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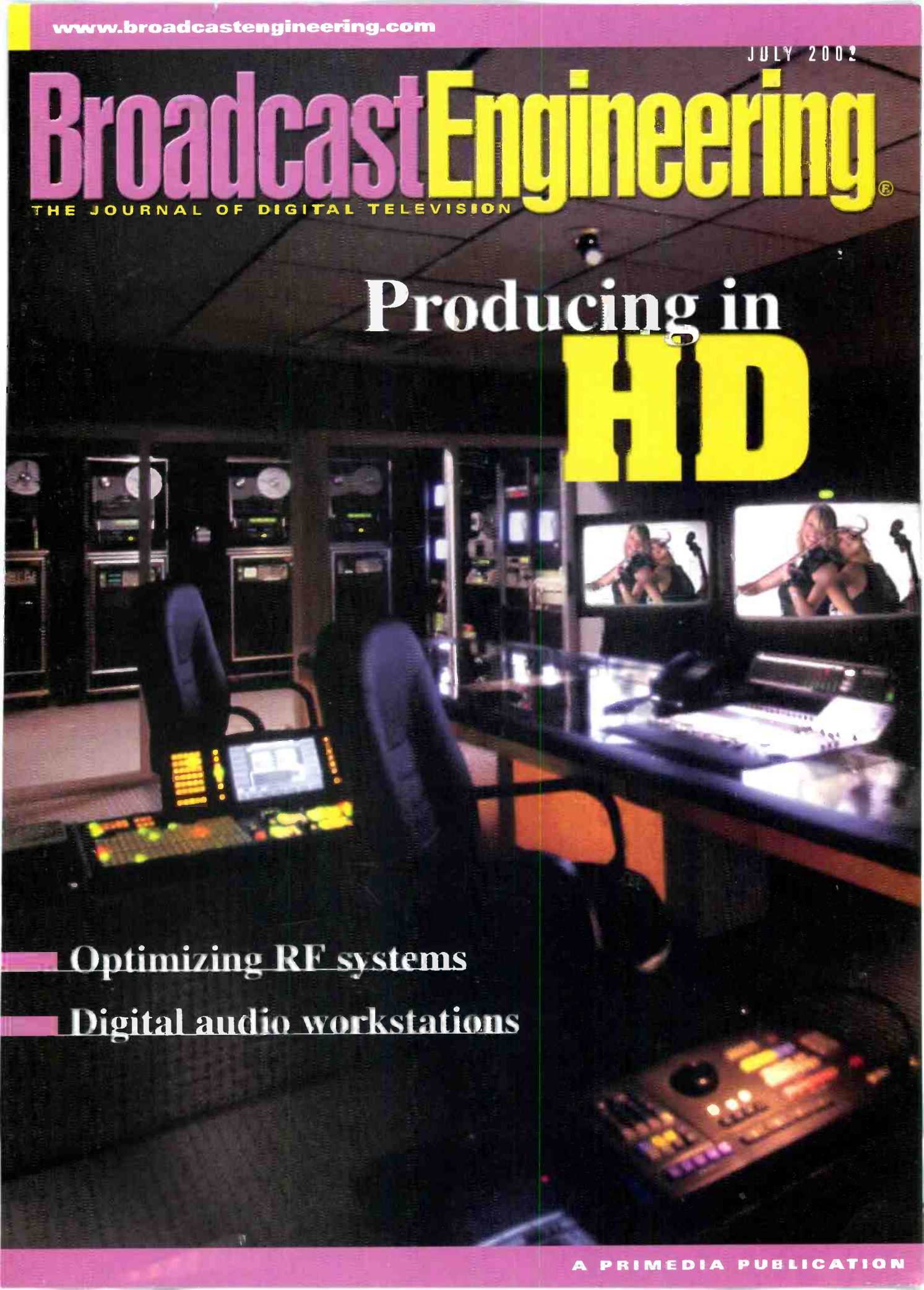

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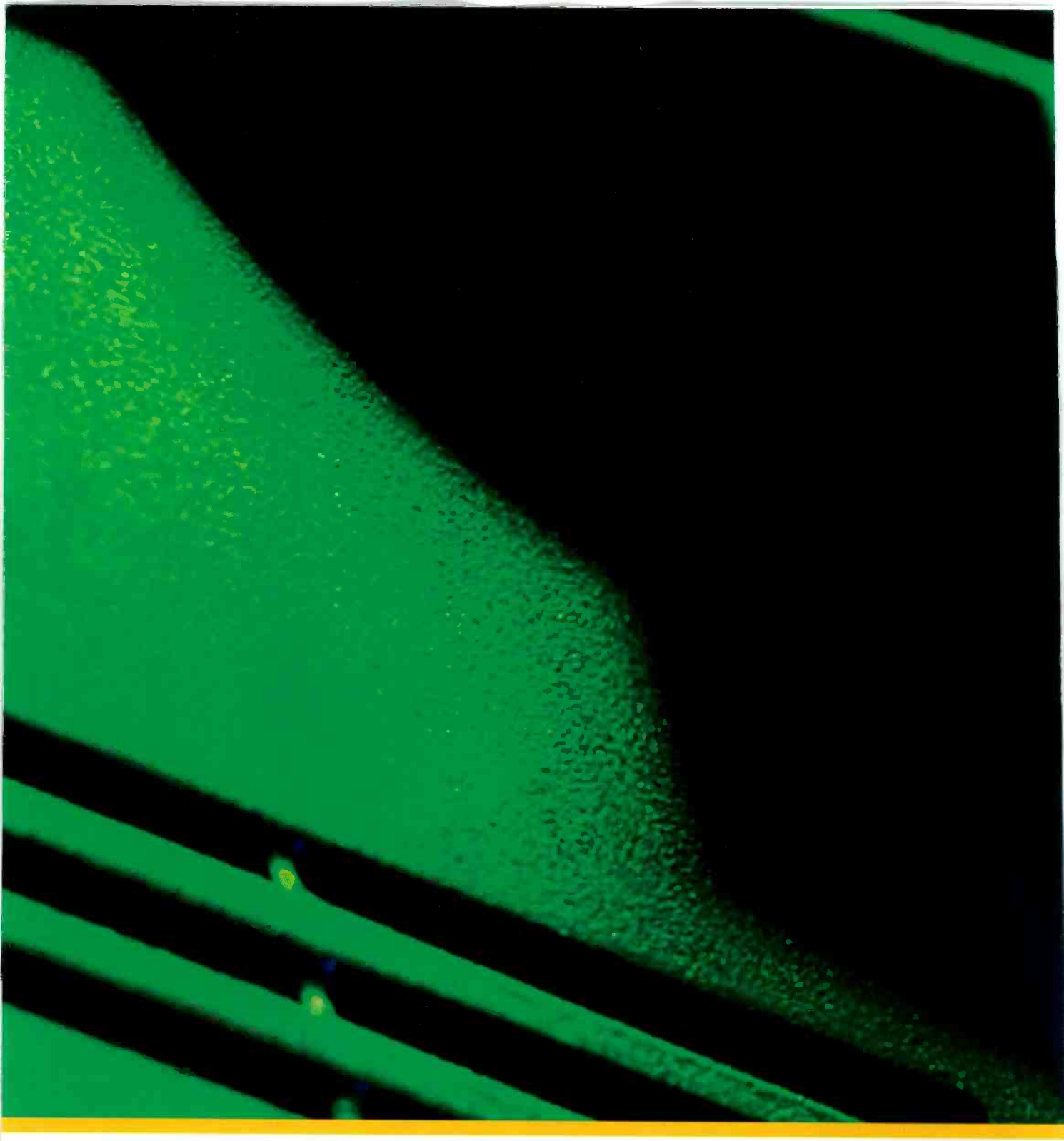

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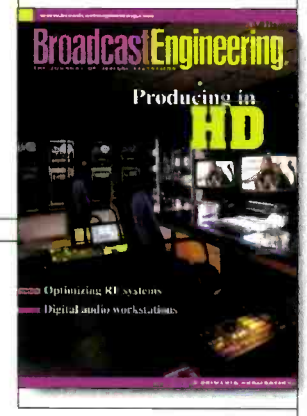

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ON THE COVER: New York-based Colossalvision's HD production suite, designed by partner David Niles, utilizes HD VTRs, a mix of Sony HDCAM and Panasonic HD D5, and DVCPRO HD. Other equipment includes a Snell & Wilcox video switcher and a 5.1 surround sound audio console from Ramsa/Panasonic. Photo courtesy Colossalvision. Photo by David Niles.

(continued on page 8)

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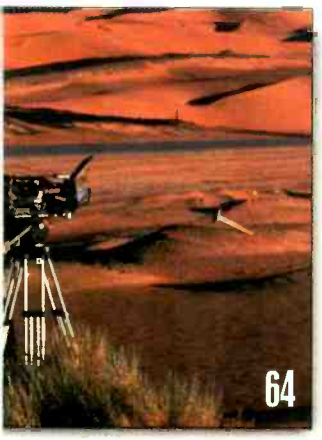

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Opportunity missed

I've recently been called by several non-broadcast publications regarding the 700 MHz auction. Most simply wanted to know what my readers thought about the delay and why broadcasters haven't been more willing to move out of the spectrum.

After giving more thought to the issue, it seemed time for me to remind my general manager readers of their opportunity missed.

It seems to me that broadcasters are running a great risk by not implementing digital, giving up this spectrum and getting on with DTV services — now! Our industry is missing a great opportunity.

Today, I read that cable systems are forcing customers to "buy up" to a digital tier if they want to retain their premium services. With most cable systems, you can get HBO, Showtime, Cinemax and other premium services the old-fashioned, RF, analog way. You don't have to have a fancy dancy digital STB and another damned remote just to watch a movie channel.

But no. Cable has found another way to squeeze $10 a month from viewers by moving all those premium channels to a digital tier. While an industry spokesman claims they are not charging more for the movie channels, viewers will still have to rent a digital set-top box if they want to continue to get those premium services. For that, they get nothing extra except an STB and another remote control to confuse their life.

While viewers may complain, they'll have little choice but to pay more or lose the service. If they've become addicted to those premium services, they'll simply have to pony up another $120 a year just to get the same thing they now enjoy.

It's no secret that there are increasingly vocal objections to the rising costs of cable service. In fact, Senate *demo-republican* John McCain has threatened hearings on the matter. It's against this backdrop that broadcast has a unique opportunity to challenge cable.

To seize the initiative, broadcast station managers must first admit that digital is the way of the future. You're either in or out, and the price to stay is investment in your plant. If you, station manager/owner, aren't willing to invest in the future of your business by purchasing the needed technology, then please immediately sell your station to someone who will. There are millions of viewers who don't want cable and will be loyal if you'll only deliver a high quality service to them.

The majority of viewers are not going to be buying new $3000 HDTV sets anytime soon, no matter what CEA says. That means the DTV transition could drag out for the next 15 years until old TV sets get replaced. We need a quicker solution. This requires broadcasters to act now and build new program streams.

If you're not a GM, then tape this editorial to their office door and run. Let me take the blame for telling them to get off their financial backside and either buy in or get out of broadcasting. I for one am fed up with their whining and moaning as they drive their BMW or Lexus to the bank with the latest deposits. These folks need to either get on with the DTV transition or get out of the business. Their duplicity is grating on my nerves.

Brad Dick
editorial director

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

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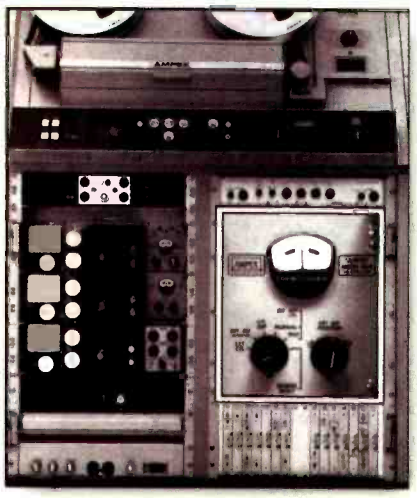
Freezeframe winners

The November 2002 Freezeframe question, "Name the early TBCs from RCA and Ampex, define the acronym and tell the key difference between the two," resulted in some great answers.

Exacting and correct answers were received from David Fibush, Don Eckis, Jim Borgioli, John Turner and Tim Stoffel. Shown below are answers from Turner and Stoffel. For you newbies out there, this represents real history!

Quad TBC



Editor's note: This question generated a number of excellent responses. Shown below are two of the most complete answers to the question.

From John Turner:

First of all, you cannot equate AMTEC and CAVEC to each other as they perform very different signal corrections.

AMTEC:

This is an electronically variable delay line based on varicap diodes invented by Charles Colson of WBBM-TV and originally called ColTEC. When Ampex hired Colson away from WBBM, the name was changed to the "Ampex Time Element Compensator", i.e., AMTEC. When used with the Ampex "Intersync" servo, the machine would output FCC stable monochrome video.

The RCA equivalent to AMTEC was called MATC for "Monochrome Automatic Timing Corrector," which worked with the RCA "Pixlock" servo.

For color stability, the manufacturers used COLORTEC and CATC circuitry, respectively.

CAVEC:

This was a module (at least pre TR-600) that performed two very different functions. The acronym stands for "Chroma Amplitude and Velocity Error Corrector." The Ampex equivalent to the RCA "CA___" was the "AutoChroma" circuitry. This portion of the CAVEC acted to equalize on a line-by-line basis the amplitude variations of chroma using the fixed amplitude of demod burst as a reference. The correction was applied to the demod and had nothing to do with the downstream TBC systems.

The RCA "__VEC" section is analogous to the Ampex "Velcomp" accessory. Both of these devices measured the burst phase at the beginning and end of a single line. This data was used to create a line time linear ramp error signal, which was added back in to the TBC error signal to reduce the appearance of color hues that shift horizontally across a picture. This correction was needed due to the "step" nature of the MATC/CATC/AMTEC/COLORTEC error signal derivation.

Just my two cents.

JOHN TURNER
PROUD OWNER OF CAMDEN AND
REDWOOD CITY BIG IRON

From Tim Stoffel:

AMTEC-AMPEX Ampex Time Element Compensator

CAVEC-RCA Chroma Amplitude and Velocity Error Corrector

The timing corrector used in earlier quad VTRs consisted of three blocks. These timing correctors used electronically variable delay lines to effect their correction. The first of these three was a coarse timing error corrector. This corrector would eliminate all but say, 30 nanoseconds, of timing jitter. (The input jitter had to be low to begin with. This is why video heads had air bearings and the female guide position was servo'ed.) This was good enough for black and white.

The Ampex device for this was the AMTEC (invented by Charlie Coleman, who lives out here somewhere in the deserts of Nevada), and the RCA device was the ATC (Automatic Timing Corrector). (RCA loved acronyms! A good future question would be to define some of them, like BALPS, BALLS and PLACH.)

The second of the three correction steps was a fine corrector. This corrector worked to get the residual jitter down to a point where color was possible. It used a shorter but faster variable delay line. The Ampex device for this was the COLORTEC. The RCA device was the CATC.

The third stage of timing correction, which was optional, removed residual errors caused by changes in video head velocity as the head scanned through each band of the picture. These errors were of a nature that required an analog memory circuit to keep track of the error from beginning to end of a video line, as well as the average error for each line in a band, for each of the four heads. These devices, which were bleeding-edge technology for their time, were generically referred to as velocity compensators. Their error correction signal was summed into the CATC or COLORTEC's error signal. The RCA velocity compensator was called the CAVEC, and the Ampex velocity compensator was simply called an "Automatic Velocity Compensator."

So, the answer to your third question might be: The AMTEC was a first stage or monochrome timing corrector, and the CAVEC was a velocity compensator.

BTW, great issue of the magazine!

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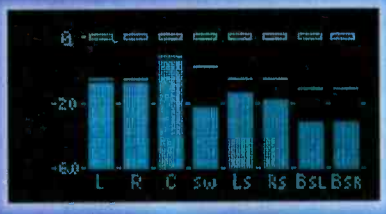

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Change is inevitable

BY CRAIG BIRKMAIER

Many TiVo subscribers were disappointed when recent attempts to watch World Cup soccer matches were tarnished when their digital video recorders (DVRs) didn't store the programming.

Is this yet another setback for digital technology, or a reflection of the reality that *change is inevitable* in the real world of television operations?

The problem was caused by a scheduling change that was not reflected in the guide used with the TiVo DVR service. The World Cup soccer matches were originally scheduled to be aired on ESPN2; however, at the last minute they were moved to ESPN. TiVo relies on television networks to frequently update their schedules so changes can be reflected in the guide. But the guide information is only updated when a TiVo box dials into a server to download guide information – typically no more often than once each day.

Centralcasting and multichannel broadcasting

While broadcasters deal with change on a daily, sometimes minute-by-minute basis, one could argue that the medium has been highly resistant to changes in the underlying business model, not to mention the technology for delivering television programming to viewers. A black-and-white television built in 1950 can still receive NTSC VHF broadcasts today. Somehow, broadcasting has endured, even as the world of television has seen radical changes in recent decades. Cable, the VCR, DBS, DVD and the Internet have expanded the options for distribution of television content. And the tools for creating video programming have been democratized with the availability of inexpensive digital camcorders and computer-based video production systems.

Broadcasting has endured, even as the world of television has seen radical changes.

With the transition to DTV broadcasting, it was assumed that there would be profound changes to the business model for television broadcasting, such as a shift to high definition or multiple channels of standard-definition television, interactive television services (ITV), data broadcasting, or perhaps even reliable mobile reception. But none of these potential changes have generated new revenue for broadcasters or enthusiasm among consumers.

Now it looks like we may need to add two more buzz words to the list of promising technologies that have been placed on hold: centralcasting and multichannel broadcasting. Once again, a major factor is the inevitability of change.

The technologies for centralcasting and multichannel broadcasting are well evolved. Many systems have been deployed successfully, although in some cases the promised benefits of reduced operational costs have been elusive. A year ago centralcasting was a hot topic of discussion at the broadcast networks and larger station groups. A year later it has been placed on the shelf alongside other promising technologies that will impact broadcast operations... someday.

In almost every major city in the United States, cable systems operate sophisticated multichannel systems that insert commercials into an average of 25 cable networks – unattended. PBS is moving forward with multichannel DTV at both the network and local affiliate level, based on a business model with limited insertion of "commercials" and promos, and the ability to checkerboard programs in multiple time slots.

The current volatility of the evolving business model for local commercial broadcasting may be the most important factor in the shelving of emerging technologies, along with the significant investments required to begin operation of mandated DTV channels. Concerns about network/affiliate relations, pending changes to FCC-imposed ownership limits, and the shift of advertising to alternative media including cable and the

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Florical's ShareCasting is used to originate three channels from the NBC hub in Los Angeles. Photo courtesy Florical Systems.

Internet, are all contributing to the current reluctance to embrace change.

Consolidation can take many forms. If network ownership caps are raised or eliminated, it is expected that the broadcast networks will go on a buying binge and move to a regional centralcasting model. NBC has already taken the first step with regional centralcasting facilities in New York, Los Angeles and Miami. The relaxation of duopoly rules, along with local management agreements and other creative partnerships between stations, has led to the development of local multichannel operations in both the analog and digital domain.

The potential for cross-ownership of newspapers and TV stations in a single market portends yet another opportunity for shared operations in local markets, feeding print, TV and the Internet. On June 17 the FCC announced that it will combine six separate reviews of six separate rules governing media company ownership into one. FCC Media Bureau Chief Kenneth Ferree said he expects the new rules to be adopted by the FCC next spring. This schedule could delay completion of one rule now being reviewed separately: a ban on ownership of a newspaper and television station in the same market, as sought by the Tribune.

Meanwhile, broadcasters are exploring the potential of multichannel broadcasting via their new DTV facilities. The variations include an HDTV program with an SDTV simulcast, HDTV with multiple SDTV programs (networks), and multiple SDTV networks.

The first and last mile

Adding to the uncertainty about pending changes to the broadcast business model and ownership consolidation is uncertainty about the cost of the backhaul connections that enable the

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shift to centralcasting. On the heels of the dotcom meltdown, we are now witnessing an equally astonishing meltdown of telecommunications companies that invested heavily in wide area fiber optic networks in anticipation of exponential growth in demand for broadband network services. Long-haul networking capacity is abundant; large bandwidth users such as broadcasters implementing centralcasting solutions can negotiate highly favorable rates.

But the cost of the local first mile bandwidth from a centralcasting facility to the wide area service provider and the last mile links to each station being fed often are higher than the cost to move bits across the country. In many cases current total costs for backhaul are higher than the costs for personnel at each local facility.

Given the current marketplace realities, broadcast station groups are looking at other ways to reduce operational costs through the application of technologies used for centralcasting, sharecasting, station automation and multichannel systems. By retaining local control over on-air operations, it is still possible to realize some operational savings across a station group.

John Luff, senior vice president of business development for AZCAR, a large systems integration company, prefers the term "centralized operations" to centralcasting. At NAB, AZCAR was promoting distributed broadcasting solutions that centralize control functions such as traffic and promotions while distributing critical elements of the on-air operations infrastructure to each station. Luff suggests that television broadcasters have been reluctant to implement centralized operations because of a prevailing attitude that "you can't run a television station from a remote location."

One example of how distributed broadcasting techniques can be employed is through the use of lower cost IP networking solutions, which can be used to move content between the servers in multiple stations.

Another example relates to forward-and-store programming. A station group may run the same syndicated programming on multiple stations. Typically, a human operator must review the feeds stored on the satellite ingest system to get the program timings, which are then provided to the traffic department and on-air operations. With centralized traffic this task can be done once in a central location, with the pertinent information forwarded to each station from the centralized traffic department. BE

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

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BEYOND THE HEADLINES

FCC to sanction DTV delinquents

BY HARRY C. MARTIN

The FCC has initiated a rulemaking proceeding to examine what measures it should take regarding television broadcasters who fail to meet their DTV construction deadlines. All commercial television stations were required to construct their digital facilities by May 1, 2002, but two-thirds have not yet done so. Instead, they opted to file for six-month waivers of the deadline.

Tentative proposals outline an increasingly severe level of sanctions every six months a licensee fails to construct, beginning with admonishment, followed by issuance of notices of apparent liability for forfeiture, and culminating in rescission of the licensee's DTV authorization. The Commission directed the staff to apply appropriate sanctions on a case-by-case basis during the pendency of the rulemaking.

The Commission also clarified that its "minimum-facilities" Special Temporary Authorization ("STA") policy regarding licensees who construct less than their authorized facilities will not be available to network-affiliated, top-30 television market licensees. In November 2001, the Commission permitted television licensees subject to the May 1, 2002 (commercial), or May 1, 2003 (noncommercial), construction deadlines to build minimal initial facilities to satisfy their DTV build-out obligations. Licensees thus operating pursuant to a "minimum-facilities" STA by their respective deadlines (either May 1, 2002, or May 1, 2003) would be considered in compliance with their construction deadlines, and their outstanding construction permits will be automatically extended until such time as the Commission determines otherwise. The Commission held that it will continue to review extension requests from network-affiliated, top-30 market stations on a case-by-case basis.

Facing substantial pressure from Congress, the FCC delayed once again the auction of the upper 700 MHz band (channels 60-69).

Channels 60-69 auction delayed again

Facing substantial pressure from Congress, the FCC delayed once again the auction of the upper 700 MHz band (channels 60-69), this time until Jan. 14, 2003. At the same time, the Commission decided to go forward on the auction of the lower 700 MHz band (channels 52-59) on June 19.

The Commission's action was the result of weeks of lobbying on Capitol Hill and at the FCC. Even the Bush administration weighed in, stating that an auction delay would be best for the Treasury since the parties who will be bidding, because of uncertainty as to when broadcasters will vacate channels 60-69, would not be willing to pay very much for this large block of spectrum. The cellular industry advocated delay on the basis of the current glut of spectrum on the market. The Commission's decision to proceed with the lower 700 MHz auction, but postpone the upper 700 proceeding, was a compromise.

There is pending before the Senate a bill which, like the House version already passed, would delay both auctions indefinitely. That bill ran into trouble when Senator Stevens of Alaska filed a counterbill requiring the FCC to hold both auctions in June. Stevens' principal interest is in deployment of lower 700 MHz frequencies in Alaska, and that auction will proceed on schedule.

New wrinkle in ownership rule enforcement

In the process of granting authorization for Viacom to purchase a second television station in the Los Angeles market, the FCC gave Viacom six months to come into compliance with the radio-television cross-ownership rule by selling one of seven radio stations it currently owns in the market.

This is the first time the FCC has given the purchaser of a single broadcast station a time period to come into compliance with a multiple ownership rule. The FCC emphasized that the only reason it was granting a divestiture period was that the size and diversity of the Los Angeles media market made it a unique circumstance that is unlikely to be present in other media markets. BE

Dateline

No biennial ownership reports are due this year.
Renewal applications will be due for all stations in Washington D.C., Maryland, Virginia and West Virginia on June 1, 2003. For stations in these locations, pre-filing public notices will have to be broadcast beginning March 1, 2003. This will begin the next renewal cycle, which will extend through 2006.

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

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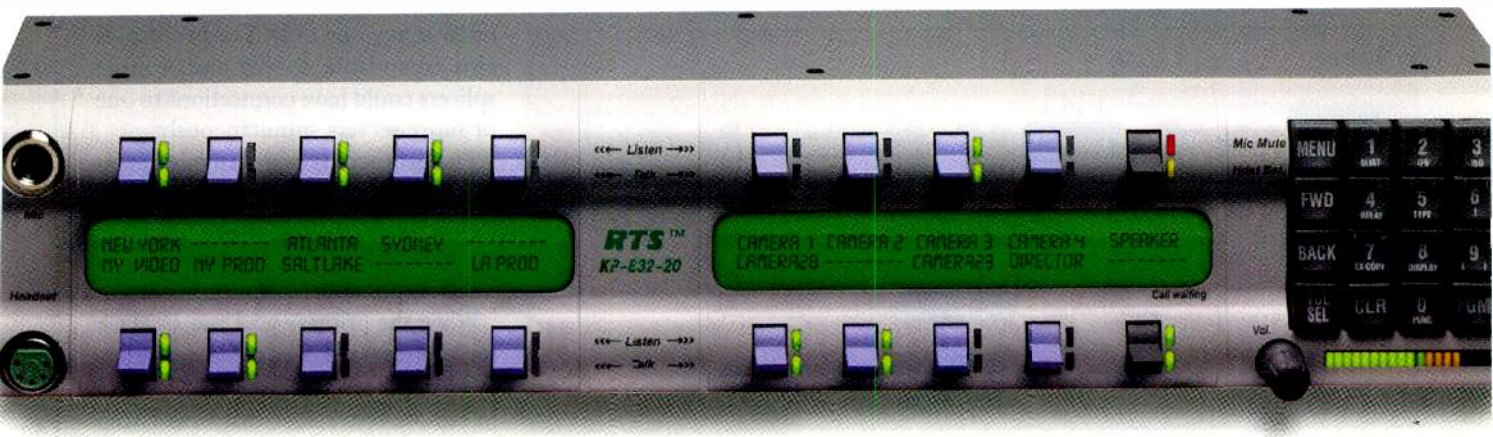

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BEYOND THE HEADLINES

Digital program insertion

BY WAYNE SHELDRICK

As the transition from analog to digital broadcasting continues, more and more traditional applications must be converted to take advantage of the new digital medium. One of these applications is the insertion of local advertising content into the program service at cable headends – a multibillion dollar revenue generator for cable operators.

Digital program insertion (DPI) capability offers a much higher degree of security, increased regional control of program insertion and enhanced management of other crucial digital server-based applications. A digital program/commercial insertion system is shown in Figure 1.

The traditional analog method sends cue tones along with the video that trigger a tape machine to start or stop playing an advertisement. A simple video switch is triggered to perform a transition between the two sources. The headend is permitted to insert its own advertising at times made available by the program provider, commonly known as "local avails." This procedure is by nature slow, insecure and offers little localized control.

In digital operations, programmers and cable operators must be able to handle this process digitally, or risk losing huge amounts of potential ad revenue. Digital offers several advantages and provides an opportunity to expand the functionality of the cueing mechanism. Today's digital technology provides a method for inserting any program content into an existing service in real-time.

Programmers and cable operators are moving quickly to take advantage of this new technology. The Lifetime Movie Network is currently conducting DPI trials across the United States to verify operation of systems by various server/splicer vendors. The DPI technology is installed as an overlay to the existing cue-tone system, which allows the use of both analog and digital ad insertion during the transition period. In addition to compressing the signals, the encoder injects DPI signaling based on cue trigger inputs.

Broadcasters introducing advanced services such as VOD will reap the benefits of the superior switching and control ability of DPI systems.

Advantages of digital

DPI has the ability to eliminate many of the shortcomings of analog. But, for DPI to be effective, the splice points where ads are inserted must be identifiable. A switching system can then be used to control the airing of content from servers and other sources.

An SCTE ad hoc committee developed a standard, SCTE35 2001 (DVS 253), to define the trigger to signal the local video server to play an ad, as well as SCTE30 2001 (DVS 380), standardizing the application programming interface (API) between servers and splicers. Typically these devices will be supplied by different companies, so a standard method of communication is required.

The API is based on an Ethernet TCP/IP connection, and allows for the setup and teardown of network connections. Each connection controls one insertion channel from a server, so there may be multiple connections open at any one time. The protocol is also expandable, so that one or more splicers could have connections to one or more servers simultaneously.

The protocol is primarily designed for use with a splice info message, but it could also be used for local control of a server, for example, in VOD applications.

While the primary goal was to allow the local insertion of ad content at a cable headend, the SCTE group also worked to remove restrictions that would keep the standard from being used for any programming and within any MPEG-compliant system, such as DVB or ATSC.

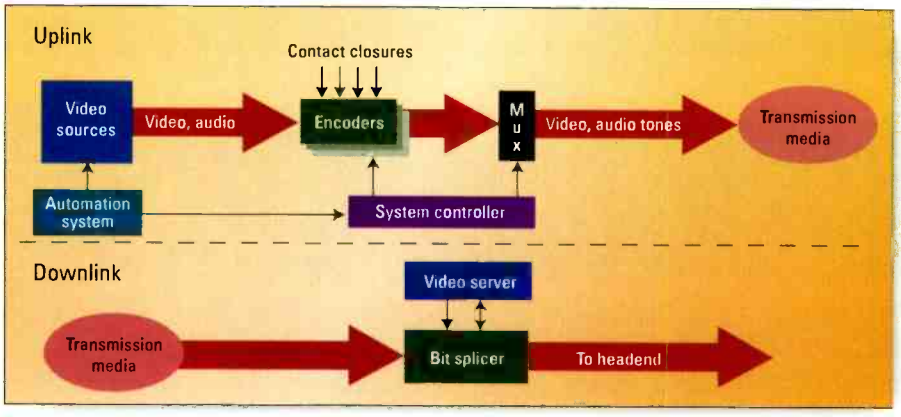

Figure 1. In the DPI system shown above, local advertising is encoded and sent to the local headend, which uses a bit splicer to insert the advertisement at the desired point in the network's programming.

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A critical component of successful program insertion is accurate splice timing. Various methods can be used to signal a splice point in an arbitrary video stream, and to signal a video server to start playing content to replace the network feed.

This splice insert command references timing information found in the video stream. However, even a digital video file server requires some time in advance of a splice point to cue up frames of video. Therefore, a splice insert command is sent at least once and at least four seconds before a splice point. The same splice insert command may be sent multiple times to guarantee successful reception.

DPI offers the ability to schedule ad insertions far in advance and ensures that the ads are placed in the correct order, at the proper times. These enhancements are made possible through the Splice Information section. This area is composed of a start command, a stop command and a cancel command.

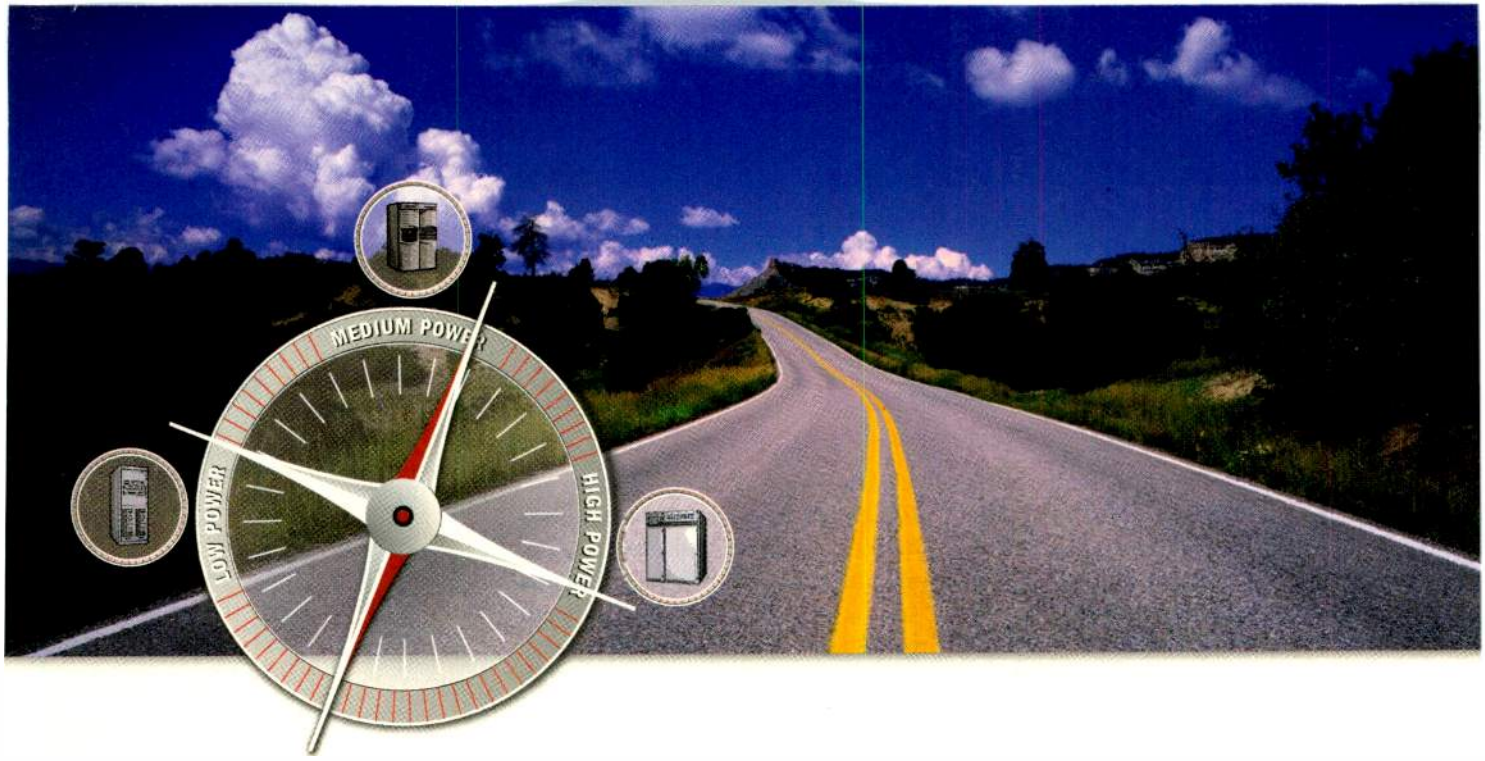
Both the start and stop commands can be signaled to activate immediately upon reception, or to activate at some time in the future. A cancel command always occurs immediately, and terminates the current insert or any cued splice point. The stop command is optional, since the ad will end when the end of the stored content is reached.

This implementation provides two key features that are unavailable with analog cue tones: scheduling of avails well into the future, and the establishment of different groups of splice insert commands for the same avail period. This is more effective than sending multiple cue-tone sequences at the same time, as is done in analog. Because these commands are sent in advance and transmitted faster than analog tones, the accuracy of the splice points is retained.

The other information related to the splice includes the unique program ID, the total number of avail periods and the specific avail period this event is referencing. This data provides better control over scheduling and allows the DPI system to automatically recover from missed events. For security, the splice information section supports a simple fixed-key encryption mechanism.

Thanks to improved technology and industry standards, digital program insertion offers tremendous revenue potential for cable operators, with greater capability for targeted advertising and faster, more efficient, secure ad insertion. As operators roll out additional advanced services such as VOD, they will reap even more benefits from the superior switching and control ability of DPI systems. BE

Wayne Sheldrick is principal engineer for Scientific-Atlanta.



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The color bars puzzle

BY MICHAEL ROBIN

Color bars signals are widely used and often misinterpreted. Their primary function is not, as is often supposed, the testing of transmission channels, but rather the precise alignment and checking of color encoding and decoding equipment. With PAL and NTSC, they can be used as means to verify that a circuit is not suffering from excessive defects in performance. Typical uses are in camera encoders, analog VTR output signal adjustments of gain, setup, saturation and hue, as well as studio color monitors and home receiver color rendition. They cannot replace standard performance measurements.

A number of different color bars signals exist. Many of them are application-specific — that is, they reflect the operational requirements of the specific organization, like color bars optimized for use with amplitude modulated transmitters. They all share a common general form.

The color bars signal produces a sequence of vertical bars displayed on the television screen showing saturated primaries and their complements as well as black and white. In the case of a signal that uses the full frame, the active line is generally divided in eight equal parts. The first is occupied by a luminance reference bar — that is, a white bar of a standard amplitude. The last is a black bar, which is black level only. In between, there are six bars representing the three primary colors and their complements. They are, in order, Yellow, Cyan, Green, Magenta, Red and Blue. The standard order of presentation has been chosen to give a descending order sequence of luminance values. The first row in Figure 1 shows the screen display of this signal.

Color bar nomenclature

A color bar generator has three outputs corresponding to the primary Green, Blue and Red gamma-corrected color signals (E'_G, E'_B, E'_R) as described in the SMPTE 253M Standard and illustrated in the second, third and fourth rows of Figure 1. These signals consist of a sequence of flat-top pulses. They are time-coincident, of equal amplitude and equal bandwidth. By a suitable overlap of the pulses in certain portions of the raster and nonoverlap in others, the three saturated primary colors, as well as the three saturated complementary colors, are produced.

These signals may be used in their original form (component analog GBR signals), matrixed into E'_Y, E'_B-E'_Y and E'_R-E'_Y (scaled or non-scaled), or encoded into an analog (PAL, NTSC or SECAM) or digital (component or composite) signal.

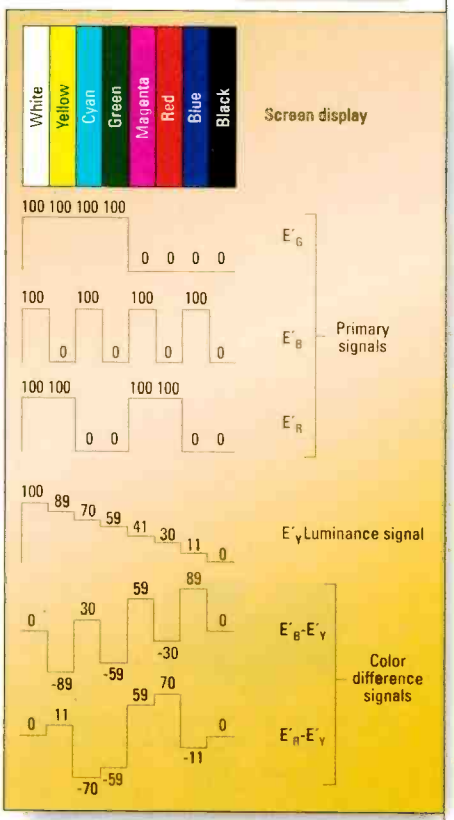

Figure 1. The top part of this figure shows the 100/0/100/0 color-bar signal as it would appear on a video screen. The remaining six rows show this signal as it would appear on an oscilloscope, with amplitudes measuring in percentages of 700 mV.

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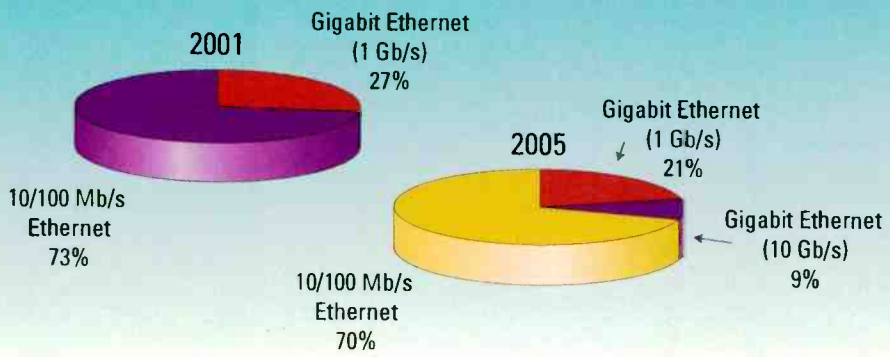

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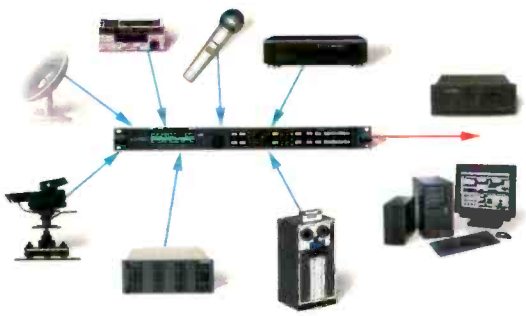

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Color bars signals are identified with four numbers, representing percentages of the maximum value of 700 mV (100 percent), with an oblique stroke between them as follows:

- The first number describes the primary color signal level during the transmission of the white bar — that is, the maximum value of E'_G, E'_B, and E'_R.
- The second number describes the primary color signal level during the transmission of the black bar — that is, the minimum value of E'_G, E'_B, and E'_R.
- The third number describes the primary color signal level during the transmission of the colored bars — that is, the maximum value of E'_G, E'_B and E'_R.
- The fourth number describes the minimum level of the primary color signals during the transmission of the colored bars — that is, the minimum value of E'_G, E'_B and E'_R.

In Figure 1, the maximum amplitudes are 100 percent (700 mV), and the minimum amplitudes are 0 percent (0 mV). The green channel signal usually has a negative-going sync pulse of an amplitude of 300 mV. As generated, these signals have no setup. This type of color bar signal is called 100/0/100/0. For certain applications, it may be convenient to reduce the amplitudes of the signals to 75 percent of their maximum value. This type of signal would be identified as 75/0/75/0. In certain cases, the white bar is maintained at 100 percent, and the colored bars are reduced to 75 percent. This type of color bar is called 100/0/75/0. It is sometimes erroneously referred to as 75 percent color bars.

Matrixed color bars signals

G,B,R component color bars have relatively limited practical uses. They are mainly used to verify and adjust the gain of component analog G,B,R distribution systems and serve as a signal source for matrixed and encoded color bars signals. The matrixed color bars signal is derived from component E'_G, E'_B, E'_R signals by a specific process. It consists of matrixing the three component analog signals into a new set of component signals: a wideband luminance signal with or without setup (E'_Y) and two narrow-band color-difference signals ($E'_B - E'_Y$ and $E'_R - E'_Y$).

The primary function of color bars is not the testing of transmission channels, but rather the precise alignment and checking of encoding and decoding equipment.

For standard definition video, the E'_Y signal is given by the following expression:

$$E'_Y = 0.587\,E'_G + 0.114\,E'_B + 0.299\,E'_R$$

The fifth row of Figure 1 shows the formation of the 100/0/100/0 E'_Y signal from the primary E'_G, E'_B, E'_R signals. The amplitudes of the eight steps are expressed in percentages of the full-amplitude signal (700 mV).

The color-difference signals are bipolar and have equal positive and negative excursions. The sixth and seventh rows of Figure 1 show the graphic representation of the two color-difference signals. Their amplitudes are expressed in percentages of the full amplitude primary signals (700 mV). These signal amplitudes are reduced by scaling factors to meet specific signal amplitude range requirements. When the allowed amplitude range of these signals is 700 mV (±350 mV), as specified in the EBU N10 Standard and the ITU-R BT 601 recommendation, the color-difference signals are given by the following expressions:

$E'_{CB} = 0.564\,(E'_B - E'_Y)$, also known as P_B in North America

$E'_{CR} = 0.713\,(E'_R - E'_Y)$, also known as P_R in North America

Different and incompatible scaling factors are used by North American versions of the Betacam and MII component analog videotape recording formats. The dominant European versions of these formats use the EBU N10 scaling factors.

The color-difference signals can be displayed on a regular component

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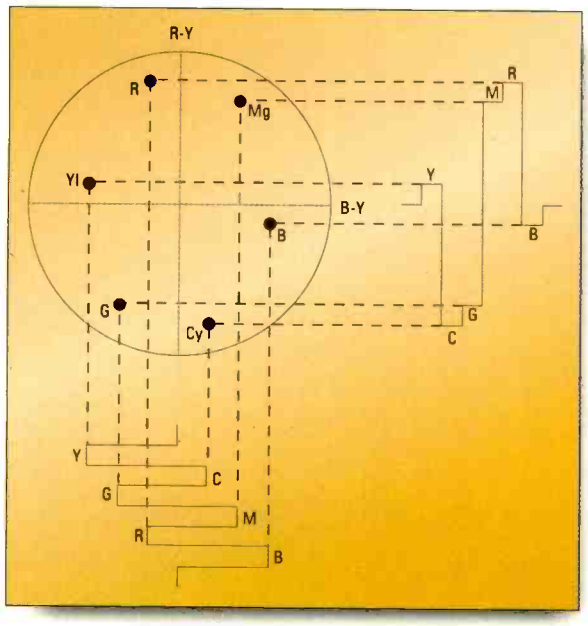

Figure 2. A vector representation of the color-difference components of a matrixed 100/0/100/0 color-bar signal.

waveform monitor, either sequentially or individually, to allow for the measurements of such parameters as signal amplitude and relative time delay with reference to the luminance component. In addition, a vector display, similar to the NTSC vector display, may be obtained by feeding the P_B signal to the horizontal input and the P_R signal to the vertical input of an oscilloscope as shown in Figure 2 on page 21. Specialized component analog vectorscopes with electronically generated reference graticules are available from several manufacturers. Note the absence of the burst in the display.

Digital and contemporary studio analog video equipment can handle 100 percent color bars without difficulty.

Next month, this color bars series concludes with a look at encoded color bars signals.

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

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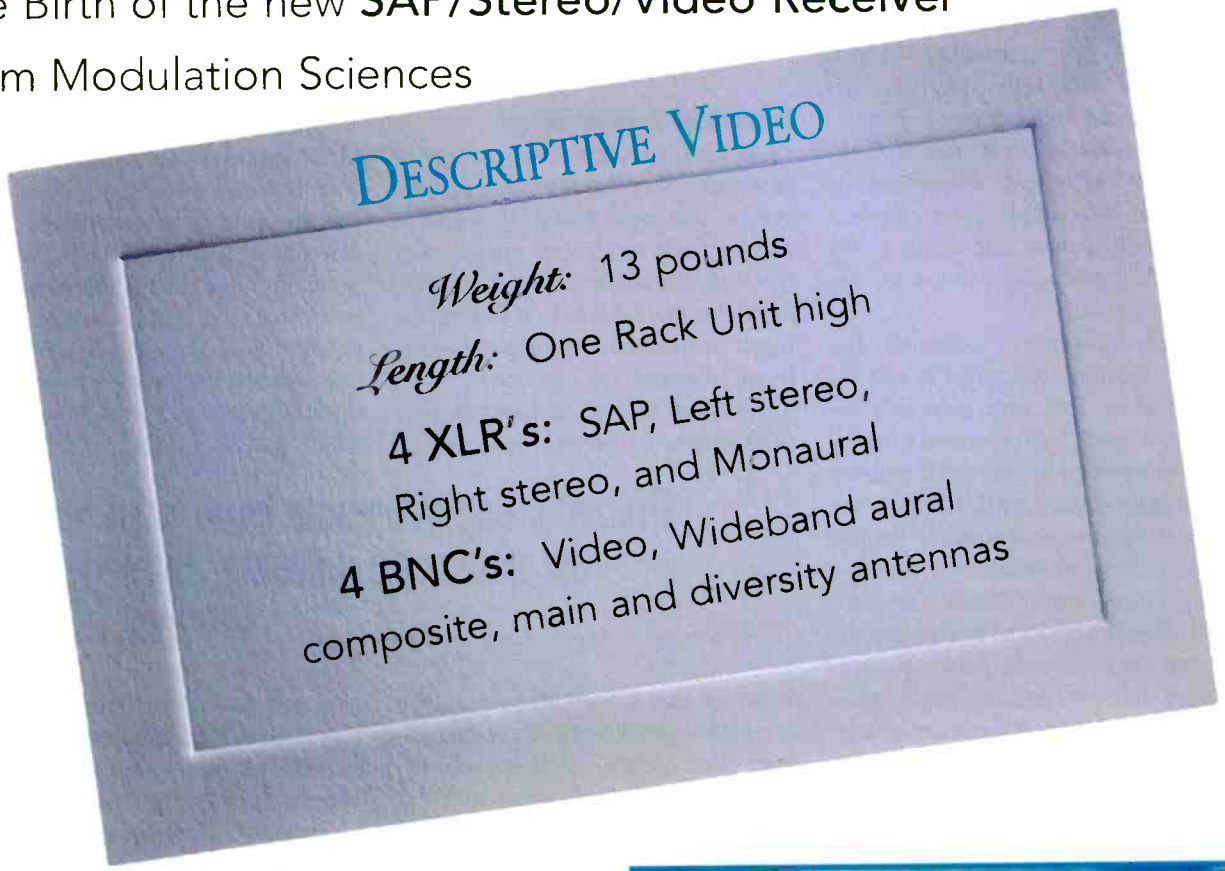

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Media asset management

BY BRAD GILMER

Media asset management (MAM) systems rapidly sift through vast collections of material to locate the material the user requests. MAM systems are particularly useful in video applications where it may be difficult or impossible to sift through thousands of hours of material manually.

Search-and-retrieve technology has been economically applied to text for many years. But, until relatively recently, it hasn't been practical to apply this technology to video. There were three main reasons for this. First, in the past, it was not economically feasible to store large amounts of video in a "computer-friendly" form. However, with the falling price of storage and the increasing processing power of computers, this problem has largely gone away. Second, while it was relatively easy to develop retrieval technologies for text systems, developing technology that aids in retrieving images is another matter. But, over the last five years, dramatic improvements have been made in the automatic indexing, cataloging and retrieval of video. Finally, cost has been a significant barrier to the adoption of these technologies for video. While cost continues to be a factor, smaller and less costly systems are beginning to appear on the market. This allows users to implement MAM on a limited basis, learning for themselves where the benefit of these systems lies.

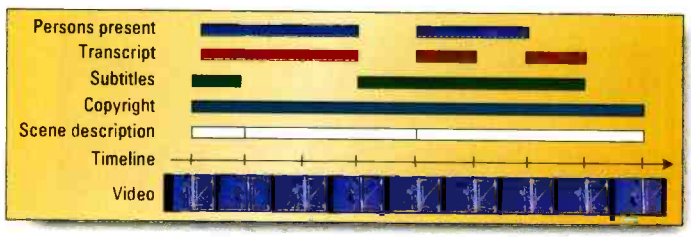

Figure 1. This diagram illustrates the stratified-documentation technique that can be used in the cataloging process.

Entering information

Ingest is the process of taking material in whatever form and loading it into the system. The ingest process may involve playing back videotapes, transferring files from one server to another, or playing back audio DATs or CDs. During the ingest process, basic slate or "clapperboard" metadata are also entered. This information consists of items such as title, length, ID number and source.

Dramatic improvements have been made in the automatic indexing, cataloging and retrieval of video.

Some of this information must be manually entered, some of it may come from other systems, and in the near future, some of it will come from the metadata contained in the file itself through something like the Advanced Authoring Format (AAF) or Material Exchange Format (MXF).

Some MAM users employ an optional triage step to filter out unwanted material before it goes further into the MAM system. Triage may also be used to identify material that should receive expedited handling. One of the powerful benefits of MAM is that it can make one clip available to many users at the same time. If a user knows that a particular clip will be heavily used, it might be a good idea to fast-track that content through the rest of the process.

During the annotation process, people make notes about what is happening while watching the scene on their computer or a separate monitor. MAM applications typically include VTR-like control of the playback, so that the person annotating the scene can pause playback while making notes. To some extent, annotation can be performed automatically. Some vendors have developed technology that harvests information from closed captions, subtitles and on-screen text. While speech-to-text technology has struggled, recent breakthroughs might make it possible to annotate scenes using words spoken either by the annotator or directly from the dialog.

Automatic indexing works by detecting naturally occurring changes in video content, such as fades to black and large changes in scene content from one frame to the next. Such changes usually indicate the end of one scene and the beginning of another. Computers automatically index ingested scenes using advanced technologies such as cut detection, scene-change detection and even image recognition. And, as research moves forward at a fast pace, driven to some extent by the events of Sept. 11, we can expect to benefit from these new advances.

Cataloging is the process of organizing information about a scene so that it can be retrieved later. A cataloger organizes information into subject areas and may store it in a standard data model. Standardized vocabularies and limited

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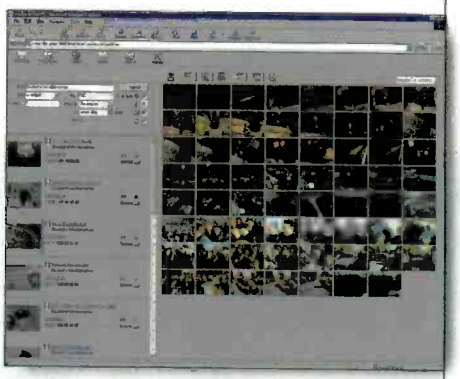
thesauri are used to aid in retrieval. Why is a standardized vocabulary important? Well, let's say you wanted to locate images containing the basketball player Shaquille O'Neal from a MAM system used to catalog images from live sporting events. Let's also assume that it was an early system that did not have a standardized vocabulary. If you typed in "Shaquille," you might get 20 hits (images that the system thought you would like). If you then typed in "Shak," you might get another 10. Entering "Shack" might yield two more. The author recently suffered this very experience. It illustrates that, if a piece of video is entered without accurate metadata, the video is lost. Actually, it is worse than lost — because you are paying to store something you will never be able to find.



Automatic cut detection and scene-change detection in asset management systems like blue order's media archive 2.8 is used to produce a "light-table" view, summarizing an entire movie at a glance. Users can quickly navigate through the content to find the desired scene.

During the cataloging process, different techniques can be used. Stratified documentation is one technique used by some vendors to make metadata more accessible. In this process, temporal stratification makes use of timelines to point to a piece of the audio or video object. Descriptions can be linked to this piece by storing them together with the time code information. The media object itself may be stored in a completely different location. This allows describing the object in several layers. As Figure 1 shows, metadata about a videotaped meeting involving the persons present, subtitles, copyright and scene description can be described in distinct layers, while each layer may employ a completely different timeline. Considering the number of new automatic indexing tools evolving that can generate much of this information automatically from the media object, this can be especially useful. During retrieval, combinations of these strata may be referenced to identify exactly the media segments you are interested in. The same approach applies for spatial stratification, virtually breaking an image into pieces and describing them individually without really touching the image.

Storage is not a separate step in the MAM process. Material is stored in the

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system as soon as it begins the ingest process, and metadata is added as it is entered, all in real time. As soon as the information is entered, it is available to other clients in the system.

Information retrieval

All the processes discussed thus far involve putting information into the MAM system. The processes discussed below involve taking information out of the system.

Using a retrieval client, users query the system to locate material. For example, a user may search for specific text or images using different still-image views that were created using cut-detection technology. The specific functions available in retrieval clients vary widely from manufacturer to manufacturer.

How might a user use a retrieval client? Consider the following example. A producer is asked to make a 30-second promotional piece for a movie that will air next Saturday night. The producer views the movie in its entirety, making notes of scenes he or she thinks will be appropriate for the promo. Using a retrieval system, he or she looks at various scenes that were detected using cut-detection technology. He or she quickly identifies the right scene, and then calls up a low-resolution copy of the video on a desktop editor. The system allows him or her to go directly to the part of the movie identified in the still-image view and begin preparing a rough-cut edit. This rough-cut system produces an EDL that can then be used to expedite the online editing process.

If a piece of video is entered without accurate metadata, you are paying to store something you will never be able to find.

Once the user identifies the material needed, the next step is packaging it. Some MAM systems allow users to output it in the resolution that is appropriate for their use — for example, a high-resolution copy, a browse copy or still images.

Some MAM systems can deliver images directly to the user in an e-commerce or Web-based model. These solutions may include billing and rights-management options.

All MAM solutions also include maintenance and user access functionality.

There are two important things to recognize about MAM systems. The first is that in some vendor implementations, some processes can occur in parallel. For a breaking news story, once the ingest process begins, operators begin indexing and annotating the material. At the same time, automatic annotation processes can begin populating the MAM system with information. Finally, editors can begin rough-cut editing material *before* recording at the ingest station has ended. The second important thing to recognize is that many MAM systems use inter-process communications. This means that when an ingest client completes an entry for a particular piece of media, those entries are immediately available to other clients on the system — without waiting for any files to close and without having to restart any applications. BE

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

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

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Digital audio workstations

BY YASMIN HASHMI

Despite the recent demise of a number of long-standing digital audio workstation (DAW) manufacturers, there are still plenty of products to suit virtually every budget and application. *The DAW Buyers Guide* at DAWguide.com lists more than 120 different manufacturers offering over 270 current products including cards, software, turnkey systems, rackmount multitracks, stand-alone desktop units and portable recorders. More than a third of these products are aimed at the post-production market for TV/video and, of these, more than 75 percent are priced at less than $10,000.

Developments in DAWs

Even before the dotcom crash, the DAW market was experiencing a shakeout. For instance, a pioneer, Digital Audio Research (DAR), no longer offers the SoundStation STORM product range, though it is still actively marketing other systems, including its four stereo output Trigger system and its OMR8 24-bit/96 kHz eight-track disk recorder/editor. iZ Technology broke its ties with Otari and is marketing the RADAR system directly. Fairlight acquired the intellectual property of DSP Media and launched the new DREAM series of digital recording, editing and mixing products.

Many new products in the digital audio industry, like HHB's PORTADRIVE, are aimed at portable tapeless recording. Photo courtesy HHB.

Sonic Solutions recently announced the formation of Sonic Studio, LLC, a new company that aims to accelerate development of the SonicStudio HD line. Merging Technologies will rescue the WaveFrame FrameWorks owners by means of a software upgrade to the Pyramix.

Apart from DAW market newcomer Apogee with its NativeTools Studio Edition, which combines Apogee converters with Steinberg Nuendo software, many of the new products available are aimed at portable tapeless recording.

The existence of more than a handful of DAWs over $30,000 shows that demand for the high-end has by no means vanished.

These include the new Mayah Flashman handheld recorder and the HHB PORTADRIVE compact location recorder for TV and film sound recordists. In addition, TASCAM has launched the Pocketstudio 5, and Digidesign has developed the Mbox portable micro project/home studio, which consists of Pro Tools 5.2 LE software and a small two-channel USB audio peripheral.

Among the new offerings from well-established manufacturers are significant enhancements that are designed not only to appeal to new customers, but to help keep existing installed bases up-to-date. AMS Neve, for example, has announced several plug-in partnerships such as the ServerSound that integrates mSoft's sound effects library and search engine into AMS Neve's StarNet environment. In addition, AudioFile SC now supports a multitrack trim feature for editing surround stems in response to the increasing demand for tools to simplify surround format editing.

As well as offering a Dolby Digital encoder plug-in for Nuendo, Steinberg has announced an alternative that automatically encodes to DTS (Digital Theater Systems) surround format and allows DTS audio to be saved in WAV format for direct burning of a 5.1 mix to CD.

The latest release of SADiE Disk Editor software for the SADiE 24.96, ARTEMiS and RADiA systems includes new display features such as individual vertical zoom settings for EDL streams, large or small PQ and video stream settings, and enhanced waveform viewing.

New developments for the Merging Technologies Pyramix aimed primarily at audio post-production applications include the ability to synchronize and control third-party applications running on the same PC, over networks and to external time code-based machines using TCP/IP, RS-232 or RS-422.

For those interested in Windows-based software-only packages for PCs, new features included with the Syntrillium Cool Edit Pro 2.0 include real-time effects and track-based EQ, MIDI and video playback support, six new DSP effects, loop-based music composition, and a compressed loop file format. Version 2.0 of the Cakewalk SONAR offers unlimited digital audio and MIDI tracks, a centralized interface design, advanced audio looping and editing tools, DXi software synthesizer plug-ins, and extensive audio loops and SoundFont libraries.

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DIGITAL HANDBOOK

Accessing more tracks

Around half of all DAWs on the market now support 32 playback tracks, and almost a quarter support more than 96. Many are also offering the ability to access these tracks through more than just a limited number of I/Os. CreamWare, for example, is offering the Luna II Extreme I/O recording package bundle that offers 36 I/Os, of which 18 analog I/Os can operate simultaneously at 24bit/96 kHz. The new Digidesign Pro Tools|HD is available in three expandable core configurations ranging from 32 I/O channels and 96 simultaneous audio tracks, to 96 I/O channels and 128 simultaneous audio tracks.

A growing number of manufacturers are also focusing on using multichannel I/O for digitizing and archiving analog recordings. Cube-Tec, for example, has introduced a new Tape-24 module for its QUADRIGA automated audio archival system that supports 24-track audio capturing of analog session tapes. The TransferStation hardware and software option for the Euphonix R-1 multitrack recorder translates R-1 formatted files to the industry-standard AES31 file format while retaining all edits, crossfades and time-stamped information. It aims to offer enhanced compatibility with current and future DAWs, and is now also bundled with the Steinberg Nuendo software, Version 1.6 of which includes support for the AES31 interchange standard.

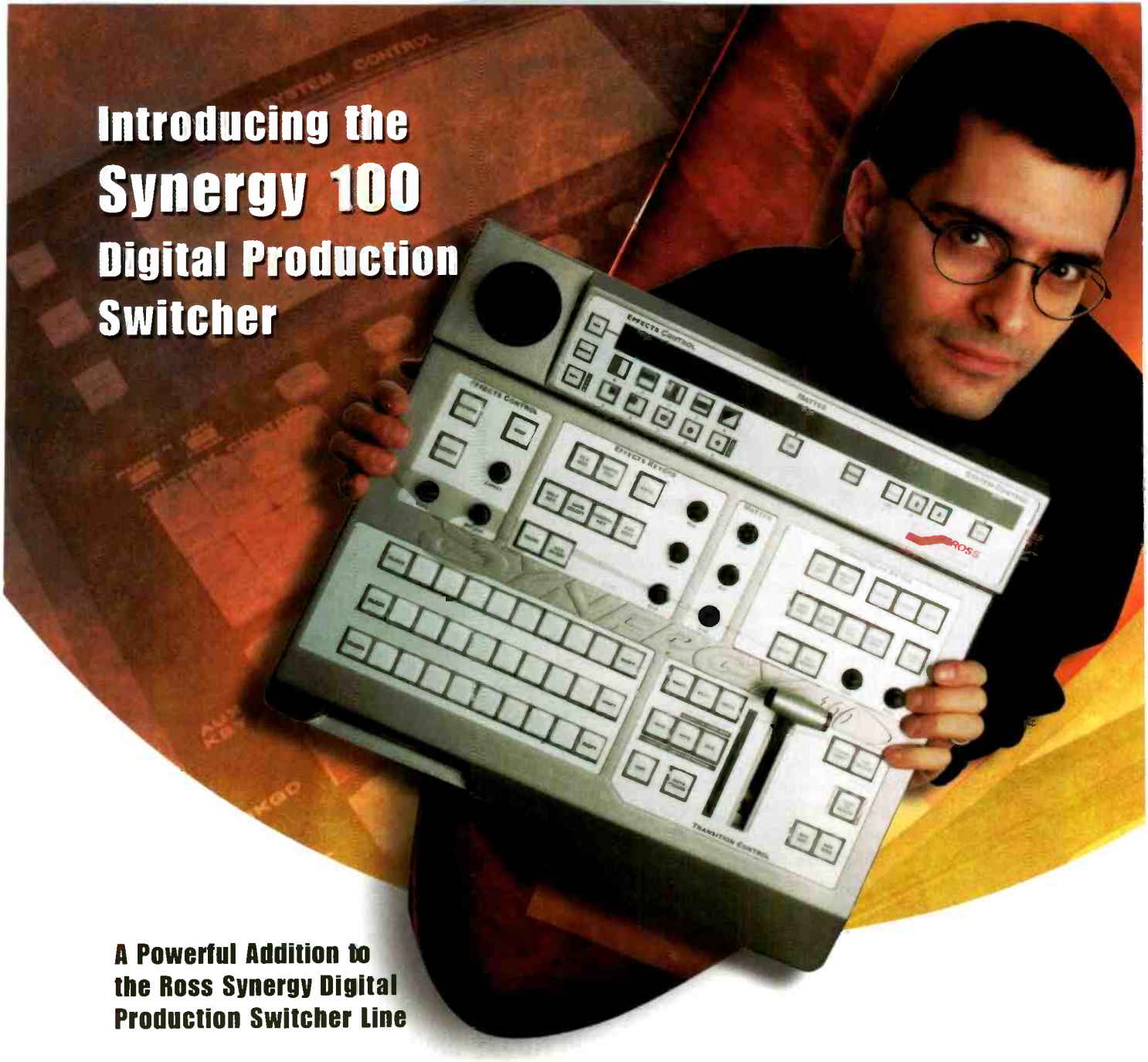
AMS Neve's AudioFile SC now offers support for a multitrack trim feature for editing surround stems, to meet demand for tools to simplify surround format editing.

On the move

While AES31 promises true interchange between different systems via more than just sneakernet, manufacturers have also been looking at alternatives for long-distance collaboration. Digidesign and Rocket Network have announced the DigiDelivery service for sending Pro Tools sessions and other data via email, while SADiE and Rocket Network intend to launch a RocketPower application for interchanging SADiE data with other RocketPower-compatible products. BE

Yasmin Hashmi is a partner at SYPHA and editor of The DAW Buyers Guide.

Introducing the Synergy 100 Digital Production Switcher



A Powerful Addition to the Ross Synergy Digital Production Switcher Line

With the introduction of the Synergy 100 control panel, Ross offers operators yet another panel option for the popular Synergy 1 series digital production switchers.

The single MLE Synergy 100 offers an impressive feature set including 16 digital inputs, 10 source buttons with shift, "Squeeze & Tease" DVE effects, 3 axis joystick, 3 keyers (2 MLE + 1 DSK), 2 chroma keyers, 8 aux buses, disk drive, advanced DSK borders, preview overlay, industry standard editor interface, and free software upgrades from the world wide web.

The stylish Synergy 100 panel comes in a choice of colors Classic Black, Tech Silver and Sport Yellow.

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SYSTEMS DESIGN SHOWCASE

KTVU-TV's and KICU-TV's dual-station master control center

Digital System Technology (DST) recently integrated a new master control into one Cox Broadcasting-owned station to form a dual-station master control center. KICU-TV, an independent station previously operating in its own San Jose, CA, facility, was relocated to the KTVU-TV facility in Oakland, CA. As of Jan. 1, 2002, the two stations now operate under one roof on a 24-hour dual-station operation schedule.

The driving force behind the move was to maximize efficiency in local operations for Cox Broadcasting. Following the acquisition of KICU, it was determined that its cost of operations in San Jose no longer justified its existence as a stand-alone station. With all of its commercials loaded onto a server, most of its programming did not require much attention. Loading tapes for programming was the brunt of its operation, and these tasks could be easily performed through a dual-station master control. Relocating KICU's operations to the KTVU facility has resulted in considerable savings in labor costs.

Integrating master control for both stations creates two additional benefits. One, the facility is designed so that one person can control operations of both stations most of the time. KTVU and KICU can be easily split into two operations during peak hours, when operators are required for both stations.

Ken Manley, director of engineering at KTVU, contacted DST in September 2001 to discuss initial plans of merging the stations and possibly including several more in the future. This requirement involved making room for multiple program streams out of the master control room to accommodate multicasting and centralcasting scenarios.

DST began the project in October 2001, with a Dec. 31, 2001, target date for completion. Due to the timeline, on-site preparations were handled by KTVU. The station team determined where the expanded master control center would be located and moved an edit suite to make room. The two parties considered a number of layout options before coming to a final decision.

DST selected and specified the equipment in a joint effort with KTVU. The result was an equipment package that meets the needs of the expanded facility and functions well with existing equipment.

Relocating KICU's operations to the KTVU facility has resulted in considerable savings in labor costs.

Master control center

Three Grass Valley M2100 switchers serve as the heart of the dual master control center. The facility was designed as an N+1, which translates to the number of stations within the facility plus one backup for full redundancy. This design is more cost efficient: Four switchers would be required for full redundancy in separate facilities. Since both stations now share the same backup switcher, the cost of backup equipment is cut in half.

The switcher system features mini-control panels installed along a secondary "live event" operational console. The main control area, located at a supervisor console in the back of the room, features a full-size control panel. This workstation allows one person to monitor and control both stations during less active time periods. The stations are equipped with Louth automation, the capacity of which was nearly doubled with the addition of KICU. In the event of an automation equipment failure, the operation can be run in complete manual mode. The switching system enables the control of any of the three switching frames via any one of the three control panels, allowing any switcher to be assigned where the operator wishes (see Figure 1).

When an operator elects to use a different switcher, the automation list remains intact. KTVU developed a unique approach where all sources are available to each of the three switchers.

The main control area of the new dual master control center at KTVU/KICU is a "supervisor console" located in the back of the room. The Sony HDTV monitor wall features Evertz custom quad splits for 960i signals. A full-size Grass Valley M2100 control panel allows one person to monitor and control both stations during less active time periods. Photo courtesy DST.

BY DWIGHT CRUMB

Once operations switch to the backup, primary sources are immediately available and only a simple re-route of the secondary signals is required. The system controls each switcher in the same way, eliminating the need for extensive reprogramming of the automation system.

For further backup of on-air operations, a Leitch 16x16 switcher is situated at the point of final output. The signals generated from the M2100s are fed via the Leitch switcher into the on-air paths. Four different versions of each program stream were designed so the stations can feed the most suitable version of their programs to six satellite and cable companies, as well as to their NTSC and DTV transmitters.

A Leitch Panel Mapper system displays sources and destinations in a matrix. In addition, in the unlikely event that all three M2100s fail simultaneously, sources can be routed directly to the Leitch switcher and put on the air for uninterrupted programming.

Monitor wall

The monitor layout of the master control center is the visual cornerstone of the room. The stations use high-quality, 1080i HDTV-ready consumer televisions for the monitor wall and feed them with Evertz Quattro units to generate native high-definition quad split displays. A total of 12, 32-inch flat monitors were installed, giving the monitor wall the look of a flat wall of glass. This layout provides the master control with a futuristic look, especially in comparison to the rows of equipment racks that traditionally encase monitors in master control rooms.

However, this unique setup proved to be challenging. The monitors, though advertised as 1080i, appear to be 960i models (480p doubled). This means that when a true 1080i signal is fed into the monitor, it is displayed in the 960i format, cutting off the top and bottom 60 lines of the image. In the end, 12 percent of the image is lost.

When this issue was discovered, the monitors' top and bottom blanking were adjusted to minimize the problem.

The Quattro system was initially designed to take in four SDI signals with embedded audio and provide one 1080i output. However, as the monitors seemed to be 960i, the system did not function properly. To solve this problem, Evertz wrote custom 960i software for the monitors.

The software is a vital aspect of the master control center. It takes in the SDI signal and provides quad splits in high resolution, with audio leveling and error checking. It also monitors numerous automated source parameters, which will alert the operator of a particular problem in any signal path. With a normal quad split device, the displays are one quarter of their normal resolution. However, because the monitors and the software produce high resolution, the quad splits retain their original standard resolution on the monitors. In addition, the inputs of the quad split generators are 601 formatted and then converted into 960i for the monitors.

Tape floor

Outside of master control, there were also changes in both the tape floor island and the "cold room." The tape floor was one of the biggest challenges, as integration work was taking place in the middle of the day. Operators were preparing broadcast materials while DST was building the appropriate media ingest stations. Four ingest stations consisting of Digital Beta machines, analog Beta machines, one-inch machines and terminals for the servers were installed in the existing space.

The cold room houses the support terminal gear and electronics for the

entire facility. KTVU already had a lot of Miranda gear, and they elected to stay within that product line when purchasing terminal gear.

All of the electronics for the M2100 frames, or "brains" of the switchers, also live in this room. The equipment is set up in three racks: System A (KTVU), System B (backup) and System C (KICU). All equipment in racks A and C is assigned to its specific station, and everything housed in the middle rack is used by the two other systems. The main digital SD and HD router is an existing ADC/Nvision system that was expanded to 64x48.

Another challenge was that satellite sources are evolving from analog to digital transmission. Sixteen analog satellite feeds are taken in, along with seven digital sources. To convert all 16 to digital and embed audio would be expensive, so DST employed a 16x8 analog pre-router feeding into eight Leitch DPS-475 frame synchronizers. Any eight analog feeds can be brought into the plant via the frame synchronizers. The DPS-475s handle audio embedding and provide an upgrade path for digital. As the satellite feeds become digital SDI signals, the frame synchronizers can be switched over to their digital inputs. All the while, the

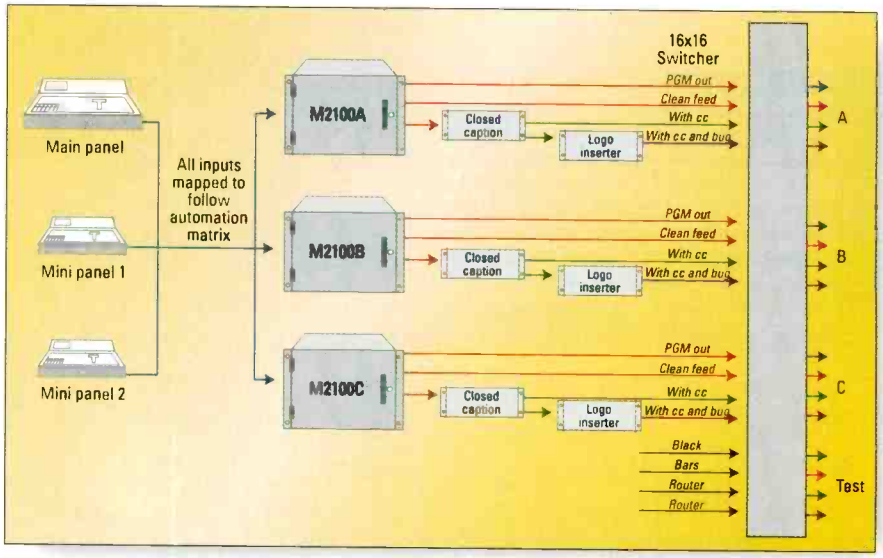

Figure 1. Operators at any of the control panels can control any of the M2100 switchers. The signals generated are fed via a Leitch 16x16 switcher into the on-air paths. All frame outputs are available for each final output path.

Louth automation system controls which of the 16 satellites are fed into the frame synchronizers, the master control switchers and the main ADC/Nvision router.

There is also a newly installed analog 12x1 switcher and Videotek VTM-200 at the supervisor's console. In addition to performing high-definition monitoring throughout master control, operators have a means to monitor the NTSC signals being sent to the analog transmitters and cable companies.

The timeline of the project was a challenge for the stations as well as DST. Decisions were made mainly on-site, and there was little time to step back and look things over. This was truly a team effort between DST and KTVU, and a successful one at that. BE

Dwight Crumb is vice president of engineering for Digital System Technology.

Design team

DST:
Lan Merrill, lead project manager
Dwight Crumb, design engineer
Garrick Huey, regional sales manager
Bill Hudson, project manager, lead installer
Simon Shepherd, project manager/installer
Andre Pappas, CAD engineer
Janet Crumb, project manager/CAD engineer
Donna Gramlich, director of purchasing
KTVU:
Ken Manley, director of engineering
Jim Wagner, technical services supervisor
Ken Dixon, Dan Calaway and George Craig, senior engineers
Ed Cesci, director of technical operations

Equipment list

Grass Valley Group M2100 switchers
Leitch RCP-16x16 routing system
Leitch 16x8VA2 ingest router
Leitch Panel Mapper system
Leitch DPS-475 frame synchronizers
Evertz 7700PS quad split and signal monitoring
Evertz 8085 CC translator
Videotek VTM-200
RDL audio level controls
Wohler MC satellite meters
Genelec 1029 APM and 1030 APM speakers
Miranda Symphonie-PS redundant power supply
Bittree patch cords

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CASE STUDY

KWCH-TV Wichita, Kansas

Company Name:
KWCH-TV

Headquarters:
Wichita, Kansas

Number of Stations:
KBSD-TV, Dodge City
KBSH-TV, Hays
KBSI, Goodland
Local Cable Channel

Critical Needs:
Multi-channel operation
CentralCasting configuration
Total automation
Flexibility of control to support live broadcasts

Don Vest, Chief Engineer

Five years ago, Don Vest, Chief Engineer at KWCH-TV in Wichita, Kansas knew facility improvements had to be made. The station needed a flexible automation solution that combined the power of disk-based media storage systems with the reliability of tape-based technologies. As a result, the station chose Odetics Broadcast to help transform its broadcast operations from its single channel, mostly manual master control to a fully modernized, multi-channel automated broadcast facility. "We chose Odetics because they demonstrated a better understanding of how a television station is programmed and operates," says Vest. With Odetics' AIRO™ Automation System, KWCH has been able to extend its capabilities from controlling one station to three others in the Western Kansas area.

Since 1996, KWCH has taken advantage of the scalability and adaptability offered by the AIRO system to meet the station's increasing channel requirements without adding complexity or additional staff. The latest upgrade included integrating the addition of a new AIRO system with their existing AIRO system. "Odetics delivered the capability to merge the media database in the two systems so it would operate as one – this has made a big difference in our capabilities," adds Vest. "This gave us an eleven channel system – eight channels in the new system using MPEG-2, and three channels in the previous system using JPEG."

With AIRO, KWCH is also able to control four stations from one central location and with one operator, all running a different playlist. "This has had a great impact on decreasing the switching errors and improving the technical quality of the commercial spots. Thanks to AIRO, discrepancies reported by the Western Kansas stations have decreased from two pages a day to maybe a single entry" explains Vest.

The AIRO system also gives Vest the flexibility he likes. "We can break away from the combined control, bring in extra operators and run each individual station as a standalone, or even combinations of stand-alone and combined control. And we can do all this while at the same time running a totally separate channel on cable that is virtually unattended."

Where is Vest looking now? "Expansion, expansion, expansion. I'm ready to work with Odetics to continue to expand the AIRO to program our DTV channel."

get on AIRO™

Now less is more popular

BY DON MARKLEY

As no real surprise to anyone who has not been asleep for the past five years, broadcasters have been having trouble meeting the FCC deadlines for DTV operation. For reasons widely reported in the press, the Commission has permitted many stations to start operation with facilities significantly less than those in their allocation – either with an appropriate construction permit or, in many cases, under the terms of a special temporary authorization (STA) – while work continues to construct higher power facilities.

Stations are experiencing significant difficulties in financing their DTV operations and/or getting the new facilities built. In many cases, this still involves obtaining the necessary zoning for new or modified towers and antennas. As has been discussed earlier in these pages, communities are becoming more sensitive regarding any new construction. Increased protests by environmentalists and concerns about such problems as bird kills are making zoning problems seemingly insurmountable.

The temporary use of reduced power has been granted to many stations upon proper application to the Commission with suitable reasons for the need for such operation. Technically, the biggest requirement is showing that the temporary facility will provide adequate service to the city of license. Usually, that requires a simple showing that can be prepared by the station's consulting engineer. The signal strength is not simply that for noise-limited service, but has been established by the Commission to ensure that the urban areas are properly served. The service area for the station, as established by their allocations, will continue to be protected from interference temporarily while the station operates with the reduced facilities. However, that will not continue indefinitely.

Stations are experiencing significant difficulties in financing their DTV operations and/or getting the new facilities built.

The reduced facilities permit the station to get on the air less expensively and with equipment that is easier to install. First, the transmitter is typically one box containing essentially everything needed at the transmitter site. As one example, Harris introduced their Ranger series of UHF transmitters with DTV power output of 460 W or 900 W. While the output power is lower, the features are essentially the same as on their larger kin. For example, the new, smaller units use the same exciter as the larger transmitters. They also have complete circuitry for automatic correction of distortions including the mask filter. The mask filter is built in, which makes the whole installation simple. For remote monitoring, they have the same system of software as in the large transmitters. Finally, these systems can be integrated into a larger solid-state transmitter when higher power operation is desired.

Another example would be the DTValue system from Axcera. That system incorporates a Dolby 5.1 encoder, an SDTV encoder and a complete monitoring package into one cabinet along with all amplifiers and the mask filter. That system is available from 50 W to 500 W. Again, it can be expanded by adding cabinets up to 5 kW.

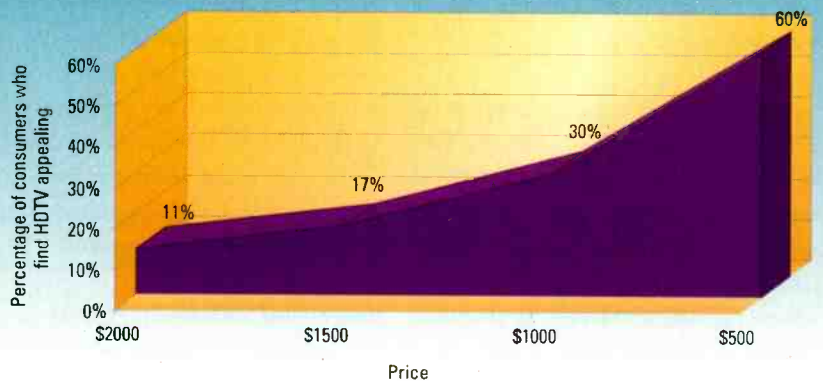
Those two systems are included here as examples of what is available at the lower power levels. Similar systems are available from other manufacturers at competitive prices. Solid-state UHF transmitters are becoming popular for

FRAME GRAB

A look at the consumer side of DTV

Demand for HD depends on price

Consumers are cost-conscious



SOURCE: CEA www.cea.org

Keep your cool with MT Production (MTP), the new compact digital console dedicated to large-scale multitrack mixing for television and music.

Designed to meet the needs of the world's leading production facilities, MTP incorporates powerful HS processing, to allow instant response to any changes the production demands.

Beneath the proven and familiar control surface, a host of production features provide secure, relaxed operation, even under demanding operational conditions.

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+ 48 multitrack busses provide clean feeds, mix-minus outputs and simultaneous 5.1 and stereo mixing
+ Discrete control surface allows instant access to the tools you need, the moment you need them
+ Wide-angle TFT screen with advanced graphics and tactile INFO faders provide outstanding information feedback
+ Redundant power supplies, hot-swappable faders and ultrafast start-up features make MTP perfect for mission-critical environments
+ Instant recall of all channel parameters and signal routing streamlines operation and allows fast turn-around
+ Unrivalled SSL quality, support and service

MTP - the perfect solution to the challenges of television and music production.

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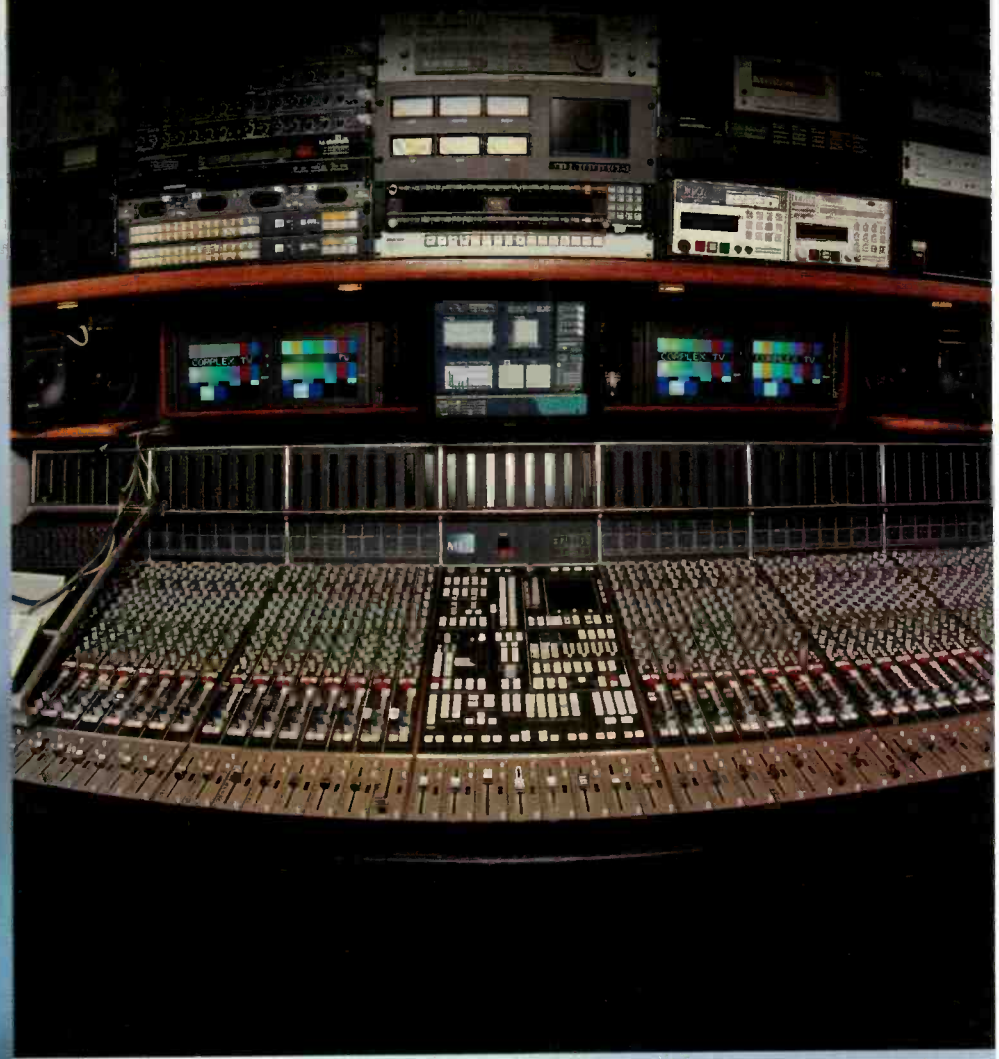

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CARTER RUEHRDANZ, PRESIDENT AND CEO, CORPLEX.TV, NORTHFIELD, ILLINOIS

MT+ Production

Solid State Logic

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DTV use since the required power output is so much lower than for most of the NTSC operations. Of course, solid-state transmitters have been the system du jour for VHF operations for some time and continue their popularity into the DTV operations.

Low power isn't the only new area in transmitters. More features and greater ease of operation are becoming the rule. Again as an example, Axcera now includes a time delay reflectometer feature in their DT2B-based exciter system. That feature is part of their DTVision signal analysis system. The reflected signals are processed in the modulator, and a graph showing the location of the reflection source is displayed on the front panel without other external equipment. While not expected to be a rigorous transmission line and antenna evaluation system, it certainly adds to the information furnished to the operator above having only a return power meter.

For ease of operation, Harris has introduced a new exciter. The Apex is the latest in their series of exciters and is for any VHF or UHF channel. It is fully frequency agile without any channel setup. The most unique feature is that it has no user adjustments at all. Everything is software controlled, and the software is field upgradeable to comply with any necessary changes in the ATSC standards. Think of it – no user adjustments in a digital television exciter with full digital processing and corrective circuitry. We have come a long way from the time it took a technician a couple of hours to get the colors matched in a camera with lots of user adjustable controls. In a completely solid-state transmitter system, maintenance has come down to dusting, changing the filters and occasionally sacrificing a small animal or two.

It would appear that simplicity and reliability have become the two most important characteristics of today's run of transmitters.

With regard to higher power, which is still around, the tetrodes still are popular in the medium power ranges – although a lot of stations are going to a single IOT transmitter. While one may be tempted to cringe a bit at having only one high power device upon which the whole station depends, their reliability has proven to be extremely good with minimal downtime. In the larger markets where zero downtime is necessary, a completely redundant backup system is a reasonable solution to the problem, permitting 24-hour operation while allowing maintenance to be done in a non-panic mode.

The diacrode is still available and has found renewed popularity for medium power. In the air-cooled version, this device has been popular for 5 kW DTV and 10 kW analog transmitters.

Finally, for high-powered UHF transmitters, multiple IOTs still seem to be the preferred solution. Those devices continue to be upgraded and improved both in their linearity and dependability. They have become to UHF what triodes used to be to the AM industry. That is, simple and economical for reliable operation. It would appear that simplicity and reliability have become the two most important characteristics of today's run of transmitters. This may be because the technical staffs of broadcast stations have become smaller. Less time is available for work on the transmitter plant and, sadly, fewer people are around with the technical expertise to work on today's sophisticated equipment.

Today's technician must have far more training than in the days of simple vacuum tube transmitters. The systems simply are far too sophisticated to be worked on by marginally trained personnel. Troubleshooting a system with multiple microprocessors isn't quite the same as watching for a color change in a mercury vapor rectifier. The older readers should explain that one to the younger staff members, who will have no idea what it means. BE

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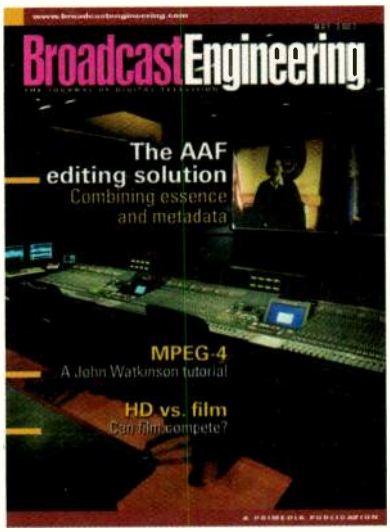

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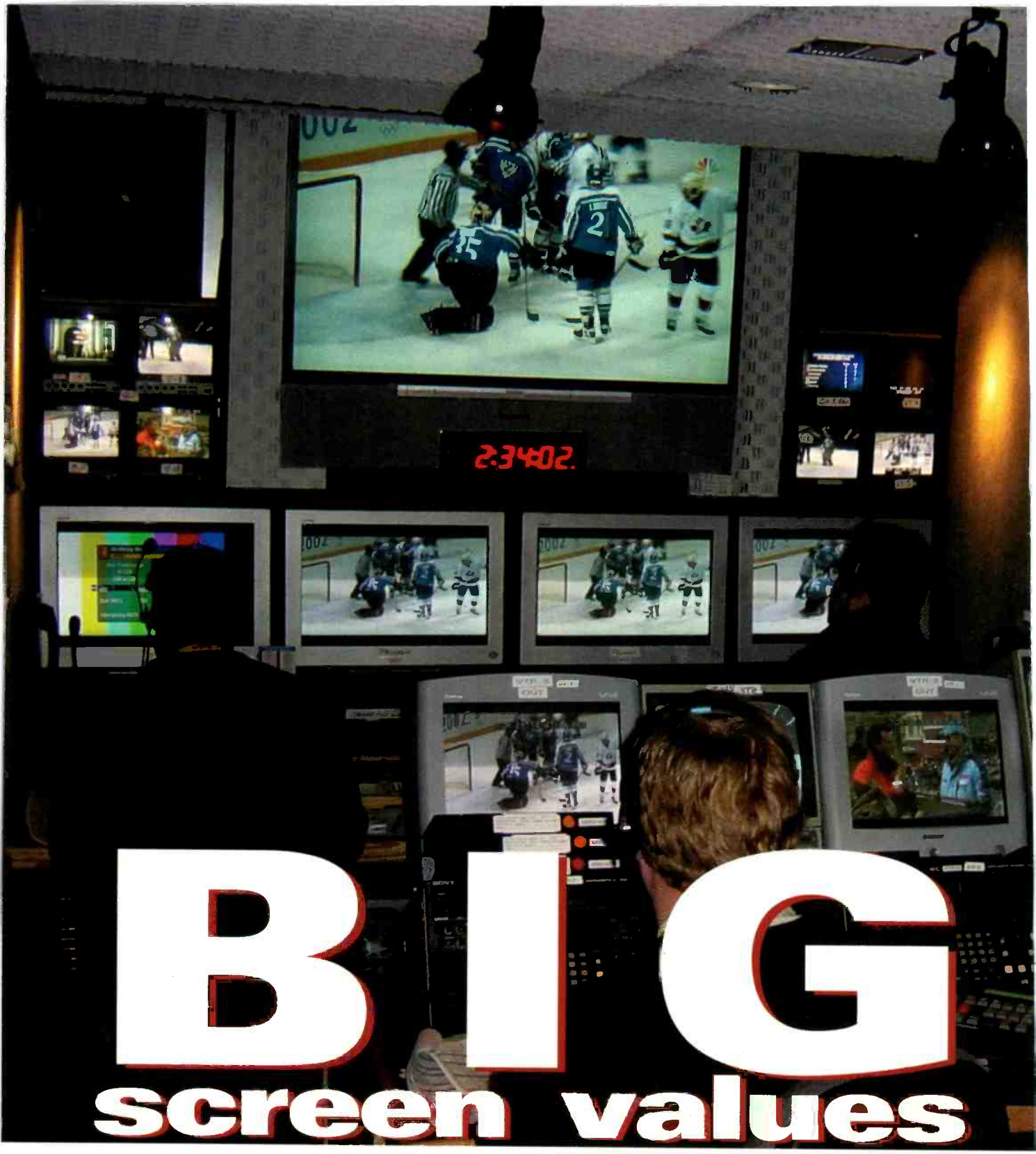


BIG screen values come to the small screen

BY JOHN LUFF

HD broadcasts over DTV channels hold the promise of delivering vastly improved pictures and sound, along with data that can augment the linear video medium in an age of hypermedia.

Ernie Kovacs once said, "Television is often called a medium because it's so rarely well done." Perhaps HDTV programming will change this cynical view. Perhaps the creative community's vision combined with the sensitive application of technology can yield innovation and high-quality programming.

This article discusses some of the

The HDNet network broadcasts all of its content 16 hours a day, seven days a week in the 1080i high-definition format. Shown here is the interior of one of HDNet's remote trucks in action at the Olympics in Salt Lake City. Photo courtesy HDNet.

issues involved in bringing big-screen values to the small screen. It begins with the politics and technology of HDTV content delivery, and then focuses on HDTV production, including the processes necessary to develop, acquire, edit and distribute HDTV content.

Powell's plan

On April 4 of this year, FCC Chairman Michael Powell outlined a plan to speed the DTV transition. Among other things, the plan seeks to advance two key goals: (1) increasing the level of compelling digital content available to consumers; and (2) providing cable subscribers access to that content over their cable systems. He proposed voluntary action to produce and deliver content that only DTV can provide.

His chief proposal calls for ABC, CBS, FOX and NBC, along with HBO and Showtime, to provide high-definition or other value-added DTV programming during at least 50 percent of their prime-time schedule, beginning with the 2002-03 season. Value-added DTV programming could be high-definition, innovative multicasting or interactive – as long as it gives consumers something significantly different than what they currently receive in analog broadcasts. This would require something more than a single stream of standard-definition digital programming.

Cable, DBS, equipment manufacturers and broadcast licensees each received their own admonishment from Chairman Powell to hold up other parts of the consumer-delivery chain. It is important to note that much of the prime-time schedule of the four broadcast networks is already available in HD, in some cases already exceeding the requested voluntary action. By allowing broadcasters to provide content that is "significantly different" as part of his plan, Powell tacitly admitted that broadcasters have significant reservations about HDTV production. The production community and the consumer electronics industry are not ready to deliver on the full promise of interactivity and other enhancements DTV can provide. What is left in Powell's list is multicasting and HDTV.

But, if the production side of the industry is to increase HDTV content, it will have to gear up significantly. Four years ago, only a small number of facilities were capable of HDTV production. Since then, the number of commercial mobile-production units widely available for HDTV productions has grown. And other facilities have joined them, many in advance of significant consumer demand and at considerable cost and risk.

Production technology

Over the last five years, the technology for HDTV production has improved and its cost has plummeted. Whole camcorders are now available for less than the cost of a single lens a few years ago. Cameras no longer need to be tethered to large VTRs that require significant power and space. Indeed, for little more than the cost of a high-end 525 EFP camera of only a few years ago, it is now possible to have an HDTV camcorder with equivalent features and reasonable power consumption. Hitachi, Ikegami, JVC, Panasonic and Sony, among others, have developed a range of camera products that offer features that, in some cases, were not practically available to the production community in 525 and 625 products. The sensitivity of HDTV cameras rivals that of their standard-definition counterparts. Colorimetry has been improved, especially in low-light areas of scenes. And some cameras can now mimic the ability of film cameras to "overcrank" and "undercrank." These improvements in camera technology and production effects will materially affect the transition from film acquisition to video acquisition, at least for television release.

This year saw a commercially successful use of HD cameras for producing a major motion picture. Also, Lucas Film, Sony and Panavision have pioneered significant developments that production professionals will need to produce HD releases in the future. Clearly much of that development work was directed at the unique needs of release to theatres, but much is directly applicable to television as well. Chief among the developments is the use of 1080p24 acquisition. Using a 24p high-resolution master will allow conversion essentially to any release format — in much the

Nonlinear HD editing systems such as this Discreet inferno HD compositing bay provide "no-excuses" sophistication. Photo courtesy Hollywood Digital.

same way that the film community is accustomed to working.

At the same time, recording technology has also improved. HD recorders of a decade ago cost hundreds of thousands of dollars. They used open-reel tape that cost over $1000 per hour and did not last as long as tape used for conventional 525 production. Today, Panasonic and Sony offer cassette-based HD recorders with performance that was unavailable a few years ago. Both lightly compressed and moderately compressed HD images can be captured and used for post-production applications.

Terminal equipment that provides virtually all of the capabilities that standard-definition systems commonly use is available from many manufacturers. Converters between analog and digital formats (all HDTV systems use SMPTE 292M for interconnection at 1.485 Gbits/s), frame syncs, DAs, audio embedding and dis-embedding, and optical links are all readily available from manufacturers such as Evertz, Miranda, Leitch, Thomson, Sony, Snell & Wilcox, AJA Video, Cobalt Digital, ADC/Nvision and others. Where once the range of products was limited, it is now quite broad and supported in standard interfaces from a number of manufacturers.

Production and routing switchers have also progressed significantly. The first HDTV production switchers were extremely expensive. Newer models are still more expensive than their standard-definition counterparts, but they have come down quite a bit in price. Generally, they support the range of normal production effects in HDTV products to about the same level as they do for standard definition. The state of the art for routing switchers is much the same, with newer models erasing much of the price penalty associated with wideband products. Many are well integrated into the product lines to which they belong, which facilitates multiformat facilities with few penalties.

In short, broadcasters wishing to ramp up HDTV production face few hurdles to prevent them from using techniques that replicate those used for standard-definition episodic and live programming. The complications come from new techniques stemming from the very nature of HDTV vision and sound.

The nature of the beast

HDTV is all about three things: wider screens, higher spatial and temporal resolution, and improved digital (and surround sound) audio. Each carries with it additional knowledge that the production professional must be aware of when preparing to acquire and edit in HDTV. Higher resolution puts a burden on the director of photography to effectively deal with the higher modulation-transfer performance of modern HDTV images. Cameramen familiar with shooting at a given depth of focus in standard definition will find that HDTV cameras are sharper and may require rethinking production techniques (lighting, camera angle and/or distance from the scene) to achieve the desired results. The same is true when comparing 8mm film production to 16mm, 35mm and 70mm media. HDTV cameras seem to be more critical on focus. They certainly show the effects of poor focus more quickly. Sports camera operators, for instance, find that they need to practice more care in following focus as the primary object in a scene moves within the frame.

HDTV offers a choice of temporal resolution between interlace and progressive formats, and several choices of spatial resolution. The most popular production formats are 720x1280(60p) and 1080x1920(30i, 24p). The majority of production is done in 1080i30, with a growing amount done in

In his plan, Powell has tacitly admitted that broadcasters have significant reservations about HDTV production.

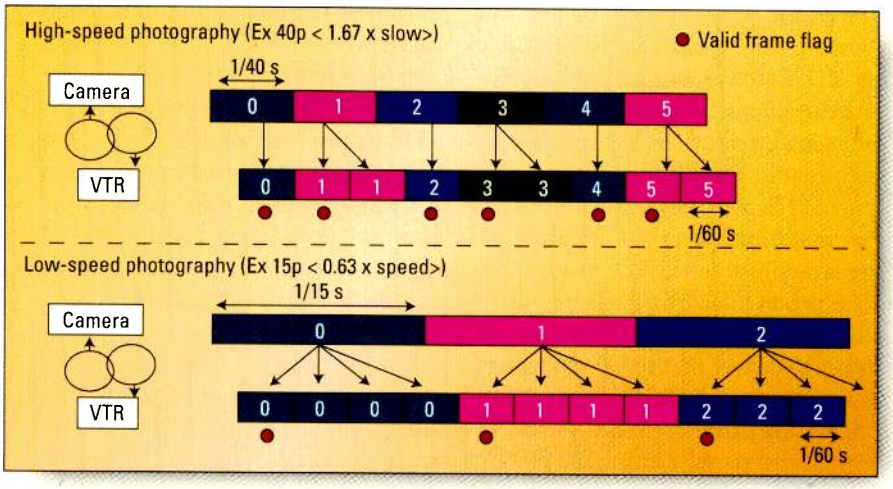


Figure 1. Some new HD cameras and camcorders can "overcrank" the frame rate for slow-motion effects and "undercrank" it for high-speed effects. This diagram shows examples of overcranking and undercranking for a 24p HD format. Image courtesy Panasonic.

1080p24. More than one major distributor has standardized on 720p60 for production and distribution, despite being limited to a smaller circle of manufacturers that fully support the required production equipment.

But 720p hardware capable of variable frame rate (1 to 60 fps) is available, and is particularly attractive for certain types of productions. Manufacturers have used a clever technique to achieve this without changing the recording medium in ways that would make it incompatible. The camera captures the specified number of frames per second, but the recorder continues to record 60 fps, repeating frames as required to "pad" or fill the sequence. The frames needed for post production are "flagged" and processed during post production (see Figure 1).

Of particular concern for HDTV production is the wider aspect ratio. A production that must release in 4:3 (1.33:1) and in 16:9 (1.77:1) has to be shot without compromising production aperture and scene composition. Images acquired in 1.77:1 HDTV can be downsampled to 525-line 1.33:1 while maintaining high quality. However, framing will clearly suffer some compromises (see Figure 2). The difficulty is serious, but since productions are now routinely released on standard-definition networks in the letterbox format, the issue is one that consumers will likely understand better than they once did. In Europe, a common compromise is to shoot in 14:9 (1.55:1), which occupies more of the screen when shown on a 1.33:1 display.

At the time of production, aspect-ratio concerns may have a larger effect on live-entertainment programming and sports, which typically have a large number of graphic elements. Tastefully designing graphic treatment so that such a production is not cropped on a 4:3 set, while showing the full intended content on a 1.77:1 set, may require a lot of creativity. For instance, a lower-third name super on a sports broadcast might have a left-justified name on a 1.77:1 screen, but would be badly cropped on a 1.33:1. One solution is to insert different graphics in each broadcast, which might be done in a system in which one control panel switches a show with two video processing frames (and different graphics generators). But this is quite an expensive approach and may only be applicable under unusual circumstances and where budgets permit.

Effectively shooting for HDTV's high resolution and wide aspect ratio also requires different framing. In the first Monday Night Football broadcast that was done simultaneously in HDTV and standard definition, the director shot the program differently for the higher resolution and framing of HDTV. At half time, the ceremony honoring John Elway was shot quite tight (and appropriately) in the 525 broadcast, but much wider in the HDTV program. Both showed the emotion and detail in Elway's face. Each was appropriate to the content and audience. Neither would have been right if it had been up- or downconverted to the reciprocal medium.

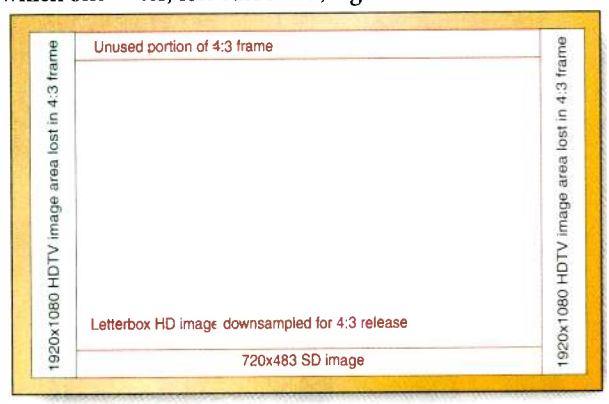


Figure 2. This box illustrates the framing compromises that images acquired in the 16:9 aspect ratio suffer when they are downsampled to 4:3.

If the production side of the industry is to increase HD content, it will have to gear up significantly.

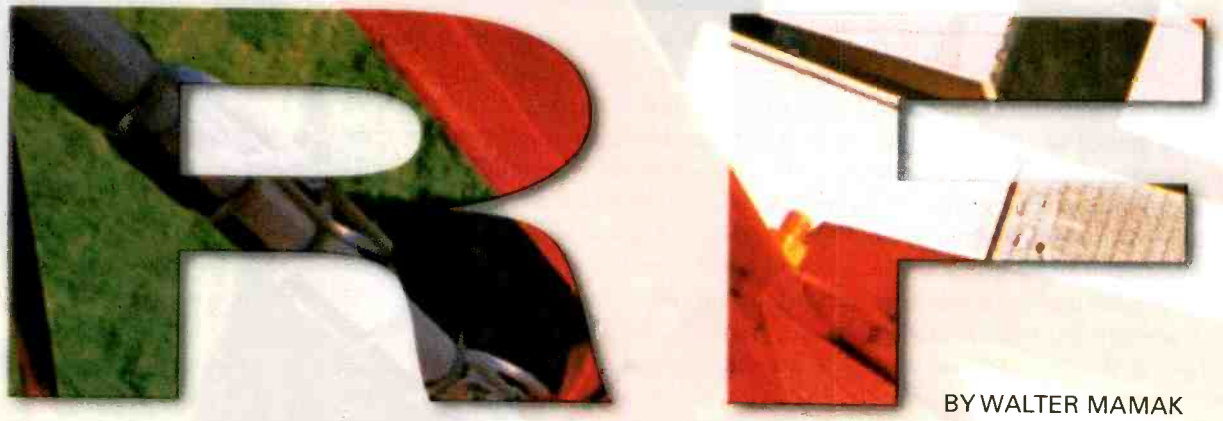
Audio requirements

Fortunately for our industry, high-quality audio has always been possible during production. But the state of the art has limited our ability to distribute that quality all the way to the home. DTV allows us to carry the (apparent) quality of the production environment to the home — apparent only because it is compressed significantly. But, nonetheless, DTV is of much higher quality than broadcast media has been able to do by other means.

Surround sound is nothing new in our industry. However, most surround sound has been four-channel surround, and DTV allows (but does not require) 5.1 channel surround sound. The channel assignments for Dolby 5.1 (AC-3 coding) are left, right, center, left surround, right surround and low-frequency effects (LFE, which is the ".1" channel). But, not all productions lend themselves to 5.1 sound. For instance, a newscast would derive little additional production value from surround sound, but a football broadcast can be enhanced quite a bit if the crowd audio is placed in the proper spatial relationship in the sound field. The viewer should hear the calls of the quarterback coming from the field, while the crowd sound seems to come from around the listener, and perhaps behind as well. Putting the crowd sound equally in all locations will not enhance the sense of realism that surround sound can project. So, just as a program needs to have a person making visual design decisions (graphics, staging, etc.), a program with surround sound also needs to have someone design the aural portion of the production.

Bringing big-screen values to the small screen involves adjusting to unique demands in the course of acquiring, editing and delivering HD content. **BE**

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



RF SYSTEMS

BY WALTER MAMAK

If you've recently upgraded your station's equipment, you'll need to optimize your RF system before the station goes on the air. Of course, system performance has many facets. This article focuses on the physical layout of a typical passive RF system and the technical concerns of optimizing VSWR performance.

Having a detailed plan right from the start will move your system performance testing quickly and keep costs down. But even the best system optimization procedure will not compensate for non-optimized components, poor system design or faulty installation processes. Always insist on trained, knowledgeable engineering technicians to optimize and monitor installation of all components. Keep in mind that these services are available to broadcasters without in-house expertise.

A few words of caution: It is essential to coordinate the activities of station engineering and management, equipment suppliers, consulting engineers, tower vendor, installation crew, and the system optimization service, to make sure that everyone is on board.

The upgraded facility

The facility discussed here is a high-power facility typical for a U.S. broadcaster, upgrading either within NTSC analog or to DTV, and providing coverage on a UHF channel.

A high-power broadcast facility requires an effective radiated power (ERP) of 1500 kW to cover the market. The transmitter in the upgrade discussed here has a total power output (TPO) of 60 kW. This facility also has special radiation-pattern requirements. Therefore, it will require a high-power, top-mounted, 25-gain directional antenna with a 6-1/8-inch, 75 Ω rigid transmission line.

The new antenna system will be added to an existing tower already loaded with broadcast, cellular and microwave equipment.

Antenna and transmission line

After selecting the antenna, you must consider the physical details of the entire passive RF system and its installation at the site. The ultimate performance of the system depends on proper planning in this initial phase.

There are several factors that determine the position of the antenna on the tower, including availability of space, antenna pattern and gain, the desired signal coverage, and wind and weight load. The other equipment on the tower may also affect the placement of the antenna and transmission line.

The proper mechanical and structural interface between the antenna and tower varies, of course, with the characteristics of the selected antenna and the existing tower. Generally, this interface entails fastening the antenna to the tower structure, providing adequate space for the antenna input and transmission line connections, routing the transmission line to the antenna, and positioning the antenna to attain the desired coverage. These procedures require detailed information about the antenna and the tower. Information on structural loads and mounting interface details for the antenna are available from the manufacturer. But, for an existing facility, the only way to be sure that the tower information is correct is to inspect the site and obtain a structural analysis, which you should do before designing the system.

Next is antenna orientation, which involves determining the azimuth position of the antenna, tower and tower mounting bolts for a top-mount antenna.

Other steps in the installation of a top-mount antenna include confirmation that the transmission line will be correctly routed to the antenna.

In the case of a side-mount antenna, perform a "scattering analysis" (see

Three installers placing a side-mount, low power, circularly polarized antenna on an existing tower holding existing antennas. Photo courtesy Andrew.

Figure 1) to obtain the best RF signal coverage. Antenna manufacturers typically have developed proprietary software for this purpose. But, to obtain accurate results, this software requires accurate, detailed information on the tower's physical details. Make sure the antenna is correctly located to minimize pattern degradation by the surrounding tower structure, transmission lines and other tower appurtenances. Side-mount antennas can be leg-mounted or face-mounted. This selection is based on the required azimuth pointing direction, the available space on the tower to clear other obstructions, and the structural requirements of the tower.

Broadcasters should also ensure tower bracing and/or other tower appurtenances do not obstruct the correct routing and support of the transmission line for weight, ice and wind load.

Transmission line considerations

When choosing transmission line, you must balance cost of the line with the mechanical, structural, thermal and practical considerations of routing the line from the transmitter to and through the tower and to the antenna input.

A detailed plan for the transmission line system includes the following items: a complete bill of material; design drawings, with all components positioned in the system; a plan for routing the transmission line from the gas barrier in the equipment building through the ice bridge and up the tower to the antenna-input flange; the location of the flange, hangers and guides; and, finally, a plan for installing the line on the station's tower.

Having a detailed plan right from the start will move your system performance testing quickly and keep costs down.

For the application discussed here, a single-channel, rigid transmission line was chosen. Other choices are available, including broadband rigid line, circular or rectangular waveguide, or flexible coaxial cable. The choice depends on the parameters of a particular installation, such as the need for broadband service, power-handling capacity, tolerable level of line attenuation, tower wind-load limitations, structural-mounting details and overall cost effectiveness.

Optimizing the aforementioned parameters is no trivial undertaking. Even at the most basic level, there are trade-offs:

1. Physical size and RF system loss vs. tower structural loading
2. Ease of installation vs. optimization of power output and attenuation
3. Structural support type and location vs. flexibility for thermal expansion/contraction
4. Mechanical routing simplicity vs. reduction of system components
5. Location of structural supports coordinated to the existing tower's structural steel
6. Strategic location of fine matcher sections (tuners) to optimize system performance

System testing and VSWR optimization

Once you've selected all the major components for the tower, you must be sure that they are up to the task of integrating into a top-performing, long-serving system. After all, tower installation is a lengthy, labor-intensive, costly process.

When the antenna is delivered to the site, ask the following questions: Were all components delivered in good working order? Have the RF tuners located throughout the system been optimized? Were the electrical and mechanical ground checks of the antenna performed? An engineering technician should supervise unloading of the antenna and perform detailed visual, pressurization and VSWR sweep tests to assure that it is in factory-quality condition.

After the transmission line system is completely installed, best current practice requires system sweep and optimization services.

To obtain the best results, inspect the transmission system after installation to ensure structural and mechanical integrity prior to the final system sweep. Inspections should be done from the input flange of the

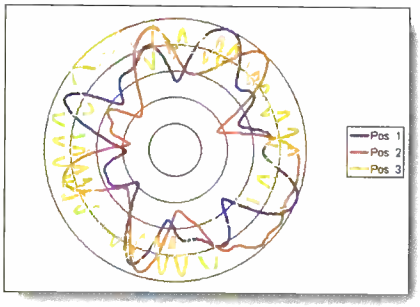


Figure 1. A typical plot produced by scattering analysis.

transmission line system to the top of the tower. Follow-up inspections should be conducted at least once per year — more frequently in a high-humidity or corrosive environment, or in high-wind areas.

The following steps detail the inspection points for all transmission line systems:

1. Check the complete transmission line system for compliance to design drawings.
2. Verify that the line is plumb to 1/8 inch per 100 feet.
3. Check for damaged hangers and ground straps.
   a. Verify free movement of spring hangers and transmission line.
   b. Verify proper extension of spring hangers.
4. Check all mounting hardware for compliance to torque requirements.
5. Check field-cut sections for proper fit by looking for binding or stress between adjacent sections of transmission line.
6. Check for proper clearances between transmission line sections and the tower's structural steel or other obstructions that may damage the transmission line under extreme conditions of thermal expansion/contraction.
7. Verify proper seating of fine-matcher hardware.
8. Verify pressure integrity of the system by performing a timed pressurization drop test.

If you chose a waveguide for your installation, follow these additional inspection points:

1. Check constant-force springs for proper extension and tightness of hardware.
2. Inspect the bearing flange; verify bolt torque.
3. Verify that one vertical hanger is installed for every two sections of waveguide above the specified level in the manual.
4. Verify that the guideline pins are aligned in the same plane.

Note: To avoid additional personnel costs, you should pressurize the systems and hold pressure for at least 24 hours before beginning the system sweep optimization services.

After visually and mechanically verifying the transmission line installation, perform RF sweep measurements and record VSWR according to the manufacturer's procedure. Several independent-contractor engineering services offer system optimization. Additionally, you can hire site technical advisory service field engineers with experience in new equipment installations to manage the installation process.

Typically, RF sweep measurement is an interactive process to optimize the system's return-loss performance. Use a network analyzer to determine the characteristics of the transmission line and adjust the system's fine matchers to achieve optimum performance. This is accomplished by attaching transitions (adapters) to the transmission line near the gas barrier. This adapter is tuned to better than -50 dB (return loss). Initial data is then taken in both the frequency domain (return-loss sweeps) and the time domain (time-domain reflectometry — TDR).

By using modern TDR techniques over broad bandwidths, you can identify the most severe mismatches because the tuning process is usually initiated at these points with the fine matchers designed into the system layout.

Broad-bandwidth, high-resolution TDR measurements check for anomalies in the installation such as pinched gaskets, split bullets, loose hardware and elbow complexes that exhibit high VSWR. You might have to replace components or correct faulty installation procedures before finalizing system sweep measurements.

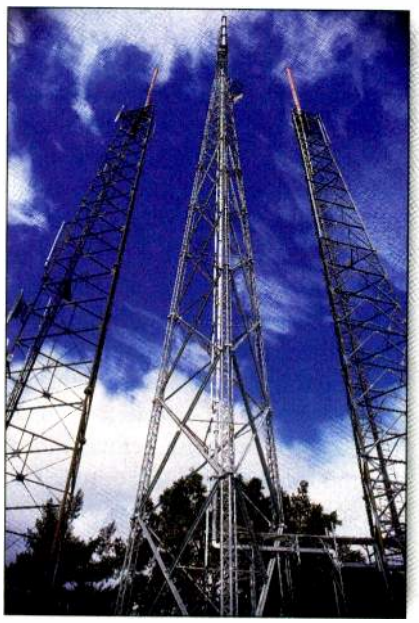
Proceeding in this manner, optimize each of the fine-matcher locations to yield the best system VSWR. When complete, re-inspect the system for pressure integrity. Usually, you can expect long transmission line systems to maintain a 0.5 psi pressure drop over a 24-hour period.

The consultant or service provider will perform an array of measurements, which can include the following:

1. VSWR and return-loss plots with each 6, 25 and 100 MHz span.
2. TDR (VSWR) format with each 6, 25 and 100 MHz span.

Final thoughts

A truly optimized system includes good planning, a detailed design, high-quality products, certified installation crews, and qualified system optimization services. Pre-test inspections are essential. Skimping here may result in costly on-site expenses for crews and RF technicians, and ultimately have a negative impact on station performance. BE



At this Mt. Wilson, CA, site, the center tower has a side-mount antenna with a rectangular waveguide transmission line. Because of the complexity and routing of the line, special attention had to be paid to the optimization process. Photo courtesy Andrew.

Walter Mamak, PE, is product engineering manager for Andrew, broadcast products division.

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NEW PRODUCTS & REVIEWS

Tektronix
MPEG test systems

BY TOM TUCKER

The worldwide transition to digital broadcasting is truly a massive undertaking. After spending months designing a new installation, the engineer is faced with all the problems implementation can bring, since the whole process of translating a complex system architecture into a working physical reality can be fraught with hidden danger. An engineer may have intermittent signal failure due to a bad connector, or complete signal failure due to an incorrectly configured multiplexer, or any number of other typical installation problems. The only real solution to this conundrum lies in the ability to identify problems generated during the installation process, so the system will continue working into the future.

TheTektronix AD920 MPEG handheld tester provides support for the two main interfaces found in digital broadcast installations worldwide: ASI and SMPTE 310M.

MPEG testers

Tektronix currently offers three test tools to assist in successfully and efficiently installing and maintaining compressed digital video installations. The Tektronix AD920 MPEG handheld tester, AD954 MPEG portable analyzer, and MTX100 MPEG recorder and player help engineers rapidly deploy new equipment – even entire installations – effectively, on time and on budget. They are tools for installation engineers, as well as anyone else tasked with maintaining or implementing an MPEG-2 infrastructure.

The Tektronix AD920 has been designed to provide support for the two main interfaces found in digital broadcast installations worldwide: ASI and SMPTE 310M. Both use BNC connections and run at 270 Mbits/s (ASI) and 19.34 Mbits/s (SMPTE 310M). The output signal level is 800mVp-p±10% (into 75 Ω) in both cases due to the active loop-through.

The only real solution to solving implementation problems lies in the ability to identify the problems generated during the installation process.

The MPEG-2 test device addresses MPEG-2-based systems including DVB and ATSC. It has been designed specifically for confidence-testing applications. For instance, it addresses tests designed to ensure that an MPEG-2 transport stream can be decoded. This means testing against the DVB-defined "TR101 290" first priority test conditions (excluding PID error). It will also enable testing of the physical layer signal.

All of the measurements are displayed on a single graphical display. Clock rate, signal level, transport rate and data rate are displayed as moving bars with an accurate numerical measurement alongside them. This gives instant visual identification of the amount of data carried by the transport stream against the overall bit rate. This helps determine if a transport stream is carrying only stuffing data rather than valid video, audio or data – even if it seems to be correctly structured. Conditional tests, such as sync byte error and continuity count error, are either true or false, depending upon whether or not they comply with the TR101 290 guidelines. The tester also allows the operator to set user-configurable alarms, allowing him or her to continue working on other tasks while still being alerted to ongoing intermittent problems.

A key distinguishing feature is the system's portability. Battery-powered, it weighs less than 1 kg. Its handheld shape lends itself to crawling around the back of racks, and checking cables in the floor, walls and ceiling. It also provides stream ID functionality, enabling isolation of a given feed from a bank of cables awaiting connection.

Complex analysis

For more complex analysis, Tektronix offers the AD954 MPEG portable analyzer, which provides a more detailed breakdown of the MPEG-2 transport stream. In addition to providing all of the conditional functions of the AD920, this tool also includes stream structure analysis, private data monitoring, and TR101 290 stream analysis for priority 1, 2 and 3, as well as other conformance measurements.

It can be hooked up to a laptop for field work, allowing the engineer to analyze a stream in real time to TR101 290 priority 1, and to interrogate a stream offline to priority levels 1, 2 and 3. The user can also trigger the unit to capture errors, including a pre-trigger

buffer if required, or sample streams for further testing offline or at a later date. Additionally, the system allows the user to analyze system information (SI) and program-specific information (PSI) tables on the laptop display.

When used in real-time test scenarios, the analyzer will maintain a log of TR101 290 priority 1 and SI scripting errors as they occur, detailing time and date for later comparison, or store as a record for ongoing system maintenance.

The tester is suitable for connection to ASI, SMPTE 310M and DVB SPI. It does not require connection to a laptop when left to capture a transport stream error, which is helpful in solving intermittent problems.

Another necessary ingredient for installing video networks is a reliable signal source. The MTX100 recorder and player allows the user to play, record and stress a design to ensure that even under the harshest operating conditions, no fault will occur. It is light, compact and portable. It offers users many interface options, including ASI, DHEI and DVB Parallel. It will play out at data rates up to 200 Mbits/s while offering seamless looping and PCR jitter insertion to test stability. Another key feature is its transport stream structure view, which allows rapid identification of the overall stream structure even before playout.

The rollout of digital video services has created a rapidly growing need for easy-to-use installation and maintenance measurement tools designed specifically for digital video applications. Whether an engineer needs a go/no-go solution or needs to provide a full analysis and characterization of a system's entire health, a test and measurement system from Tektronix can fulfill this need. BE

Tom Tucker is a marketing manager for the Americas for Tektronix.

Lobo & Associates shoot Saudi Arabia with Panasonic

BY MAL WOLFE

Lobo & Associates, a Santa Barbara, CA-based producer of large-format films, television productions and high-end corporate films, has just finished shooting a corporate high-definition video project for Saudi Aramco. *Forging of an Industry: The Future of a Nation* (working title) will provide corporate image exposure for Saudi Aramco's Natural Gas Operations division. It is intended to show the Saudi public how the new gas era will affect everyday lives in Saudi Arabia.

The company has commissioned two versions of the video. A one-hour television version will be aired in the Gulf countries, and a half-hour version will be on permanent exhibition at the Saudi Aramco Museum, House of Discovery, in Dhahran. *Forging of an Industry* replaces a vintage 16mm film narrated by Orson Welles that had been used by the museum for nearly three decades and had become outdated.

Mike Braniger, Lobo & Associates' director of photography, uses Panasonic's AJ-HDC20A to shoot scenes for a high-definition video project for Saudi Aramco. The cameras were used in a variety of locations, from studios to deserts like the Rub' al-Khali (shown above).

Before shooting any tape, Lobo & Associates undertook detailed pre-production planning for the project. The pre-production phase included close communication with Saudi Aramco to ensure the production plan would be representative of their vision for the project. This phase also included obtaining all necessary government permits, hiring a local support staff, and arranging air travel and support vehicles within Saudi Arabia.

Aside from the logistics of organizing the actual shooting, scouting was a critical part of the pre-production phase. The scouting trip entailed a one-month trip in September 2001 to visit all possible shooting locations. The crew then returned to Santa Barbara to prepare themselves for the grueling production phase in January.

The production team utilized Panasonic's AJ-HDC20A DVCPRO HD 2/3-inch 2.2 million pixel FIT 3-CCD camcorder with Fujinon's HA10x5BERM and HA15x8BERM HD ENG high-definition lenses. Lobo & Associates chose to employ the same shooting techniques for this project as they would for a large-format film, including keeping the cameras moving at all times through the use of dollies, jib arms and rails. We also had a grip truck specially outfitted for the same purpose. Overall, the quality of the video shot is comparable to large-format film work, but film stock and processing costs were eliminated through the use of digital.

The taping took place in extremely varied environments with a large array of equipment.

The taping took place in extremely varied environments with a large array of equipment. Film locations ranged from remote desert or mountains to studios to interiors of Saudi homes. The crew shot tape in the desert at daytime temperatures of 115°F to 120°F and nighttime temperatures sometimes dropping below freezing.

We took two AJ-HDC20As on the shoot, one for primary shooting and one for time-lapse sequences and backup. Neither camera malfunctioned, despite the rigors of travel and hostile environments, and constant loading and unloading.

The production schedule was strenuous and exacting. The crew members, however, overcame all challenges, brought home excellent footage for the project and were enriched by their experiences in Saudi Arabia. BE

Mal Wolfe is a producer/director for Lobo & Associates.

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MPEG testing and monitoring

BY JOHN LUFF

A few years ago, I did a series of seminars with Michel Proulx, director of product development for Miranda Technologies, on two topics: SDI systems and "Quantum Video 101 for Analog Engineers." The goal was to help engineers and production professionals understand and feel comfortable with video they could no longer "see." We saw lots of blank stares and a fair number of nods of comprehension, and we heard a few cogent questions. One of the questions we heard in more than one city was how to "do video" without scopes. That was a difficult question then; today the tools of the technical trade have begun to catch up markedly.

Not long ago, the only MPEG testing and monitoring equipment clearly was not ready for operational environments, and it sometimes cost more than the encoder it was monitoring. Today, the tools have become much more approachable, more affordable and considerably more intuitive. Of course, we also are more comfortable with video that can be seen only after it is reassembled to simulate the original signal.

For the purposes of this article, I want to define "testing" as verifying compliance, validity and compatibility. Similarly, "monitoring" might be redefined as verifying acceptability, suitability and quality.

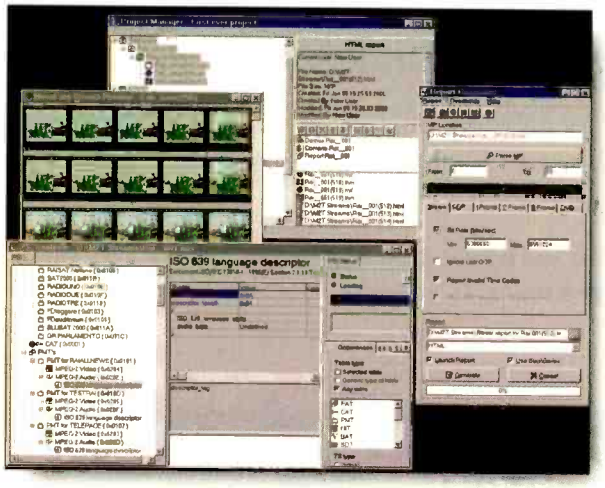
Without the right tools, it is difficult to know just how good your MPEG bit stream might be.

Decoding MPEG

MPEG typically uses an interconnect, which is usually DVB ASI. ASI is 270 Mbits of data, coded NRZ as opposed to NRZI in SMPTE 259M, and containing any number of services multiplexed together. Unlike analog or digital video, looking at the carrier cannot tell you anything about the content. SMPTE 259M at least can be quickly decoded to show the sync information. It is not much more complex to turn the video itself from what appears to be random bits into the original picture.

MPEG reception requires several steps to be taken. Sync must be identified, program tables must be decoded, and elementary streams must be extracted. Only then can the proper bits be directed to a decoder to reconstruct the original signal, or at least a representation of the original signal, for MPEG is not about reproducing reality as closely as possible. MPEG is entirely about reproducing a level of quality that will show the perception of the original reality that is defined as acceptable by most viewers for the intended use.

Monitoring in the context of this article then is about establishing that qualitative assessment of the content. It is done by testing a range of material that has been encoded, decoded and displayed before an audience in a formalized testing regime. (CCIR REC BT-500 defines the method of consistently performing this testing.) The key is to find an electronic measure of quality that can be correlated to real-world viewers under these controlled conditions.



Achieving the right MPEG-2 quality and bit rate is more important than ever due to the increasing use of DVD, streaming video and multichannel digital transmissions. Shown here is Snell & Wilcox's Mosalina, which provides MPEG-2 users with a means of assessing picture compression quality.

Monitoring modes

Several manufacturers have developed the technology required to do this in two modes. One uses a set of standardized sequences, runs them through the encoder and then looks at the results after decoding in a closed-loop system. This technology produces good correlations to the real world, but of course it cannot be used on live material for which no difference signal can be computed using the closed-loop system. This approach is quite good at testing in the manufacturing environment and establishing global parameters for an MPEG system (bit rate, GOP, coding standards). You might liken this type of equipment to automated measurement equipment in the analog world, which either requires full-screen test patterns or the

presence of an inserted test signal in the vertical interval.

The other approach looks for the signature of compression artifacts in an open-loop system. In this method, the expert viewers are shown a wide range of material and judge the presence of various coding "errors." The correlation of necessity is not as strong, but if the samples are statistically large enough and the range of content tested is varied enough, it is easy to see that the correlation can be statistically valid, even if the accuracy on an individual scene is not as good. This approach is more applicable to online testing in a program environment and will establish when something is stressing the system in unexpected ways, or perhaps the failure of a part of the system. In this case, the analogous test instrument would be a waveform monitor that you can use to interpret the quality of a signal if you understand signals in general and how to interpret the display.

Both of these approaches required considerable research and testing to establish the validity of the technology. Under certain circumstances, each can be an extremely valuable tool in subjective measurement of quality. Each has its strong points, and the reader is advised to contact the manufacturers for in-depth reviews of their products and the methods of use they recommend. This tests the content, but it does not say anything about its adherence to uniform standards needed for successful interface and communication between equipment.

Testing

The other half of the equation, testing as defined above, is more about ensuring that the bit stream is compliant with the specifications for the physical layer (bit rate, levels, jitter, rise times), as well as the compliance with requirements for the syntax of MPEG. MPEG is a decoder-centric specification. Bit streams can be produced by any means as long as they can be decoded by a compliant decoder. The encoder must follow all the rules for assembling the MPEG syntax. It must use all the management tools correctly, inserting valid data in all the tables, and properly referencing all of the elementary streams. Time stamps must be valid, and the use of the compression algorithms must match those specified for the profile and level in use.

For instance, MP@ML is permitted to vary up to 15 Mbits/s. A stream identified as MP@ML, but using 4:2:2 coding at 30 Mbits, would break syntax rules and be labeled as not compliant, even though many decoders might be able to produce a perfectly acceptable picture.

MPEG testing can be done without reference to the content of the picture. It suffices to decode the syntax and compare it to the standards, and display the content in ways that users can interpret. Often alarms are set that will notify the user when particularly important parameters are not within those expected.

Only a few years ago, a number of manufacturers were building larger and much more expensive MPEG testing hardware. Today one can buy, for a couple of thousand dollars, a system that can be controlled completely over an IP link. One overseas manufacturer brought his system to my office in the form of only an Internet address for demo. I connected to a box on the other side of the world, and we worked through their offerings in some detail without ever leaving my desk. Other manufacturers have concentrated on comprehensive hardware solutions with integral displays. Exploring the range of offerings is not easy though, as they now number in the dozens.

At the end of the day, you should consider having both testing and monitoring capability if you use MPEG professionally. Without all the right tools, it is difficult indeed to know just how good, and valid, your MPEG bit stream might be. BE

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

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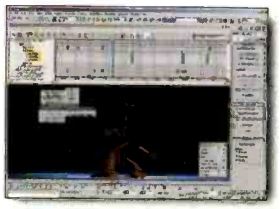

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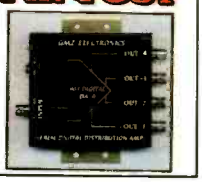

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BROADCASTENGINEERING.COM

Help Wanted

Audio Facility Technician
Television, Radio and Film Production

Reporting to the Director of Broadcast Technology, the Audio Facility Technician will install, perform preventative maintenance and repair audio and related equipment in WERS, WECB, VMA Audio and VMA Video, Film Transfer, Film and Video Mix to Pixs, New Media, Equipment Distribution Center, Broadcast Journalism, locations throughout the campus. In addition, manage part-time student staff, interface with faculty instructors and students, and assist with purchase supplies and equipment. Specific duties will include: 1) Periodic and preventative maintenance on all studio equipment both analog and digital; 2) Construction and modification of studios including wiring and documentation; 3) Manufacture of custom cable and wire-harnesses; 4) Maintain campus wide audio inventory; 5) Maintain Digital Audio Delivery System (Dadpro 32 Enco); 6) Maintain Pro Tools Systems; 7) Manage student engineers; 8) Work with outside service vendors; 9) Assist with budget planning; 10) Assist with system administration of network computer systems (Mac, PC and Novell); 11) Provide on-call back-up for WERS; and 12) Perform additional assignments as needed.

Bachelor's Degree in Electrical Engineering and/or related Audio Production field with experience in Electronic Systems Engineering preferred. Four or more years of experience in technical audio repair and maintenance within a broadcast or recording facility and proven ability to troubleshoot and repair audio and related systems. Experience with Apple and IBM computer systems, LAN and WAN networks, nonlinear editing systems and audio streaming for the web. Experience with Pro Tools and other nonlinear editing systems preferred.

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LIN-TV ENGINEERING MEMORANDUM
KNIN-TV has an immediate opening for the position of Chief Engineer. This person must have a solid RF background with VHF transmitters (Larcan NTSC and DTV) tube and solid state, studio facilities including video servers and associated master control systems. Also, a knowledge of computer systems is needed, as is TCP/IP networking knowledge, and associated telecommunications systems, including telephone systems. This individual will report to the General Manager and be responsible for operational and capital planning, and on-air crew supervision. The successful candidate will be required to carry a pager and/or cellular telephone. The setting is Boise, Idaho, very scenic, with moderate temperatures. Please mail resumes with cover letter to General Manager, KNIN-TV 816 W Bannock #402, Boise, ID 83702. Fax to: (208) 472-4660 or e-mail to: genmgr@knin-tv.com EOE

NUCOMM, INC.: Rapidly expanding manufacturing company currently has sales positions open for both International and Domestic sales to sell to the Microwave Broadcast systems market including STL, ENG systems. Must have 5 years plus related experience. Please mail or fax resume att: Elizabeth Payne at Nucomm, Inc. 101 Bilby Road, Hackettstown, NJ 07840. FAX: 908-813-0399

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ALAN CORNISH / MARK KELLY 09/01

MAINTENANCE ENGINEER- Immediate opening for a Maintenance engineer at KOAT-TV. Duties include installation, operation, repair and preventative maintenance of all broadcast related electronic equipment. Candidate must have beta-cam and studio equipment experience. Broadcast Engineering experience required. Resume along with a cover letter stating where you found out about this job to: Fred Bragg, Chief Engineer, KOAT-TV, 3801 Carlisle Blvd NE, Albuquerque, NM 87107 - KOAT-TV, A Division of Hearst-Argyle Television, IS AN EQUAL OPPORTUNITY EMPLOYER

Broadcast Engineering
Jennifer Shafer
1-800-896-9939
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NEWS 24 HOUSTON Time Warner Cable and Belo's newest 24-hour news channel has an opening for an **IT Manager** to ensure all hardware, software, network database and automation systems are functioning optimally, maintained and secured for 24/7 operation. Must be proficient in Windows 2000 Professional, Advanced Server and NT operating systems, Active Directory Architecture, Cisco Switches, Firewalls and VPN connectivity, SQL server/database integration, IP Addressing and Video Servers. College degree a minimum of 3 years of "hands-on" IT experience. MCSE Preferred. P.O. Box 41440, Houston, TX 77241 or news24@houston.rr.com Equal Opportunity Employer

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NEWS 24 HOUSTON Time Warner Cable and Belo's newest 24-hour news channel has an opening for a **Studio Maintenance Engineer** to maintain studio and building systems for a next generation 24-hour news station. Should have maintenance experience with DTV and NTSC signals, system integration and signal processing, routing switchers, ENG and EFP cameras, VTRs and video server technologies, satellite and ENG systems and be familiar with computers and IT. Associates degree and 3 years television maintenance experience required. P.O. Box 41440, Houston, TX, 77241 or news24@houston.rr.com Equal Opportunity Employer

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From pornography to hypocrisy

BY PAUL MCGOLDRICK

There are many things that parents are fearful about when it comes to their children. The worst is when you fear for them physically — in road traffic accidents or criminal activity like kidnapping. But how would you feel if you went downstairs one morning and found the kids were watching not their usual TV fodder of *Blue's Clues* or *Sesame Street*, but instead were engrossed in an "adult" television show. What happened to your carefully selected programming for their on-screen menu, or the V-chip's programming?

Can't happen, I can hear you say. Well, if the people behind some less than tasteful channels catch on to what can be done with the TiVo machine that is sitting in your media/TV room, you might have this or a similar scenario happen. That little snippet of information came to the surface in the UK. Some bright spark in the BBC decided that a new situation comedy called *Dossa and Joe* simply wasn't getting the viewers that such a fine show deserved. (Adults have described the show as totally foul-mouthed garbage; given European standards of propriety, that means it must be really bad.)

Mr./Ms. Bright Spark must have talked about his/her problem with an engineer who understood what could be done about that little audience problem. The show was transmitted one evening after 9 p.m. (the "watershed hour" after which all children are supposed to be in bed), but the next morning the owners of TiVo recorders found that the BBC had changed their priority settings, and the machine had recorded the show. More than 50,000 households were involved, and well over a thousand complaints were voiced in a TiVo Web forum.

TiVo has been billed as the consumer's friend, the machine that allows you to watch what you want, when you want and how you want. I have been generally much in favor of the technology (and its well-deserved Emmy) and the machine's features. But if the commercial TV industry, that has loudly and legally complained about the machine's ability to skip advertising, generally becomes aware of this little quirk that is available to them, then TiVo will be their "friend" too, in a big way. Imagine: Tell the public what they want to watch — why, that's even better than hypnotism! Obviously there need to be software changes made to the existing generation of machines to prevent this remote control but, until then, if you're not set to record a program you want, yank the telephone cord connected to the machine, or Big Brother may have some surprises for you.

Tell the public what they want to watch — why, that's even better than hypnotism!

Hypocrisy in the NAB

If you see some hypocrisy in the BBC's actions, then you will find oodles in the fact that the NAB has come out squarely in favor of consolidation in the radio industry. In answer to an FCC review of ownership, the NAB has said that the FCC has no authority to tighten radio ownership rules, but even if it did have such authority it should do nothing. Why? Because the NAB contends there is no proof that consolidation has reduced competition. Their apparent definition of competition is really interesting – the lobbying body sees that advertising rates are softening in radio; therefore, there must be sufficient competition. Diversity, local news and the like are not considered in its equation because, of course, basically the only NAB members left in radio are the consolidators themselves. The NAB told the FCC that it should do what Congress ordered it to do, and that was to take a fresh look at ownership rules every two years to determine whether they are needed at all.

But in TV the NAB is still in favor of antiquated ownership rules, and the networks have variously pounded the organization for that viewpoint. Why do you think the NAB is not in favor of consolidation in TV? Is it because the local stations are seeing a real softening in advertising rates, so competition must be really healthy? That softening is certainly happening, but it's the market, not terrestrial competition. No, the NAB is against consolidation in TV because at the moment its membership is the small guys. There's nothing wrong with that – that's what lobbyists do. But the hypocrisy between the two different faces of the broadcasting industry – using different definitions, as appropriate – is difficult to accept with a straight face. Really difficult.

If I had TiVO maybe they would be able to download an explanation for me. BE

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

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

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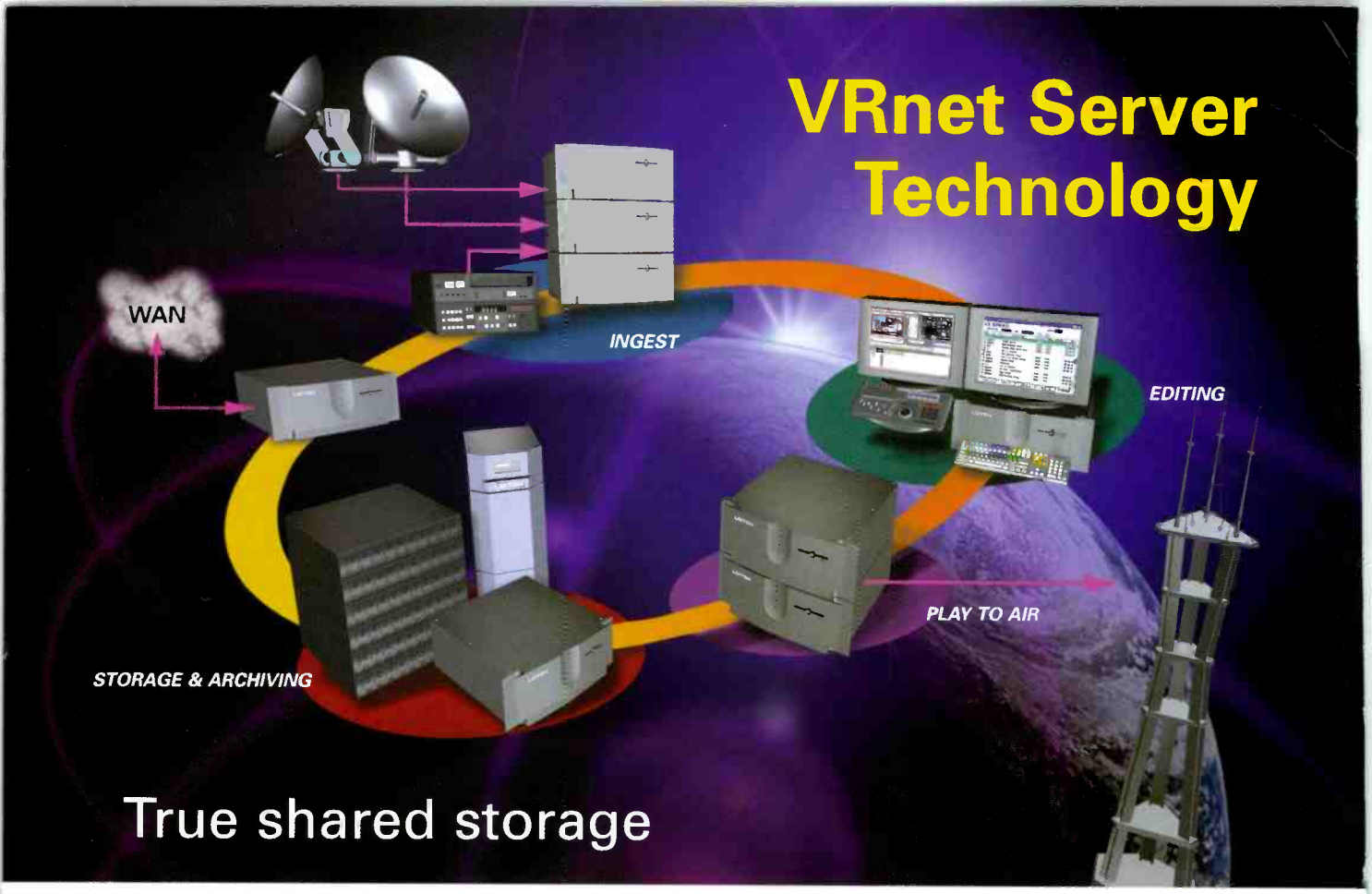

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