCE ENGINEER

WOFL is seeking a full-time TV Broadcast Maintenance Engineer. This position will involve installation and maintenance of all types of audio, video and transmission broadcast equipment. High Power UHF transmitter maintenance experience required. Candidate must have a minimum of three years TV broadcast maintenance experience, including transmission equipment. Knowledge of FCC technical regulations also required. WOFL has a very modern transmission system with a 4 year old NTSC installation and a DTV system currently being installed. Send Resume to:

Personnel Manager
WOFL-TV
35 Skyline Drive
Lake Mary, FL 32746

WOFL is an EEO Employer.

Resumes must be received by 11/30/99.

Meredith Broadcasting Group

MAINTENANCE ENGINEER: KUVN-TV, an Univision O&O, seeks a full time Maintenance Engineer in Dallas, TX. Candidates must have 2-5 years experience with TV studio broadcast equipment and the ability to repair all electronics to component level. Above average computer and technical skills needed with some UHF transmitter knowledge helpful. EOE

MASTER CONTROL OPERATOR: KUVN-TV, an Univision O&O, seeks 2 part time Master Control Operator in Dallas, TX. Candidates must have some experience with TV studio broadcast equipment. Must be able to demonstrate meter reading ability, waveform/vectorscope interpretation, and ability to add and subtract time/time codes. Must be willing to work nights/weekends/on-call and have reliable transportation. Computer skills are a must. Bilingual English/Spanish is strongly preferred. EOE Reply to: Univision Center, Human Resources Department, 2323 Bryan Street, Dallas, TX 75201 or Fax resume to: (214) 758-2338

MAINTENANCE ENGINEER: NBC6 (WCNC-TV), a subsidiary of Belo located in Charlotte, NC, is recruiting for a highly qualified Maintenance Engineer to specialize in computer systems. Position available with emphasis on ability to maintain computers, computer network systems and software including Internet, Intranet, Email, LAN, WAN, servers, routers, workstations, cabling, etc; provide technical support for station web site; perform routine computer maintenance procedures; diagnose equipment problems and perform corrective maintenance; plan and execute technical projects with minimum supervision. Must be familiar with Windows NT, Novell, Unix, Windows 9x and DOS. At least 2 years of computer systems experience in a broadcast environment with knowledge of broadcast systems is required. Studio equipment maintenance experience is a plus. The position requires strong trouble shooting skills and the ability to work in a highly time sensitive environment. Applicants should possess a 2-year degree in Computer Science or equivalent computer systems training/experience. MCSE, MCP, CNE, CNA, SBE certification and/or FCC license is a plus. Qualified applicants need to send your resume and salary history to: (NO PHONE CALLS, PLEASE) NBC 6, Human Resources Department, Re 99-38, 1001 Wood Ridge Center Drive, Charlotte, NC 28217 EOE / M / F / V / H

INDIAN RIVER COMMUNITY COLLEGE, Fort Pierce, Florida: VIDEO ENGINEER (F/T) Salary range: $26,360 - $33,540 with full benefits. Applications will be considered until the position is filled. Please contact (561) 462-4806 or e-mail jrussaki@ircc.cc.fl.us to request minimum qualification requirements, job description and employment application. For more information about Indian River Community College, please visit our homepage at www.ircc.cc.fl.us. An EEO/ADA/Drug-Free Workplace Employer.

WJTV MAINTENANCE ENGINEER. Candidates must have formal education equivalent of AA Degree in electronics, military training, or trade school certificate preferred. Three years of broadcast maintenance experience preferred. Must be able to troubleshoot broadcast eqpt. To component level in timely matter under deadlines. Send resume, salary history, and cover letter to Human Resources Dept., WJTV Maintenance Eng. WJTV, 1820 T.V. Road, Jackson, MS 39204. WJTV is EOE, M/F. Pre-Emp. Drug Test Req.

Classifieds Help Wanted

DIRECTOR OF ENGINEERING: WVPT-TV, an award-winning PBS station located in the beautiful Shenandoah Valley, seeks a Director of Engineering. The ideal candidate will manage all aspects of the Engineering and Operations departments. Capital planning, familiarity with budgets, and strong supervisory skills required. Will oversee WVPT's DTV conversion, maintenance, and technical operations. Requires excellent communications skills, prior management experience, working knowledge of analog and digital transmitters, microwave, studio, master control equipment, linear/non-linear production systems, MAC, PC, UNIX, computer networking systems. Prefer FCC General Class license or Senior Engineer SBE certification. Plant in very good condition; capital needs have been addressed annually as we begin our migration to DTV. Reply to Executive Secretary, WVPT, 298 Port Republic Road, Harrisonburg, VA 22801 EOE/AA

CLARK COUNTY SCHOOL DISTRICT 2832 East Flamingo Road, Las Vegas, NV 89121, FOR DEVELOPMENT OF THE QUALIFIED SELECTION POOL AND CURRENT CHANNEL 10 VACANCIES. POSITIONS ARE LOCATED AT KLVX-TV CHANNEL 10. **TV ENGINEER II** STARTING SALARY $35,266 - $38,879 + BENEFITS. Submit detailed résumé to Madelyn Barnum, 4210 Channel 10 Drive, Las Vegas, NV 89119 or FAX (702) 799-5586. Screening packet will be mailed to competitive applicants. KLVX-TV, Channel 10, CCSD, Las Vegas, NV Brdcst, ITFS, MATV, CATV maint. eng. Exmpl Essential Tasks: We currently have 2 vacancies. Position 1 - Assists in the design , evaluation, inspection and repair of TV distribution systems in new schools and rehab projects. Position 2 - Installs and repairs cameras, VTRs, switchers, routing, editing, electronic graphic paint, monitors, and related broadcasting systems. QUALS: HS grad or equiv (i.e., GED, college, tech/trd schl trnscrpt, foreign equiv, etc.); and Three (3) yrs. Exp. in repair/maint of television brdcst equipt. will satisfy formal educa/Exp. OR, an AS deg. In Elect. Eng. OR two (2) yrs formal tech. training/ courses in electronics from accredited college, school/vocational institution plus, one (1) yr. Exp. repair/maint of television brdcst eqpt. EOE

ENGINEER-IN-CHARGE for KU satellite/ production truck. Requires 5 years experience. Responsibilities include operation and maintenance of vehicle. FCC general class license required. Travel required. Competitive compensation package with excellent benefits. Fax resumes to: Human Resources-HRNY 212-586-0823.

Command Audio, the world's first audio-on-demand service, delivers hundreds of continuously updated local, regional, national and special interest audio programs, including audio versions of newspapers, magazines, top TV shows and popular radio programs. Subscribers can select from dozens of information and entertainment categories, ranging from in-depth news, business and personal finance, to sports, traffic, talk shows, and home and living. The award-winning, handheld CA-1000 receiver (manufactured by Thomson under the RCA brand) delivers audio programs whenever and wherever listeners choose.

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The Operations Director requires additional people to assist with the technical operation and maintenance of our Production Control Center. This operation consists of multiple production and edit studios as well as our transmission systems. The Technical Operations Engineers install, maintain, troubleshoot, and repair a variety of audio, studio, broadcast and satellite equipment. A minimum of 3 years experience with broadcast equipment such as production mixers, consoles, analog and digital tape machines, and computer based production editing systems as well as knowledge of satellite transmission systems and land-line based digital transmission systems is required.

Network Maintenance Technician

We require an individual to install, test, and maintain satellite and landline-based transmission systems including satellite uplinks, downlinks, VSAT, ISDN, T1 and related equipment for the installation and wiring of broadcast technical studios, transmitters, and remote control monitoring systems. We seek an individual with basic system-level troubleshooting and repair knowledge and a minimum of 3 years experience working with professional test equipment, including spectrum and network analyzers, oscilloscopes, etc. Proven ability to plan and schedule projects and execute within budget are also required.

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Or fax us at 650 / 631 – 6155.
Or e-mail us at: jobs@commandaudio.com.

COMMAND AUDIO

UPLINK ENGINEER: First Call UP*Links* in Northeastern Ohio seeks qualified applicants for operation of SNG/DSNG vehicle. Applicants must have minimum of 2 years relevant experience, good driving record, professional demeanor and be willing to relocate if necessary. Must be willing to travel and work nights, weekends and holidays. Forward resume, references and salary requirements via e-mail, fax or mail. E-mail to JimMassaro@FirstCallUPLinks.com, fax to (330) 726-1914 or mail to First Call UPLinks, 841 Boardman-Canfield Rd. Suite 308 Youngstown, Ohio 44512. NO PHONE CALLS PLEASE

THE VICTORY TELEVISION NETWORK, The Christian Voice of Arkansas, seeks an Engineer/Operations Manager for our full-power UHF station in Jonesboro, AR. This station covers all of NE Arkansas, and portions of Missouri and Tennessee, including Memphis. Successful candidate should have solid work track record in TV broadcast engineering and transmitter maintenance. Duties include full maintenance of the main transmitter site and associated microwave repeater sites, along with other duties as the network expands. Send resume to Ron Brown, Director of Engineering, The Victory Television Network, 701 Napa Valley Dr., Little Rock, AR, 72211. Fax to (501) 221-3837 or e-mail to ron.brown@kvtn.org

Classifieds Help Wanted

Broadcast Engineers

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

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

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

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

abc 7

EXPERIENCED KU TRUCK OPERATOR wanted to run and maintain a new truck to be based in the Northeast. Opportunity for the right person to invest and be a partner. Send resume and salary requirements to: Classified Ad Coordinator, Broadcast Engineer, Dept. 795, 9800 Metcalf, Overland Park, KS 66212.

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TELEVISION BROADCAST ENGINEERING/ INSTALLATION ENGINEER: In this critical role, you will coordinate, perform and maintain the installation of new audio & video wiring for broadcast systems and components. The ideal candidate is skilled in diagnosing complex system problems and providing rapid, temporary solutions to keep broadcast operations functional. Must have familiarity with TV and Radio broadcasting equipment including cameras, robotics, VTRs, digital recording, routing equipment, production switchers/mixers, computer control & power systems. Must be able to maintain/construct wire and cable assemblies and possess a thorough understanding of PC hardware & Software. May be required to work flexible hours including regular evening and/or weekend shifts. Independent, quick thinking in high pressure situations is essential. Send resume AND cover letter indicating salary history and qualifications to: Bloomberg L.P., Human Resources Dept. Bdcst-Eng, 499 Park Avenue, New York, NY 10022. Fax: 212-893-4040; e-mail: careers@bloomberg.com. Qualified candidates will be contacted. Resumes without cover letters will not be considered. No Phone Calls Please. EOE M/F/D/V.

MAINTENANCE TECHNICIAN: Denver's WB2, a Tribune Broadcasting station has opportunity in Engineering. A minimum of 5 years relevant broadcast maintenance experience, with a valid FCC general class license and/or SBE Certification is preferred. Ability to troubleshoot electronic/mechanical systems to the component level. Must be able to perform well in a fast paced environment. A valid driver's license is required. Ability to work flexible hours. www.wb2.com Send resume to HR Dept. #MT61, KWGN-TV PO Box 5222, Englewood, CO 80155. EOE.

VICE PRESIDENT OF ENGINEERING: Sunrise Television Corp. is looking for a progressive individual to lead our transition into the digital world. Candidate should be a team oriented, hands on broadcast engineer. Applicant should send a cover letter and resume to Nancy Klein, STC Broadcasting, Inc., 720 2nd Avenue South, St. Petersburg, FL 33701 or e-mail to nancy@stc-sunrise.com. Equal opportunity employer. All replies strictly confidential.

MANAGER OF ENGINEERING / CHIEF ENGINEER

Washington, D.C.-based all news cable station seeks Manager of Engineering. Engineering chief will perform hands-on maintenance, and employee supervision and training. Extensive experience with video systems and computer networks is desirable.

COMPUTER ENGINEER

NEWSCHANNEL 8 seeks engineer to maintain LAN and workstations, perform hardware and software upgrades, and maintain computer-based video equipment. Experience with Novell Netware and UNIX LANs is desirable.

To apply, please send cover letter and resume to: Director of Human Resources, NEWSCHANNEL 8, 7600 D Boston Blvd., Springfield, VA 22153 or fax to (703) 912-5436. No telephone calls. EOE.

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EOM

Patently useless

BY PAUL MCGOLDRICK

Intellectual property has become an industry all of its own this decade with an enormous amount of trading and licensing to help the whole of technology marching ahead. Most companies in the electronics industry, and in broadcasting in particular, take the matter of seeking patents as a most serious one, and rightly so. But the days of a company — such as we had with an earlier version of Ampex — standing behind its patents as a sign to the rest of the world that the market is impenetrable to anyone else have gone. Developing patents in the company portfolio is only the first stage of continually striving for engineering developments in your field.

A few years ago, a number of older patents became available by being turned over to the original assignees, who were leaving the original company. Some of these patents were questionable because they did not describe prior art that was probably available, and many of the claims were absurd in engineering terms, something like being awarded a patent for electrical resistance.

The players of the patents (for lack of a better term), in what became an industry tragedy, took their paperwork to a couple of the larger companies in our industry and claimed breach of the patents in various combinations. As is, unfortunately, commonly the case in these larger companies, they basically verified that they were producing products that — on paper — violated the patents. Once that was verified the whole matter was turned over to the corporate legal officers.

The corporate attorneys studied the claims and came to the conclusion that there was at least a court case in the matter. That meant monies would be expended. As their task is to minimize the exposure of the company and stockholders, they did what they do best — they negotiated. With little effort, the patent players now had several hundreds of thousands of dollars in their war chest. Even after the Mercedes cars appeared on the scene, there was still plenty left over to chase the smaller companies.

A couple of the smaller companies simply handed over some tens of thousands of dollars each, just so the problem went away. Most of the others would have followed, but there was one magnificent, angry hold out. That battle went on for several years, with the patent players finally having to go on the defensive when hearings on the patents themselves suddenly started to result in the removal of claims and doubts about originality. During this time I remember one engineer — a West Coast Emmy winner — showing me a circuit board that he had kept in his cupboard, pre-dating the patent claims by a couple of years, and incorporating virtually all of the patent claims that had been filed elsewhere.

Developing patents in the company portfolio is only the first stage of continually striving for engineering developments in your field.

Without the courage of what was a medium-sized company in our industry, the patent players would have cleaned up; as it was they spent a great amount of the easy pickings they received from the big guys in asserting their claims and losing. But the defending company's costs were horrendous. It would clearly have been easier and cheaper to have just caved in. There are a lot of companies who didn't pay up, and who have good reason to be grateful to both that company and its U.S. president. In the end, this was probably one of the factors that cost him his position.

History repeats

Why the history lesson? It is happening again. Another couple of patents that are very close to expiration have come onto the litigation circuit. The claims probably affect 90 percent of the manufactured equipment, at least for composite video, and maybe component as well. The players are different from the last skirmish, but the intent is the same — pay up and save your attorney fees. Again, it all starts with the big companies; if they cave in for expediency then the battle will fall on the shoulders of smaller companies who can far less afford it, and I don't really know if there is another golden knight out there.

I am not suggesting that the large companies should fight these claims; that is an unfair burden on the stockholders, even though they can afford it. What I would urge them to do, however, is not to cave in with a check. Even if you decide that you will eventually have to settle, make it eventually rather than sooner. Hopefully the patent players' cash will disappear before the check is cut. ■

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

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

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For local branding of your upconverted signal, ezHD™ also includes Leitch's HDTV logo generator and inserter. You can store multiple logos for linear keying with user-selectable logo positioning and transparency.

Rounding out ezHD™ is an HDTV digital-to-analog converter for monitoring your signal before ATSC encoding. The ezHD™ package includes a DigiBus frame and control panel, which allows you the opportunity to further upgrade your facility with any of the following products:

- **HD frame synchronizers**
- **HD test signal generators**
- **HD A/D converters**
- **HD distribution amplifiers**
- **ATSC STL solutions**

Other Leitch HD products include:

- **Master Control Switchers**
- **Integrator HD16x16 Routers**

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