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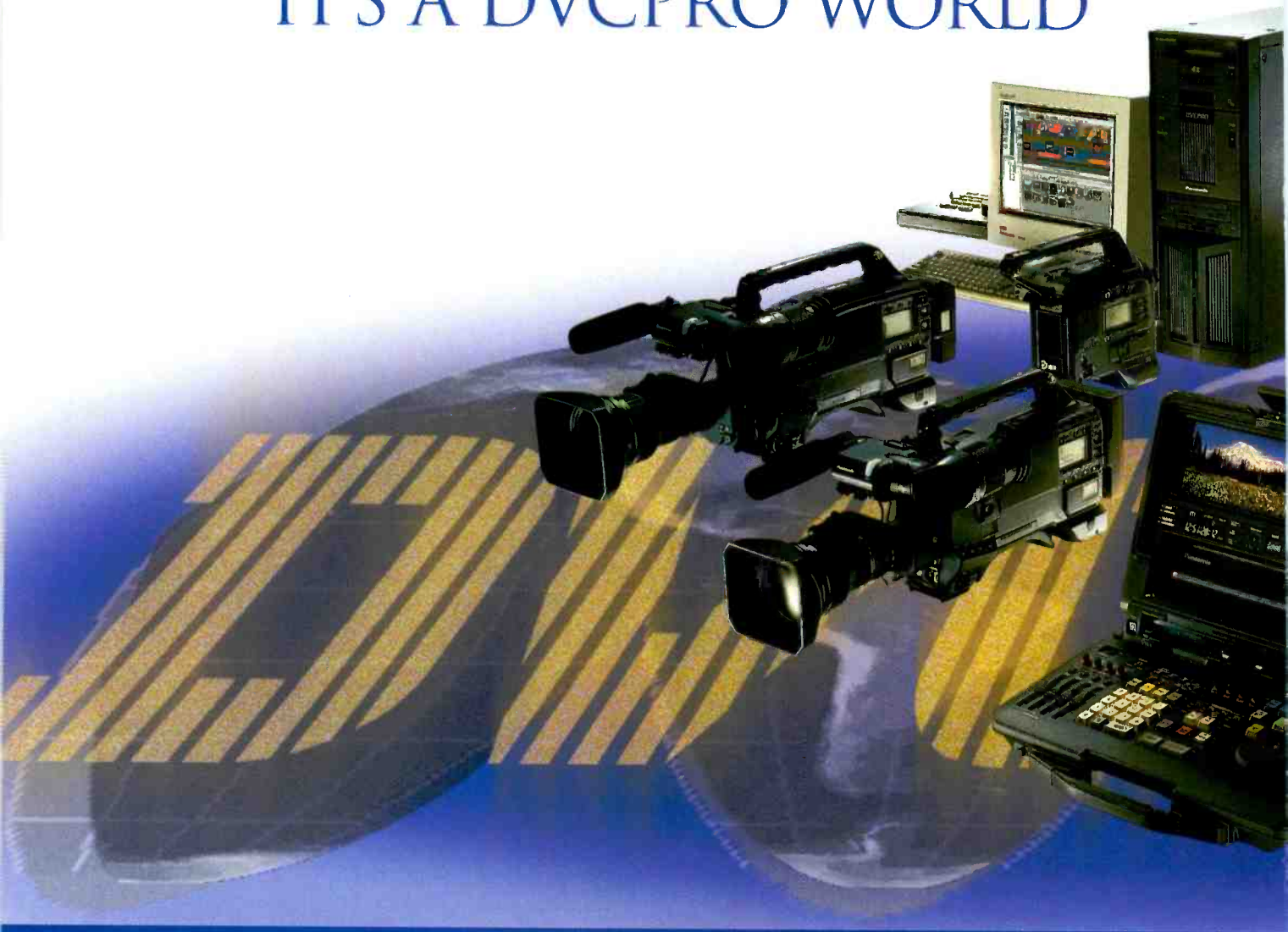

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April 1999
Volume 41
Number 4

Broadcast ENGINEERING
THE JOURNAL OF DIGITAL TELEVISION

IN THIS ISSUE

Features

DTV Update

Beyond the Headlines

NEWS

FCC UPDATE

EXPERT'S CORNER/VENDOR VIEWS

(continued on page 8)

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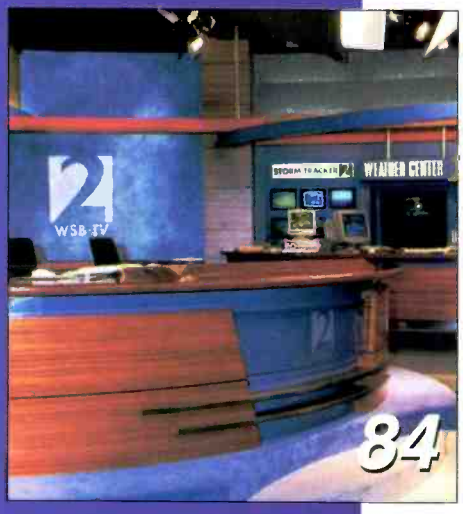

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FREEZE FRAME

A look at the technology that shaped this industry.

Do you remember?

Two hot topics from August 1982. Photo cartridges and HDTV. In the HDTV story, the Sony HDTV system was reviewed: a portable, 1-inch C-format HDTV recorder, using RGB, 3-channel recording, a Saticon-based camera with microprocessor control, providing for a "minimum of maintenance", and an HDTV projection system with "none of the resolution limitations" of a shadowmask. How far we've come.

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Editorial

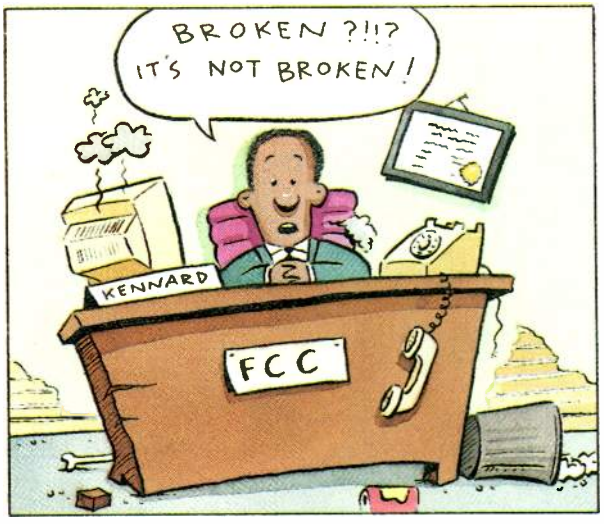
The FCC's fallen and can't get up

Step up and get your bandwidth. Right here, only $10 a hertz. How much do you want, 1MHz? That'll be $10 million. You need 6MHz? (Want to put on a TV station, right?) That'll be $60 million dollars. Please step to the payment window.

Sound strange? Maybe not so much?

FCC kingpin William Kennard often promotes his agency as protecting the *public* interest. However, Congress and an increasing chorus of others think a more accurate statement would be that the FCC is protecting the *White House's* interests. It often seems that Kennard's actions are more directed toward seeing how much money his agency can raise rather than how much the public interest is served.

Despite his claims of a consumer-focused agency, the facts show quite a different picture. Americans are incensed at what's happened under his watch. Let's start with cable rates. Despite the chest pounding from his predecessor, Reed Hundt, and himself, the FCC's deregulation of cable has brought nothing but higher rates.



Just as free IP (Internet Protocol) telephone service gets off the ground, phone companies have gotten the FCC to move a step closer to classifying IP communications as a form of long distance communications. They want to block competition. Can you hear the toll charges adding up as you check your e-mail on the Internet?

Perhaps Kennard's most egregious actions have been with regard to turning the FCC into the tax collector for the White House.

The FCC recently levied another new tax on telephone bills to support Internet access for schools and public facilities. Often called the "Gore tax," every telephone line user now pays a monthly fee, and the FCC decides who gets rewarded with it.

Add to this the Universal Service tax and the latest FCC scam, the Number Portability tax, and consumers are learning that an agency conceived to regulate spectrum and communication issues has become just another federal taxing agency, often used for social engineering and political purposes.

The commission has moved from protecting users from interference to hawking America's spectrum to the highest bidder and charging the rest of us for services we don't want, didn't ask for or will never use.

Even House telecommunications subcommittee chairman Billy Tauzin (R-LA) has called the FCC a "horse-and-buggy agency trying to bridle a supersonic technology." Spokesman for the committee, Ken Johnson, recently called the FCC "an arm of the White House," noting that "We want to rein in a lot of its assumed authority."

To that I say, Amen!

It's time to restructure the FCC all right. And when Congress does, I hope they'll implement an SBE proposal promoted back when I was the Society's president. That proposal would require at least one FCC commissioner have an engineering background. Now wouldn't that be a novel idea — an engineer on the FCC?

Brad Dick

Brad Dick, editor

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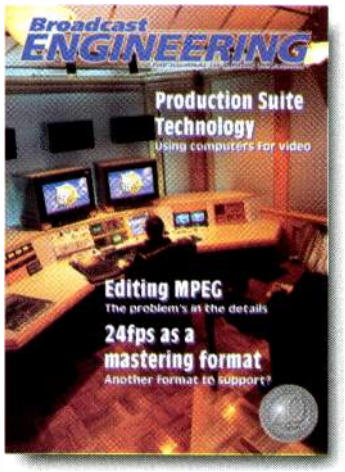

Power trip

Dear Mr. Martin:

In your February column about the DTV power increases, you stated that the recent FCC action will allow parties to submit applications requesting DTV power levels above the former 200kW limit. When I look in the table of allocations for the sixth R&O, I see that our station, KOOD was allocated 495.6kW DTV power level and our satellite station, KSWK was allocated 1000kW DTV power level.

My question is how does this all tie together?

Lloyd Mintzmyer
Director Engineering
Smoky Hills Public TV

Harry Martin responds:

Both KOOD and KSWK are VHF stations, which were not subject to the 200kW limit mentioned in my February article. As a result, when the FCC first made digital allocations, your stations got maximum possible power up to 1000kW. The idea was to permit replication of VHF analog service areas. In contrast, UHF stations were allocated maximum 50kW digital power, with permission to apply, where possible, for up to 200kW.

This discrimination was based on political, rather than technical, rationale — i.e., the FCC did not think it could, through mandatory digital conversion, simply erase the coverage and resulting economic advantages existing VHF stations have over competing UHF stations. This would have caused economic upheaval in the TV business by creating a windfall for UHF licensees.

UHF stations, seeing an opportunity to achieve long-sought parity with VHF stations, at least in the digital world, protested to the FCC. The FCC relented, as reported in my February article, and will let UHF stations apply for as much power as the interference rules will allow, up to 1000kW. The problem for many UHF broadcasters is that the digital table already gives VHF stations precedence by providing interference protection to the high-power facilities all of them got in the first go-round.

Perhaps the confusion here resulted from my not specifying that it was UHF stations, not VHF stations, which were initially subject to the 200kW power limit. My omission resulted from my involvement on behalf of several UHF stations in efforts to achieve maximum power. There just hasn't been any issue about a limit on DTV power for VHF stations.

Coming soon to a satellite near you

In your February issue (News), it's mentioned that DirectTV will soon begin delivering two channels of HD programming and that these broadcasts will be available for viewing at local Radio Shack stores. I just talked to some at "The Shack" and they know nothing about this happening anytime soon. Is there anything new on the subject?

John Hitt
Shreveport, LA

Here's the scoop, John. DirectTV began delivering one channel of high-definition to dealers last October. The programming consists primarily of movie trailers and special "demo" HD material. It runs basically from 6 a.m. EST to 10 p.m. PST, which means stores can get it during normal business days. This feed is not available to the general public.

Several set manufacturers have announced plans to release sets and set-top boxes to decode the DirectTV broadcasts. The sets will be available this summer. Those announcing the future delivery of sets with built-in HD decoding include Hitachi, Thomson (including the RCA and Proscan lines) and Toshiba. The HD-receive capability will first be incorporated into the top-line sets, not STBs. Why? That's the subject for another time, but suffice to say it has to do with profit margins.

Receiving satellite HD programming will require a new satellite dish and a new HD decoder. The HD service will be provided by a different satellite, hence even those with the current DirectTV dishes will have to replace them along with the decoder to get the service.

A spokeswoman for DirectTV said the company has yet to make a decision on when the second channel of HD programming will go on the air. It comes down to when there will be sufficient receivers (customers) to support the service. Nor was she able to verify whether any HD service will be provided on a PPV basis or as another tier of service. Expect HBO and New Line Cinema to be the first providers of HD programming.

Bottom line, John, is that high-definition via satellite is not readily available yet, but the more noise consumers make the faster it will get here. While there is one other provider who claims to be feeding high-definition nationwide, you certainly can not see it in many local stores. Watch your local electronic stores for the first demos in your market. Suggested places to see satellite high-definition include Best Buy, Circuit City, Good Guys and Sears. There are bound to be more stores with satellite HD receivers as we get closer to the broadcast date.

Brad Dick
Editor

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News

ANSI audit impacts SMPTE

BY LARRY BLOOMFIELD

SMPTE underwent an ANSI procedural audit this past year. That audit appears to have had a serious impact at the Society. Results were not made public, but as pieces of ANSI's evaluation were leaked, rifts inside of the Society have begun to show.

According to Amy Marasco, spokeswoman for ANSI, all ANSI-accredited standards developers are required to undergo periodic audits in order to maintain their accredited status. Marasco said, "The contents of such audits are confidential and may only be disclosed by the auditee," or in this case, SMPTE. When asked what was involved in one of these audits, Marasco said, "ANSI audits do not in any way address the technical content of standards, but rather the administrative and procedural aspects of the development of consensus in accordance with ANSI procedures and the accredited procedures of the developer." To put to rest any questions about where SMPTE stands, Marasco concluded, "SMPTE was and is accredited by ANSI to develop candidate American National Standards."

Gavin Schutz, chair of SMPTE's Committee on Multimedia Technology (M21) and its Technology Committee on Imaging (I23), explained further, "One aspect of the standards process is that it involves industry consensus. This sometimes takes time and can sometimes be mistaken for lack of direction." Schutz added, "Over the last 18 months, the SMPTE engineering committees have been more productive than at any other time in their history."

Gavin Schutz, SMPTE

If anyone thinks that things are moving too slowly, Schutz offered interested parties an invitation to get involved. "The best way to appreciate the standards making process is to become involved in it. Those who do will benefit from participation at the pinnacle of the engineering process. The engineering and standards-making process is open to all industry parties — you do not even have to be an SMPTE member."

Irrespective of the deliberate pace in establishing a full set of standards for digital television, ANSI's issues with SMPTE are focused on "the administrative and procedural aspects of the development of consensus in accordance with ANSI procedures." The operative words here are "the development of consensus."

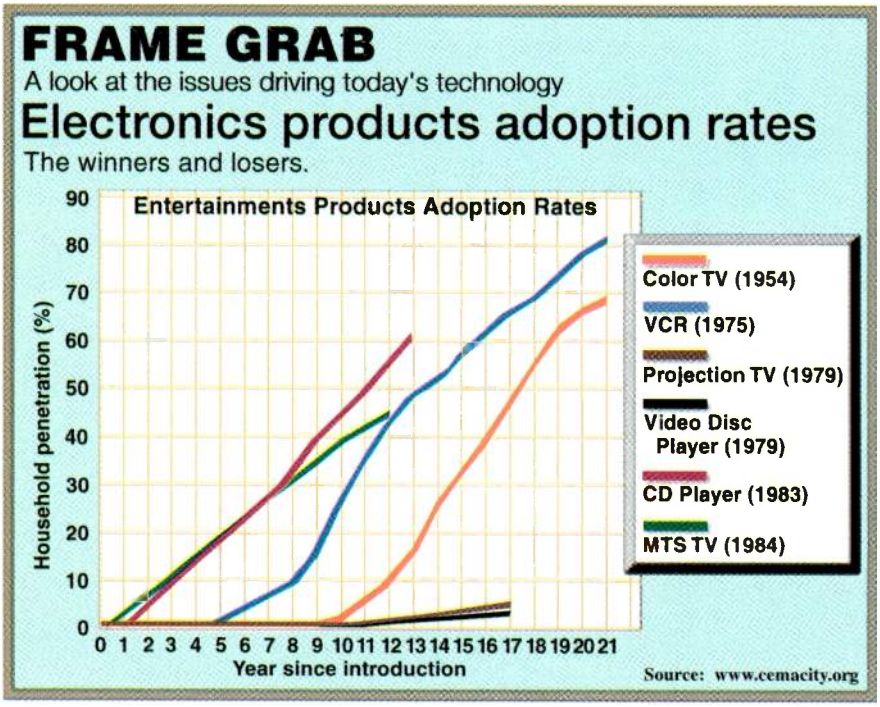
Trying to get engineers to agree upon a standard is, at best, difficult. When television engineers come to the table to discuss new technologies, many, because of the pace of innovation, are under-prepared or misinformed. It makes the task of establishing standards next to impossible.

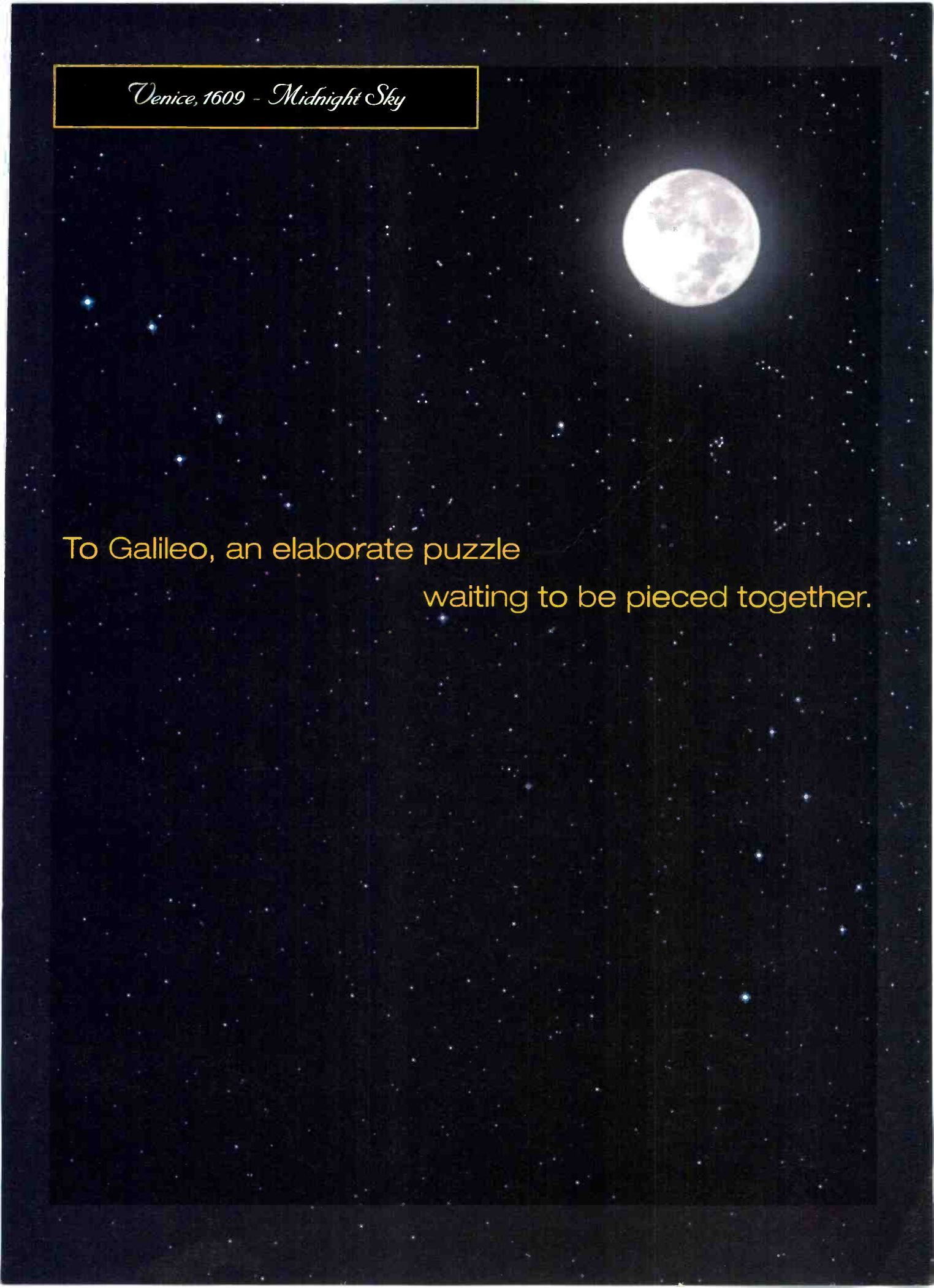
In recent survey of chief engineers, nearly 25 percent of those responding demonstrated a poor understanding of the basic concepts of DTV. It is likely that many network engineering executives would also fail an exam on the DTV fundamentals. Many of these high-priced, decision-making engineers are the very individuals who have been immersed in the SMPTE committees.

Schutz said that, "A vital service that SMPTE supplies is the education of its members and the industry in general. Today, a record number of books, publications, Recommended Practices, and other support media are available. " It's one thing to have a repository of information; it's another thing to make use of it.

For more information on ANSI's audit of SMPTE, see *A SMPTE member responds*, pg 18.

For more information about SMPTE, visit www.smpte.org. ■

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A SMPTE member responds

William Miller, vice president, Engineering, for SMPTE responds:

SMPTE underwent a procedural audit by ANSI at the end of 1997. The audit revealed, among other things, that while ANSI's procedures had been revised, SMPTE's Administrative Practices had not kept pace. At the same time, we were fully involved with the work of the SMPTE/EBU Task Force for the Harmonization of Standards for the Exchange of Program Material as Bitstreams. That effort identified a huge amount of work that would have to be undertaken by the Society, and also showed us that the structure of our standards, and consequently our Engineering Committees, would have to change to keep pace.

Improved process

As a result of the audit and the Task Force work, we initiated a top-to-bottom overhaul of our standards development process. That effort is now complete. While it primarily affects the television side of the house, there is considerable spillover into the film side, with more to come as electronic cinema becomes more important. Here are the highlights of the changes:

- We're moving heavily into Internet communications to expedite our work. For some time, we've been using our website for trial publication of Standards, Recommended Practices and Engineering Guidelines. We're now going to be using e-mail and FTP for circulation of Committee documents, including ballots and ballot comments. In addition to helping our Committee members get their documents faster, we expect the savings in postage to be substantial, more than covering the cost of the site. We even bring a portable network, including document server and Internet access, to Engineering meetings.
- We're making it easier for people to participate. We've established a new class of Committee member, the *Observer*. Observers are entitled to all Committee documents, including ballots, meeting notices, minutes and contributions, but do not vote on ballots. They do have the right to comment, however, and under ANSI (and SMPTE) rules, those comments have to be given the same consideration that comments from Participating (voting) members get. Unlike the Participating members, Observers are not required to attend meetings, nor are they required to return a minimum number of ballots. Note that SMPTE does not charge any fees to participate in its Engineering Committees; you don't even have to be a SMPTE member.
- We've reorganized the Television Engineering Committees into a layered structure. In the multiformat, multistandard world in which we now operate, it makes sense to separate image representation from image transport, for example. The data-processing world has operated this way for years; that's why you don't have to change Web browsers if you switch from, say, Ethernet to Token-Ring connections.
- We've made our Standards, Recommended Practices and Engineering Guidelines more accessible. Last February we issued our Television Standards, Recommended Practices and Engineering Guidelines on CD-ROM; in March we did the same for the Motion Picture documents. Not only are these easier to keep track of (two CDs versus a foot-thick stack of paper); we cut the cost of entry by more than half. We can't give our engineering documents away; I wish we could, but the income we derive from them helps defray the cost of running the Society's Engineering Department.

Consensus building

There's more, but one thing hasn't changed; as a due-process standards developer, we still work by consensus. Consensus-building can be a slow process, and with the rapid pace of innovation these days, that can sometimes be misinterpreted as paralysis. I often hear complaints of "SMPTE should do this" or "SMPTE should do that." Well, SMPTE isn't a nameless, faceless monolith; it's made up of volunteers, and it can only accomplish what those volunteers can find the time to do. If you think SMPTE should do something, you're free to propose it, but expect to be asked to contribute your own time and energy to help get it done.

A long time ago, I showed up at a meeting of the old SMPTE Studio Video Standards Working Group because I thought something should be standardized. The group listened politely to my arguments and told me to come back with a written proposal. I did so the next day and promptly found myself the chairman of a drafting group. The document got done (it's SMPTE RP-157, for the curious), and I got involved in a continuing education program without equal in this industry. The great thing about our engineering committees is you get to learn about new technologies from the people who are inventing them, often as they're being invented.

For more on ANSI...

Please visit ANSI Online at www.ansi.org. The Reference Library contains procedures, forms, guides and information about proposals undergoing public review and recently approved procedural changes. Also look for recent issues of Standards Action so that you can participate effectively in the American National Standards process. ■

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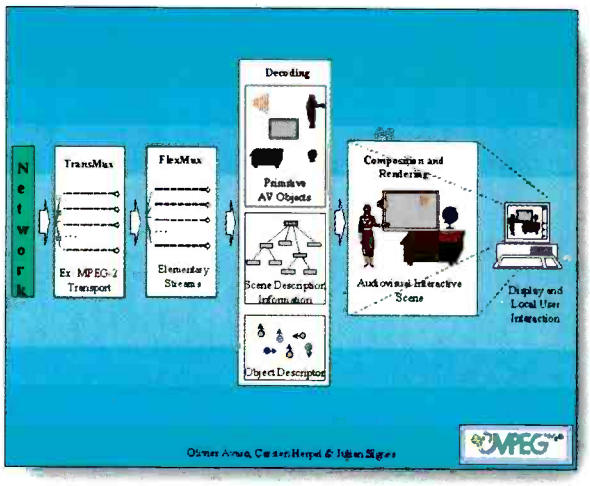


Major components of an MPEG-4 terminal (receiver side).

MPEG update

The Moving Pictures Expert Group has announced the completion of a new compression standard for digital video and audio, and the group has begun work on another standard for describing different forms of multimedia information.

Most broadcasters are familiar with MPEG-1 and -2. Oversimplified, the difference is MPEG-1 deals with the entire television picture, a frame at a time, where MPEG-2 deals with the television picture field by field.

Next on the horizon are MPEG-4 and -7. Dr. Leonardo Chiariglione, convener of MPEG, said, "MPEG-4 is the result of coordinated efforts from hundreds of researchers from the major players of the 'converging' industries. MPEG-4 provides the best solution for audio and video - both natural and synthetic - for media scene composition and transport, and for content management and protection. The demos assembled in Atlantic City were a sample of the efforts that companies are making to exploit the benefits of an open multimedia standard applicable across a variety of communication, broadcasting and information technology environments."

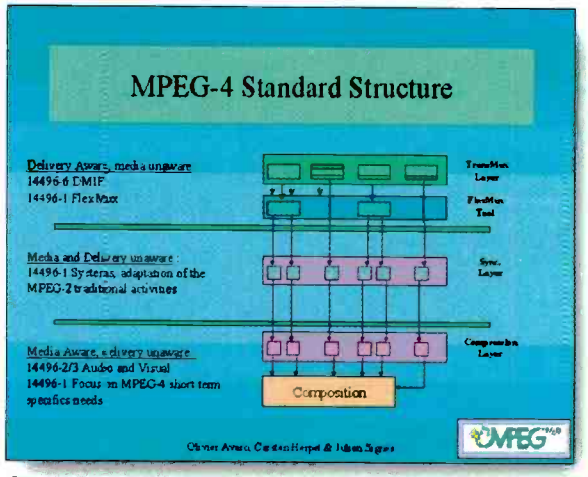
There are many who believe that MPEG-4 will play a very active role in the data aspects of digital television in both ATSC and DVB.

The new player on the scene is MPEG-7. According to Chiariglione, MPEG-7 will be a standardized description of various types of multimedia information. This description will be associated with the content itself, to allow fast and efficient searching for material that is of interest to the user. MPEG-7 is formally called "Multimedia Content Description Interface." The standard does not comprise the (automatic) extraction of descriptions/features. Nor does it specify the search engine (or any other program) that can make use of the description.

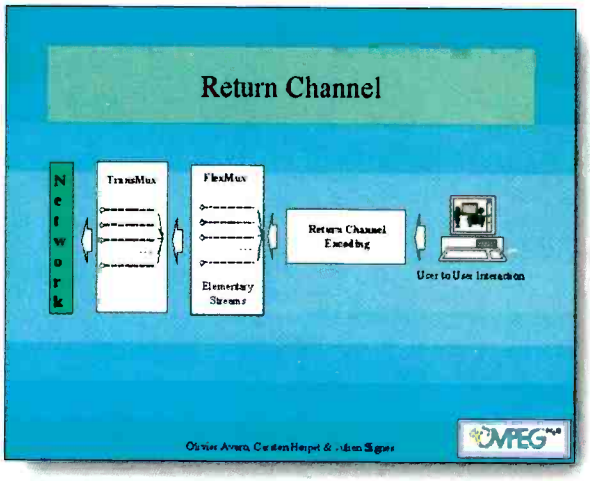
With the increased availability of audio-visual information from many sources around the world and the increase in the various sectors that want to use this audio-visual information for various purposes, it must first be located. Obviously the increasing availability of potentially interesting material complicates this search. MPEG-7 could address this need and provide the solution of how to quickly and efficiently search for various types of multimedia material.

There is little doubt that this will have far reaching effects on news departments and news archive organizations through out the broadcast world.

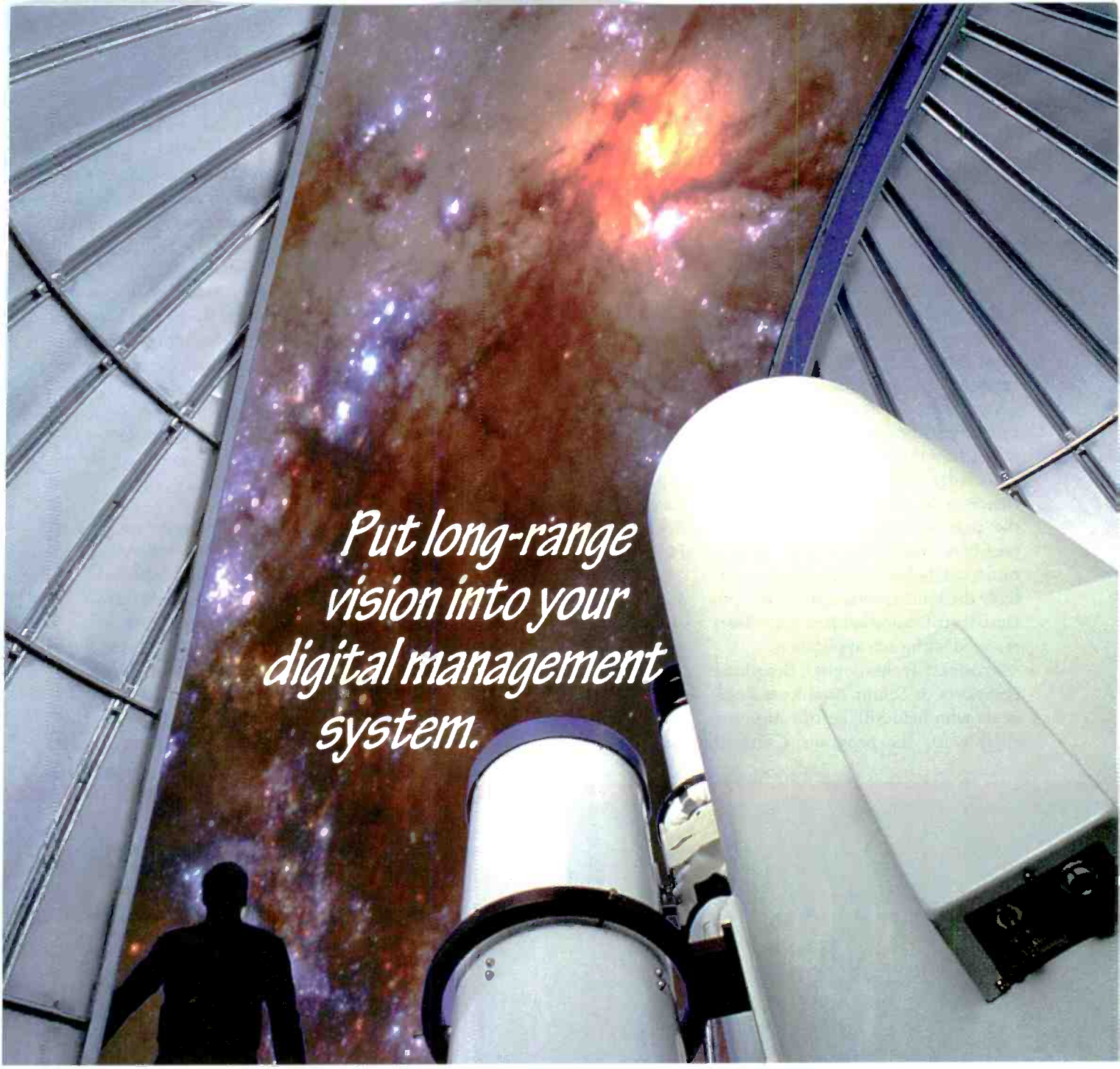
For additional information on these new and existing MPEG standards, visit the MPEG home page at: www.cselt.it/mpeg/. ■



Structure of the MPEG-4 standard provides for media stream composition and transport, as well as content management and protection.



Breakdown of the MPEG-4 return channel which provides for user interaction.



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SBE offers recertification program

The Society of Broadcast Engineers is offering engineers who have let their certification lapse a chance to become recertified without having to take another exam.

Under SBE's Millennium Certification Project, engineers with lapsed certification can apply for reinstatement through Dec. 31, 1999. Under the program, applicants must submit a two-page application to the National Certification Committee detailing how they have maintained their knowledge and enhanced their experience in broadcast technology over the past several years. Committee members, who review the applications, will judge them based on essentially the same criteria applied to non-lapsed certification holders. A $99 fee is required with each application.

Broadcast Technologists, Broadcast Engineers or Senior Broadcast Engineers who held SBE certification are eligible for the program. Certified Professional Broadcast Engineers may also reapply; they will be recertified at the Senior level. After being recertified at the Senior level, former CPBEs can apply to be certified at the CPBE level.

For those who have never held SBE certification, here are the basic SBE certification levels and a brief description. Upon receiving SBE certification, it is valid for five years.

- *Broadcast Technologist* – This is the entry level certification and there is no experience requirenent. Candidates can either take an examination, hold a valid Lifetime General-Class license with a minimum service experience, hold an FCC Amateur Extra Class license, or hold a valid license equivalent to one of the above FCC-type licenses.
- *Broadcast Engineer* – This candidate must have five years of experience and achieve a passing grade on the proficiency exam. The Broadcast Engineer certification level may be endorsed as either AM/FM or TV. Endorsements are by examination only.
- *Senior Broadcast Engineer* – This candidate must have 10 years of experience and pass an examination. There are several ways, other than just broadcast, to amount the 10 years experience requirement. The Senior-level certification may endorsed as either AM/FM or TV through an examination process.
- *Professional Broadcast Engineer* – The Professional Broadcast Engineer certification is the highest certification level provided by SBE. It requires 20 years of professional experience and one must be presently certified at the Senior Broadcast Engineer level to be certified at the professional level. ■

For more information on SBE certification or the Millennium Certification Project, contact the SBE at: Society of Broadcast Engineers, 8445 Keystone Crossing, Suite 140, Indianapolis, IN 46220, 317-253-1640. Or see its website at: www.sbe.org.

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PBS leads HDTV with hot air

Can you imagine the sight of nearly 800 hot air balloons rising *en masse* at dawn? You don't have to. The next best thing to being there is to see the PBS documentary on the International Balloon Fiesta in Albuquerque, NM, shot by HD Vision Inc., Irving, TX. The HD digital shoot was completed in October 1998.

The program is scheduled to air in high-definition on PBS this June. HD Vision's Randall Dark believes the program will be much more than just fun and information for viewers. He says, "This program boasts some of the most beautiful HDTV imagery I've seen in my 13 years in the industry. Imagine giant pear-shaped envelopes of every color imaginable speckled across a cloudless blue sky. It's fascinating content and eye candy all in one."

HD Vision first attempted a shoot of this kind at the 1997 Fiesta. Because the HDC-500, with its 40x1 lens, had to be tethered to its record deck by a cable, shots were limited. Dark was able to convince PBS to hold off for another year in anticipation of the company taking delivery of new Sony HDW-700 camcorders.

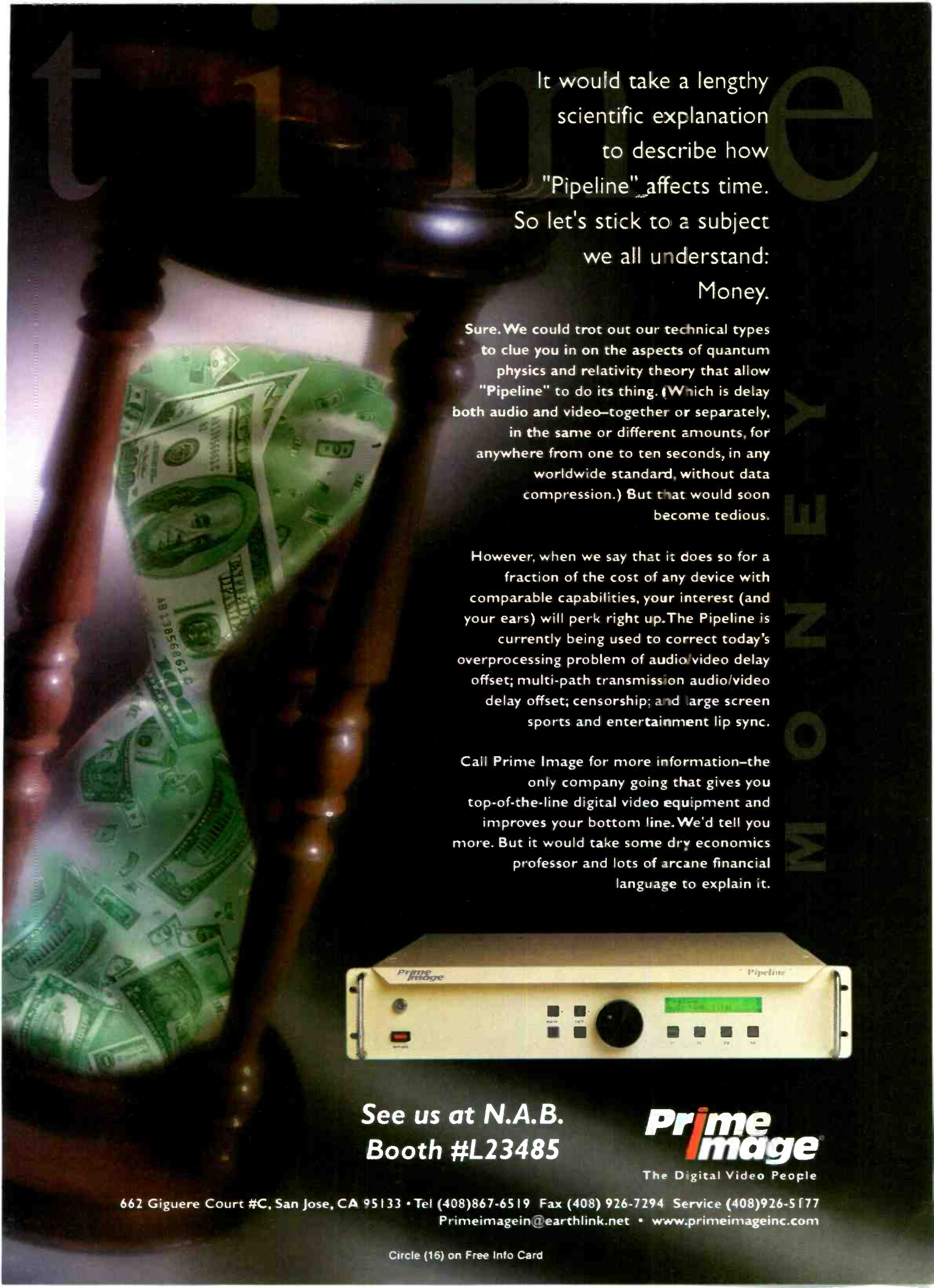
With the new camcorder in hand, the 1998 event proved even more spectacular. The first day on location, Dark was able to capture the mass ascension spectacle from the perspective of a balloonist, inside the basket. This was followed by showing the solitude of floating in a balloon 8000 feet above the ground.

Freed by Sony HDW-700s to take the best shots where they happened, HD Vision shot this year's Fiesta in spectacular HD.

Perhaps one of the most visually exciting of the events captured by HD Vision was the Rodeo Glow. This is where the pilots gather at sunset and inflate their balloons, but don't take off. As soon as it gets dark, the pilots take their cue from spectators, who give them a count down which culminates in hundreds of burners firing all at once, lighting the tethered balloons up like a giant string of Christmas lights.

Dark believes that world famous family event will get viewers involved in every aspect. "The quality and detail of the images are beyond compare. HDTV is the ultimate medium for showing off the rainbow of colored balloons against a clear blue backdrop." Recognizing that the quality of the pictures could only be as good as the equipment, Dark concluded: "The HDW-700 performed beautifully at the event and the images prove it."

For more information about HD Vision see its website at www.hdvision.com. For more information about PBS high-definition specials, visit their website at: www.pbs.org. ■



It would take a lengthy scientific explanation to describe how "Pipeline" affects time. So let's stick to a subject we all understand: Money.

Sure. We could trot out our technical types to clue you in on the aspects of quantum physics and relativity theory that allow "Pipeline" to do its thing. (Which is delay both audio and video–together or separately, in the same or different amounts, for anywhere from one to ten seconds, in any worldwide standard, without data compression.) But that would soon become tedious.

However, when we say that it does so for a fraction of the cost of any device with comparable capabilities, your interest (and your ears) will perk right up. The Pipeline is currently being used to correct today's overprocessing problem of audio/video delay offset; multi-path transmission audio/video delay offset; censorship; and large screen sports and entertainment lip sync.

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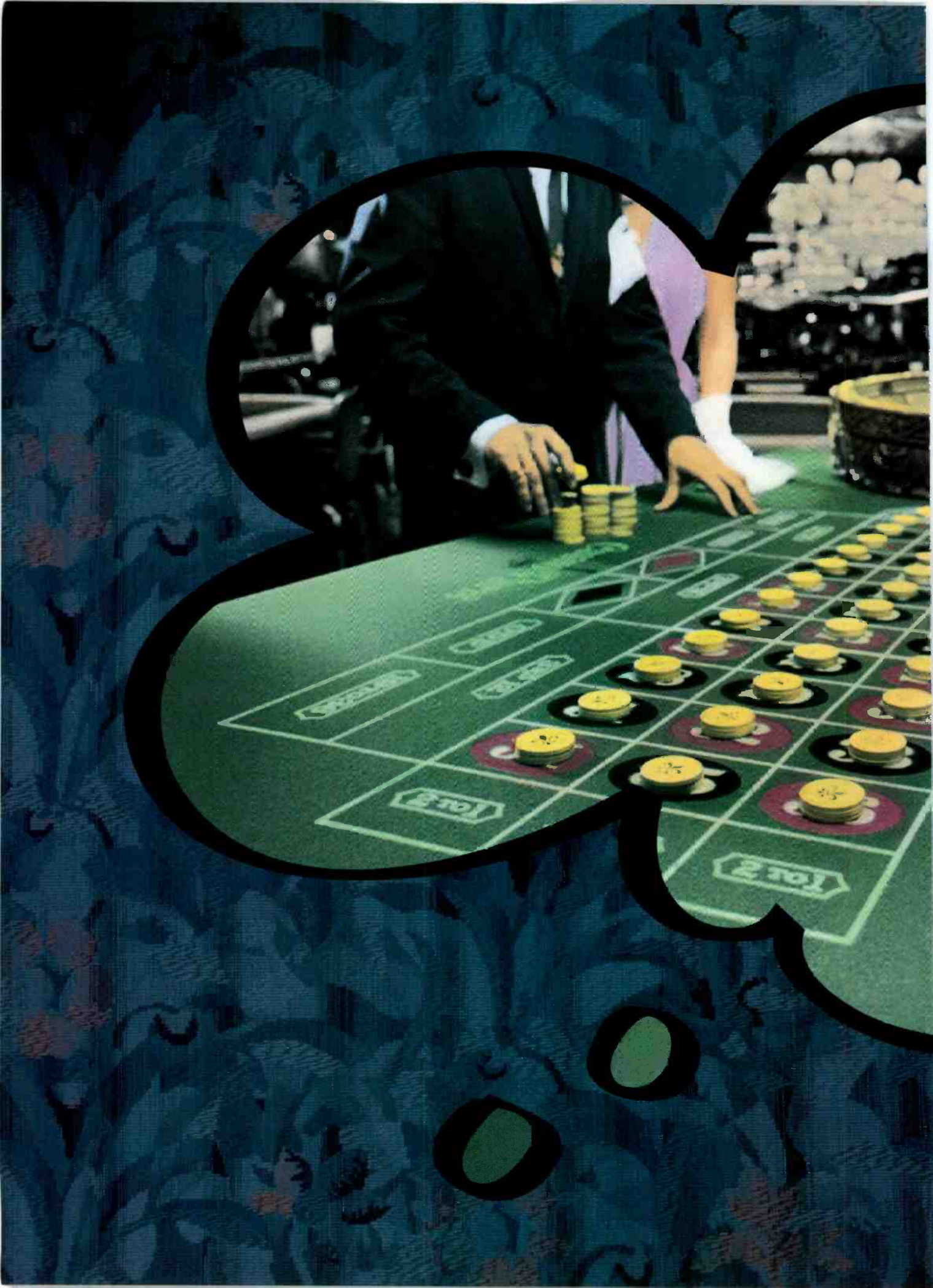

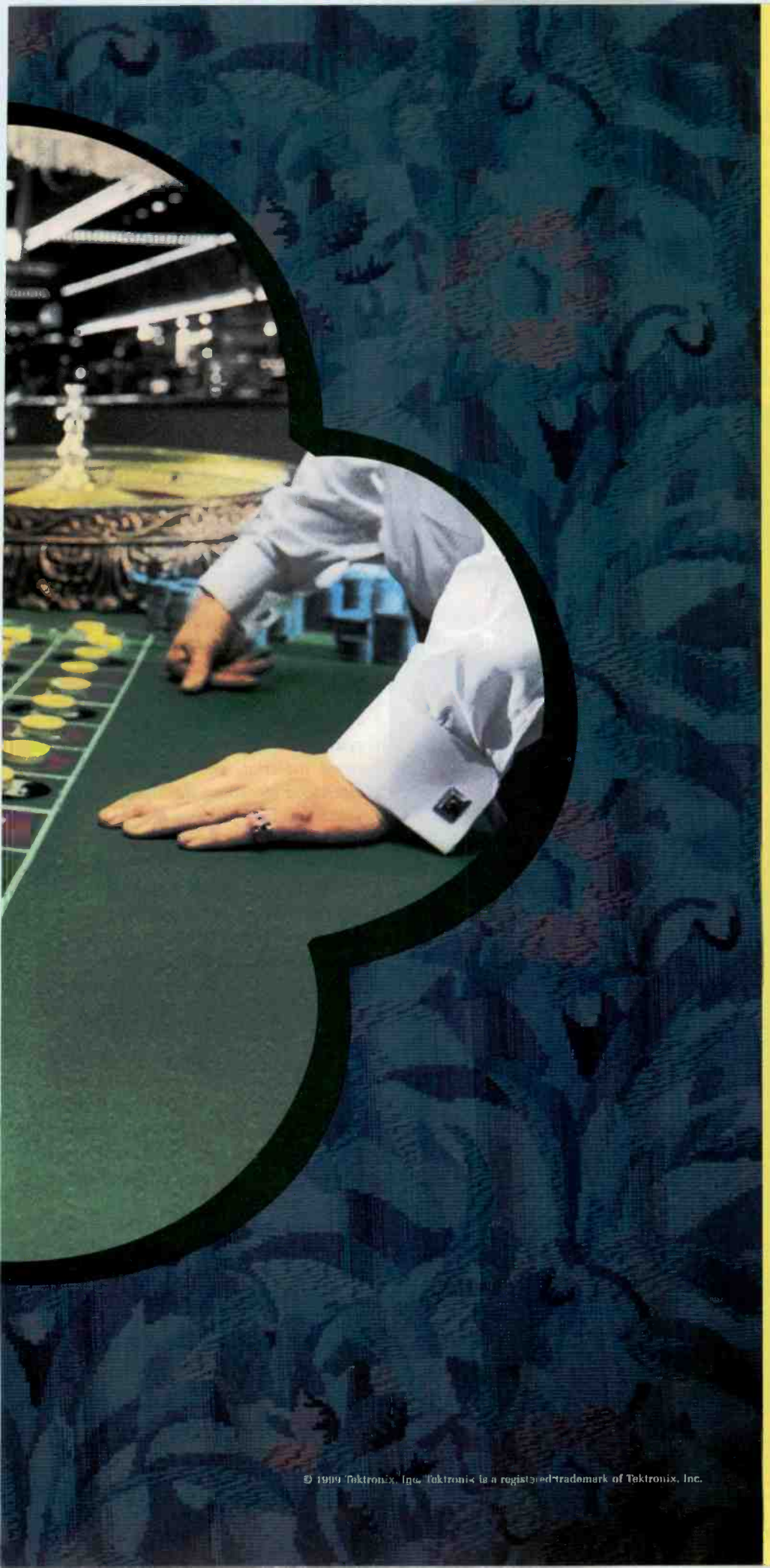

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The 24p approach

As we navigate our way though this interesting new world of digital television, new approaches seem to be cropping up all over the place. It isn't difficult to get manufacturers of various new digital television products to bring their "dog and pony show" to your local SBE, SMPTE or other area engineering colloquium. Although concentration at this stage of the game might better be suited to studying the fundamentals of digital television, it is necessary to know what is out there and where it can be gotten.

Michael Vitelli, Sony

An example of this kind of this was demonstrated in a presentation by Sony to a group known as BABES (Bay Area Broadcast Engineering Society), a San Francisco-area group of SBE and other engineers. What was interesting was Sony's approach. One got the impression that if you wanted to buy only one item from them, you were out of luck; you had to buy "the system." Chances are that this was a misleading and probably false impression, and, if you had the bucks for a "whatever," Sony would most likely sell it to you in a heartbeat, system or no.

An example of this system approach is the 24-frame progressive (24p) High Definition Post-Production System that was unveiled at Laser Pacific Media Corporation in Los Angeles. (See Broadcast Engineering, Feb. 1999 "Mastering at 24p")

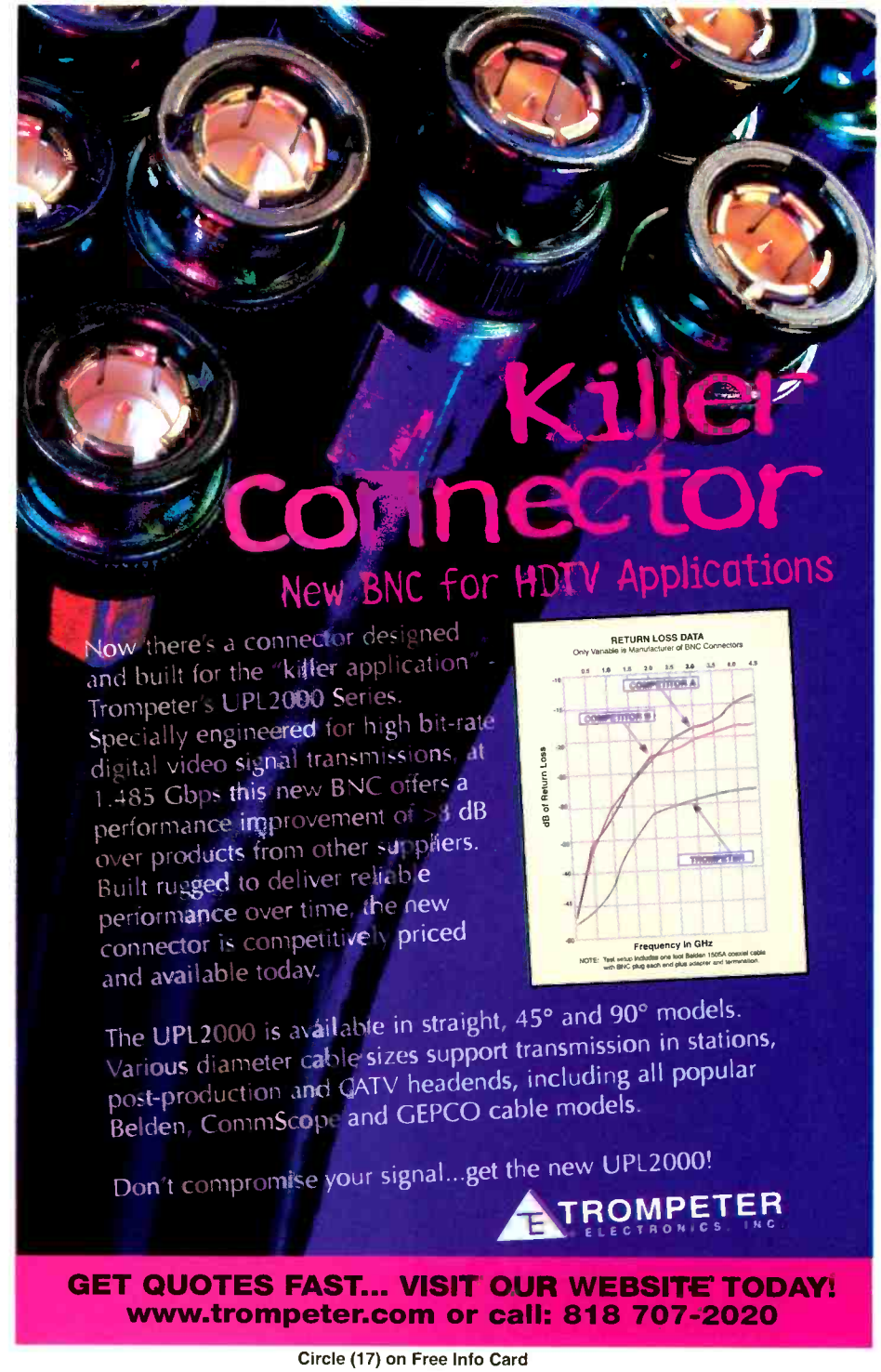
Sony and other broadcast equipment manufacturers have been leaning toward a 24p solution for "DTV, DVD, the Internet and all other electronic and digital distribution mediums," according to Michael Vitelli, executive vice president of Sony Electronics. Vitelli claims that this is the first format ever created specifically to suit this need.

The 24p approach allows a single post production facility to switch between 1080/24p and 1080/60i/50i (25p). The reasoning is based on a post-production system that scans in 24p for film-originated material, allowing for 60 field interlaced recording for high-definition video and in 25 frames progressive for international distribution.

Vitelli stressed Sony will provide a "a full family of products, including an HD telecine, VTR, editor, production switchers, digital effects, monitors, multiformat converters, and peripheral products." Panasonic has also announced 24p products at this year's NAB.

LaserPacific's President Emory Cohen says, "The industry has long recognized the need for a digital production standard to complement the new ATSC broadcast standards. I believe 1080/24p not only fills that need, but it also reduces economic barriers to HDTV program production."

It would certainly appear that if your are interested in investing in a digital post facility, a strong look at 24p should be part of the process. For those needing 24p EFP equipment, just wait ; several companies have announced those products will be available later this year. ■



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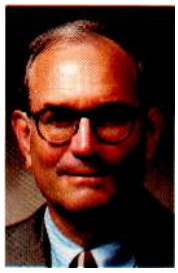
FCC Update

DTV/data convergence

BY HARRY MARTIN



DTV will allow for the wireless provision of multiple broadband datastreams into the home, and it is likely that broadcasters will have to join forces with experienced providers of data transmission and content services in order to use this new medium effectively.

Under the FCC's DTV rules, the DTV phase-in starts with network-affiliated stations in the top 25 markets and moves to other stations and smaller markets thereafter. Currently, all commercial stations are to commence DTV broadcasts by November 2002, although this deadline may be pushed back for stations in smaller markets. In any case, approximately 70 DTV stations will be on-air by May of this year, and it is estimated that 120 to 140 DTV stations will be operating by the end of the year, reaching approximately 60 percent of the nation's population.

DTV broadcasters will have a substantial amount of bandwidth (6MHz) to use for transmission of multiple information streams. It is estimated that even while transmitting an advanced high-definition video signal, broadcasters also will be able to transmit 4Mb/s of data. As digital compression technologies improve, broadcasters will likely be able to transmit even more data.

While broadcasters will be required to use at least some of the DTV spectrum to provide traditional free video entertainment programming, broadcasters may use the remainder of their spectrum to provide other point-to-point or point-to-multipoint services, such as delivery of computer software, data transmission, teletext, voice services, and interactive or subscription video services. The flexibility to combine services will provide significant marketing opportunities (e.g., insertion of data and nonvideo product information into video commercials), and those opportunities will likely be maximized as consumer equipment manufacturers continue to develop products that combine the functionality of traditional computer and television monitors. Indeed, DTV may become an important medium for providing high-speed Internet access to homes.

Under the FCC's regulations, DTV services other than traditional free video entertainment are classified as "ancillary and supplementary services." Broadcasters may provide any such ancillary and supplementary services as long as such provision does not derogate the required transmission of free video services. However, if the broadcaster charges a fee for any ancillary or supplementary service, or receives compensation from a third party in return for transmission of ancillary or supplemental services (not including transmission of commercial advertisements), then the broadcaster will have to pay special regulatory fees to the FCC. Such fees are to be paid on an annual basis, and will be equivalent to five percent of the station's gross revenues from ancillary and supplementary services.

Dateline

Commercial TV stations in the following states or districts must file the first bi-annual ownership reports on or before June 1, 1999: Arizona, Washington D.C., Idaho, Maryland, Michigan, Nevada, New Mexico, Ohio, Utah, Virginia, West Virginia and Wyoming.

Cable/telco convergence

Another significant manifestation of technological convergence in the communications industry is the provision of data and even voice services, traditional to the telephone industry, over cable systems. However, no regulatory mold has yet been developed to govern cable-provided voice and data services.

The principal regulatory problem from a conceptual standpoint is whether the provision of an Internet-related service by a cable operator constitutes a cable service, which is subject to very little regulation and no encroachment from competitors, or whether it constitutes the provision of a federally-regulated information service whose telecommunications component must be dealt with in the same manner as telephone or other common carriers.

Cable systems are not subject to the interconnection, resale and unbundling requirements that govern local exchange telephone companies (LECs). That is why the cable operators have strongly urged that Internet-related services are cable rather than information services, even though that means the revenue from such services is subject to local franchise fees. On the other hand, the LECs believe that if cable provides telecommunications services to subscribers, open access must be provided to cable TV facilities, as the law currently requires for LECs and other carriers.

Which viewpoint is right? The FCC has not provided the answer, and the courts have not yet had the opportunity to rule. However, it is becoming clear that the FCC's staff favors allowing cable to provide Internet-related services unfettered by telco regulation and competitive access requirements.

With technological conglomerates such as AT&T/TCI planning to merge telecommunications with cable and to deliver converged services to virtually every home and business in the country, the answer should be forthcoming sooner rather than later.

Ultimately, whether Internet protocol telephony finally is determined to be an information service or a telecommunications service is not as important as how the federal regulatory scheme will be adapted, as it eventually will have it to be, to treat all telecom facilities with the same functions in the same manner whether they use wireless, wireline or cable TV technology. ■

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

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The consumer connection: The really big question mark for DTV

BY JERRY WHITAKER, BE CONFERENCE CONSULTANT

The challenge of putting a DTV station on the air, as difficult as it is, pales in comparison with the challenge of accurately predicting what consumers want out of DTV: more choices or better pictures. The easy answer, of course, is that they want both. Beyond the easy answer, however, is the rather considerable question of consumer acceptance of this new technology, which will ultimately determine whether the numerous DTV business plans now being formulated will be wildly successful or will fail miserably.

There are many yardsticks being offered for the consumer market; the arguments for some of the more popular ones are outlined well in the accompanying viewpoints. However, the bottom line is that, quite frankly, nobody knows for sure.

One often-cited parallel to DTV implementation is the transition from black-and-white to color transmission of NTSC. There are certain and obvious flaws in this parallel. The larger message for DTV is that it took 10 years for color to become a significant factor in consumer sets. While this probably argues for beginning with multicasting and slowly moving over to true HDTV, remember that after color took hold, it took over the market. And beyond a certain early-adopter mortality rate, the marketplace always rewards those companies and services that are first to market with a product or service that the consumer wants.

We do not profess to settle the consumer acceptance question in this month's column, but at least we can present three viewpoints that will illuminate the critically important issues at hand. ■

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

Question: There have been widely differing viewpoints on consumer acceptance of HDTV. What does your research say about when consumers will be demanding HDTV programming?

EXPERT

BY JOSH BERNOFF

Have you considered the idea that DTV may succeed, but HDTV may not?

Forrester recently completed a report called "HDTV dreams, SDTV realities," for which we interviewed over 50 companies — consumer electronics, broadcasting, cable, and others — to examine the future of digital television. In a nutshell, here's what we found:

• Consumer electronics manufacturers are making good progress in bringing down the cost of DTV decoders, but progress in displays remains more difficult. Consider the $1500 price point, below which 95 percent of TVs are sold. SDTV sets with 480p display will be available at this price in two years, while HDTV sets with 720 or 1080 lines of resolution will remain above this threshold for at least five years. As a result, the heart of the market will be unable to see HDTV resolution.

• Local broadcasters and networks continue to talk mostly about HDTV — ever since Preston Padden of ABC got lambasted for telling Congress he might consider delivering multiple SD signals. But except for blind faith — "consumers always go for better television" — we found no one able to articulate a business plan for how to make money with high-definition television. As local broadcasters like Sinclair and national networks like Pax Net and PBS begin multicast experiments, we believe that they will find the most profit potential in multicast standard-definition television, not single HDTV broadcasts.

• The cable industry has spent billions building out broadband networks, with the most immediate profit potential coming from premium channels and pay-per-view. With a single HDTV channel taking up the space of four to six compressed SDTV channels, cable operators will fight any requirement to carry full HDTV versions of broadcaster's signals. While the FCC is con-

With Congress watching every move, the safe action is to talk as if HDTV and DTV were equivalent.

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sidering must-carry for digital signals, it's unlikely that any regulation with teeth will emerge any time soon.

With these realities in plain view, why is high-definition television the mantra of the TV industry? Because once significant players admit that HDTV is not the ultimate goal, the prospects become even dimmer. With Congress watching every move, the safe action is to talk as if HDTV and DTV were equivalent. But HDTV works only when every single link in the chain — production, network delivery, local broadcast, cable or satellite carriage, and the consumer's television — carries the signal in full resolution. As a result, smart players all over the industry are quietly considering non-HD alternatives such as multicasting.

So what should you do? Here is what Forrester recommends:

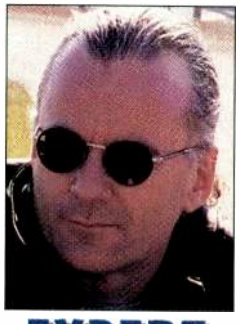
• **Produce in high-definition, but don't plan to deliver high-definition:** With HD production equipment coming down rapidly in price, go ahead and invest in HDTV production. HD-formatted video can readily be down- and cross-converted to any other format. Alternatively, create in film and protect for wide-screen 16:9 display, but expect consumers to view that content in standard definition television.

• **Prepare to multicast:** When planning networks and stations, prepare now for multicasting. Can you run multiple broadcasts at once? How automated is your facility? Are you prepared to run network programming simultaneously with the State of the Union address? To broadcast a local all-news channel? To rebroadcast syndicated shows at different times of day on different multicast channels? When management comes to the conclusion that these alternatives are worth pursuing, stations and engineers had better be ready to implement.

• **Don't give up on cable:** DTV won't put a dent in cable's 70 percent penetration; cable will dominate future delivery for broadcast networks, cable networks, and local broadcasters. Better to negotiate carriage agreements now — as Time Warner and CBS did — and cooperate on multicast than to expect the FCC and must-carry regulations to maintain the status quo.

• **Keep an open mind:** Despite the industry's focus on HDTV, DTV offers multiple profitable alternatives, including embedded data in signals. Simplistic thinking — it's just like current television, but high-definition — ignores these alternatives. With so few viewers signed up, now is the time to experiment with datacasting, multicasting and new business relationships. Expand your mind now, and you will be ready when the industry settles in the coming decade. ■

Josh Bernoff is principal analyst for television research at Forrester Research, Cambridge, MA.



EXPERT

BY RANDALL P. DARK

Immediately. For the past six years I have been giving HDTV demonstrations at HD VISION and the response is always the same. The quality of the images leaves the audience in awe. I'm not just talking about industry executives but everyday consumers as well. At HD VISION, I make it a policy that every month we reach out to the community by doing HDTV demonstrations for high school students, college students, neighbors in our business complex or anyone else that shows an interest in what we are doing. The first three statements out of everyone's mouth are generally the same: "Wow! That looks like 3D ... I can see every detail in the background just like I'm looking out the window," "When can I get one of these?" and "Where can I get one?"

Recently, I walked in the screening room to find a staff member giving a demonstration to a truck driver that had delivered equipment to our facility. The gentleman had asked if we were doing that new HDTV stuff he had heard about. When a Dallas Cowboys football game came up on the 28-inch HDTV monitor, his eyes lit up and his face looked like that of a small child seeing Disney World for the first time. On the way back to the dock, he turned to thank us and said, "I'm going to start saving up for one of these now. How am I going to explain it to my wife?"

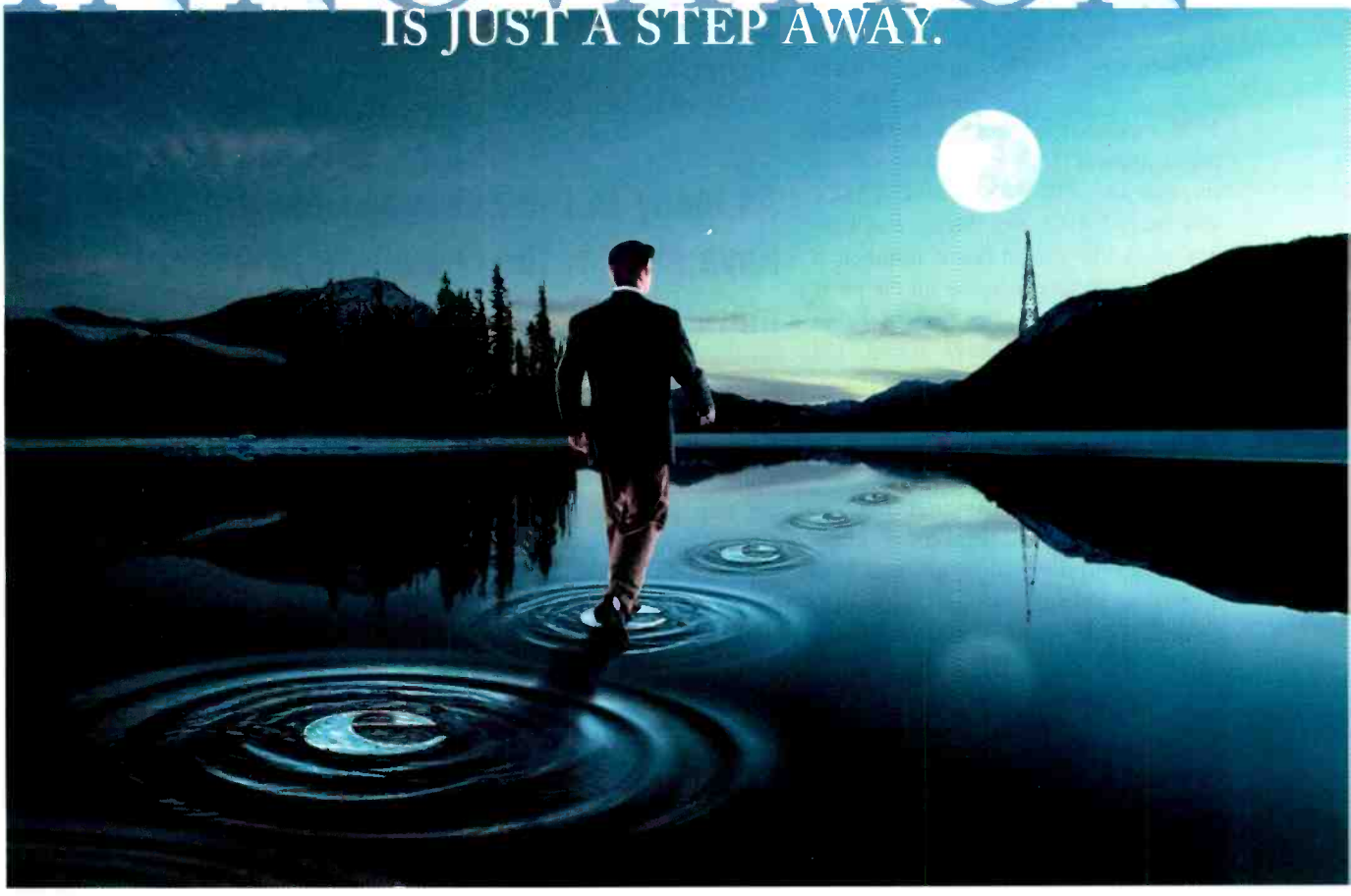
It's no secret. Consumers have always wanted bigger, brighter and better.

It's no secret. Consumers have always wanted bigger, brighter and better. Over the past 20 years we have been able to offer them bigger sets with a horrible picture. The response has been amazing. Big-screen televisions equal big sales. Now we can offer big-screen images with big-time quality. NASCARs seem to roar through the living room, and it feels like you can touch the bear in the nature documentary you are watching. For the first time, you can watch a concert and tell what color the singer's eyes are and see a bead of sweat drop off his or her brow.

I remember hearing, "Personal computers? Who needs a personal computer at home? ... CD players? My cassette tapes sound fine. Why would I want to spend all that money to start over with a new music collection? ...VCRs? They cost too much!" When color televisions were introduced, they cost as much as a car and there was only one color program to watch a week. Over the years, consumers have proven time and time again that they will find a way to afford the quality products they desire. HDTV is no different. ■

Randall P. Dark is president & CEO of HD VISION, Irving, TX

THE NEXT INNOVATION IS JUST A STEP AWAY.



Ever tried to walk on water? Producing and distributing multichannel audio for DTV can be just as difficult. But now up to eight audio channels can be carried through the existing two-channel broadcast infrastructure with the latest innovation from Dolby Laboratories...Dolby E. With the Dolby E Encoder and Decoder, programs created for DTV broadcast can be decoded, processed, re-encoded, and edited many times without sacrificing sound quality. And Dolby E allows metadata to be carried throughout the entire production and broadcast distribution stages, which means programs sound just the way they were originally intended all the way down the line. Take the first step...visit our website for more information.

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VENDOR

BY GARY SHAPIRO

The long-awaited introduction of DTV is underway and progressing at a projected pace. CEMA is pleased to report that from Nov. 1, 1998 — when the first DTV broadcasts began and HDTV sets went on sale — through Dec. 31, 1998, sales of DTV sets exceeded 13,000. While this may not seem like a significant number, it truly is when you consider all the parts of puzzle. As many in the consumer electronics industry have stated, the transition to DTV will be a marathon, not a sprint. We project that sales of DTVs will reach 150,000 units in 1999, escalating to 600,000 in 2000. These are steady increments that can be achieved through the total cooperation of the broadcast, cable, satellite and television manufacturing industries. Overall, during the first eight full years on the market, CEMA conservatively projects DTV set penetration of 30 percent. In comparison, color TV penetration rose to only 10 percent during the first eight full years on the market while penetration of both VCRs and CD players reached 30 percent in their first eight years on the mass market. Presently, more than 20 TV manufacturers are selling or demonstrating DTV at retail, and consumers will have an increasing variety of DTV products to choose from in the coming months. Manufacturers are currently introducing rear projection, front projection, direct view and plasma units, as well as a variety of digital set-top boxes that will decode DTV signals for display on today's televisions. While current prices may not fit the budget of the average consumer, consumers can expect that these prices likely will follow a traditional downward trend as the technology matures. Over 50 television stations in more than 25 markets are now broadcasting digital programming. By May 1, 1999, broadcasters in the top 10 markets — New York, Los Angeles, San Francisco, Washington D.C., Chicago, Atlanta, Detroit, Dallas, Boston and Philadelphia — are mandated to deliver digital broadcasts. It is expected that every market except Chicago will meet this deadline. In fact, many of them already have. Stations in the top 30 markets, which comprise nearly 60 percent of the country, are required to be broadcasting digital programming

As many in the consumer electronics industry have stated, the transition to DTV will be a marathon, not a sprint.

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by Nov. 1, 1999. While the broadcast industry is actually ahead of the FCC schedule, the cable industry still lags behind. To date, only two major cable systems, CableVision and Time Warner, have made commitments to carry HDTV broadcasts. HBO will begin HDTV transmissions in March. CEMA is currently working with the cable industry to establish interconnectivity standards for DTVs and set top boxes. To ensure a smooth transition to DTV, an extensive education effort is required for consumers, retailers, manufacturers and broadcasters. Retailers will lead the way in educating consumers, as in-store demonstrations will be one of the first ways consumers are introduced to DTV. Our research tells us that once consumers see the crystal clear pictures and hear the digital surround sound, their interest and excitement levels jump.

As all the pieces of the puzzle come together, the DTV transition will pick up speed like a snowball going downhill. It is going to take the cooperation of everyone involved but the ball is definitely rolling. ■

Gary Shapiro is president of the Consumer Electronics Manufacturers Association (CEMA), Arlington, VA.

EXPERT

BY DAVID MERCER

It is surely one of the great ironies that the last nation in the world to show an interest in HDTV is the only one left with a realistic chance of achieving the goal. After more than twenty years of developing these systems, how have we reached this situation?

After more than twenty years of developing these systems, how have we reached this situation?

There is one overwhelming reason why HDTV could survive in the U.S. where it has failed elsewhere — lots of American consumers spend serious money on big TV sets. To be precise, a million households a year spend an average $2000 on a large screen projection set. Six percent of households now own such a product.

It is this market which gives hope for HDTV proponents, and it is also what makes the U.S. market different from any other. In Japan and Europe, there simply isn't the demand for these "super-size" displays to justify the move to HDTV.

Why are large displays so critical? Because it is only on displays of this size that the benefits of HDTV have a significant impact. We disagree with the idea that HD has no benefits compared to SD. On 40- to 70-inch rear projection sets, high-definition, whether 1080i or 720p, represents a marked and noticeable improvement over standard-definition images. In isolation, HDTV sets displaying properly originated material are of a quality which is stunning enough to make many potential buyers wish they could afford today's $7000 to $10,000 asking prices.

There is indeed a demand for HDTV receivers, but that demand is confined to the 40"+ sector. The Europeans and Japanese have already discovered, to their immense cost, that on direct view sets in the 30" and below range, 700 to 1000 lines of resolution simply do not represent a great enough improvement in image quality to justify the considerable additional cost of the HD display and electronics. As we reported to our clients ten years ago, consumers can't see the difference and don't think HD is worth the money. It is in this smaller-screen, direct-view market where we believe SD displays will continue to dominate.

So what are we left with? The best indicators we have for demand for HDTV sets are the projection TV market. We can assume the quality of HD will increase the size of this market compared to demand for NTSC models. Let's face it – if 6 percent of households have invested in NTSC rear projection with all its weaknesses, it is reasonable to assume more, perhaps 10 or 20 percent, might eventually want to own an HD equivalent.

All of this assumes HD prices can fall close to current NTSC prices, and this is a pretty big assumption. There is a lot of chicken and egg here — manufacturers are constantly judging whether the prospect of additional volume sales can justify price cuts. We expect slow, but steady erosion in HD-capable projection TV prices, from today's levels to $2500 to $6000 by the 2002 timeframe. At the low end, this would make HD sets competitive with the standard NTSC projection market, and should help persuade many consumers to make the step up to HD.

It's clearly going to be a long haul for HDTV. As far as programming is concerned, broadcasters should be aware that their potential audience will never equate to the entire U.S. population. In the foreseeable future, there isn't a scenario where every household, or even half the population, will wish or be able to own an HD-capable receiver. Programming strategies need to address the niche market represented by HDTV owners.

This is precisely how the satellite, and eventually cable, operators are expected to move forward. DirecTV is rapidly emerging as the *de facto* standard direct-to-home satellite platform for the U.S. market. With the capacity for hundreds of channels in the future, DirecTV can afford to allocate space for HD transmissions to the small minority of its viewers who can see them in their full glory. HBO, for one, has indicated that it is very much interested in this market.

It is in this smaller-screen, direct-view market where we believe SD displays will continue to dominate.

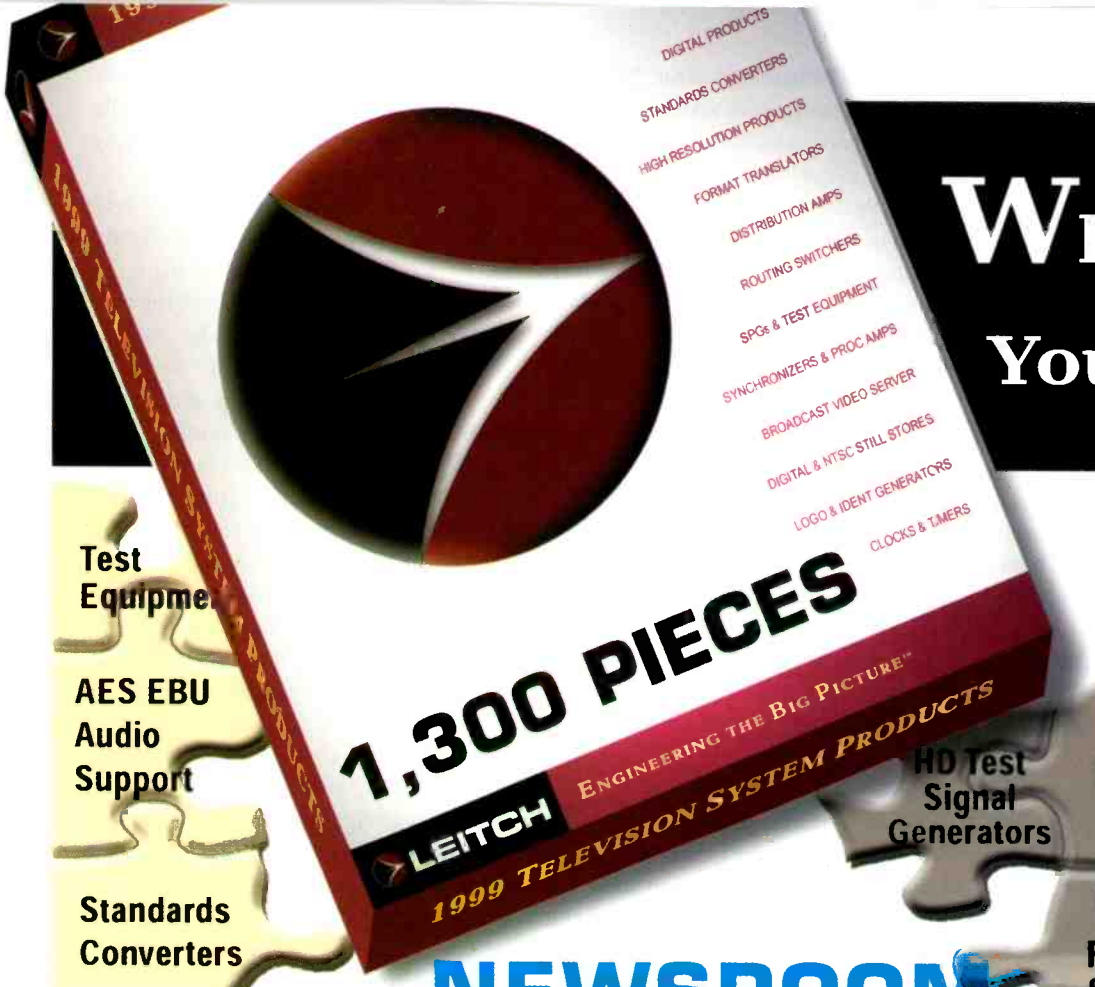
By 2002 there will be around a million HD-capable sets in U.S. homes. Many of these will have access to cable or satellite services, and so represent an interesting niche market for HD programming. HD services will need to be funded by subscription or pay-per-view models, if only because popular content will inevitably be movies and premium sports.

And what of ATSC? For various reasons, we doubt the viability of digital terrestrial TV. Aside from the early technical problems emerging in both the U.S. and U.K., other factors will also prevent a rapid switch from NTSC to DTV. Consumer cost is the main issue: with NTSC TV sets selling at an average $350 retail, it will be many years before integrated DTV sets become competitive.

Official DTV transition strategies in the U.S. and Europe are already in disarray. We have recommended a "universal broadband" strategy which will allow governments to switch off analog transmissions by 2015. Under the current strategy, this cannot happen before 2025.

One glimmer of hope does remain, and that is HDTV. Yes, Americans will pay for it — both the receivers and the services. How many of them, we're not sure, but it could represent a profitable niche market for some broadcasters. Just don't be deluded that you'll reach everyone, and plan to continue with NTSC and SDTV for many years to come. ■

David Mercer is director, Interactive Home Service, Strategy Analytics.



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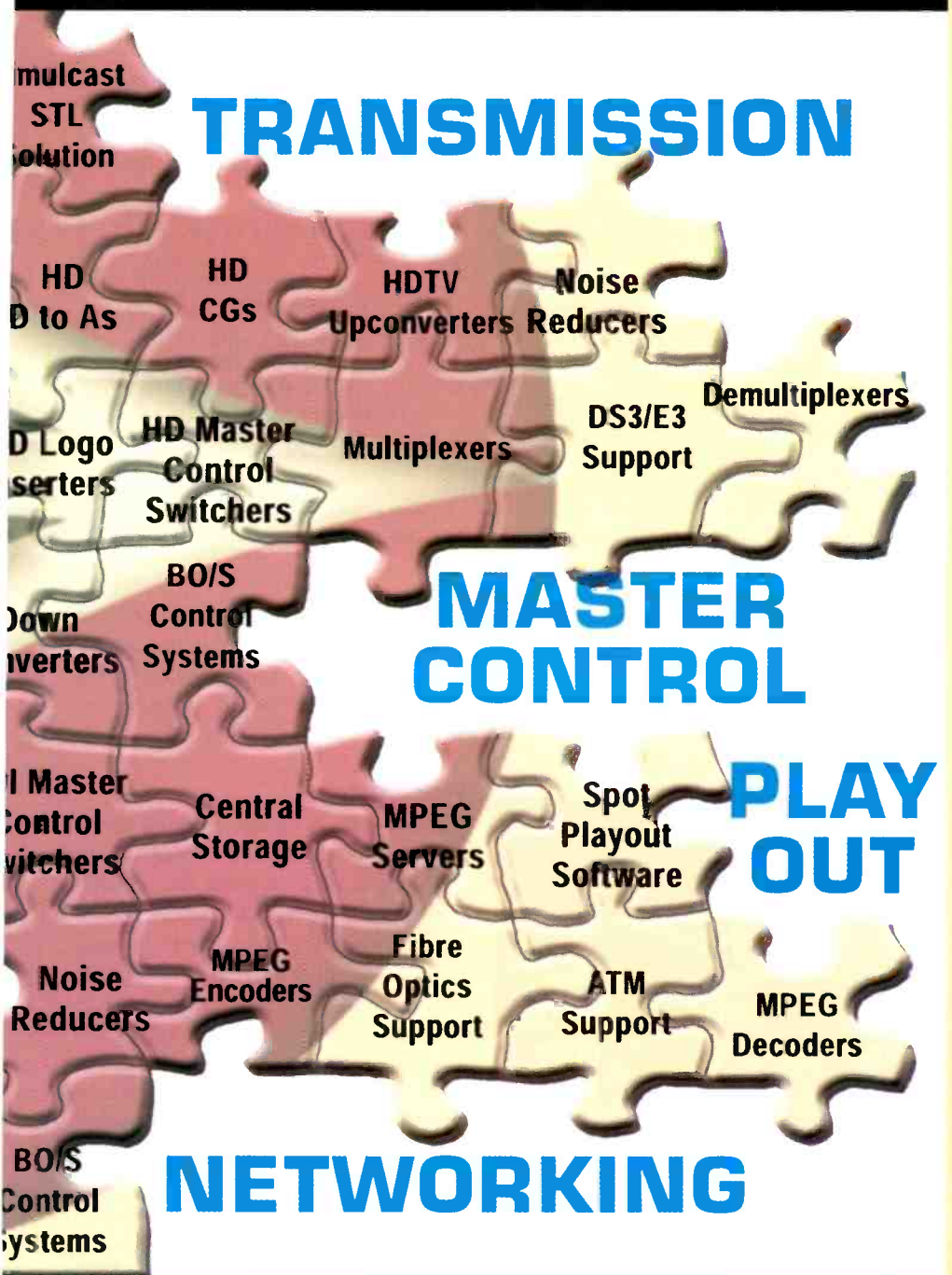

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AES/EBU digital audio

BY MICHAEL ROBIN

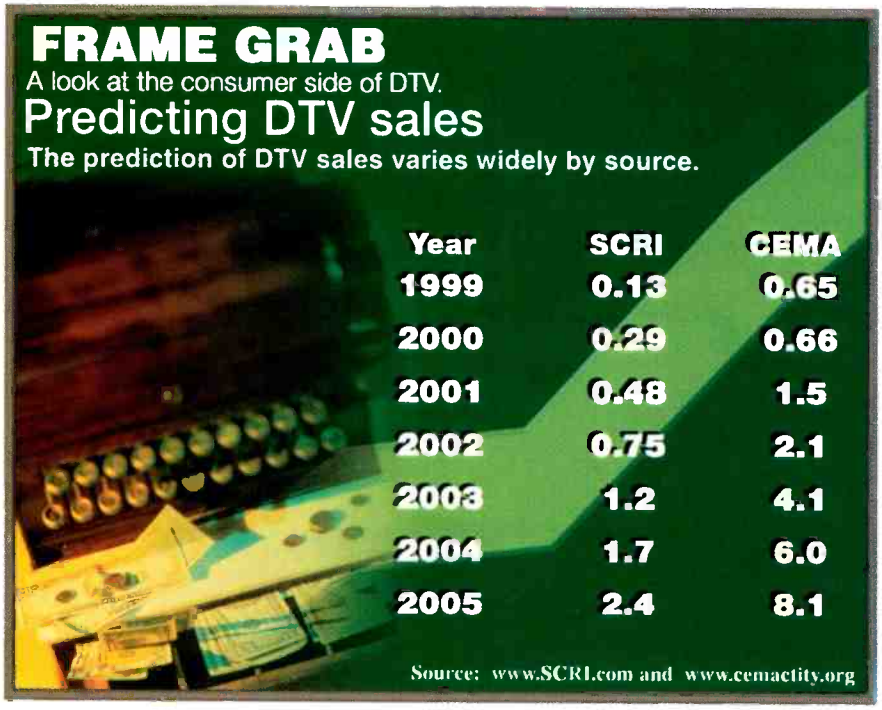
Digital audio first found its way into studio environments in the form of digital delay and reverberation units in the mid-70s. Digital audio stationary head (DASH) tape recorders first appeared in the early 80s and were used for multitrack and audio mastering. These machines were quite primitive in terms of the facilities offered. For example, tape-cut editing was not possible and the machines had to be supplied in pairs to allow electronic editing. All these machines operated as digital black boxes with analog I/O ports.

	AES3-1992 (Revision of AES3-1985)	AES-3id-1996
Transmitter characteristics	Balanced output with XLR connector Source impedance: 110±20% Ω Balance: <-30dB (to 6MHz) Output signal amplitude: 2 to 7Vp-p across 110Ω load (balanced) Rise and fall time: 5 to 30ns Jitter: <20ns p-p	Unbalanced output with BNC connector Source impedance: 75Ω nominal Return loss: >25dB (0.1-6MHz) Output signal amplitude: 1Vp-p±10% across 75Ω load DC offset: 0.0V±50mV Rise and fall time: 30 to 44 ns Jitter: <20ns p-p
Receiver characteristics	Balanced input with XLR connector Input impedance: 110±20% Ω Common mode rejection ratio: Up to 7Vp-p to 20kHz Maximum accepted signal level: 7Vp-p Cable specification: Shielded twistec pair, 100 to 250m maximum Cable equalization: Optional	Unbalanced input with BNC connector Input impedance: 75Ω nominal Return loss: >25dB (0.1-6MHz) Minimum input level sensitivity: 100mV Cable equalization: Optional

Table 1. Electrical characteristics of the AES3-1992 and AES-3id-1996 interfaces.

In the early 80s, digital audio achieved wider usage with the introduction of the Sony PCM-F1 codec (A/D and D/A converter). This allowed digitally encoded audio to be recorded on U-Matic VTRs. These units were used in the early recording of CD's. The 44.1kHz sampling frequency resulted from this approach.

Some proprietary bit-serial distribution formats were developed to allow for digital interconnection between various types of equipment. However, a universal digital audio interconnect format was needed. From this came the AES/EBU digital audio interconnect format.



Fundamentals

Binary data is most efficiently transmitted through a medium when a channel code is used to meet the requirements of the specific channel. A/D converters typically produce a parallel output. To simplify wiring and storage requirements, the parallel output signal (one pair of wires for every bit), is converted to a bit-serial signal. Bit-parallel signals require a bit clock to identify the start of each bit. Converting to a bit-serial signal requires the addition of a word clock, which allows the receiver to identify the start of each sample.

The Audio Engineering Society (AES) together with the European Broadcasting Union (EBU) developed a digital audio transmission standard known as the AES/EBU standard. It is also known as AES-1992, ANSI S.40-1992 or IEC-958. The

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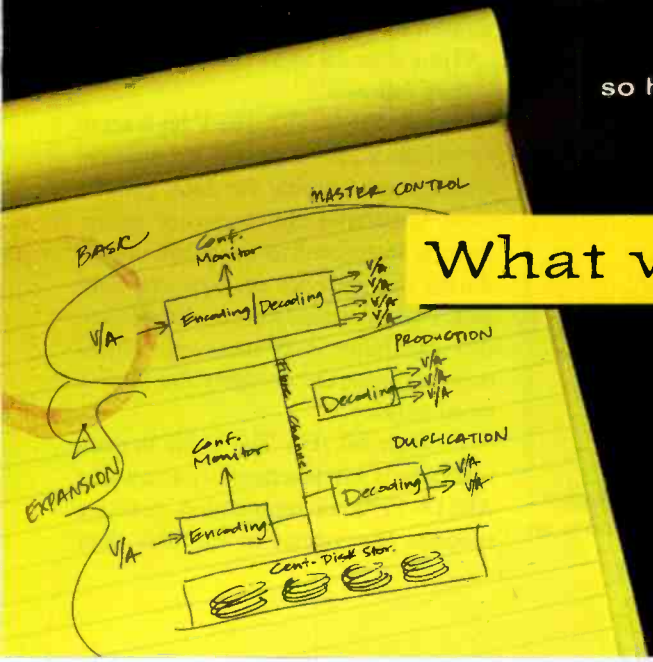

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transmission medium is wire, which has a wide bandwidth capability and allows for bit-serial transmission of the digital audio data. The interface is primarily designed to carry monophonic or stereophonic signals in a studio environment at a 48kHz sampling frequency with a resolution of 20- or 24-bits/sample.

The bit-parallel data words are serialized with the least significant bits (LSB) first. Word clock data is added to the bitstream to identify the start of each sample in the decoding process.

The bit-serial datastream uses nonreturn-to-zero (NRZ) coding. This means that a low voltage indicates binary zero (0) and a high voltage indicates binary one (1). NRZ results in the signal voltage remaining constant and not returning to zero between each data bit. As a consequence, information about signal polarity needs to be transmitted to correctly interpret the message. Because a single NRZ serial datastream does not contain information about the signal polarity, another coding format is required. The format chosen is the biphase mark code (BPM).

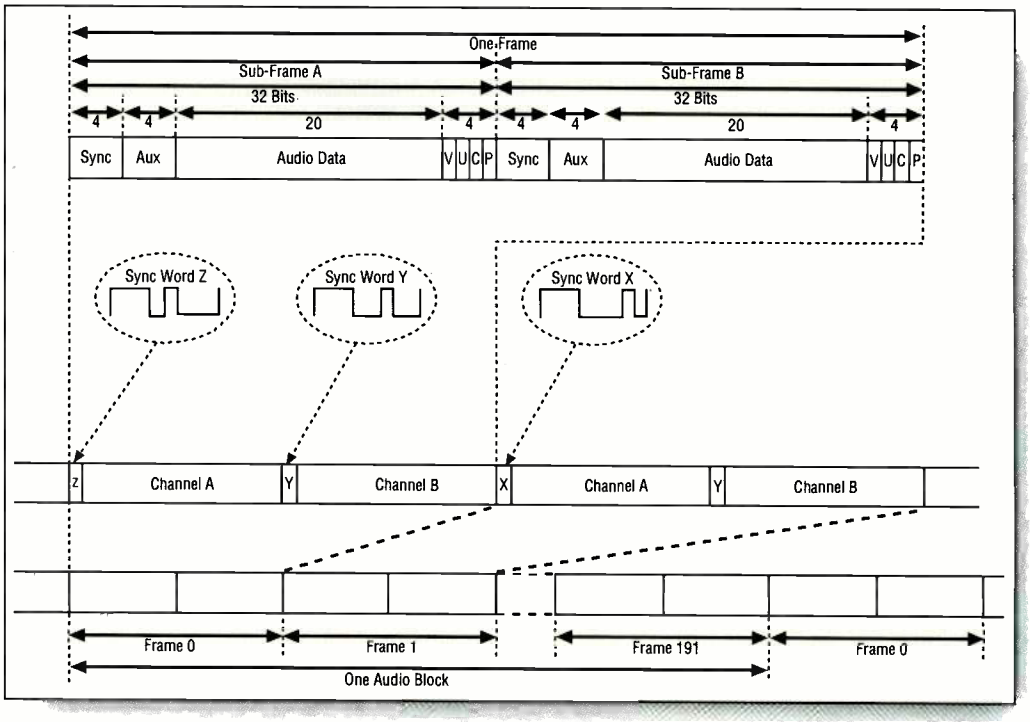

Figure 1. The AES/EBU signal is based on a block of 192 audio frames. Each frame consists of two subframes, each of which is 32 bits in length.

AES/EBU interface protocol

The AES/EBU digital audio interface is designed to transmit two channels of digital audio, each using between 16- and 24 bits/sample on an electrical wire. The original AES/EBU standard specified a twisted/shielded wire. A more recent version specifies 75Ω coaxial cable.

The AES/EBU signal format's structure is shown in Figure 1.The signal is transmitted as a succession of audio blocks. Each block is made up of 192 frames (numbered 0 to 191). Each frame is made up of two subframes; subframe A and subframe B. Each subframe is divided into 32 time slots (numbered 0 to 31). Within each subframe, sample data from one audio source or channel is combined with auxiliary data, sync data and associated data. Subframe slots 0 through 31 are arranged as follows:

•Time slots 0 to 3 carry one of the sync words denoted as X, Y or Z: Sync word Z indicates the start of the first frame of an audio block.

•Sync word X indicates the start of all remaining frames.

•Sync word Y indicates the start of every B subframe.

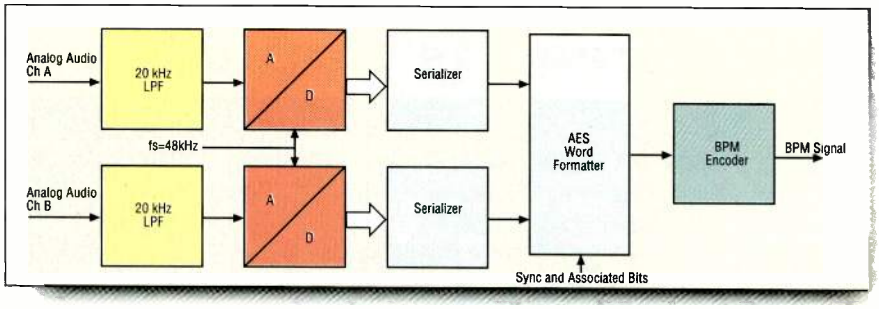

Figure 2. Simplified block diagram of an encoder used to convert analog audio to an AES/EBU datastream.

The sync words are not BPM encoded. Their structure minimizes the DC component on the transmission line and facilitates clock recovery and subframe identification as they are unique in the datastream.

•Time slots 4 to 7 can carry auxiliary information such as a low-quality auxiliary audio channel for producer talkback or studio-to-studio communication. Alternately they can be used to augment the audio word length to 24 bits.

•Time slots 8 to 27 carry 20 bits of audio information starting with the LSB and ending with the MSB. If the source provides fewer than 20 bits, the unused LSB's are set to zero.

•Time slots 28 to 31 carry associated bits as follows:

- **Validity bit** (V): The V bit is set to zero if the audio sample word data are correct and suitable for D/A conversion. Otherwise the receiving equipment is instructed to mute the output during the presence of defective samples. Not all manufacturers implement this capability, and some equipment may not generate or verify the sample word validity.

- **User bit** (U): The U bit in each subframe is sent to a memory array. The AES18-1992 recommended practice specifies the format of the user data

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Wayne Chmieleski, Mgr. of Broadcast Operations for The Nasdaq-Amex Markets, is a big fan of Vinten Robotic products.

"It makes sense to stay with a product that's reliable, and Vinten's AutoCam™ products have been integral to our newscasts for a long time." says Paul Brenner, Engineering Operations Supervisor for WPIX. "We started out in 1985 with the first MicroSwift system and began using AutoCam™ products in 1996. Then, as now, Vinten robotics were a very dependable way to get the right shot every time."

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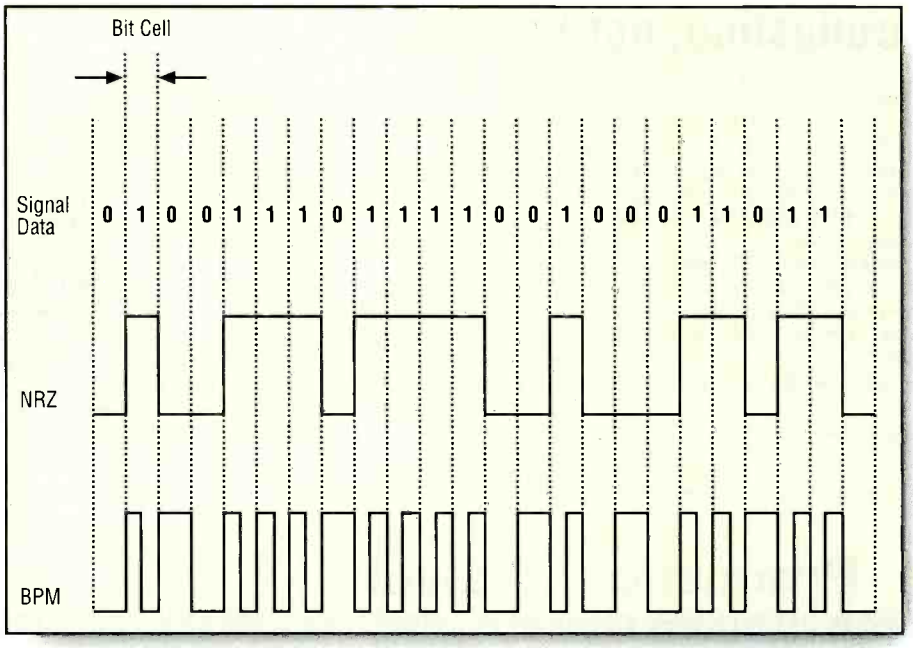

Figure 3. Waveform characteristics used for NRZ (nonreturn-to-zero) and BPM (biphase mark) encoding.

channel of the interface.

- Channel status bit (C): The C bit carries, in a fixed format, information associated with each audio channel which is decodable by any interface user. Examples include the length of audio sample words, pre-emphasis, sampling frequency and time codes.

- Parity bit (P): A parity bit is provided to permit the detection of an odd number of errors resulting from malfunctions in the interface. The P bit is always set to indicate an even parity.

Figure 2 shows a conceptual block diagram of an AES/EBU encoder, while Figure 3 shows the BPM encoded signal waveform as obtained from an NRZ datastream. The NRZ is characterized by ones having a determined high value and zeros having a determined low value. This means that long strings of zeros and ones have no transitions, which makes clock recovery difficult. BPM alleviates this condition by introducing transitions in bit intervals with a value of one.

At a 48kHz sampling rate, the total data rate is 32 x 2 x 48,000 = 3.072Mb/s. After BPM encoding, the datastream rate is doubled at about 6.144Mb/s which yields a Nyquist frequency of 3.072MHz. The BPM spectrum distribution exhibits nulls at multiples of 6.144MHz. Figure 4 shows a conceptual block diagram of an AES/EBU decoder.

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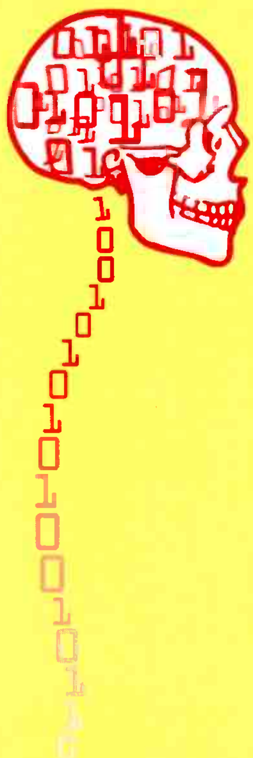

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7530	CM	.318"	4.28	421	129
5765	CMR	.272"	5.41	335	102
5565	CMR	.242"	7.26	249	76
2279V	CMP	.237"	6.09	295	90
2065V	CMP	.207"	7.45	242	74
7538	CMG	.159"	9.67	186	57

*Note: The distances shown above represent 90% of the distance obtained when calculated per SMPTE standard 292M, using a 20 dB total loss budget. Distances may be affected significantly by variations in equipment, connectorization and temperature.

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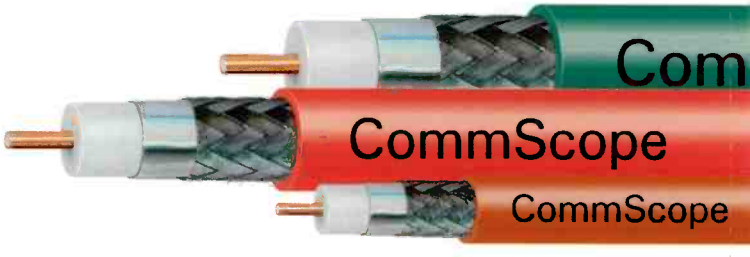

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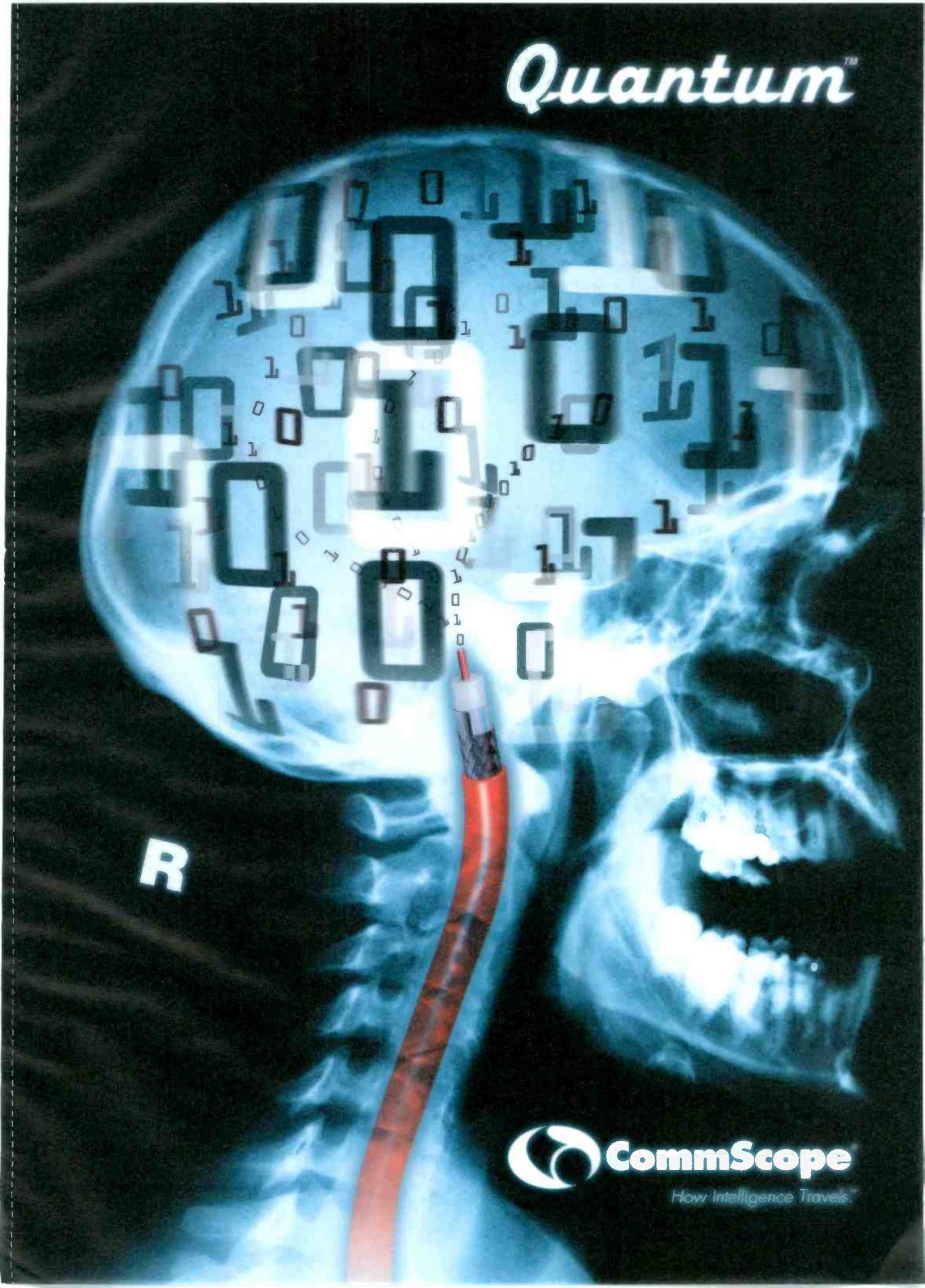
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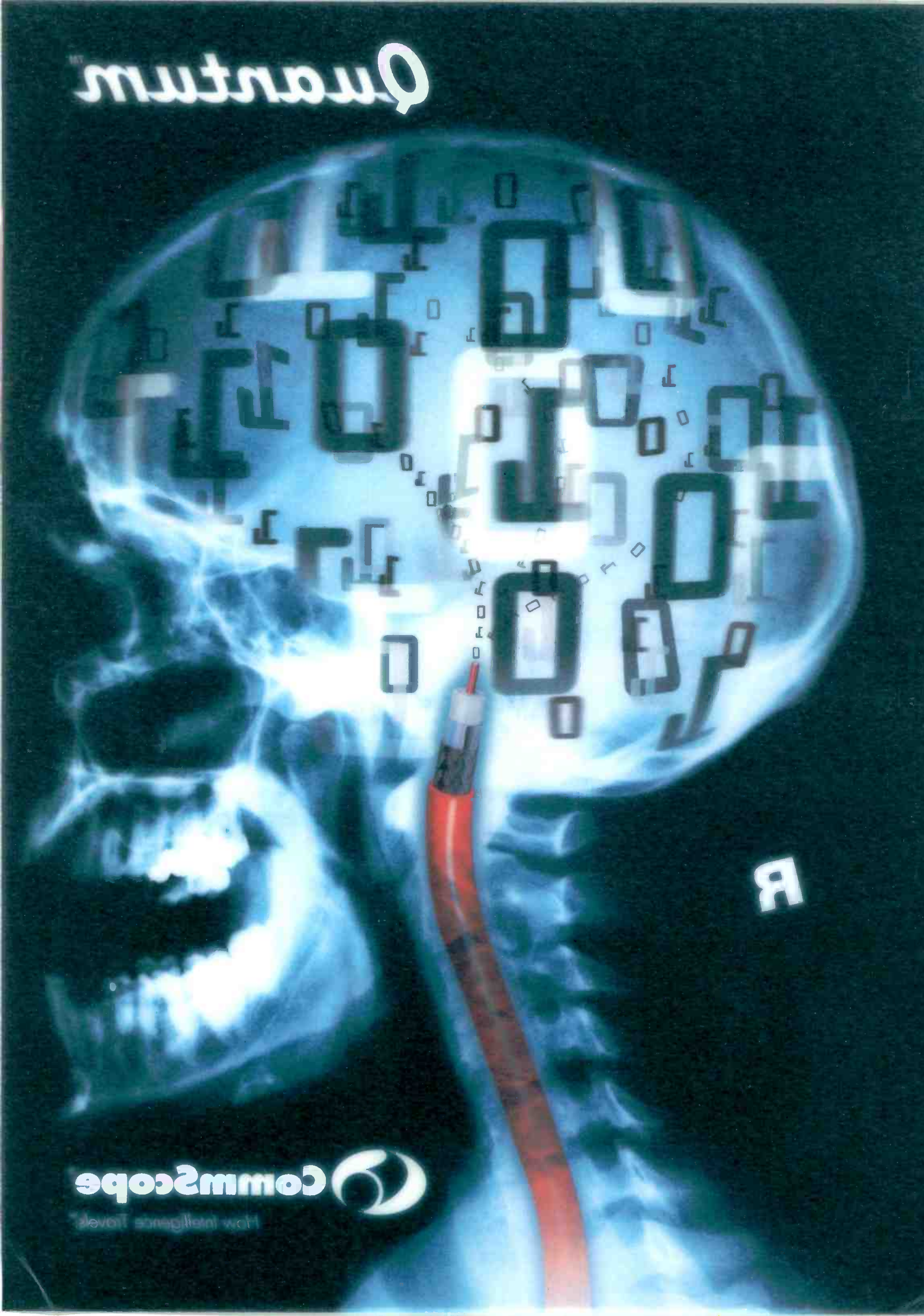
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Interface characteristics

Table 1 lists the characteristics of two types of interfaces: balanced and unbalanced. The original AES3-1985 standard defined the distribution of AES/EBU signals through a twisted-pair shielded audio cable. It specified a transmitter source impedance of 110Ω, a receiver input impedance of 250Ω and stipulated that up to four receivers could be connected in parallel across the audio cable. However, it gave no guidance on necessary precautions. This resulted in difficulties with reflections and standing waves. The performance of the distribution link was unpredictable and depended on the wide variety of installation conditions encountered in practice. This unpredictability is compounded by the loose specification of the output signal amplitude which puts additional stress on the receiver. The standard was revised and reissued as AES3-1992. This second version specifies a receiver input impedance of 110Ω and warns against the use of more than one receiver across the feeding cable. The AES3id-1996 standard defines the unbalanced 75Ω interface. This version recognizes the need to narrowly specify impedance tolerances in terms of return loss and transmitter output signal levels. When properly implemented, this results in predictable performance as it is based on well-known standard-definition video signal distribution concepts. However, most digital audio equipment is equipped with XLR connectors and conversion to BNC connectors including the use of 110Ω to 75Ω balun transformers and signal amplitude normalizers must be considered. ■

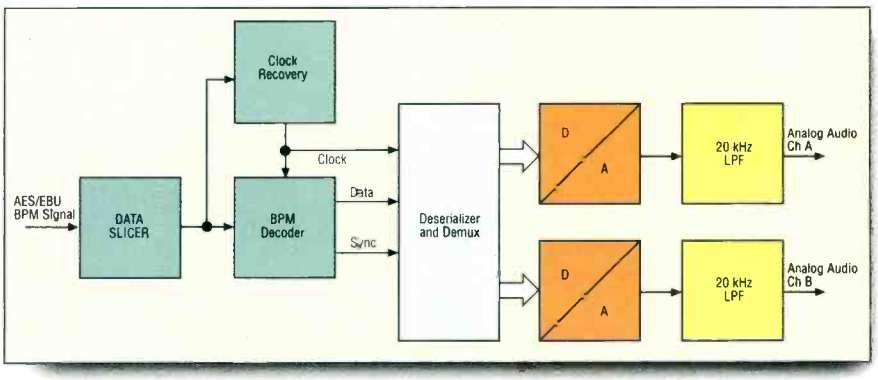

Figure 4. Simplified block diagram of a decoder used to convert an AES/EBU datastream to analog audio.

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

Send questions and comments to: michael_robin@intertec.com

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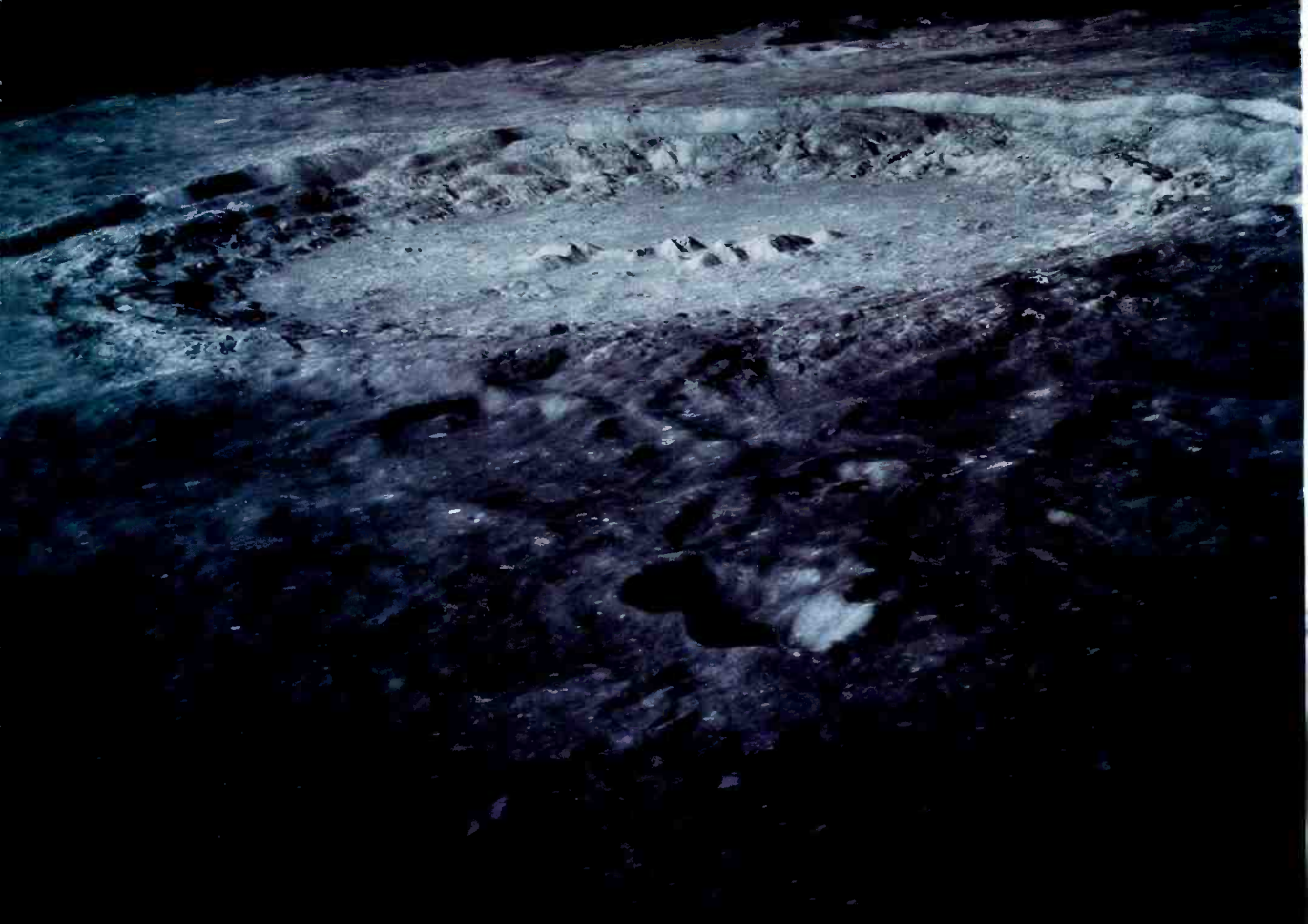

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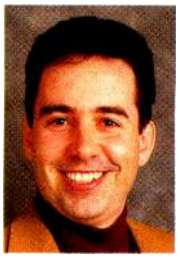


The EBU/SMPTE Task Force – Part IV, Wrappers and Metadata

BY BRAD GILMER

This article is the fourth in a series that explores the EBU/SMPTE Task Force report and its impact on the industry at large. The report is divided into four sections – Systems, Compression, Wrappers and Metadata, and Networks and Transfer Protocols. This month we will focus on Wrappers and Metadata.

Why we need Wrappers

Wrappers allow the various elements that constitute a piece of broadcast content to be placed in a single container. A common physical wrapper in use today is a videotape case. The case typically contains a videotape with one or more video elements as well as associated audio and timecode, and perhaps a piece of paper or a diskette describing the timing of the material on the tape. This sort of wrapper has served well, and will continue to do so into the future. However, other types of wrappers are also needed to keep material together when it is not associated with physical media. (See, "*A perspective on broadcast wrappers*," p. 64). Wrappers are already employed in devices such as video file servers.

In most video file servers, the video and audio are kept as separate files. Timecode may also be captured and stored separately on the server. When an operator requests a particular clip, the system retrieves all elements of the clip and plays them out together.

Figure 1 illustrates the concept of a wrapper as it applies to physical media, streaming and file storage. Wrappers let the user associate video essence, audio essence and other information about the video and audio (metadata) in all three environments. Different types of wrappers are used in each environment. The differences between the physical media wrapper and the file storage and streaming wrappers are pretty clear. The tape case or rubber band holding things together in the tape case just does not make it into the server. However, the differences in needs for streaming and storage may not be as clear. The Task Force wanted to provide optimized wrappers for each application. In both applications, it is important to keep wrapper overhead to a minimum. However, streaming provides extra functionality that results in increased overhead. Two different wrapper formats were decided upon because it did not make sense to store the extra overhead needed for streaming applications in the server application.

Streaming video on a network allows a piece of video to be sent from one place to another without having to make a typical 601 router assignment. The wrapper can contain information about the stream's destination. Equipment along the way can route the stream appropriately. (This is very similar to the concept of IP protocols and routing.) The streaming wrapper can also use specific interleaving and multiplexing optimized for the interconnection.

The concept of a wrapper can be extended beyond keeping the video, audio and associated descriptive data together under one reference. For example, imagine your news department is doing a series of shows on some local event. It would be possible to use a wrapper to keep together not only video and audio, but all other associated information, including scripts, approvals, edit decision lists, and so on. The complex relationship between all these items could be maintained, and the whole package could be transferred between systems, or even across the country.

Wrapper standards are needed

If we are to use the concept of wrappers, it is important that certain things about these wrappers be standardized. That way, users can interchange material between systems made by different vendors. One area of standardization might be in defining how digitized or compressed video could be wrapped for transport so that it can be retrieved at the other end. This is called mapping. Other standards work is ongoing in the area of wrapper headers. Without standardized wrapper headers, it will be necessary to open each wrapper individually to determine its contents, a time-consuming chore that wastes processing time.

The concept of wrapper headers leads to another concept; that of a registry. If headers contain information that iden-

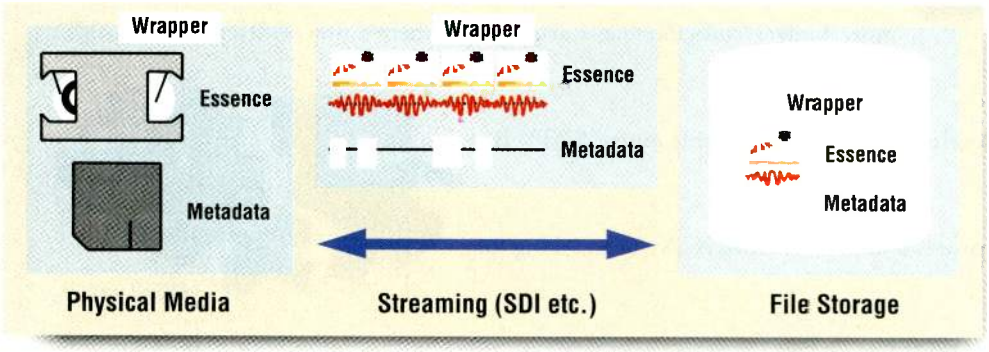
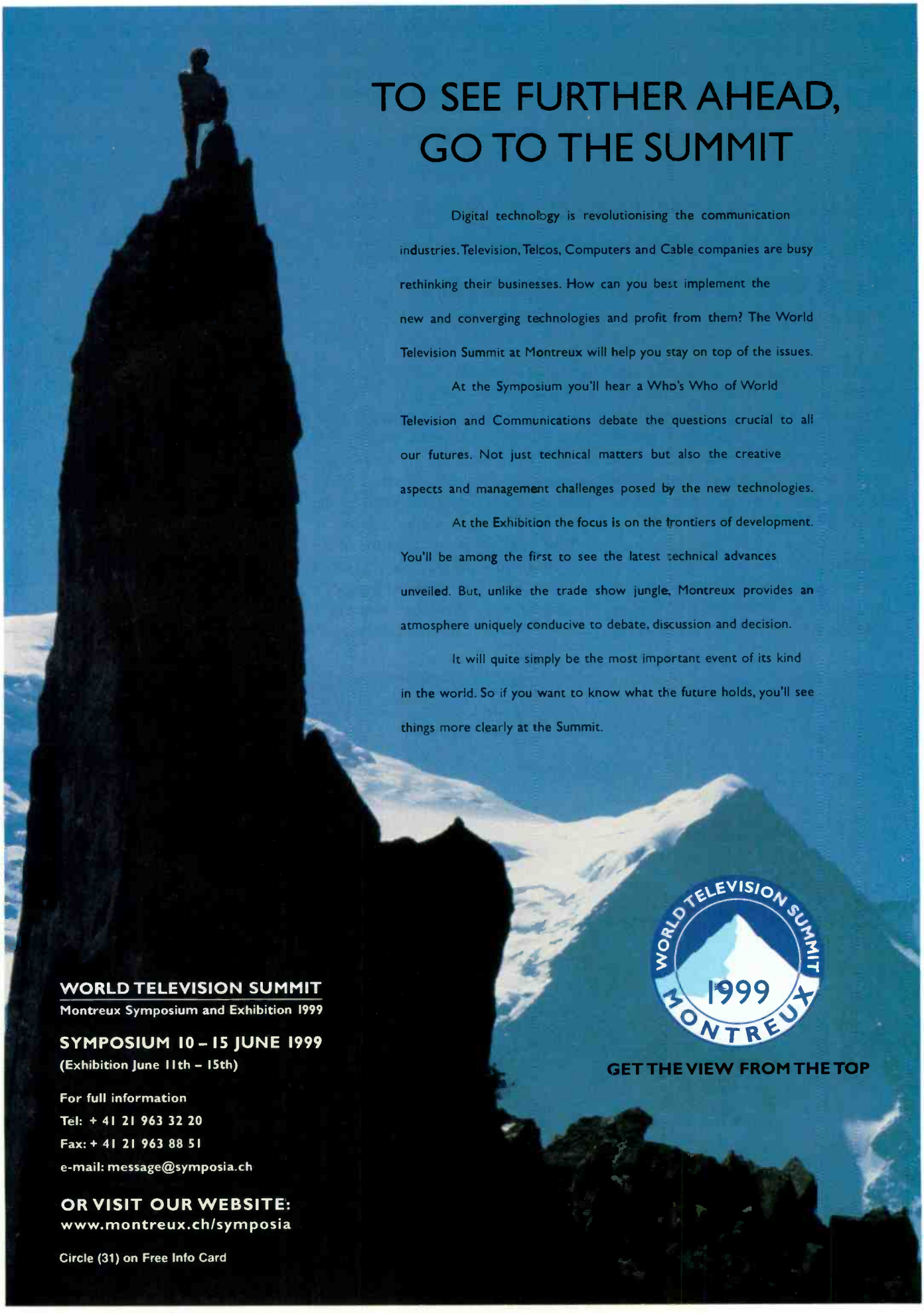


Figure 1. A wrapper lets the user associate video essence, audio essence and other information about the video and audio (metadata) in all three environments; physical media, streaming and file storage.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tify the contents, then those header codes must be registered and in the public domain. That way, different manufacturers can build equipment using these headers knowing the equipment will interoperate with other systems. Generally, such public information is contained in a Registration Authority. The SMPTE Registration Authority was established to register header codes and other information and to make this information available to all parties on an equal basis. You can take a look at just such a registration authority at www.smpte-ra.org.

Metadata

A lot has been written about metadata. The term is attributed to Nicholas Negroponte and first appeared in his book, *Being Digital*. The term has been in use for several years, and has contributed to significant confusion. Some of this confusion is because the term metadata can be applied to about anything. However, metadata is a useful concept, and with a little definition, it may be one of the most enabling things to come along since compression.

Currently, there are numerous websites with excellent search engines that may allow you to find a variety of useful information including images, audio files, and more. Metadata provides the power behind these search engines.

Your news people may dream of the day they could log into the network's archives, search for video to support a particular story, download that video and integrate it with their local material. Such capabilities will be enabled by the metadata associated with the video content. Searching metadata associated with the video is much faster than searching the video itself.

Metadata is defined as data describing other data. This definition is a little

Metadata is a useful concept, and with a little definition, it may be one of the most enabling things to come along since compression.

Obtaining a copy of the Task Force report

The Final Report is published jointly by the EBU and SMPTE. Contact the EBU or SMPTE and ask to be sent a paper copy (the EBU can supply a Special Supplement, SMPTE can supply a Journal) or download the .pdf document from the EBU website (www.ebu.ch/pmc_es_tf.html) or from the SMPTE website (www.smpte.org/engr/ebumeet1.html)

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broad to say the least. Table 1 provides some appropriate metadata classifications in an attempt to harness the term and put it to some useful work.

It is important to realize that all metadata is not equal. Some metadata is more important than others are. For example, the digital video flags *start of active video* (SAV), *end of active video* (EAV) and MPEG SI (service information) are vital – without this information, the video may not be displayed. Other metadata such as a shot description may not be vital, but it is still important information that should remain associated with the video. Second, some of this vital metadata must be repeated at particular intervals, every frame for example, while other metadata could be repeated at much longer intervals, if at all. Third, some metadata must travel with its associated video, and other material could be kept on separate media. Fourth, some metadata remains static throughout the duration of a piece of program content, and other metadata continuously changes. A show title remains static, but timecode changes on a frame-by-frame basis.

As discussions of metadata evolved, it became clear that vital data required specific handling. It has to travel with the program content – meaning that it has to be embedded in the media in some way. Since it is vital to displaying and manipulating the video or other program content, it has to be repeated at periodic intervals. This assures that the video can be displayed. Other metadata might not be transmitted with the program content at all. Metadata regarding rights payments or approvals for actors in a movie would very likely be removed from the metadata stream before the movie leaves the distributor. However, the studio would want to be sure that this metadata could still be re-linked to the content if required.

It is important to realize that all metadata is not equal.

Another category of metadata falls in-between these two examples. There is metadata that should travel with the content. This metadata might be important, but since the metadata capacity on most media is limited, this metadata must travel separately from the program content. An example might be descriptive data about a news story, news scripts, or voice-over pieces. These things are important to keep wrapped with the news story, but cannot travel with the program content embedded in a tape. For this concept to work there must be a unique identifier that establishes a link between the program content and the metadata. Two Requests for Technology were issued, and a number of companies responded with proposals. These proposals are currently being evaluated.

One of the things about using a unique identifier is that the identifier is likely not to convey any useful information in and of itself. This is a change in operating philosophy for many broadcasters who, as a general practice, have used ranges of house numbers to identify material stored on tape. For example, ID1000 to ID2000 are news promos. To guarantee that an identifier is truly unique, the number must be generated using a randomizing technique with some seed, perhaps based upon time, date, etc. This is a change that must be worked through as our facilities move more into the computer domain.

A metadata dictionary will soon be available. The dictionary clearly organizes metadata into different classes based upon its importance, whether the metadata is meant for public or private use, and so on, generally according to the classifications shown in Table 1. Entries in the dictionary generally have three fields – key, length and value. The key is a unique identifying name that can be used in a database to locate the particular parameter. The length is the length of the value of metadata that is allowed. The value is the actual metadata itself. The example below is a simplification of the concept.

Key: ShowTitle
Length: 100
Value: Gone With the Wind

In this example, when an operator searches the metadata associated with a particular piece of content, a computer program could look for a key of "ShowTitle," expect a value that is not longer than 100 characters, and then retrieve and display the text, "Gone With the Wind."

What is the significance of wrappers

Term	Definition
Essential metadata	Information required to use the essence related to the metadata. For example, an MPEG stream cannot be properly decoded without the presentation time stamp (PTS).
Parametric metadata	Information such as camera setup and pan & scan information.
Access metadata	Information that is required to access the essence. For example, copyright information or descrambler authorization information.
Composition metadata	Information that describes how essence was composed. Examples include edit decision lists, zoom lens settings for virtual sets, and rundown lists for news programs.
Relational metadata	Information necessary for synchronization between different content components.
Geospatial metadata	Information related to the position of a source. For example, GPS coordinates of a field camera when a particular scene was shot.
Descriptive metadata	Information that can be used to describe a particular piece of content. This information is particularly important for content retrieval operations.

Table 1. Definitions of various types of metadata that would be associated with audio and video essence.

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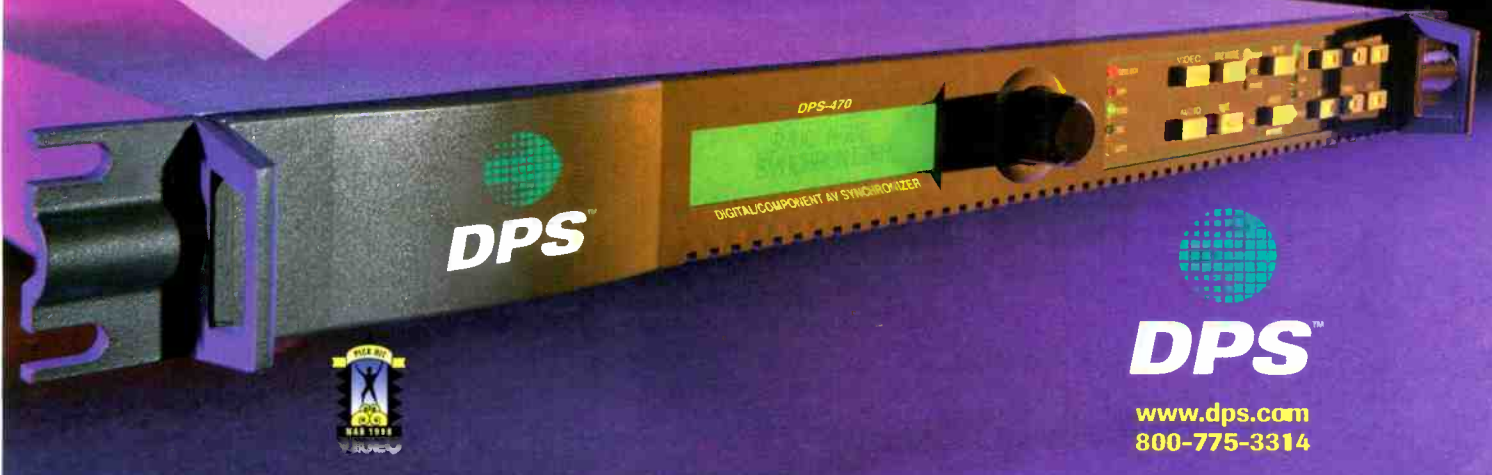

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and metadata? This work will allow us to efficiently collect, transfer and retrieve material using computer-based technologies. If the recommendations of the report are followed, and if appropriate standards are developed, we will be able to do so using equipment from a number of different manufacturers. We will be able to better describe the material we produce, and we will be able to locate it when we need it. Hopefully, this will translate to more efficient operations and lower costs.

These changes will not happen overnight, or even in the next two years. But many people continue to work to resolve the challenges that have been identified. Answering these challenges will produce techniques and technologies that will shape the design of our facilities for years to come. ■

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

Send questions and comments to:
brad_gilmer@intertec.com

A perspective on broadcast wrappers

BY OLIVER MORGAN

Early on in the wrappers and metadata discussions, it became clear that we could either try to stretch one of a number of ready-made but application-specific solutions to cover our broader requirements, or we could create a generic solution framework using modern object-oriented software design techniques and have optimizations for specific applications (such as recording, SDTI interconnect, nonlinear editing, or asset management). It seemed to me that the second choice had a much better chance of delivering on the most important user requirement – interoperability of mixed software and hardware systems in a time of perpetually changing content types – so I always pushed for the big picture solutions as opposed to the simpler but limited-horizon solutions.

I am very happy that the Task Force agreed to go down this path. What I am now seeing is that while we are still discussing and standardizing the minute details, implementations of the architecture are being worked on and will start to appear in products this year. Next year, I expect to see complete systems processing SMPTE metadata and wrappers end to end, with gateways for compatibility with existing equipment. Once these systems start to be deployed, broadcasters will enjoy the benefits of greater uniformity and interoperability, that is fewer headaches and better productivity.

Oliver Morgan is subchairman of the Wrappers and Metadata Group of the EBU/SMPTE Task Force.

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Ask Dr. Digital

RGB or YUV?

BY STEVE EPSTEIN, TECHNICAL EDITOR

Appreciated your article in the January 1999 issue on aspects of single-sensor cameras compared to three sensor types. The question of how the combined digital stream, Y plus two-color difference signals, is processed for editing or other production functions is not discussed widely. In fact, for best editing quality, digital RGB signals could go directly to the editor. Could you explain how this is being handled in SDV and perhaps indicate how these same problems might be handled for a HDTV signal?

Frank McArdle
Roxbury, NY

Dr. Digital responds:
Moving video in an out of devices has always been a challenge. Many devices have standard I/O ports (video connectors), with some sort of internal signal translation based on the device's needs. For instance, Betacam SP and MII are both component analog formats with composite video I/O connectors. Internal encoders and decoders provide the necessary conversion.

If the proper digital RGB signals are available, then using them within the production equipment would be ideal. Unfortunately not all digital signals are equal. Different values for colorimetry and gamma as well as color space issues can cause signals that look good in one format to fall apart in another. For example, there are colors that are achievable in RGB color space that cannot be translated to YUV. Moving digital RGB signals directly to the editor assumes a native RGB device, and that the originating device uses the same values to represent pixels–something that is not always the case.

Although many of today's nonlinear systems are native RGB devices, many represent pixels with values that are different than those used for SMPTE 259. In both the eight and 10-bit specs, SMPTE 259 has several reserved values at the top and bottom of the range. However, within computers, the image values go to the limit. Some conversion or compromise is required when transferring images between devices based on these standards. The same challenges exist relative to HDTV production. Currently many HDTV devices are still analog and conversions to digital as well as down conversions to SDTV must be accommodated. To maintain the best signal quality throughout the production process, minimize signal translations. Converting from composite to component or analog to digital, as well as the reverse, causes artifacts that degrade signal quality.

Compression/decompression cycles are much like generations on analog tape. Each time through the processor causes some hit to signal quality. For the most part, the biggest hit occurs on the first time through. However, shifting the video as little as a single pixel in any direction changes everything, making the next pass through much like the first pass. Using the same compression system or techniques such as Mole reduce the problem.

Many of today's nonlinear systems are a combination of all of the above — signal conversions, compression, etc. However, once the signal is inside the editor, as long as it remains there, very little if any degradation takes place. As stated, for best signal quality, keep the number of conversions to a minimum.

Tape trouble

In December 98 I wrote about apparent problems related to using metal evaporated tape in machines designed for metal particle tape. At issue was the use of DV and DV-CAM tapes in DVCPRO decks. Since then I have received several letters concerning recommendations for head cleaning in DV-CAM decks, as well as a question concerning the use of metal particle tape in decks designed for metal evaporated tape stock.

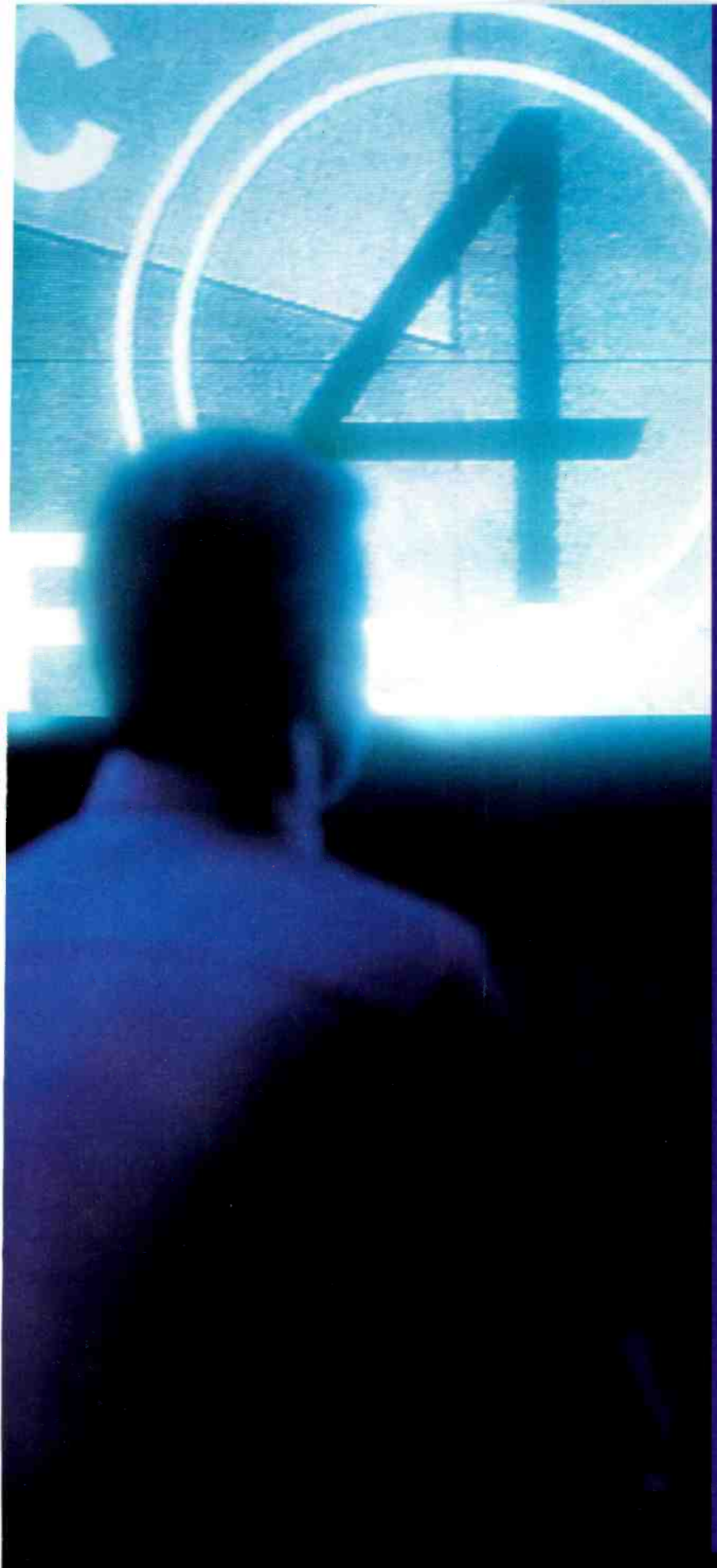
I got in touch with the folks at Sony to see what they thought about this, and here is their response:

Sony developed DVCAM based on the DV consumer format. The DV format was designed for use with metal evaporated tape, which offers approximately 5dB better carrier-to-noise figures than metal particle tape. Customers have requested VTRs that can play additional DV-based 6mm formats such as the consumer DV LP and DVCPRO. Sony will be offering new VTRs that can play back both of these additional formats without headclog and tape path issues.

It was realized early on that the VTR transport needed to be optimized to play various tape formulations and thicknesses. In addition, there is no need to dub DV LP or DVCPRO footage to another format for use as source material. This new VTR is the DSR 2000 DVCAM Studio recorder, and it is expected to be available later this year.

Robert Ott
Vice President for storage products and marketing
Sony Electronics
Park Ridge, NJ

Not exactly the answer I had in mind, but it is a solution to the problem. If you have a problem or comment, drop me a note at drdigital@compuserve.com. ■



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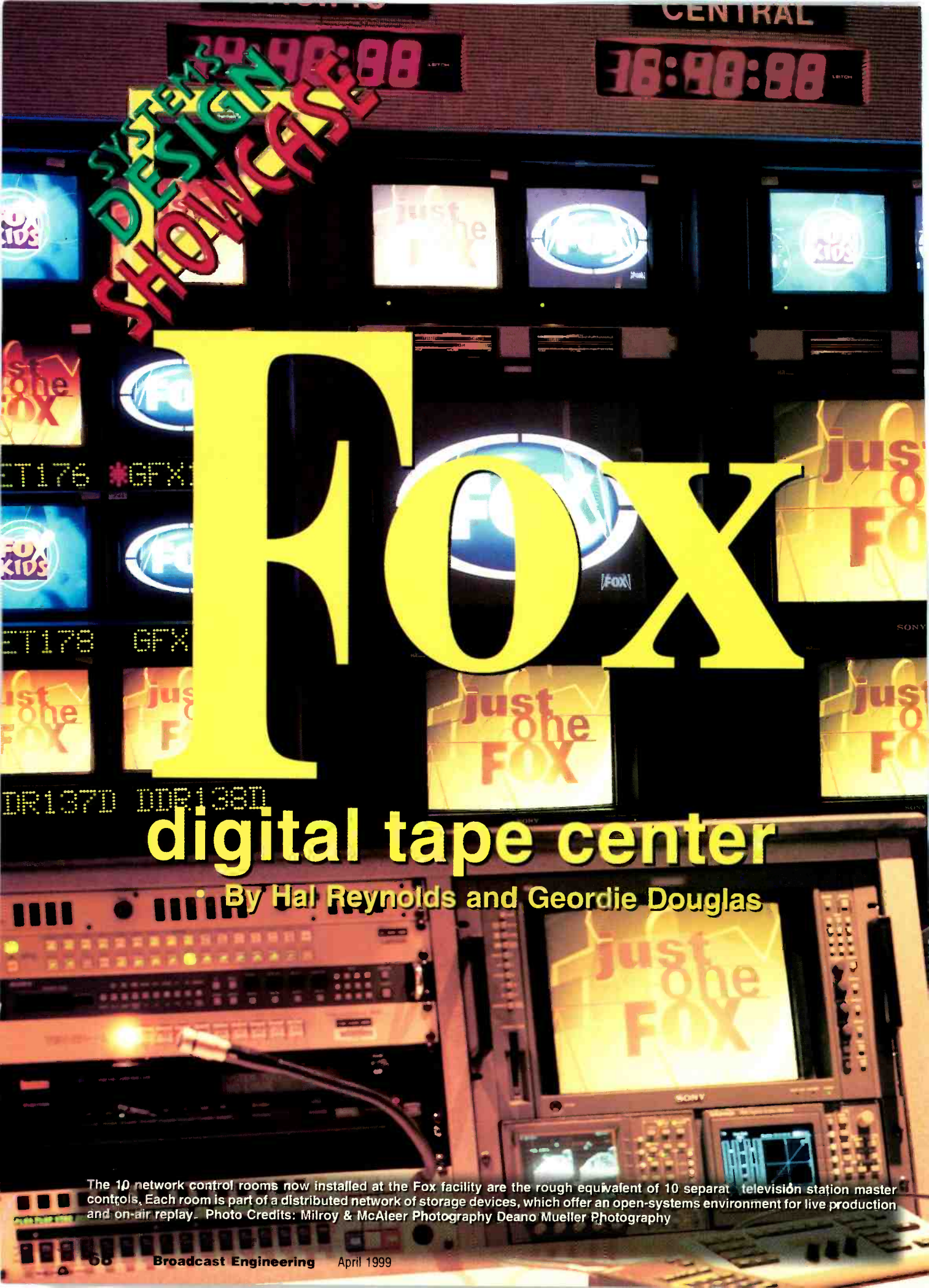
SYSTEMS DESIGN SHOWCASE

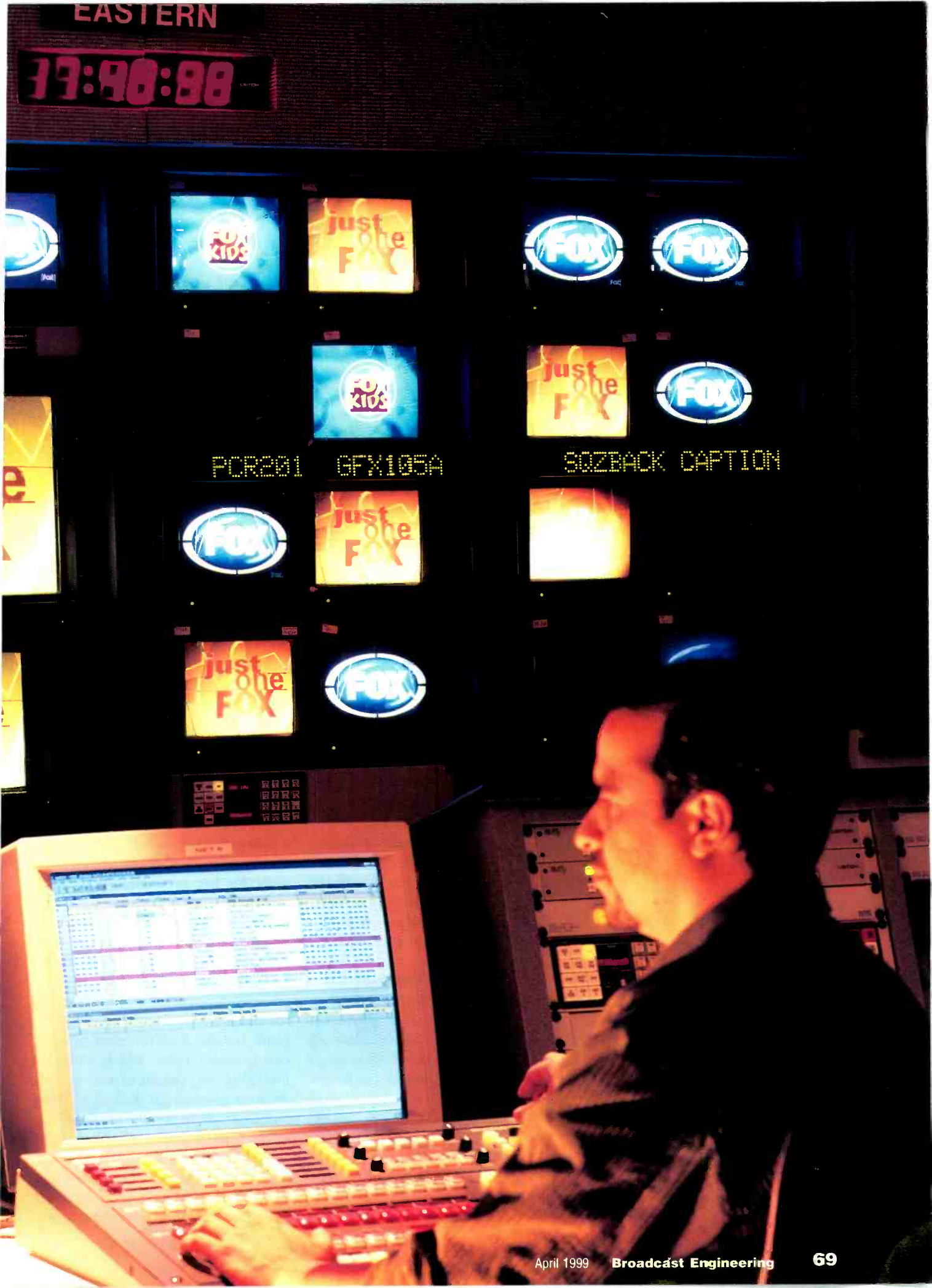
Fox

digital tape center

By Hal Reynolds and Geordie Douglas



The 10 network control rooms now installed at the Fox facility are the rough equivalent of 10 separat television station master controls. Each room is part of a distributed network of storage devices, which offer an open-systems environment for live production and on-air replay. Photo Credits: Milroy & McAleer Photography Deano Mueller Photography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Fox

Nearly two years ago, *Broadcast Engineering* detailed what was to become the nation's first fully tapeless network master control operation: the Fox Network Center (FNC) in Los Angeles. The planned system depended on a trio of cutting-edge technologies: video servers, data recorders and gigabit data networking. Today, behind the new glass and polished steel, deco-styled building, and the famous 20th Century Fox logo on West Pico Boulevard in Los Angeles, the technical specifications and promising architectural renderings have become reality. In addition, the tapeless operation has proven to be quite cost effective.

The Ampex DST 412 library storage system, fully integrated with the Tektronix Profile video server, runs under Louth Automation. The DST 412 automated cartridge library provides an optimum balance of system performance, cost of storage, and manageability.

The FNC Network Operations facility first went on air Dec. 10, 1997 with an afternoon block of children's programming and, one week later, with Prime Time. (Live Sports followed a short time later.) In this tapeless, totally file server-based broadcast playout center, video is touched once and never tinkered with again.

Fox's two-and-a-half-year initiative to re-engineer its facilities has resulted in a high level of operational flexibility and cost effectiveness, and the highest quality video images possible. Not far off is Fox's ability to simultaneously transmit material to a number of caches or multicast. The goal is complete flexibility in moving material concurrently from one room to another.

In partnership with Tektronix Inc. and Louth Automation, Fox developed a Fibre Channel and file server-based, networked, digital topology supported by Ampex DST recorders. The fully server-based facility eliminated a day-to-day reliance on video tape, which engineering management regarded as a weak link in the overall operation because of the high level of manual maintenance and multiple quality control checks it required. As a result, the number of steps in the process is dramatically reduced, easing the rigors of responding to last-minute programming changes characterizing the Fox News, sports and on-air promo environments.

Open systems environment

The powerful engine driving these efficiencies within Fox's new fully digital (SMPTE 259M) facility is the Network Operations Digital Resource System (NODRS). The NODRS accomplishes the same functions as the former NTSC analog facility but with more efficiency and flexibility, higher quality video images, and greater reliability.

At a macro level, NODRS captures programming and interstitial material, converts the video and audio to data files, translates the daily log into a schedule of file transfers and playback sequences, and interconnects the servers to the satellite transmitters for distribution to Fox affiliates throughout the U.S. The system handles all programming for Prime Time, Fox Children's Network, News and Sports. The design of the system allows for expansion of capability, including adding day parts to the schedule or incrementally adding net control rooms.

In this tapeless, totally file server-based broadcast playout center, video is touched once and never tinkered with again.

The rough equivalent of 10 separate TV station master control rooms comprise the NODRS system. Each of these stations, or net control rooms, is part of a distributed network of storage devices that offer an open-systems environment for live production and on-air replay. This integrated suite of digital systems linked by digital routing technologies and a Fibre Channel network provides faster-than-real-time audio/video transfers.

The requirements of broadcasting NFL football dominated the design of the net control rooms. Each room can generate two program feeds, which, during a football game, consist of two entirely different commercial packages. These two feeds run in parallel for broadcast to different segments of the national audience. Two master control processing frames connected to a single operator control panel with automation-assist allow this very challenging opera-

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Fox

tion to be managed reliably by the technical director.

Recently, the two-channel capability built into each net control room has allowed another network programming first when used as simultaneous NTSC and DTV playback channels. Since Nov. 1, 1998, all Fox Prime Time programming has been delivered to DTV viewers as a pure digital signal.

The number of net control rooms in operation changes based on the time of day. The highest usage is during live sports, when nine of the 10 rooms are used for sports. The tenth room is dedicated to the distribution of the Fox Family Channel, which uses its two channels to feed the East and West Coasts.

Programs originate from NODRS and then are sent to the transmission operations center for distribution. The content includes prerecorded and live programs (including sports, news and entertainment) and interstitials (consisting of commercial spots, IDs and promos).

ibility for last minute changes.

The video servers consist of two mirrored Tektronix Profile PDR networks. One network stores long-form material, such as programs, and a second network contains short-form material — chiefly promos and commercials. A total of 32 PDR systems are involved in the complete operation.

Four separate routing switchers are connected to each other through tie lines. These systems service network operations, transmission operations control, sports operations, and on-air promo post production. Each of these matrices has a dedicated control system.

The Profile PDR long-form network (main and backup) consists of 16 PDR200s, two Ampex DST 412 Library Systems, and four Ampex 312 stand-alone recorders. Typical material flow for a Fox program begins with the play of the program master tape and its recording into a Profile. At this point, the show is timed and checked for technical quality. Further quality checking will never again be required for this program, as it is now a data file. After quality checking, the program is written as digital files to dual DST312 recorders for offline storage. If the program is needed immediately, the material can be directly transferred in less than half of the running time of the program to a program-cache recorder through the Fibre Channel network. Long-form materials stored offline are hand loaded into dual DST 412 robotic systems for transfer when the schedule calls for their use.

The combination of audio and video hardware is coordinated by an automation system that provides high-level control to the Fox engineers and unprecedented flexibility for last minute changes.

A total of 10 four-output program caches provide material to the 10 network control rooms. The Profiles are arranged as a pair, backing each other up by feeding two program streams to each of a pair of control rooms. One pair of program caches has a second function of recording live programs for delayed broadcast. This function is used weekly for Fox News Sunday, which is delayed one, two and three hours for each of the western time zones. The Louth Automation system automatically segments the recording of the live program in real time by observing the actions of the Net Control TD operating the M-2100 master control switcher. This segmenting allows the delayed broadcasts to have unique commercial content during the replay.

The short-form network is composed of 12 Profile Recorder systems supported by a 144GB RAID-3 disk storage system. Once short-form material is recorded into the RAID drives,

In the tapeless, totally file server-based broadcast playout center behind the new glass and polished steel, deco-styled building and the famous 20th Century Fox logo in Los Angeles, video is touched once and never tinkered with again. Fox's tapeless operation has proven to be quite cost-effective.

NODRS System

The NODRS System consists of networked video server systems, master control switchers, networked routing switchers, RAID disk systems, and data tape archive recorders. This combination of audio and video hardware is coordinated by an automation system that provides high-level control to the Fox engineers and unprecedented flex-

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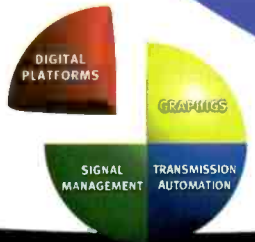

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it never sees tape again. The RAID system operates in a server configuration, delivering commercials and promos via Fibre Channel to 10 short-form playout caches that feed the net control rooms. Again, the Profiles are arranged in pairs and provide 100 percent backup of equipment. Four additional short-form Profiles are used to create up to six unique commercial blocks within a single Fox Network program. These commercial blocks allow advertisers to tailor messages for the regions of the country that are likely to need the product, such as snow tires in New England and suntan lotion in Florida. In this case, the Profile acts as a mini-master control by passing the network feed in an electronics-to-electronics mode during the program segments. The Profile drops into play frame accurately when a commercial is to be replaced.

Most Profile recorders are resources that can be assigned in the NODRS system. This is accomplished by routing the video and audio and connecting the RS-422 control via a port router.

The Louth Automation System controls and manages the Profile PDR networks, the insert switcher and the master control switchers. 20 Grass Valley M2100 digital master control switchers are used in the NODRS.

One Louth ADC-100NT device server is allocated to each of the 10 net control rooms. Each is currently configured with 44 RS-422 ports for control of various devices.

The NODRS routing distribution system is composed of four large routing switchers, all based on a Tektronix SMS 7000 Serial Digital Routing System. NVision AES routers provide two AES streams per videostream. This includes routing matrices for sports operations, net operations, transmissions operations and on-air promotions. Each of the separate SMS 7000 routing systems is assigned to a particular functional area of the FNC facilities, and each router has its own redundant control system. This enables each system to be capable of independent performance. Appropriate control panels in each area are connected directly to their own router, with source and destination selection accomplished through standard push-button operation. Additionally, the four major routers are interconnected through video and audio tie lines, and their router control systems are networked together over a closed Ethernet system. This interconnection allows an operator in one area to select, on his own control panel, a source that is located within one of the other router matrices. After selection, the audio and video signals may then be passed from within the "remote" matrix by way of tie lines to the "local" matrix for use by destination(s) within that local matrix.

This configuration provides a protection mode to insure that important source/destination relationships are not inadvertently changed. Source inhibits can be defined to prevent the routing or proprietary sources to unauthorized destinations. Groups of sources and destinations can be switched together by the use of a single salvo name entry on a control panel.

Tektronix SMS 8900 distribution amplifiers (DAs) are used ahead of the routing matrices to provide extra outputs for distribution. A unique advantage of these DAs is the passive loop-through feature. This allows more than a quantity of eight outputs without the reduction in reliability of cascaded DAs.

The system can have as many as 2048 source and destination names. Matrices can be virtual-mapped, and are designed to allow expansion in 16x16 I/O building blocks. All modules and most power supplies within the SMS 7000 system may be removed and reinserted while the system is online.

An expanded system video output monitor on each routing system allows quality control monitoring of any destination in the switching system without interrupting the output signal. Finally, alarm contact closures are connected to an external visual and aural display to alert FNC operators that a switch to a backup MCPU, node controller or power supply has occurred.

In partnership with Tektronix and Louth Automation, Fox developed a Fibre Channel and file server-based, networked, digital topology supported by Ampex DST recorders. The fully server-based facility eliminated a day-to-day reliance on videotape. Mirrored Tektronix Profile video server networks store both programming and interstitial material. A total of 32 video servers are installed at the FOX facility.

Louth Automation system

The Louth system includes six independent Media Prep dub stations for entry of interstitial content onto main and back-up Tektronix RAID-based

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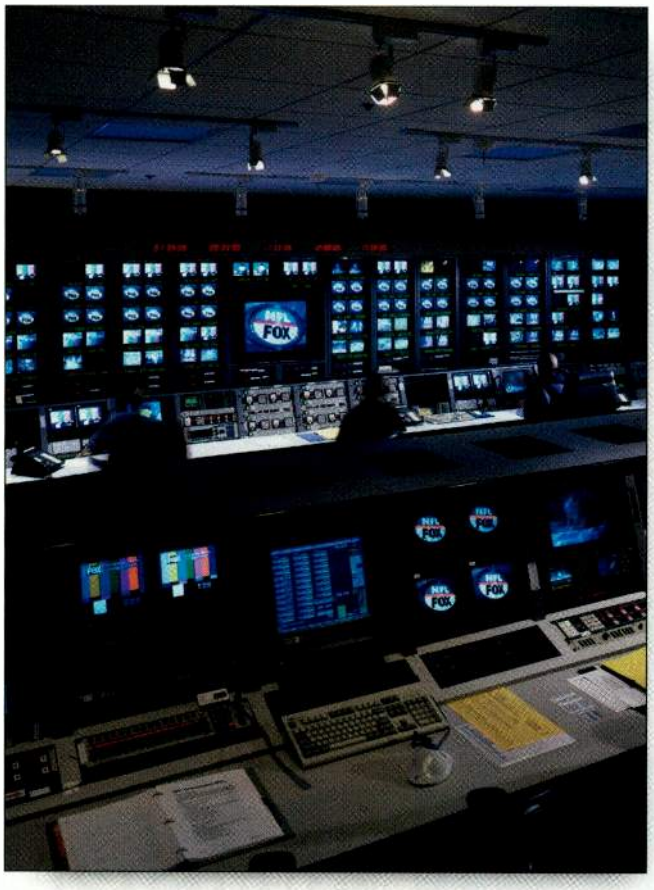
Profile PDR200s (commercial servers). All dub stations are configured identically with software. All of the dub stations are located in the commercial input room and share a routed array of source tape machines. Each Louth Media Prep station is equipped with VTR drivers to support: Ampex DCT, C Format, JVC Digital-S, Sony Betacam and Sony Digital Betacam.

The source VTR is connected to the Media Prep dub station via an RS-422 data router. The destination Profiles (four used as commercial servers and two as program input recorders) are controlled by the ADC-100NT Device Server. Each of four source outputs feed the respective record inputs of both commercial servers. The Media Prep station causes a simultaneous "gang record" to occur on both the main and backup commercial servers. Once the commercial has been dubbed, pressing the PVW (Preview) button on the Media Prep station causes the respective PLAY channels on the main and back-up commercial servers to be played back synchronously for previewing. Up to four independent pairs of streams (main and backup) can be recorded or previewed simultaneously (one per Media Prep Station).



The "central nervous system" for the Fox Network Center, the transmission operations control manages network operations for Prime Time, Fox Children's Network, News and Sports.

Digital video vs. traditional tape handling

Prior to the completion of the fully digital Fox facility, quality checking consumed extensive labor and maintenance resources. For example, quality checking for Prime Time required four separate passes — a process that had to be completely repeated prior to each airing of a show. Digital video has significantly reduced the amount of labor and maintenance resources needed to support Fox's stringent quality requirements.

Reduced tape handling is achieved through the following process. Videotape is compiled into the program input recorder, and the program is then checked for quality and trim. Next, the program data file (main and backup copies) is transferred simultaneously to two DST312's. The two DST cartridges containing the main and backup copies of the program are inserted into the main and backup DST412 libraries. Finally, the data file is transferred from the DST to the program server and then transferred over the video network via Fibre Channel to the appropriate program cache. (As noted earlier in this article, material can be directly transferred to a program-cache recorder through the Fibre Channel network in less than half of the running time of the program.)

Interstitial material arrives on various videotape formats. The commercial spots received on videotape are processed at one of four commercial compile stations. An operator loads the tape machine and works with the Louth Media Prep to dub the commercial spots into the commercial server. Once the spots are in the commercial server, they can be transferred to the commercial caches under the direction of Louth for play to air. All of these transfers are done via Fibre Channel at a fraction of real time. (No video router connection is used.) This use of Fibre Channel allows a significant reduction in router crosspoints, thereby realizing significant savings.

Digital video has significantly reduced the amount of labor and maintenance resources needed to support Fox's stringent quality requirements.

Ampex DST expands storage exponentially

Ampex digital data tape (DSTs) provides near-line archives of what previously would have been warehouses of videotape. For example, prime time shows are now files that are moved around on networks and copied on digital data tape (which provides for speed and compactness). The combination of servers and DSTs has eliminated the need to move material around on tapes or baseband video. Additionally, this technology has increased quality and reduced generation losses at the Fox Network Cen-

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The VSC 300D converts computer images up to 1600 x 1280 and offers eight levels of horizontal and ten levels of vertical filtering, giving the VSC 300D the most stable, flicker-free image available. To run high resolution computer-video on digital displays such as LCD, DLP, and Plasma, workstations resolutions may be scaled to as low as 640 x 480. For home theater applications, the VSC 300D outputs HDTV 720p.

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ter, while storage efficiency is dramatically increased.

Fox can now store approximately 20 program episodes in a single cassette the size of a large laptop computer, and transfer that programming in one third the amount of time it would take in real-time. Rather than only one episode of "The Simpsons" being stored on a cassette, the 330GB Ampex digital tape is capable of storing an entire season of episodes.

Faster-than-real-time transfers with Fibre Channel

In the configuration at the Fox Network Center, Fibre Channel provides a high-speed, arbitrated-loop network connection between Profile servers. The decision was made to use Fibre Channel to complement traditional standard-definition routers in developing a file transfer network designed for reliability and simplicity.

In this configuration, a high-bandwidth network is shared between users and provides an efficient means of moving materials in two modes: file transfer and streaming. In both cases, error-checking protocols are used to ensure transparent movement of material. Streaming provides the advantage of allowing playback to commence while the transfer is in progress. This is done under conditions that insure that play-to-air is not delayed by lack of incoming data.

Recording or playback operations are guaranteed even if a Fibre Channel transfer is in process or is initiated after the real-time recording/previewing operations. The Profile PDR software allocates available bandwidth to ensure simultaneous processes.

The Louth system initiates file transfers via an RS-422 control port. The command can be received on any RS-422 control port on the network. This includes issuing a command to Profile 01 to transfer file X from Profile 02 to Profile 03. These dynamically scaled, variable-time transfers enable concurrent tasking of resources to play back and record video, as well as play to air (with play to air prioritized).

NODRS capable of future expansion

The design provides for future expansion to be incrementally scaled as required by Fox's expanding service requirements. The current system allows for the number of net control rooms to expand to 20 or more.

Network connections via low-cost telecom networks will soon make it even easier to be able to share information between sites or around the world.

Sharing material among a group of stations is an important way to increase future productivity. Network connections via low-cost telecom networks will soon make it even easier to be able to share information between sites or around the world.

One of the most important future developments this year at the FNC is the migration of Fibre Channel hubs to Fibre Channel switches. This will enable multicasting with switches that can connect servers, as well as back-up servers. The ability to crisscross the entire network will increase the redundancy of the system.

Cutting-edge technologies, video servers, data recorders and Gigabit data networking within the Fox Network Center have turned digital plans into digital reality. Since the initial broadcast in December 1997, Fox has achieved much with this high-risk venture.

The Fox facility represents the first fully tapeless, totally file server-based network broadcast playout center. Fox has leveraged the storage of programs and commercials in a digital file format and the handing of these files with industry standard computer networking techniques to lower costs and increase reliability. The system in place enables Fox to keep a complete commercial inventory online, providing instant and highly effective access to material.

The NODRS system represents the first application of Profile server/Ampex DST/Fibre Channel and Louth technology on this scale, and it stands as a leading example for other facilities to follow in the transition to digital. ■

Hal Reynolds is vice president of broadcast systems engineering at Fox. Geordie Douglas is business development manager of Tektronix's Video and Networking Division.

Equipment List

Tektronix Profile video servers (32) connected by Fibre Channel
Tektronix PRS250 RAID Disk systems (4)
Ampex DST 412 Data Tape Library Systems (2)
Ampex DST 312 Data Tape Archive Recorders (4)
Louth Automation Systems with Media Prep dub stations (6)
Louth ADC-100NT Device server (13)
Tektronix M-2100 Master Control Systems (20)
Tektronix SMS 8900 Series Distribution Amplifiers
Tektronix SMS 7000 Serial Digital Routers (4)
NVision AES Routers (4)
NVision RS422 Data Routers (2)

Design Team

Andrew G. Setos, senior vice president of broadcast operations and engineering, Fox Television
Hal Reynolds, vice president of broadcast systems engineering, Fox
Tedd Rosenfeld, vice president of operations, Fox
Jim Hopkins, vice president of engineering, Fox
Geordie Douglas, business development manager, Video and Networking Division, Tektronix
Larry Mast, project manager, Systems Management Group, Tektronix
John Joannou, president, Teklogic Systems
Jim Schoedler, senior project director, National TeleConsultants

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SYSTEMS DESIGN SHOWCASE

Cox's WSB broadcast center

The news broadcast studio features an anchor desk area with both sitting and standing positions, all located adjacent to the operational weather center.

By Donald P. Archiable

Cox Broadcasting's flagship television and radio operations in Atlanta began airing programs in May 1998 from one of the most advanced broadcast centers in the world. The facility is home to WSB-TV Channel 2 and four radio stations.

As part of a strategic business plan begun in 1995, Cox determined that to enhance its market position, WSB-TV would become one of the first commercial TV

WSB

Stations to make the leap into the digital realm. Although WSB-TV's original facility, known industry-wide as White Columns, had been serving the station's analog needs, Cox realized that a new state-of-the-art, all-digital broadcast center was essential to achieving its objectives.

Conversion from a traditional analog signal to the new digital signal without disruption to ongoing operations required sophisticated, multidisciplined planning, design and engineering of the broadcast center to accommodate current and developing technologies. Cox called upon The Austin Company, a leading architectural, engineering and construction firm that designed and built White Columns in 1955, to provide facilities planning, architectural design, engineering and construction services for the new broadcast center. Cox also selected Sony for the systems integration. Austin worked closely with Sony in the design and engineering for the required systems infrastructure.

The third floor of the 198,000-square-foot facility includes a 6000-square-foot television technical center, two production studios, a "live" news studio and a newsroom with studio production capabilities for airing live news broadcasts.

Austin developed and maintained an overall schedule for planning, design, engineering and construction of the new broadcast center, as well as coordinating the installation of the systems and equipment. This enabled WSB-TV to meet a primary objective: broadcasting its analog programming in addition to the new digital signal without disruption.

Although WSB-TV's original facility, known industry-wide as White Columns, had been serving the station's analog needs, Cox realized that a new state-of-the-art, all-digital broadcast center was essential to achieving its objectives.

Planning the center

In planning the broadcast center, early discussions focused on the new digital-based facility's technical infrastructure needs and the impact of this infrastructure on the requirements of the overall facility. In February 1996, Cox, Austin and Sony began technical programming for the new TV facility.

A major challenge was how to combine television and radio under one roof. Television and radio infrastructures require unique design and engineering services to meet the operational needs of each medium.

The television portion of the programming required spatial planning, specialized electrical and mechanical engineering, broadcast systems integration, and massive cable management for both present and future technical applications. Enormous design parameters had to be maintained in a linear and architecturally concentrated footprint. The relocation of Cox's four radio stations into the new facility also required specific design criteria to meet their needs for cutting-edge technology in the digital radio industry, such as stringent acoustic standards in the radio studios and uniquely designed ductwork.

After specific criteria were ascertained for each of the components, the combined facility design parameters for television and radio had to be determined. Preliminary planning indicated the need for a facility of 198,000 square feet to accommodate Cox's projected operations for the TV and radio stations. Detailed adjacency planning followed, incorporating the area requirements for technical, production, office and support operations, and responding to the traditional television and radio station functional adjacency requirements coupled with the new demands of digital technology. Flexibility and adaptability to

The WSB newsroom uses Avid News with individual editing stations for all working journalists. The system is tied to a Sony BZN-5000 server system using dual servers, a news server and an on-air server. The 12 linear editing bays will soon be updated with clip edit capability where last-minute edits automatically update to the on-air server. The room provides two on-air broadcast locations, so news updates can be handled directly from the working newsroom.

new technologies were key considerations as design of the center progressed.

WSB technical facility design

WSB-TV's technical center consists of a master control room, one news control room, one production control room, two audio rooms, and a central rack room with capacity to house 100 broadcast racks.

• Television control rooms: WSB's engineering staff, together with Austin and Sony, defined equipment requirements and developed mirror-image ergonomic layouts of the control rooms for the three studios. Cooling and lighting level requirements were based on the control rooms each containing 70 monitors at 4:3 aspect ratio with 30 percent expansion capability for use with 16:9 aspect ratio monitors at a later date. Six-inch risers separate front-deck and rear-deck operations while resting on computer flooring placed 18 inches above slab. The audio control rooms, located within each studio control room area, were designed for 5.1-channel surround sound ergonomics and acoustics for the later implementation of AC-3 audio.

• Television master control room: The master control room's "control point" area provides operating positions for four individuals. Master control can operate the channel 2 NTSC and channel 39 DTV at 720p 16:9, ultimately from a single Sony switch. The room architecture provides stations for individuals to control multichannel, second-signal digital revenue stream opportunities as defined by Cox and WSB management.

• Television central rack room: A 2448-square-foot room houses 100 broadcast racks. The first row bay is separated by glass and serves as the swing point of tape transition to nonlinear server technology. The remaining rack room rows support the all-Sony technical plant, including the large digital routing switcher and electronics that feed all news operations.

Central rack room and tech core space is serviced by isolated fifth-wire grounding, generator and UPS-regulated power. Power is provided via dual neutral feeders from the electrical switchboard and K-rated transformers for switching power supply loads with extensive third harmonic conditions. The increased power requirement of digital technology necessitates engineering that is sensitive to the switching of enormous power supply loads.

• Television tape archiving: A 3300-square-foot vault was designed to archive over 40,000 historic tapes and provide tape storage for news and production. The precast structure in this area has been strengthened to accommodate the additional concentrated loading. The strategic business plan for this space includes retrieval of tape until these programs become server-based and tape is completely phased out.

• Television cable management: One of the most significant aspects of the TV

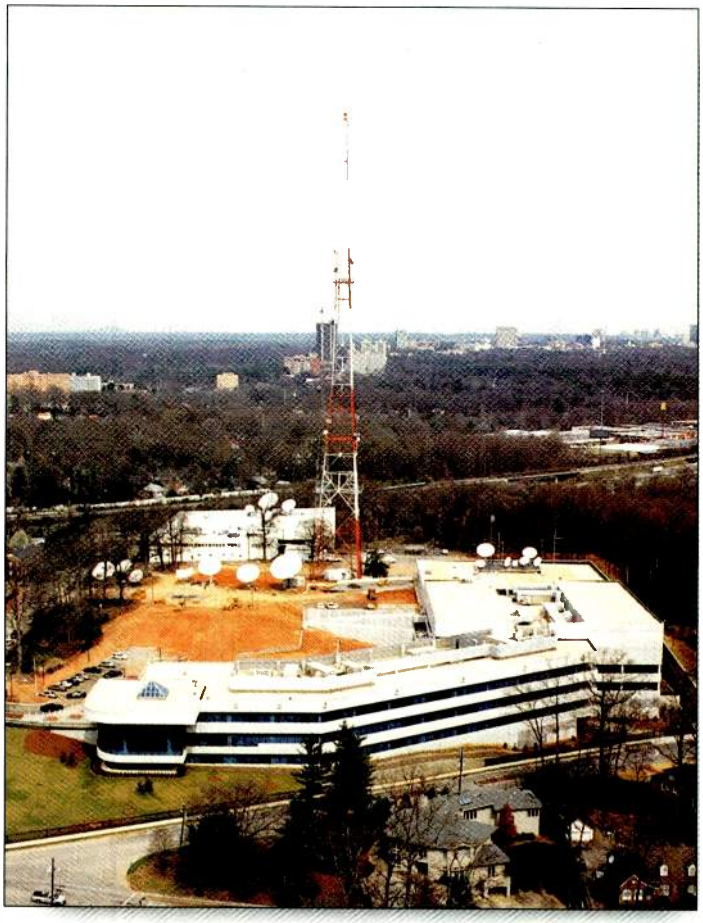
Main corridor through WSB's technical center, which houses 100 racks of support equipment.

WSB

signal design is the elaborate cable management program. All broadcast systems integration cabling is separated by its own engineering discipline (e.g. video, audio, intercom, IFB, etc.), with special attention to the separation of telephone, MATV and CATV cable. Most computer flooring rests on a pedestal 18 inches above the floor slab, and cabling has quickly filled this space in the central rack room. For future use, all main corridors serving the technical operating points from the tech core are provided with a 24-inch empty cable tray in the ceiling spaces to provide the capability of cable swing loading as new technology changes bandwidth requirements. The intent of this design is to break from the traditional practice of piling good cables over bad as technology changes are made within the facility.

• **Transition cabling:** In addition to combining the new electrical and telecommunications cabling for separate integrators, Austin developed a swing-phase plan to allow the television and radio transmission cable to remain hot for an undetermined period of time. During the move operation, an interconnect room was developed with 16 four-inch conduits that traverse underground from the old building to the new facility. This interconnect room has the ability to amass cables via duct bank conduits from all existing site satellites. All site satellites, STL/TSL tower feeds and microwave dishes home run into this new interconnect room.

This complex network of duct banks had a two-fold purpose. The first priority was to tie all technical operations bidirectionally throughout both facilities and distribute signals to the final destination. Second, after all respective TV and radio stations were on-air, the bypass cables were removed leaving an empty conduit system to service any future facilities on the site of the old station. Once the site raceway network was installed in four-inch PVC schedule-40 pipe, a ground network was required to follow all duct bank groups with a 20-gauge, four-inch-wide copper ground strap. This grounding network bonded all site towers and metal parts back into one main ground grid. More than 100 satellites, microwave dishes, STL assemblies, news and weather antennae and related equipment were transferred from the roof of the old building to the new facility using transfer tie lines. In addition, three 70-foot Rohn 45 towers were added to the new building, two for radio and one for television. A large steel platform was built over the parking garage of the new building to house two KU-band and four C-band satellite dishes. These dishes range from 3- to 5.4m and are supported by 24-inch beams and expanded metal grating platforms attached to the precast structure and extended up through the building system to pick up significant overturning moment loads. All roof towers, satellites and equipment were bonded to the lightning protection system and connected to the main ground counterpoise.



Located in Atlanta, GA, the new Cox Broadcasting complex provides almost 200,000 square feet of operational space for the network's flagship television station, WSB-TV.

• **Television studios:** The studio portions of the precast structure are 25 feet high from the finished studio floor to the roof. The roof system is cambered in a unique engineering design to provide an open span 16:9 format structure to meet camera blocking requirements. The studio lighting grids level at 17 feet above the finished floor with a four foot by four foot locked grid utilizing a 1½-inch outside diameter black iron, schedule-40 pipe system. The lighting in the three studios is a 3200° Kelvin color temperature Strand lighting system, fed from three 800A Strand CD-80 dimming boards. The three-way split, 2400A main feeders are serviced all the way to the main switchgear. Each studio is furnished with a 12-inch perimeter cable tray that connects to one large broadcast service panel on each studio wall. These trays provide triax, video and audio distribution, as well as other broadcast system integration signals, via four-inch EMT conduits.

Studio A, with an area of 4200 square feet, is designed for live productions. Studio B, with an area of 3000 square feet, is designated for smaller post-production activities. Studio C, with an area of 3600 square feet, is utilized exclusively for WSB Action 2 News. The news studio includes a new 30-foot wide news set and a 40-foot long weather center designed by Broadcast Design International (BDI). All three studios were designed to consider 16:9 camera blocking as final criteria for all dimensions. Off-site field data gathering and computer modeling based on

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Sony's 16:9 digital equipment determined these dimensions.

• TV newsroom: The newsroom cavity has a floor-to-roof height of 25 feet, with provisions for future mechanical and electrical lighting grid application. The outside wall of the entire newsroom is a continuous, tinted, bullet-resistant glass with structural support loading designed to accommodate the massive weight loading.

During the initial schematic stage, WSB-TV described its concept of facilitating information flow and distribution from the assignment desk to the director prior to the director's transition into the news control room. The Austin Company and BDI designed the newsroom set to implement WSB-TV's vision. The set was built by BDI in California and shipped to the Atlanta site.

The newsroom set includes a sophisticated assignment desk, show prep area and 28 reporter workstations. All newsroom computers, monitors and related equipment are cable-managed by a network of cable trays below the newsroom floor. This fully accessible grid design was based on an interstitial concept wherein all cable trays return to localized server areas and the central rack room. Ten news edit suites, five production edit suites and an news graphics operation surround the newsroom, with all computers networked to the central rack room and local server areas. Due to the large heat and power load requirements, all electronics for these large mainframes are locally serviced in the tech core area.

The outside wall of the entire newsroom is a continuous, tinted, bullet-resistant glass.

The ENG/SNG control center is located in a room adjacent to the assignment desk area of the newsroom. ENG/SNG cabling links the interconnect room with the tech core and all related technical areas. All of the tech core, control rooms and technical perimeter spaces are linked by nonramped, depressed-slab computer floor systems.

• Television broadcast service panels: The entire television facility is connected by 16 broadcast service panels that facilitate all functions for news and production within the broadcast plant, separating signals for clean operation by distributing them via separate metal conduits. This design allows the news talent to do a stand-up cut-in at almost any strategic location in the building or on the site, including the roof.

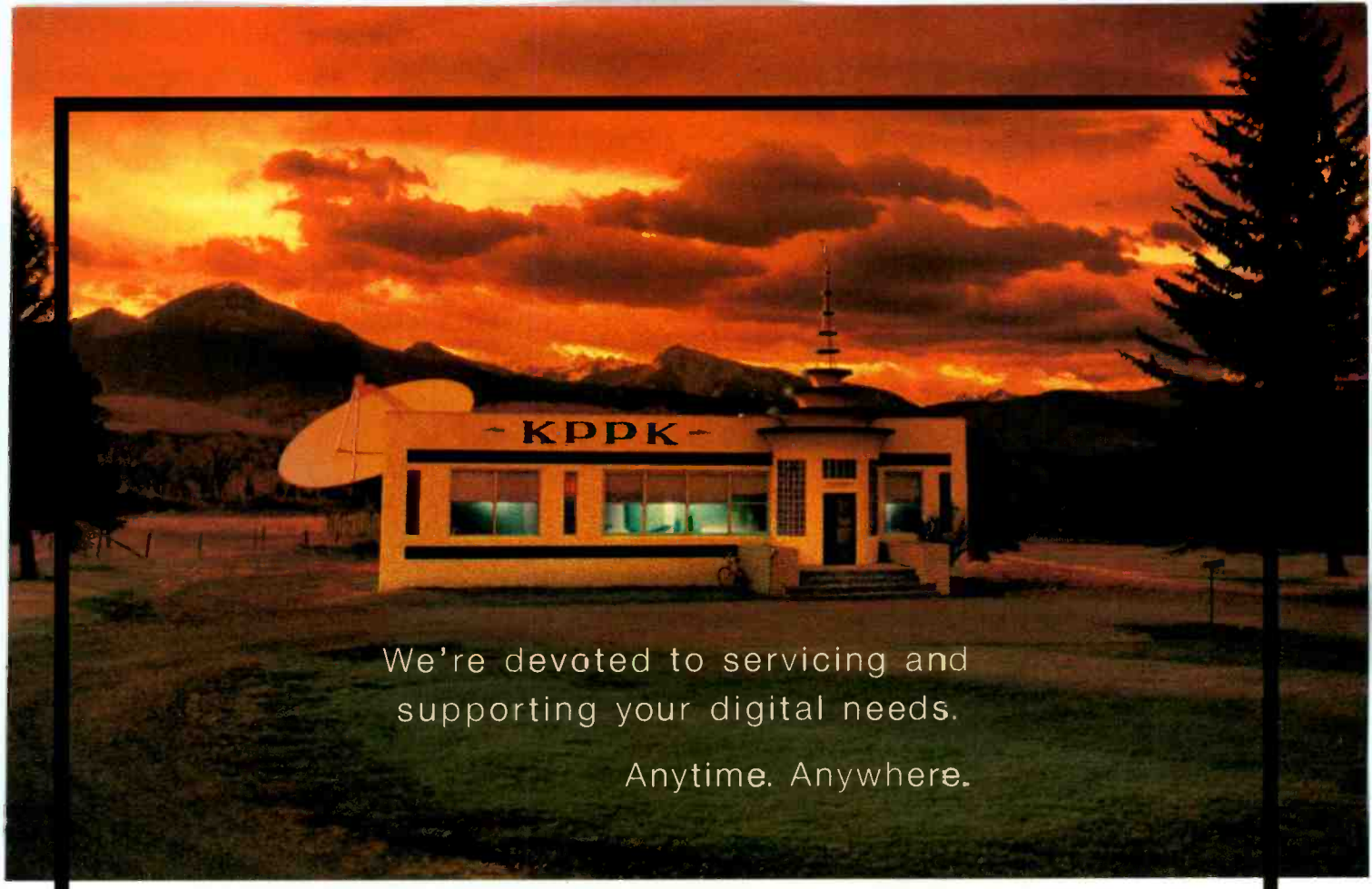
Power structure

Initially, basic utility parameters had to be determined for the entire facility's load requirements. At first glance, the original electrical requirements appeared to be in the area of 4000A. The increased requirement for the facility load resulted in an 8000A main switchboard serviced by two utility grids. The combined integrator requirements for the new digital electronics equipment would be over and above the standard three-phase, four-wire, Wye mechanical ground. All parties agreed there needed to be a fifth-wire isolated grounding system.

The facility's entire electrical distribution, including the television tech core, radio tech core, MIS/IT computer rooms, interconnect room and roof equipment electronics, is serviced by the fifth-wire "clean" ground system. The fifth-wire ground system has an extremely complex design formula, serviced by a perimeter counterpoise matte, bonded at the service neutral and distributed to the equipment room bus bar provisions, which are always insulated from the building four-wire ground. Ground-cluster panels were provided for distribution to serve the sophisticated digital equipment operating needs in the technical areas.

The Austin Company and Sony worked together on a variety of factors in the design process, and none was more crucial than the uninterruptible power supply (UPS) requirements. Traditional requirements for nonglitch generator switching were inadequate and brought about voltage regulation needs from the integrators and other related equipment that re-

The main audio production room provides full AC-3 and 5.1 surround capability supported by a Sony MPX-700 console.



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sulted in a total UPS load of 800kVA. The UPS system is an expandable Exide system located on a grade slab (due to its massive structural load requirement) adjacent to the electrical switchgear. The generator provides backup power for an emergency program of primary, secondary and tertiary distribution. A complex automatic transfer switching system accomplishes this. Because a high-voltage generator that could provide 1750kW of power was needed, a Phoenix custom-designed generator set was installed. The generator included an above-ground 10,000-gallon diesel tank, which is located away from the sound-sensitive studio area.

The architect and integrator worked together on a variety of factors in the design process, and none was more crucial than the UPS requirements.

An elaborate MATV system was designed by the Cox Cable Division. This sophisticated 55-channel system furnishes all radio and television departments with the full complement of signals as defined at the beginning of the project. This in-house RF system is fed from the roof's head-end dog house, which is specifically designed for all antennae that home run to an RG6 header trunk. This new RG6 header trunk provides a 75Ω-branch system to the communications closets, two of which are located on each floor. Special plenum-rated branch circuit coax feeds 75Ω to office F-connector plates. A high-tech amplification splitter system is utilized to produce an extremely efficient in-house RF system from the six racks in the central rack room.

Mechanical systems

The air temperature and humidity in the television central rack room are controlled by three modular air-conditioning units, one of which serves as a standby. The cold air is supplied below the computer flooring and blows up into the electronic equipment racks through holes in the raised floors. The air temperature and humidity in the production master control rooms are controlled by an overhead air-distribution system supplied by Leibert air-conditioning units located in adjacent spaces. To eliminate noise, Austin designed and installed duct silencers in the supply and return air ducts where they penetrate the wall of the master control rooms.

The three studios are served by their own air-handling units with a high-velocity overhead, low-velocity duct air-distribution system. Custom-designed duct silencers are installed in the supply and return air ducts where they penetrate the studio wall. The 14 central-station-type air-handling units and two cooling towers are located on the roof. There are three indoor units with chilled water coils for cooling and electric resistance heating coils for preheat.

Positioned for the future

WSB's new broadcast center, with its ability to simultaneously broadcast an analog and digital signal, is one of the industry's leading state-of-the-art digital facilities – a sophisticated complex with the flexibility to meet the changing needs brought about by the latest format and equipment innovations of DTV. ■

Donald P. Archiable is vice president of planning and design for The Austin Company's broadcast/entertainment group, Cleveland.

Equipment list

Routing switcher: Sony DVS6000 Series – seven level 256 frame 80% populated
Cameras: Sony Model 550 with 4:3 and 16:9 blocks
Camera pedestals: Vinten Robotic System, six pedestals and two pan/tilt heads.
Production switchers: Sony DVS7000 Series with four downstream keyers and two channels of Sony DME7000.
Server: Sony Flex, Sony MAV70.
Long-form show playback: Sony Digital Beta
Audio production console: Sony MXP-700
Computer newsroom: Avid News
News servers: Sony BZM5000 software base, with Sony MAV70's. 70 hours on daily server; 10 hours on-air server.
Graphics: 3 Chyron Infinites
1 Chyron Maxine
6 Quantel Picture box
2 Quantel Paint box
1 edit box
3 Soft Image "DS"
Intercom: RTS Adam System
Lighting: Strand CD80
Live ENG trucks: on-board editing and Sony Beta SP equipment
SNG truck: by BAF
2 helicopters: 1 with duplex feeds and gyroscopically stabilized WESCAM camera. The other with electronically stabilized Sony camera and microwave TX.

Design Team

COX / WSB-TV Channel 2
John Swanson, vice president of technology and new business, Cox Broadcasting
Greg Stone, general manager, WSB-TV Channel 2
Mark Morgan, president and general manager, Cox Radio Operations
David Lamothe, director of broadcast operations, project manager for radio and television
John Talbert, director of technical operations, WSB Radio
Mike Howey, director of engineering, WSB Television
Ron Wilson, director of information technology, WSB Radio
Gary Alexander, assistant director of engineering, WSB Television
Art Rogers, director of news production and local programming, WSB Television
Planning, Design, Engineering and Construction of Broadcast Center: The Austin Company
TV Systems and Equipment Integration: Sony Electronics, Inc.
Radio Systems and Equipment Integration: Pacific Research and Engineering Company (PR&E)
Studio Set Design: Broadcast Design International (BDI)
Technical Equipment Specification: WSB – Channel 2 Engineering

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DTV STL systems

BY DON MARKLEY

Among the various problems presented by DTV implementation is the task of getting the signal from the studio to the transmitter. A vast majority of stations currently use analog microwave links carrying NTSC video, one or more audio channels and, in some cases, control signals for the remote control system. The obvious first problem is that the wide bandwidth necessary for the DTV signal simply isn't available on these older systems. Unless the signal is simply handed over to a local carrier for a fiber optic system, another solution has to be found.

The more demanding ATSC signal in turn demands the more sophisticated systems.

Spectrum availability

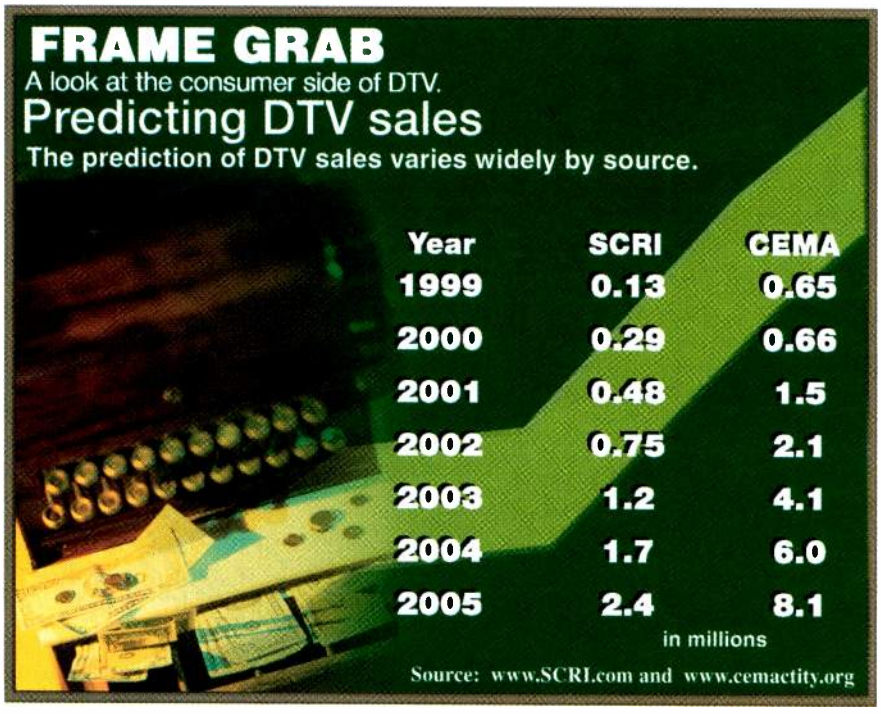
Everyone should be familiar with the contents of Subpart F of Section 74 of the Rules and Regulations, which deals with television auxiliary services. A brief review shows that a total of 10 channels with 25MHz bandwidth are available in the 7GHz band along with 43 channels in the 12GHz band. Actually, that is somewhat misleading as the channels in the 12GHz band are interleaved. This overlap means that fewer completely clean channels really exist. Traditionally, the 7GHz channels have been more desired, especially for long haul systems, due to their more robust nature. The 12GHz channels were once treated as almost unusable due to greater path loss and waveguide losses. However, as the 7GHz channels filled up, the industry learned to live with those challenges making the use of 12GHz channels routine. The worry now is going to 18GHz or higher.

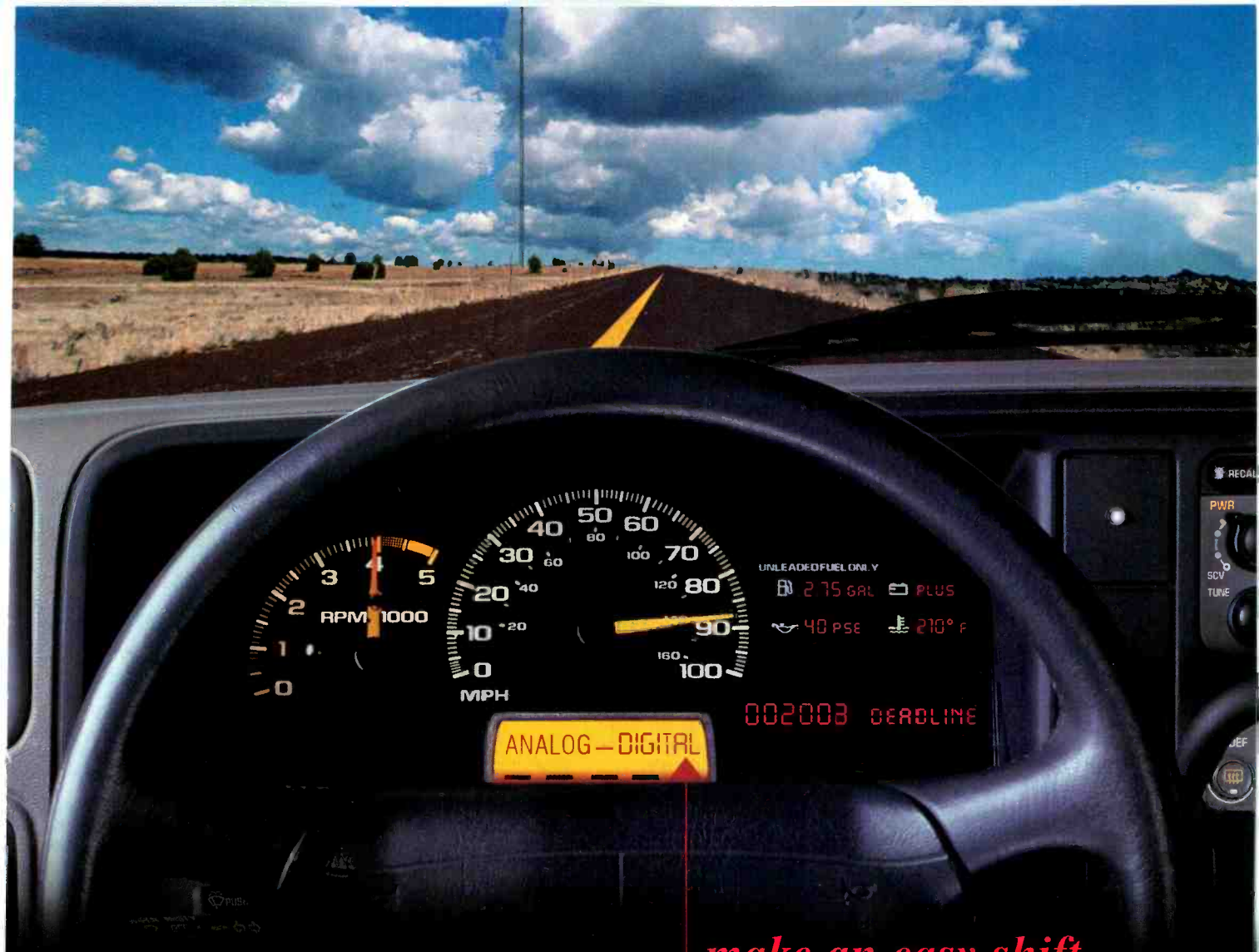
In small markets, the availability of sufficient channels usually isn't a problem. With few stations, everyone can fit on the desired 7GHz channels given minimal coordination between users. However, spectrum problems often are found when stations use 7GHz for STL systems as well as long haul links to their sister stations in other parts of the state. This is a common problem in the Western parts of the country and is aggravated when some stations are reluctant to change their short hop STLs over to 12GHz.

For all markets, operators have an understandable aversion to buying a totally new microwave system just to accommodate DTV. The simple cash outlay is significant even if a second channel is available. To work around this problem, microwave system manufacturers have been working toward new systems that combine both the NTSC and DTV signals, including the NTSC audio and control signals, onto a common carrier. Various modulation schemes have been proposed, all of which can operate within the 25MHz bandwidth.

Combined DTV & NTSC

Two basic schemes are used to combine these signals. One simply uses the fact that many existing NTSC systems only use a portion of the 25MHz bandwidth. It is proposed that the DTV signal will be modulated on a carrier that uses the rest of the channel. This obviously requires an additional transmitter/receiver with circulators and filters. It may not be feasible with some equipment because these devices may





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Microwave systems are common in today's television operations, with most existing systems having been in use for some time. Newer modulation schemes allow broadcasters to replace older units with systems that can transport all necessary signals.

have a spectrum that isn't as clean as newer systems. Still, it's a reasonable approach that will allow the NTSC system to remain mostly unchanged. This may be desirable to some stations because there seems to be a sentiment in that industry to do nothing to upset the NTSC station, where the money is still being made.

STL systems have traditionally been the little black boxes that were ignored.

Other manufacturers are looking toward systems which will multiplex the NTSC video, audio and data signals into a transport scheme, which is then multiplexed, with the 19.39Mb/s ATSC signal. The resultant signals are separated in the receiver system. The output of which provides all of the NTSC signals along with the 19.39Mb/s signal ready to be inserted into the DTV exciter. This requires a new digital radio system, but will allow everything to be handled on the channel the station currently uses. Hot standby radios are still applicable when desired.

These microwave radios were much in attendance at NAB98. In fact, some old manufacturers that were primarily involved with common carriers came to the show with new digital systems. The use of digital methods for microwave systems has been widely used for years in the common carrier industry, but hasn't found wide acceptance with broadcasters. The problem, simply put, is that broadcasters didn't have to be that fancy. Analog radios are much less complex than their digital brethren as well as significantly less expensive. In addition, the bandwidth of the NTSC video signals simply doesn't require the greater complexity. The more demanding ATSC signal in turn demands the more sophisticated systems, which has prompted the return of those manufacturers to broadcasting.

In particular, those showing at the last NAB included Alcatel, Harris/Farinon, Itelco, Microwave Radio Communications (MRC), Nucomm, RF Technology and an entry by Moseley Associates. While Moseley is well known in digital radio circles, this is their first venture into television. They showed a very interesting STL along with an option of a narrower bandwidth system aimed at remote pickups. This year's show will likely have these and other manufacturers with more refined systems.

It is interesting to note that the manufacturers have proposed a wide variety of digital modulation schemes, depending on the number and types of signals that are to be combined into one RF path. Each of these schemes has its own set of pluses and minuses that are a bit to varied to go into in this column, but for a quick rundown, see Table 1. Instead, it is recommended that stations visit the various booths at the show and see what is available this year. Arm yourselves with a listing of the signals that you need to transport to the transmitter site including such items as NTSC video, audio, data, several radio signals and the ATSC datastream. The manufacturers will determine which of their products will best meet your needs and explain just how their systems will integrate into your existing operation.

Type of Modulation	M	Bits/Hertz M/(1+a)	C/N (db)
PSK	1	.833	10
QPSK	2	1.66	10
8-PSK	3	2.50	14
16-QAM	4	3.33	17
64-QAM	5	5.00	23
256-QAM	6	6.66	28

Table 1: Spectrum efficiency in bits/hertz and carrier-to-noise level for various digital modulation techniques. M refers to the type of modulator coding. (1-Normalized C/N corresponds to a BER of $1x10^{-6}$, 2-Assumes No FEC and a = .20.)

It is interesting to note that STL systems have traditionally been the little black boxes that were ignored. They have long shown an extremely high degree of reliability and stability that causes the station staff to forget about them. The only problem has been that of finding enough frequencies for everyone without the need for complicated antenna systems. Now comes the ATSC signal which, compared to the old analog systems, really is the equivalent of putting more pounds of stuff into the bag than it was designed to hold. Thanks to modern compression and modulation schemes, it appears that this part of the DTV transition is going to be relatively painless and suprisingly inexpensive. ■

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

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

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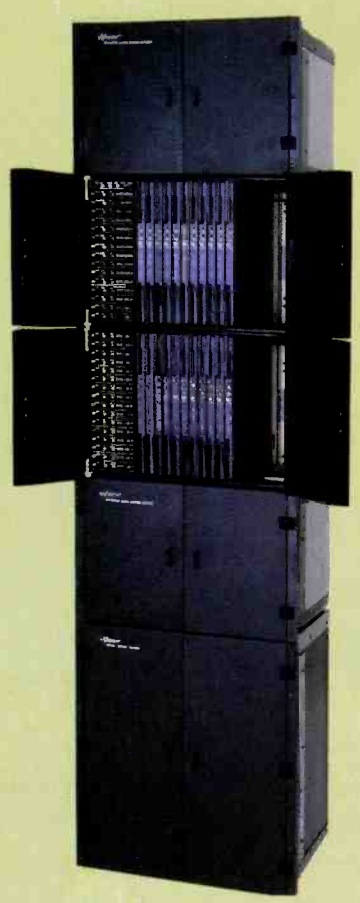

The NV3512, used by all of the major broadcasting networks and post houses, is a large-scale, expandable routing switch for synchronous and asynchronous switching of digital audio as well as time code. It can be controlled by most of the current router control systems, so it is easily integrated into existing as well as new facilities. It can be purchased in sizes of 8 x 32 all the way up to 2048 x 2048. (One customer has a synchronous NV3512 that is 2048 x 512.)

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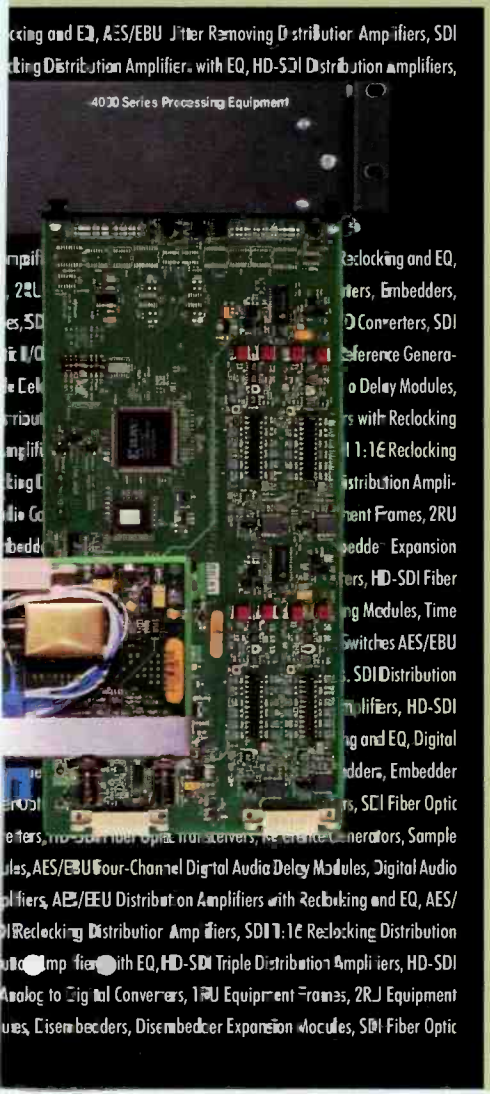

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Wireless microphones

BY BENNETT LILES

Wireless microphones have become as common to television production as lights and cameras. Still, the axiom for these tools is, "Never use a wireless mic when a wired mic will do the job." But if you need a close-up mic without cables, you will have to enter the wireless world.

Newer wireless microphone systems operate in the UHF from 470MHz through 800MHz. While this gets such equipment safely above many sources of interference, broadcasters should pay particular attention to a number of other factors to ensure a clear signal and the optimal performance of their wireless mic systems.

Dropouts and noiseups

The term "dropout" describes a momentary loss of the signal at the receiver. It has three possible causes: the transmitter is out of range, the signal is blocked by architecture, or the signal is arriving at the receiver antenna by both direct and reflected paths and is partially phase canceling itself. With the greater range of newer systems, this "multipath" cancellation is the most common problem. Noiseups, marked by a hissing, spitting sound, are the first warning that a dropout is coming. To prevent these problems, ask the vendor to make an on-site inspection. Many companies have databases showing frequencies used in some metropolitan areas and they can suggest less-used frequencies.

Careful separation of AC and sound cables can help keep your microphones and other low signal level equipment hum free. Once the equipment is in place, inspect all components for loose or damaged connectors and areas where insulation is damaged.

Antennas and diversity reception

Receiver antennas come in a wide array of designs, but you should stick to those supplied with your system. UHF systems most often use a quarter-wave design either extended to that physical length or confined within a smaller housing and kept at the quarter wavelength electrically with loading coils.

Note the two types of coax used in this installation. The longer antenna runs use RG-214, instead of the much smaller RG-58A/U. The difference in loss between the two cables becomes significant at 900MHz.

The best, and most expensive, systems have pre-amplified antennas DC powered from the receiver by a method similar to phantom powering for microphones. The receiver will have two kinds of antenna connections; a "dry" one for passive antennas (no DC) and a "wet" one that supplies a constant DC current to the line to power the antenna's internal pre-amp.

This pre-amplification is usually just 10db or so and is not intended to substantially beef up the signal. Its main purpose is to maintain the correct impedance between the antenna, the cable and the receiver. Most often these are 50W systems and require 50W coaxial cable. The most often used on permanent installations is RG-58A/U. With a signal attenuation of about 7db per hundred feet at 200MHz, this cable will do for most installations. RG-214 can be used with about the same loss at 900MHz, but it is much thicker and is more difficult to install. With multiple receivers, an active signal divider is needed. Simply using splitters will cause too much signal attenuation.

Diversity reception should always be used and it comes in several flavors. Space diversity places antennas apart at the distance needed so that at least one will always have an unobstructed signal. Phase-switching diversity uses a phase shift in the receiver so that one antenna's signal phase is shifted to reinforce rather than cancel the other. Audio-switching diversity actually uses two receivers and switches to the audio signal from the one currently getting the strongest signal. "RF" diversity switches one receiver to the antenna getting the strongest RF and only uses one antenna at any moment. This RF switching method is the fastest and most quiet.

Changes coming

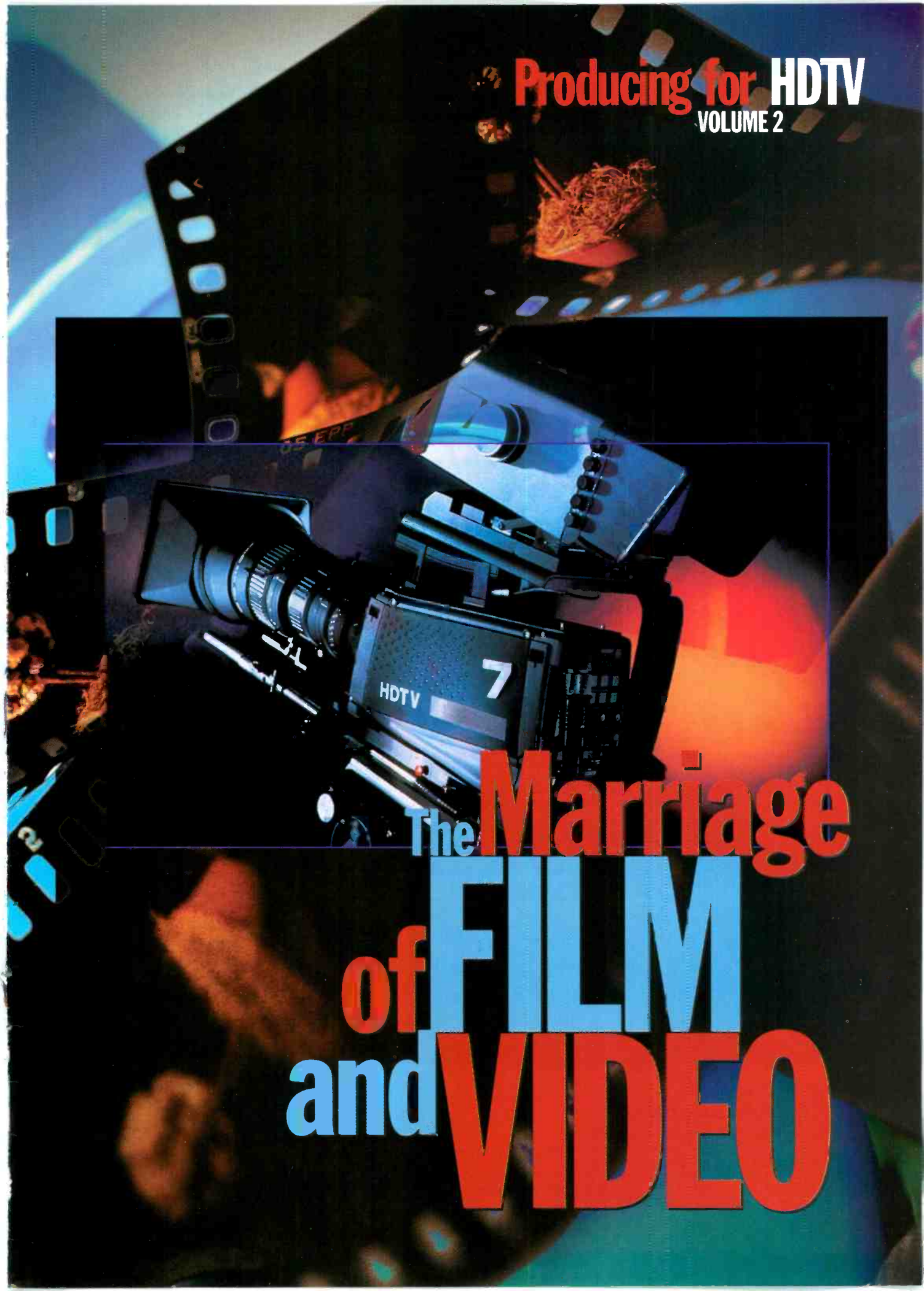
The implementation of digital television has resulted in the reallocation of some wireless mic channels to digital television and public safety. TV channels 63-64 (764-776MHz) and 68-69 (794-806MHz) will begin being used by public safety. This transition will be complete by Dec. 31, 2006. After that time, TV channels 60-62 (746-764MHz) and 65-67 (776-794MHz) will be released for use by wireless microphone manufacturers. During the transition period, however, wireless microphones may continue to operate on these channels. Just expect more interference.

When your system is in place, each unit should be tested with mics on and off. Then all units should be tested together. Keep antennas moveable until results are good. Work carefully to match your system to your building and you should not fall victim to the problems of the wireless world. ■

Bennett Liles is an audio engineer at Georgia Public Broadcasting, Atlanta.

Producing for HDTV

VOLUME 2



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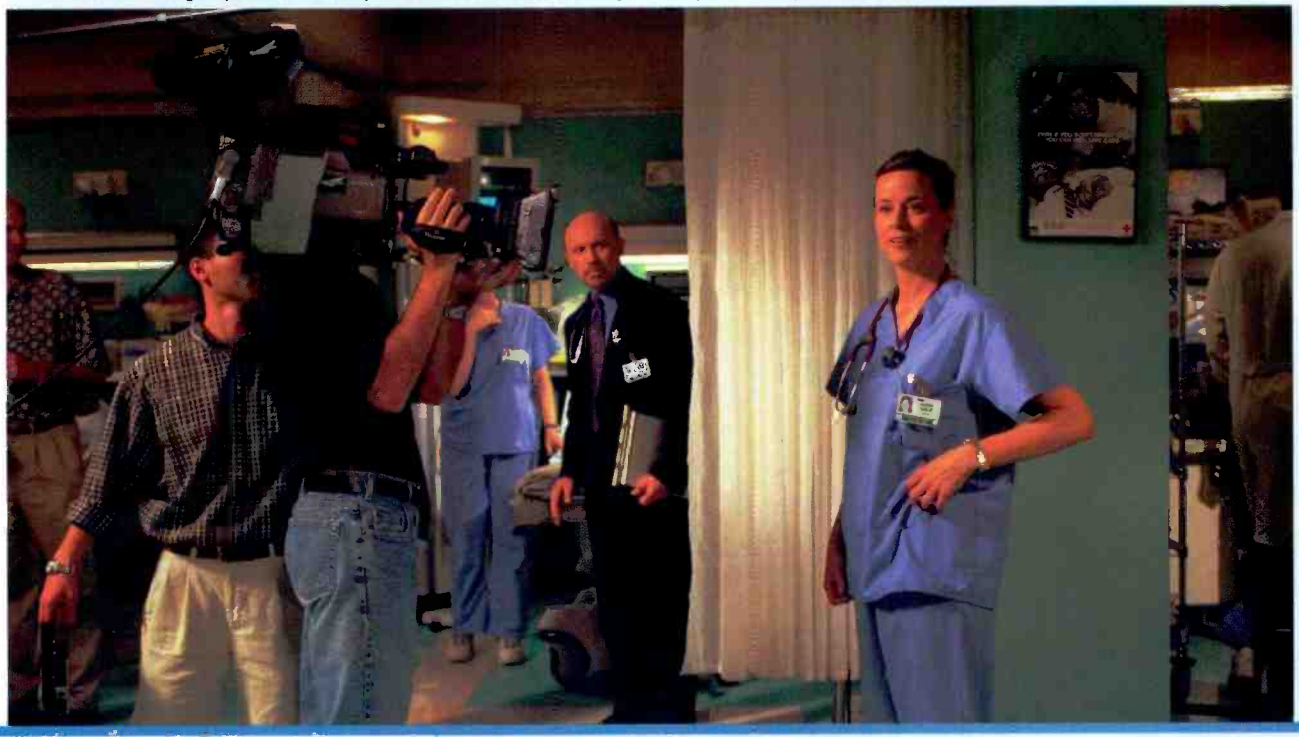
The CBS drama *Chicago Hope* became the first prime-time series to be telecast in digital HDTV. (*Photo Courtesy of Sony.*) See *HDTV: Finding Its Place in the World of Video.*



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NAB '99: VIDEO on a Roll

The professional video industry is in the midst of rapid, fundamental change. Nearly every aspect of corporate television, broadcast and post-production operations has been touched by digital technology; some have been completely remade. At the 1999 National Association of Broadcasters Convention, the key technologies that are driving video into the new millennium will be identified, explained and demonstrated.

There can be no doubt that DTV has taken center stage. And although it is certainly true that NTSC pays the bills, DTV represents the future of television. The uncertainty involving the transition to DTV has essentially vanished. The ATSC DTV standard works, and consumers will flock to take advantage of the new benefits and features that it offers.

All-digital video facilities are now practical, and, indeed, many already exist. The new tools offered by digital technologies – well covered in the technical conferences of NAB '99 – have made practical new ways of producing programming.

It is no secret that marketplace forces have redefined professional video and that technical developments have stepped up to the challenge, making it possible to accomplish more with less. The practitioners who understand and embrace this paradigm shift are finding considerable success in the new world of video. At NAB, you will find the future of television.

In this issue

This HDTV special supplement features the following:

HDTV: Finding its Place in the World of Video
HDTV: The Marriage of Film and Video (finally)
New HDTV Products

We hope you find this special supplement informative and useful. As always, your comments are welcomed. Additional background information on HDTV can be found at *www.technicalpress.com*.

Jerry C. Whitaker, editorial consultant

HDTV: Finding Its Place in the World of Video

The director of photography for *Chicago Hope* used two HD cameras in the landmark production, integrating film and video to effectively tell the story. (*Photo Courtesy of Sony.* Chicago Hope *is produced by David E. Kelley Productions in association with 20th Century Fox Television.*)

In the first production of its kind, Los Angeles TV station KTLA used a full complement of high-definition equipment to broadcast the Rose Parade in HD and simultaneously in NTSC to viewers.

Jerry Whitaker, *editorial consultant*

It's HDTV on parade. Really!

As the trade show season comes into full bloom, there remains little doubt that HDTV is rapidly finding its way into mainstream video post-production and broadcast television. Allied fields, including non-broadcast corporate video and medical imaging, are likewise quickly finding the many benefits offered by the DTV system in general, and HDTV in particular.

There have recently been a number of groundbreaking events using high-definition (HD) products and new production techniques, many borrowed or adapted from the film industry, which has a great deal in common with HDTV (as illustrated elsewhere in this publication). One visible recent effort involves the broadcast of the Tournament of Roses Parade on New Year's Day from Pasadena, CA, over Los Angeles station KTLA.

On the air

KTLA, no stranger to the implementation of new technologies for television, broadcast the parade live to viewers in what was probably the most ambitious HDTV effort since the coverage of the launch of the space shuttle carrying John Glenn. The Rose Parade coverage was the first major live broadcast shot in HD and transmitted via digital and standard analog transmitters to viewers. Among the station's other premier technical achievements are the first live broadcast from a helicopter and the first surround broadcast of the Rose Parade.

In coverage of a live event, there is no room to work out the bugs of a new technology. Millions of people were watching the digital truck's downconverted NTSC feed on KTLA and through a separate feed

to the HGTV cable network. Adding to the pressure, KTLA's Rose Parade coverage, although locally produced, is the station's highest-rated broadcast of the year, often drawing just as many viewers as the ABC, CBS and NBC stations combined. The production had to bring the benefits of HDTV to a select, but important, audience without compromising the quality of the NTSC broadcast.

As you would expect, there were a number of adjustments in dealing with the HDTV element. None was described by staff, however, as major differences. Most crew members, from camera operators to the TD to the audio mixer, said little adaptation was required. One point of considerable interest had little to do with the new technology and everything to do with editorial judgment – specifically how to handle the issue of shooting for two aspect ratios.

The Kansas City Chiefs vs. Oakland Raiders game on Dec. 26, 1998, was broadcast in HDTV by CBS using the NMT HD-1 high-definition production truck. (*Photo courtesy of Sony.*)

The Oakland football broadcast was one of four pilot events covered in high-definition by CBS Sports during the past season. (*Photo courtesy of Sony.*)

To a point, this issue turned out to be easier to solve than expected, because of the type of event being covered. The viewfinders in the Sony cameras used by the National Mobile Television (NMT) production truck displayed the full 16:9 high-definition image, but they also included safe-area markings for both the 4:3 and 16:9 safe-title area. Furthermore, they also had a function that grayed out the added side area of the 16:9 screen so that all critical image information was kept in the 4:3 safe area. The camera operators, thus, were able to shoot the widescreen image without compromising the 4:3 standard-definition picture viewed by the vast majority of the audience.

This technique works particularly well for parades or sporting events. Considerably more challenging, however, are the editorial issues involving other types of productions, such as drama. But for the purpose of this event, the editorial issues were minor.

Camera operators at the Rose Parade quickly discovered that swish pans did not work well and that extreme close-ups were usually not desirable when shooting for HD. Higher resolution encourages viewers to sit closer to their sets, and a close-up shot of a moving object can be disconcerting. HD's added resolution also required adjustments in sets and makeup, because facial characteristics not visible on NTSC can be apparent in HD.

There was speculation before the event that HD-originated pictures would look better in NTSC than comparable images captured and processed entirely in the NTSC domain. Trained observers concluded that there was a difference. The images were noticeably sharper, even when viewed off-air.

Widescreen football

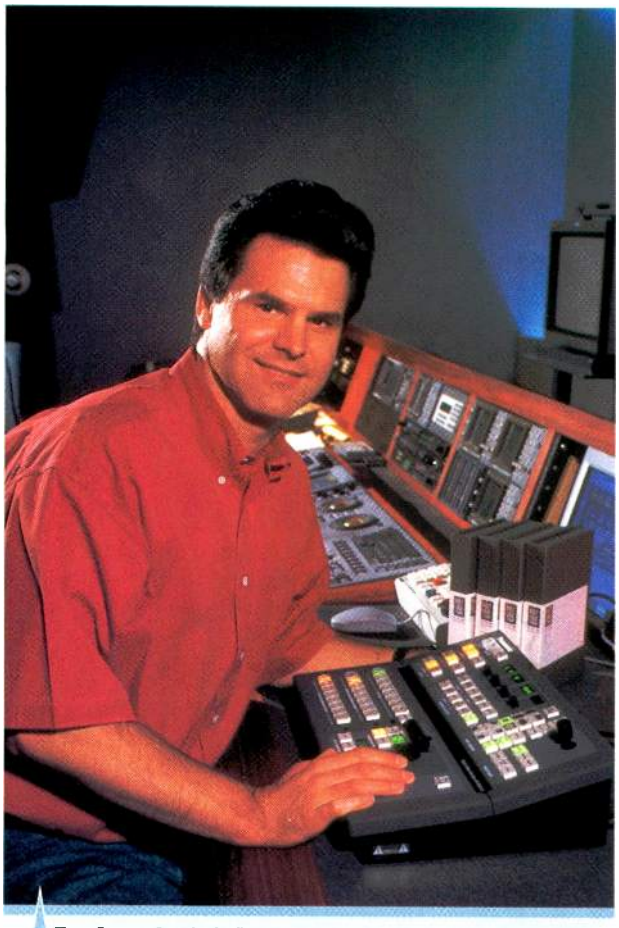
It has long been stated that the great benefits of both the higher resolution offered by HDTV and the wider aspect ratio will remake the way sporting events are covered. CBS tested that theory in a series of broadcasts, beginning with the Buffalo Bills vs. New York Jets on Nov. 8, 1998. That event marked the first professional football contest to be broadcast live in the digital 1920x1080 HDTV format.

The historic telecast, presented with the support of Sony high-definition production equipment, was the first of four professional football games presented in HD by CBS Sports during the season. The live HDTV telecasts were produced and transmitted independent of the regularly scheduled CBS Sports football coverage being broadcast on the conventional analog network.

To facilitate the broadcast, CBS used the NMT HD-1 high-definition production vehicle, which was outfitted with the necessary Sony HDVS gear. Ten HDC-700 studio cameras and HDC-750 field cameras were used to shoot the games.

The HDTV program distribution used a combination of General Instrument Corporation's high-definition encoders and decoders – for both fiber and satellite links. Original content was compressed using a GI encoder configured for DS-3 transport via fiber to CBS Broadcast Operations. There it was decoded with GI HD decoders to baseband HD for editing/graphics application.

CBS is using General Instrument's DigiCipher II system for the conversion of its total network distribution system from



Thom Ferman, Post Logic director of engineering, in one of the company's two telecine rooms that comprise the Post Logic HD Mastering operation. (*Photo courtesy of Panasonic Broadcast & Digital Systems Company.*)

analog to digital. This project includes the digitization of all current CBS programming and future advanced HDTV programming.

The football games were transmitted in high-definition nationally to CBS-owned stations and affiliates with digital transmission capability.

NMT's digital HD mobile production unit, first unveiled at Madison Square Garden last fall, is a 53-foot expandable trailer capable of full-bandwidth HD broadcast, as well as simultaneous 4:3 standard output. The truck, which supports the 1920x1080 HDTV format, was designed by Mark Brooks, NMT's vice president of engineering. NMT provides remote trucks, broadcast equipment and crews for more than 7,000 events annually, including major sports, entertainment and corporate events.

Chicago Hope

CBS marked another HD first with the telecast of *Chicago Hope* in high-definition. The first broadcast of a prime-time series in digital HDTV happened Nov. 18, 1998. It was transmitted in the 1920x1080 format by 11 CBS-owned and affiliated stations, giving viewers a glimpse at the future of television. This particular episode of the CBS medical drama was well-suited to the use of video integrated with 35mm film.

As explained by Jim Hart, co-executive producer of *Chicago Hope*, "The story line of this episode, which was from the point of view of a news crew visiting the hospital, needed to have a feel other than what film could provide. Therefore, we decided to shoot the episode on HD video. And for archival purposes, high-definition was the preferred video format. Because we are always searching for new and dynamic looks for the show, it was a perfect opportunity for us to create this episode in digital high-definition."

The episode was shot and recorded with two Sony HDC-750 digital high-definition studio cameras and an HDCAM HDW-500 studio VTR. The High Definition Lab at Hollywood's Laser Pacific completed post-production.

James Bagdonas, ASC, director of photography for *Chicago Hope*, said it was easy to become acclimated to the high-definition cameras: "I found that the only major difference between using film and shooting in high-definition in the indoor hospital set was related to lighting intensity, which was easily adjusted."

Digital Denver

Being on the leading edge of technology brings with it a number of challenges, but often the rewards far outweigh the risks. On March 1, 1999, Denver station KMGH-TV (Channel 7), Denver's ABC affiliate, made regional broadcasting history by being the first station in Colorado to air high-definition (HD) programming. Using an HD turnkey system purchased from Panasonic System Solutions Company, KMGH re-broadcast ABC's theatrical presentation of *Tin Cup*, a feature film starring Kevin Costner.

The HD station system, whose major components included two Panasonic AJ-HD2700 1080i/720P switchable D-5 HD VTRs, a Leitch Juno upconverter, and Tiernan ATSC encoder, allowed KMGH to record the HD broadcast in the 720P high-definition format transmitted nationally by the ABC network and re-broadcast it an hour later for their time zone.

Since late last year, ABC has been airing prime-time theatrical releases in HDTV. Broadcasts originate from the network's HDTV Release Center in New York.

HBO launches HDTV service

HBO, the country's oldest and most distinguished entertainment cable network, has launched a 24-hour-a-day HDTV service. The 1080i HDTV-based service plans to offer more hours of HDTV programming than any other network in the country.

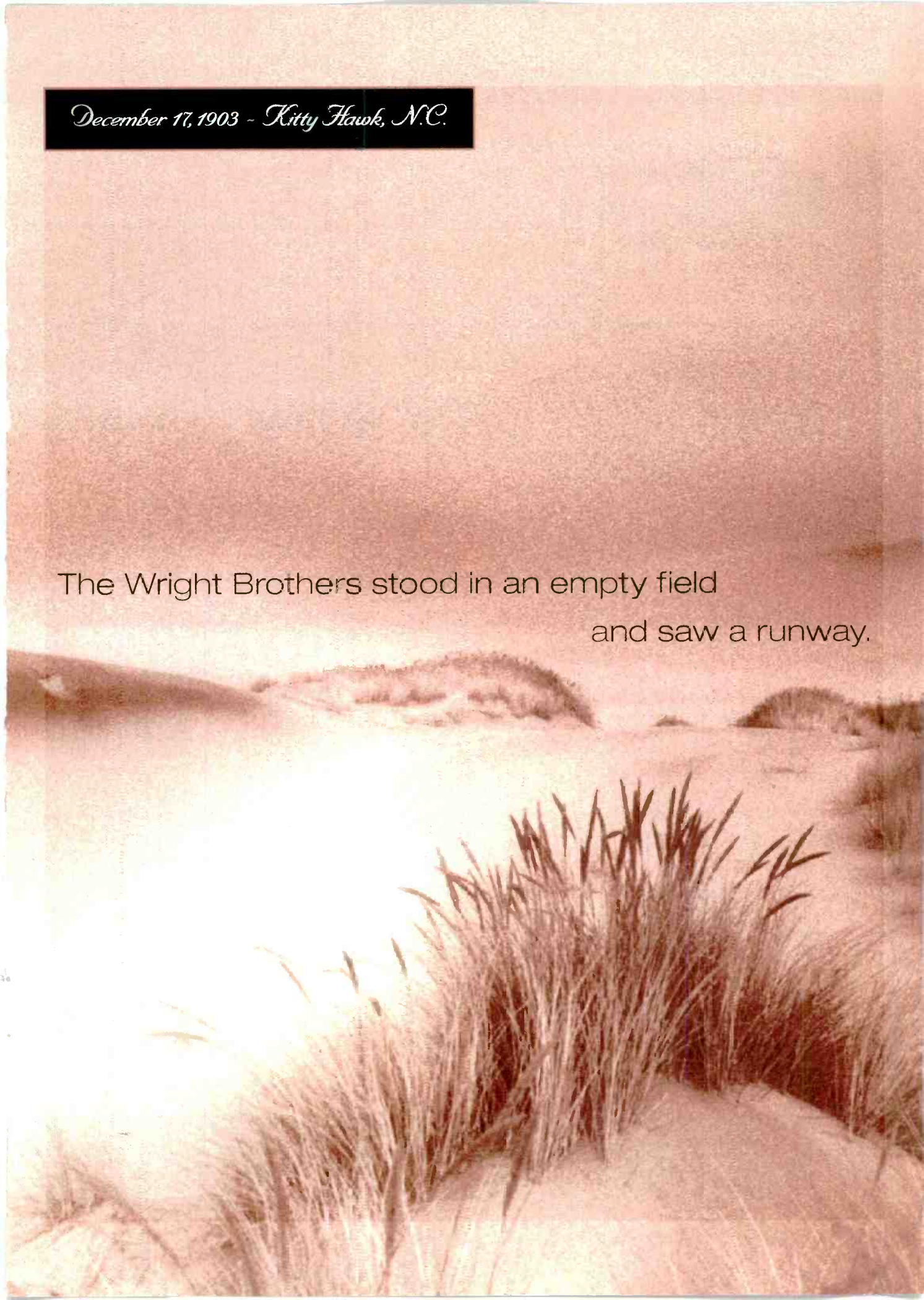
HBO, whose cable network subscriber base is 33 million, has big plans for HDTV. According to Dom Serio, senior vice president, HBO Studio & Broadcast Operations, "Our audiences through the years have become accustomed to the highest-quality programming from HBO, and we wanted to be the first cable network to bring them the excitement of HDTV."

The HBO effort is being facilitated by a major purchase of D-5 gear from Panasonic. Nineteen AJ-HD2700 VTRs are being used for film-to-tape transfers and tape-to-tape color correction in HBO's Manhattan-based editing center. Three HD Smart-Cart automated record/playback systems, equipped with AJ-HD2700s, are used for HD network origination at HBO's uplink center in Hauppauge, NY.

Mastering at Post Logic

Post Logic of Hollywood, CA, has started a separate business entity known as Post Logic HD Mastering. Post Logic, which specializes in HD feature transfers and commercial, trailer and long-form finishing, counts such major studios as Dreamworks SKG and Warner Bros. among its clients. An important element of the Post Logic HD Mastering facility was the installation of two Panasonic AJ-HD2700 D-5 HD VTRs, switchable between 1080i and 720P, and an AV-HS3110 1080i MillenniuM HD switcher. The hardware has been used in recent Post Logic assignments, including film-to-tape work on the motion picture *Saving Private Ryan*.

The primary application of the MillenniuM switcher is film-to-tape work in concert with a Cintel Turbo HD telecine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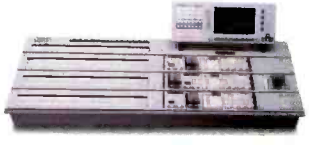

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SONY

National Mobile Television's HD-1 is an all-digital, high-definition mobile truck. Here it is parked outside New York's Madison Square Garden with a Fujinon 66X lens shown in the foreground on a Sony HD camera. (*Photo courtesy of Fujinon.*)

Laser Pacific Media Corporation, one of the pioneers in HDTV mastering for prime-time TV programs. (*Photo courtesy of Sony.*)

and a DVS Movie Video HD still-store as a reference frame device. The AV-HS3110 also is used for tape-to-tape color correction and to lay off to the D-5 HD equipment.

The audio element

Numerous studies demonstrate that, given the same images, audiences will conclude that the program with improved sound also offers improved pictures. Of course, this is one reason that improved audio was deemed critical to HDTV early in the planning stages of the ATSC DTV standard. In demonstration of the market value of better audio, F.D.S. Labs has begun work on the re-release of more than 50 films for the HDTV and DVD markets. F.D.S. Labs is handling the audio, and Complete Post, Hollywood, is doing color correction.

One of the most challenging projects was the audio remake for *Nightbreed*. F.D.S. Labs faced the challenge of transforming the stereo composite track into a complete 5.1 mix. To make matters worse, the dialogue track was peppered with distortion and noise. "We created the 5.1 mix from the two track," said owner Hank Waring, "separated the dialogue (the center channel of the DVD mix), cleaned it up, and reinserted it into the 5.1 mix." That mix was then summed to stereo for HDTV, with no resulting phase problems.

In addition to *Nightbreed*, other films processed by F.D.S. include *Incognito*, *Skin Deep*, *Freejack*, *Renegades*, *Pacific Heights*, *Coupe DeVille*, *Young Guns II*, and *Enemies: A Love Story*.

HDTV: Here at last

The pioneering work of LA-based Laser Pacific Media Corporation is well-known. As the market for HDTV-based programming begins to build to a critical mass, the company is planning efforts in the area of TV mastering and post-production. Laser Pacific's efforts in HDTV development go back almost 15 years, so charting new waters is familiar territory for the company, which has won four Emmys for technical achievement during the past 10 years.

Laser Pacific has operated an end-to-end HDTV mastering service for nearly a year. Customers include New Line Cinema and Fox Television. Laser Pacific is a leading provider of post-production services for prime-time TV sitcoms and dramas. Among its services are motion-picture processing, telecine, online and offline editing, color correction, duplication, digital video compression for DVD authoring and mastering, and production services.

Laser Pacific is just one example of the technological leadership taken by the post-production industry in advancing digital technology. In the mid-1980s, when the post-production industry really came into its own, the hot technology was digital effects – islands of computer-based devices in a sea of bulky analog tape machines, huge routers, and M/E-enabled switchers.

At this point in the deployment of DTV, there are a number of leaders – stations and companies that lay claim to being the first to accomplish some given task. These accomplishments are significant because they advance the state of the video art.

The production houses, broadcasters and business/industrial video departments that have survived 15 years of technological waves never forgot that technology is simply a tool and that video is a business. In order to stay in business, you need to put technology in its place. In the case of HDTV, its place now is front-and-center.

Editor's note

In an article in the first HDTV supplement, "HDTV: In the Field and On the Air," (January 1999), there is an error in some of the technical details given about the live HDTV broadcast of the space shuttle launch. The article stated that the QPSK satellite transmission of the launch was set up for "1:2 Reed Solomon encoding" on one link, and "3:4 Reed Solomon" on the other. What that referred to actually was not Reed Solomon encoding but to Viterbi *forward error correction* (FEC), which is expressed as user bits to total transmitted bits, with the overhead being FEC (typically ½, ¾, etc.). A colon (:) is not typically used in expressing FEC.

Reed Solomon encoding/decoding, on the other hand, is expressed as total bytes in a transmitted packet to actual application payload bytes, where the overhead is the RS bytes used. For example, a typical application for RS encoding is 204,188, where 204 is the size of the transmitted packet, and 188 is the size of the MPEG-2 packet. RS encoding becomes a part of the bit rate to which FEC is applied. ■

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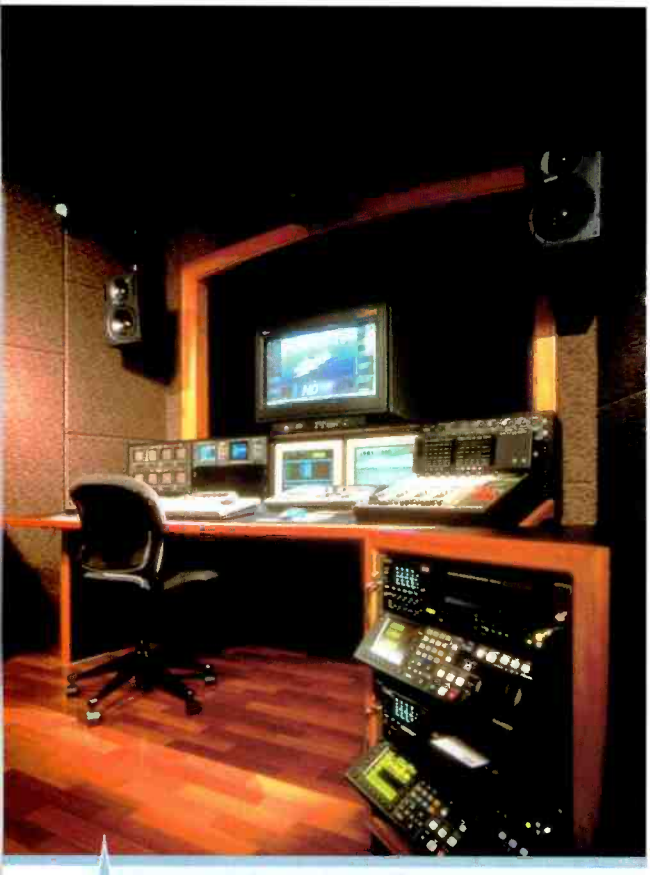

In the video realm, the concept of the 24P video mastering format will have the greatest effect on high-end, post-production houses. Although far from settled, 24P is emerging as a true marriage of film and video. *(Courtesy of American Production Services and Sony.)*

Jerry Whitaker, *editorial consultant*

Is it film or is it video? It's both.

As little as five years ago, nobody in the video business would ever suggest attempting to broadcast film-originated programming at 24frames/s. And capture at 24frames/s? I don't think so.

Today, however, these concepts are becoming the rage. The historical constraints of different frame rates prevented what many industry leaders are now heralding as "the next big thing." All of this excitement, of course, has been enabled by an extremely flexible transmission system, commonly known as DTV.

Standards: Less is better

About 75% of prime-time programming is shot on film at 24frames/s. By means of well-known standard converters (telecine machines), these programs are downconverted to the 525- or 625-line broadcast formats of conventional television. Essential to an understanding of the process is this fact: Film is a program production standard with *no direct compatible relationship* with any TV standard. Indeed, it has no technical relationship whatsoever with television. The process of standards conversion is, thus, a fundamental philosophy inherent to the total scheme of programming for conventional television. A 24-frame celluloid medium is converted to a 25-frame or a 29.97-frame TV medium – depending on the region of the globe – for conventional TV broadcasts.

This paradigm changes, of course, with the introduction of the ATSC digital TV standard. Multiple frame rates are possible, including the 24frames/s rate native to film. The question then becomes, why convert at all? Instead, simply broadcast the material in its native format. This simplifies the production process, simplifies the encoding process, and results in higher displayed quality. With regard to the last point, it must be understood that no standards converter (telecine or otherwise) is going to make a film-based program look better than the film product itself, scratch removal and other corrective measures notwithstanding.

High-quality transfer between any two media is important because it allows easy intercutting of separately captured images. Regardless of the medium of production, 35mm film programming can be released as HDTV. Likewise, HDTV programming can be released as 35mm film.

The road from here

To solve or at least lessen conversion problems between the multiple transmission standards in use and the original material, most of which originate from the ubiquitous 24frames/s film standard, a new mastering format has been proposed to the video community. The concept is to master at 1920x1080@24P. This would simplify the process of converting to the various video standards in use worldwide by networks and broadcasters, relative to the inter-format video conversions that now occur. Such an approach makes the final video program spatially and temporally compatible with 480i@24, 480P@60, 720P@60, and 1080i@30.

A working group of SMPTE is currently accepting comments from the production and post-production industries on the 24P mastering issue. The proposal includes two important characteristics:

- A 1920X1080, 16:9, 24P mastering format standard for film-originated TV programs.
- A new 24P standard referred to as 48*sF*, where each frame is progressively scanned and output as two *segmented Frames* (*sF*). Under this scheme, segmented Frame 1 contains all the odd lines of the frame, and segmented Frame 2 contains all even lines of the frame, derived from the progressively scanned film image.

Perhaps the most important reason that 24frames/s post-production is gaining interest is because of the many scanning formats that broadcasters are likely to use in the DTV era.

Posting film-shot productions at 24frames/s with 1920x1080 resolution, intuitively, makes sense. It is relatively simple to extract a 1920x1080@60i signal, a 1280x720@60P or 24P signal, a 480P signal, or a 480i signal. However, a 50Hz signal can be extracted by running the 24Hz tape at 25Hz. This makes a PAL tape that is the same as if you used a 50Hz high-definition telecine and ran the film 4% faster at 25frames/s.

Motion-picture producers also are interested in 24Hz electronic shooting. Producers want to be able to seamlessly mix material shot on film and tape, both for material that will end up as video or film. The easiest way to accomplish these objectives is to shoot video at 24 frames/s.

Synergy between film and HDTV

HDTV is not intended to replace film as a primary source of program production. This is a vital point in the marriage of film and video. HDTV, instead, provides a

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powerful new synergy that offers the choice of two media (of approximately comparable picture quality) by which a given program may be produced. The result is greater flexibility, in a new imaging tool, for program producers.

Filmmakers will, no doubt, make their choices quite independently of the viewpoints of technologists and equipment vendors. They will, in fact, make their choices based upon specific imaging requirements, which usually will be based upon the particular script under consideration. The film industry, although quick to adapt new technologies to the production process (computer-generated special effects immediately come to mind), is slow to discard technology that has worked well. And there is no doubt that film has worked well. Indeed, film continues to set the standard by which all other imaging devices and systems, including HDTV, are judged.

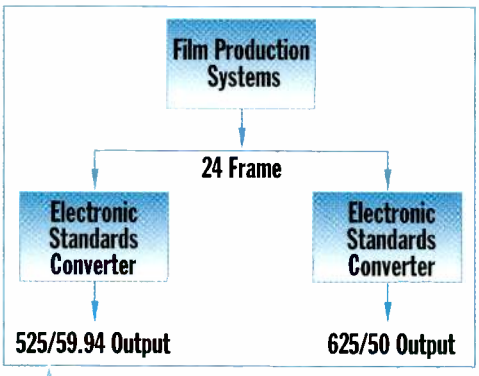


Figure 1.The conventional telecine process.

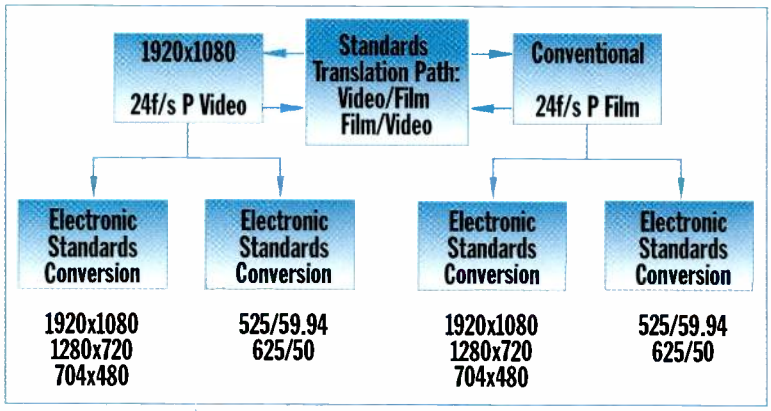


Figure 2. A practical implementation of the integration of HDTV video and film.

Electronic imaging has been attempting to reach the level of quality offered by 35mm film since the beginning of television. During the development of the original black-and-white standard for the United States in the late 1930s and early '40s, one of the arguments for the higher resolution offered by the then-proposed 525-line system was that it approximated the quality provided by film. Although that claim was more than just a little overstated, the fact remains that electronic imaging has been chasing film for decades.

The requirements of a given script may clearly dictate 35mm film as the medium of choice, or it may suggest an electronic HDTV medium offering unique picture-making advantages. The script may even suggest the use of both mediums, each applied to those scenes in which a particular form of imagery is sought, or a certain logistical convenience is required.

This freedom is possible because of the capability to transfer between media. This was part of the overall planning of the HDTV production standard (SMPTE 240M). Just as important was careful protection of the capability of program producers to release their programs via any distribution medium of choice, anywhere in the world. Figure 1 illustrates the methodology of program origination and TV distribution in widespread use today.

So, is 24P the answer?

The use of a 1920x1080@24P mastering format means that all telecine-to-tape transfers would be done at the highest resolution possible under the ATSC transmission standard. Just as important, all other lower quality formats can be derived from this 24P master format. This means that NTSC, PAL or even the HDTV 720x1280 formats with their slightly lower resolution can be downconverted from a high-definition, 24frames/s master. With the 24frames/s rate, higher frame or segmented frame rates can be generated.

In order to simplify the transfer process to make a 1920x1080 image, 24P becomes the more economical format of choice. It complies with ATSC Table 3 and is progressive. Being a film rate and progressive, it compresses more efficiently than interlaced formats; a progressively scanned 24frame/s image running through an MPEG encoder can reduce the needed bit rate 25% to 35%. Or viewed from another perspective, image quality may be improved for a given bit rate. With a lower frame rate and adjacent picture elements from the progressive scan, motion vector calculations become more efficient.

Figure 2 shows the telecine concept applied to the all-electronic system of HDTV studio mastering at 24frames/s, followed by conversion to the existing 525/625 TV media and to the DTV transmission formats. As illustrated in the figure, the telecine has been replaced with electronic digital standards converters. The principle, however, remains identical. This concept is the essence of the long search for a single worldwide HDTV format for studio origination and international program exchange. All HDTV studios the world over would produce programs to a single video format. This key point was the original driving force for standardization of the 1125/60 format by SMPTE and other organizations. The fact that a consensus failed to materialize does not diminish the importance of the concept.

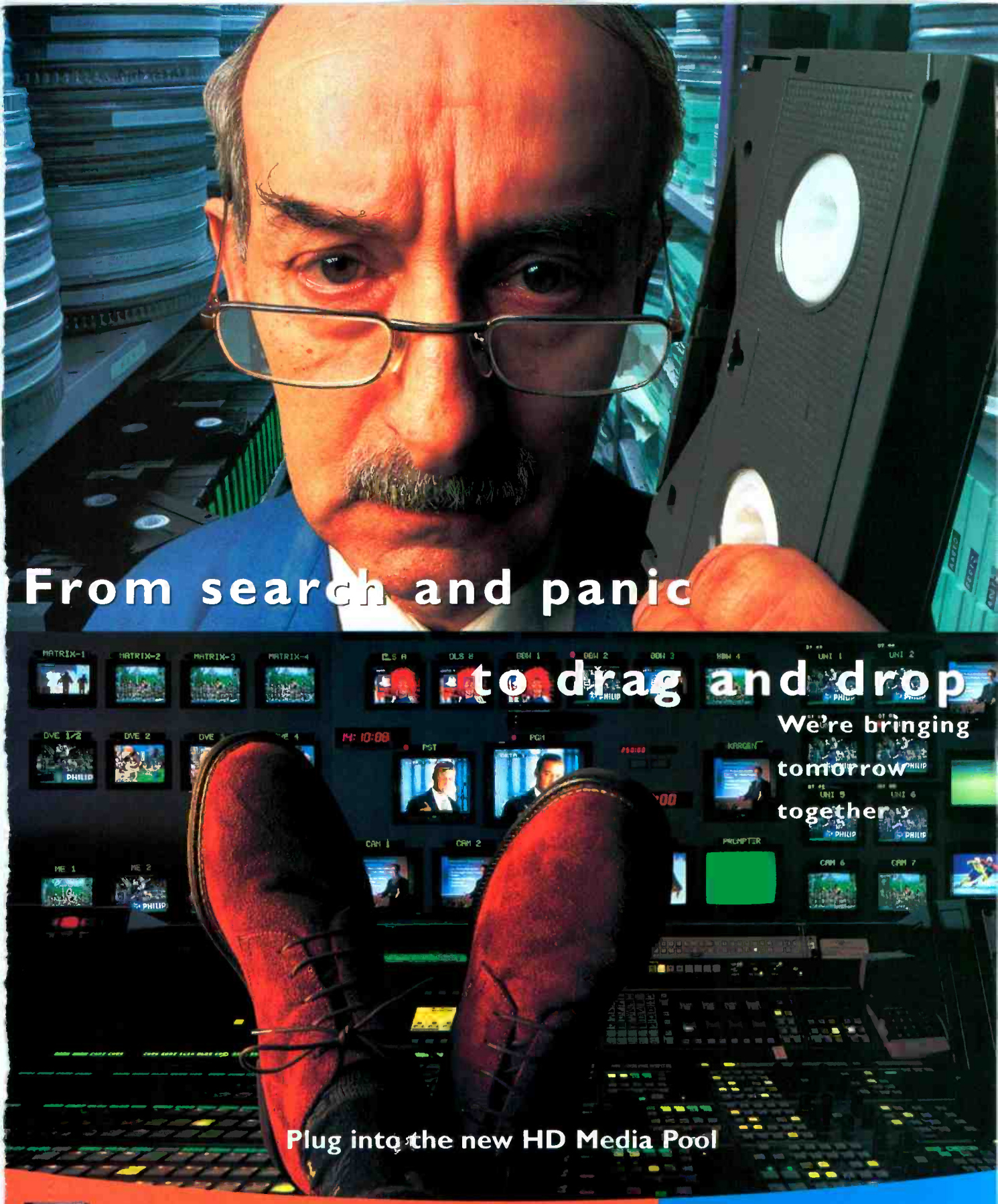
It is fair to point out, however, that the increasing use of MPEG-2 compression is leading to the environment envisioned by the early proponents of 1125/60 standardization for program production. MPEG-2 is rapidly becoming the de facto standard for professional video, and related signal parameters tend to fall in line behind it. Indeed, program exchange capability was one of the reasons MPEG-2 was chosen for the Grand Alliance DTV system and for the European DVB project.

Furthermore, the video standards harmonization efforts of ITU-R Study Group 11/3 and SMPTE/EBU have essentially brought the worldwide HDTV production standard issue full-circle. The 24frame/s video mastering concept takes electronic imaging to a higher level of standardization and interchange capabilities.

Film types

In addition to the higher level of technical performance required of an HDTV film-to-video transfer system, a variety of film formats must be accommodated. Scene composition poses some of the greatest production challenges. The most common film formats include:

- Conventional television aspect ratio of 1.33
- Widescreen nonanamorphic aspect ratio of 1.85
- Widescreen anamorphic aspect ratio of 2.35
- Positive and negative films
- 16mm film (optional)



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The major source of 35mm program material consists of films produced for television and prints of features made for theatrical release. In anticipation of HDTV broadcasting, some filmed TV programs have been produced in widescreen formats. On the other hand, most theatrical productions are in widescreen formats either horizontally compressed – *anamorphic CinemaScope* (2.35:1) – or nonanamorphic (1.85:1). Because of this variation in screen size, some image truncation (pan and scan) or variable-size letterbox presentation may be necessary with certain material.

VIDEO	FILM
Sensitivity	Exposure index (EI) Speed
Resolution	Resolving power
Colorimetry	Sharpness; Modulation transfer curves
Grayscale	Color reproduction
Dynamic range	Exposure latitude
Noise	Diffuse rms granularity

Table 1. The different terminologies used in the video and film industries for comparable imaging parameters.

Between the sprockets

To appreciate the role that HDTV production systems can play – and, indeed, are playing – in the film industry, it is appropriate to briefly examine some of the important parameters of 35mm film.

Color motion-picture film consists of three photosensitive layers sensitized to red, green and blue light. Exposure and processing produce cyan, magenta and yellow dye images in these layers that, when projected on a large screen or scanned in a telecine, produce the color pictures.

Film manufacturers continue to improve their product specifications for speed, grain and sharpness. It has been estimated that another 10X improvement still is possible with silver halide technology. The quality of film images, versatility of production techniques, and worldwide standardization keep 35mm film an important and valuable tool for the production of images for TV broadcast.

Motion pictures, most prime-time TV programs and TV commercials are originated on color negative film. From these originals, prints can be made for broadcast and distribution in either 35mm or 16mm formats. Duplicate negatives can be made and large numbers of prints prepared for theatrical release. Telecines are capable of scanning color positives or color negatives. A program originated on color negative can be transferred directly to tape, edited electronically, then broadcast. The same negative also can be edited, then broadcast from either film or a transferred tape.

There are many reasons why film remains the medium of choice for origination. One of the main reasons is an undefined phenomenon called the "film look." This characteristic has defied quantification by performance parameters but continues to be a major consideration among producers and commercial product customers. Another advantage of film origination is that it is a standard format worldwide and has been for many decades. Programs originated on film can be readily syndicated for distribution in any of the conventional video standards.

HDTV camera/film production

So, what does the future hold for film and video? Quite apart from the issues surrounding the final portrayal of HDTV and film images are the more important implications of what happens when images from the two media are brought together in the production and post-production environment. In this context, the primary concern is about *matching* the two images to achieve a seamless intercut or, possibly, a blue-screen composite. This integration of images, originated from two separate media (video and film), can take place in one of two domains:

Film domain – Image processing and integration follow the transfer of HDTV to film by an electronic-beam recorder or laser recorder.

Electronic domain – Image processing and integration follow the transfer by telecine of the film imagery to HDTV.

Electronic integration is perhaps the more likely option because of the numerous advantages of all-electronic post-production and image manipulation. Indeed, the concept of electronic intermediate film post-production has been a topic of considerable interest since the original adoption of SMPTE 240M in 1988.

Just the facts? Maybe not

During evaluation of any new electronic imaging system, discussions tend to focus on horizontal pixel counts and scanning line numbers, to the exclusion of other important parameters. In the case of HDTV, the image is, in fact, multidimensional. The aggregate aesthetic quality of the picture is a complex combination of the following elements: aspect ratio, horizontal resolution, vertical resolution, colorimetry, grayscale, and total dynamic range for still images, and other "dimensions," such as temporal resolution and lag, for moving images.

The historic difficulty in finding a common ground for discussing high-definition video and film imaging lies as much in the disparate terminology as it does in the task of properly quantifying some of the technical parameters. (See Table 1.)

When images, originated either on film or video via an HDTV camera, are to be combined in the electronic domain for possible integration (a *composite* or an *intercut*), they should (must, in some cases) match each other as closely as possible in all of the imaging dimensions. The seamless operation of an electronic intermediate film system relies upon the success of such matching.

A good match between the characteristics of separate images originated on film and HDTV depends upon the specific transfer characteristics of each and upon the exercise of certain operational discretionary practices during their separate shooting. Some fundamental disparities between film and video have worked against such an ultimate matching of grayscale and other parameters. However, a number of advancements have been made to improve the degree of match between the overall operational transfer characteristics of the two media, including:

- Substantial improvements in video camera pickup devices.
- A better understanding of the respective media transfer characteristics.
- Innovations in manipulation of the video camera transfer characteristics.
- Increasing interest in HDTV possibilities within the creative community.

Together at last

The marriage of film and HDTV is an important, ongoing effort. Regardless of which high-definition image mastering format is used, it must offer interoperability with film. In spite of its many variations in format and aspect ratio, film has served – and will continue to serve – as a major worldwide exchange standard, unencumbered by the need for standards conversion or transcoding. Thus, the image quality achievable from 35mm film has served as a guide for the development of HDTV.

Debate will continue over the "film look" vs. the "video look." However, with the significant progress in HDTV resolution, gamma, chromaticity and dynamic range, the ultimate performance of film and video have never been closer. ■

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Hitachi SK-3000 HD camera

Hitachi's SK-3000 studio and SK-3000P portable multistandard digital cameras, with newly developed 2.2-million-pixel CCDs, provide true 1080i output for HDTV. Because of the modular design of these cameras, 720P and 480P formats also can be accommodated. Also, NTSC (480i) outputs are provided in both digital and analog representations. Hitachi's SK-3000 series cameras provide separate processing and control of the HDTV and NTSC signals.

JVC D-9 HD recorder

JVC Professional Products Company will show working samples at NAB '99 of its D-9 HD recorder, switchable from 1080i to 720P. This ½-inch component digital editing recorder will record more than 60 minutes of true HDTV at 100Mbits/s – twice the data rate of current Digital-S models. It will also play back existing 50Mbits/s recordings, allowing stations to preserve their current libraries and ease into HDTV broadcasting.

AMS Neve audio consoles

AMS Neve is offering a digital processing platform for its digital broadcast and post-production consoles. Known as *ESP*, the processor cards make use of the latest 0.6-micron technology chips, and they feature 21 AMS Neve custom ASICS to turbocharge nine DSP chips. ESP is the third generation of proprietary processing platform developed by AMS Neve.

Snell & Wilcox HD production switchers

Joining the HD1012 and HD1024 is the Snell & Wilcox HD1010 switcher – a compact unit designed for telecine/post-production and small OB van applications.

The control panel has a small footprint, and the mainframe takes up only 5RU. The HD1010 is ideal for color correction, using its frame stores and optional color corrector, and for picture rotation, using the optional DVE. All the HD production switchers (HD1012, HD1024 and HD1010) support 1080i and 720P and soon will support the 1080P/24 format.

Leader Instruments HDTV waveform monitor

Leader Instruments Corporation has upgraded its HDTV digital/analog waveform monitor with the LV 5152D, which operates in both 720P and 1080i systems. Extensive monitoring functions include waveform, vector, picture and stereo monitoring. Line-select, precision cursors, menu control of digital and analog setups, and storage of 10 front-panel setups round out the operating features. The LV 5152D accepts two SDI inputs, switchable from the front panel, and provides a buffered SDI output from the feed selected.

Dolby E audio system

Dolby Laboratories is introducing its end-to-end solution for broadcast audio delivery, Dolby E, models DP571 and DP572. Dolby E is an audio coding technology that allows for post-production and distribution of discrete multichannel audio via the existing digital audio infrastructure.

The DP571 encoder provides inputs for up to eight audio channels, plus SMPTE time code, which can help establish solid audio/video synchronization.

The DP572 decoder recovers the metadata and decodes the Dolby E audio data to four PCM audio output pairs locked to the local sampling rate by a video color black reference signal.

Leitch ezHD

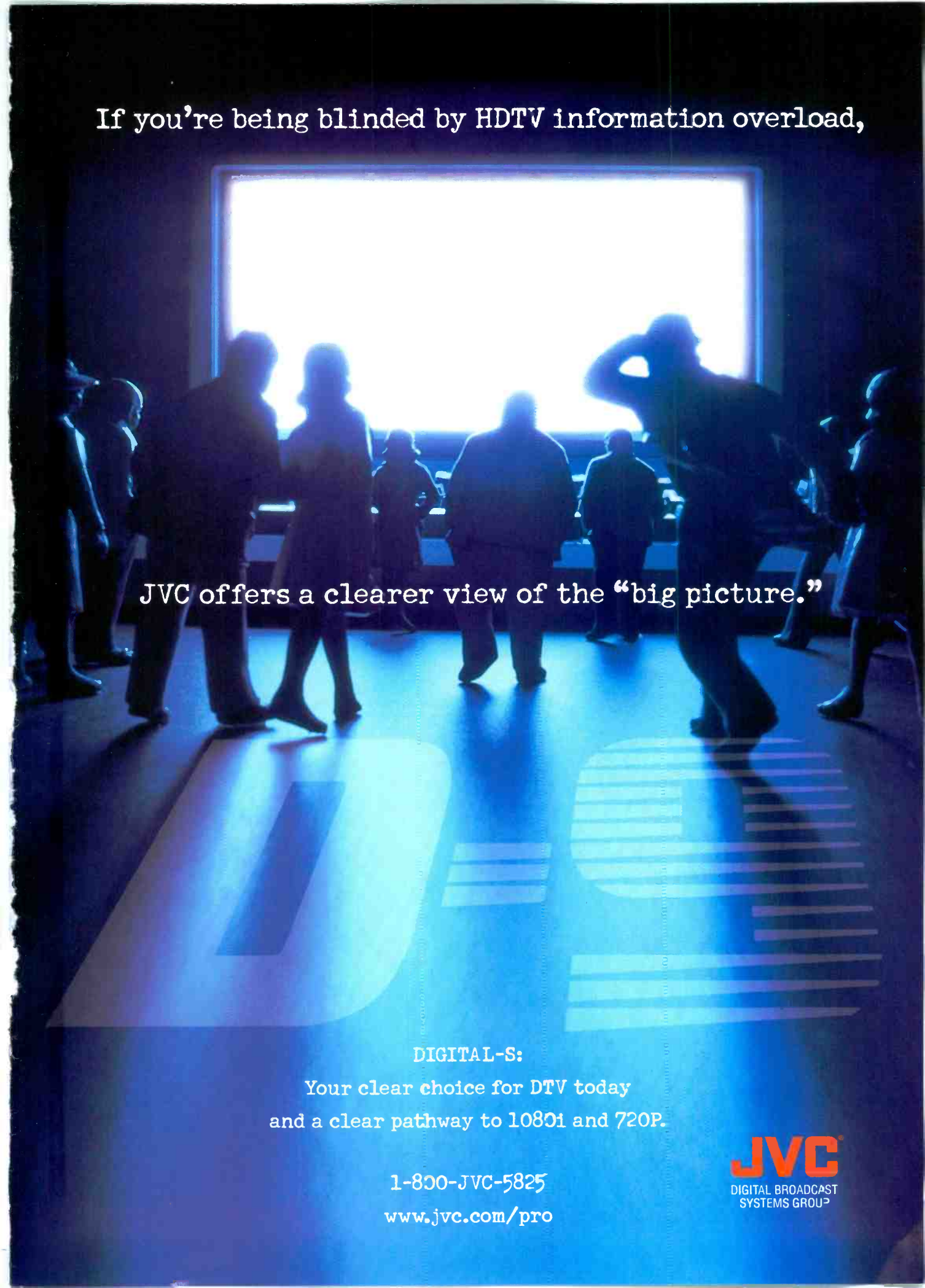
Leitch Technology Corporation introduces an integrated HDTV solution for broadcast facilities. The ezHD package of high-definition products includes Leitch's award-winning Juno HDTV upconverter, its HDTV logo generator/inserter, the HDTV digital-to-analog converter, and a DigiBus frame with remote control panel.

Orad CyberSet HD virtual set

Orad's high-definition virtual studio system supports both the 1080i and 720P HD formats. CyberSet HD removes the expenses that regular studios find when converting or creating sets in the widescreen format. With CyberSet HD there is no need to repair or improve physical scenery and backdrops; high-resolution images are achieved in software. Moreover, any existing set model can be upgraded to the HD format. All Orad products are compatible and can be incorporated into the high-definition system.

Philips LDK 9000 HDTV camera

Philips, in conjunction with the Polaroid Corporation, introduces progressive HDTV camera technology. The LDK 9000 series camera produces high-quality HDTV pictures with advanced 1-inch frame transfer CCD sensors that offer a choice of either 720P or 1080I formats. The series 9000 control system provides a full array of OCPs and MCPs to enhance operational capabilities, and allows for seamless integration with other Philips cameras under one control system. The LDK 9000 cameras can be configured for either the studio or the field. ■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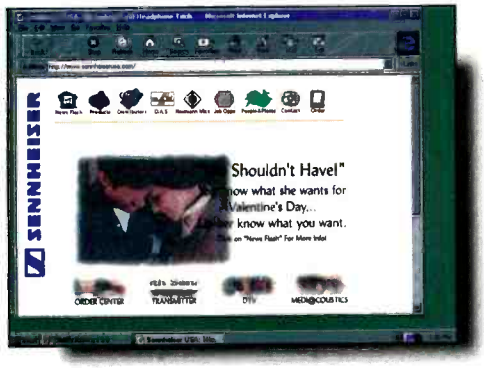

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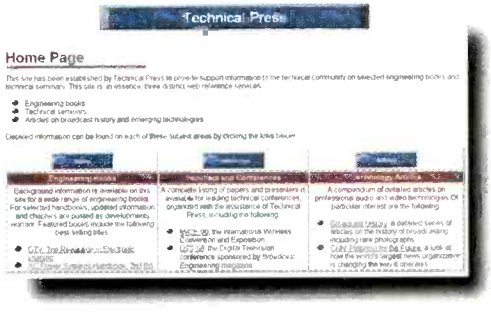

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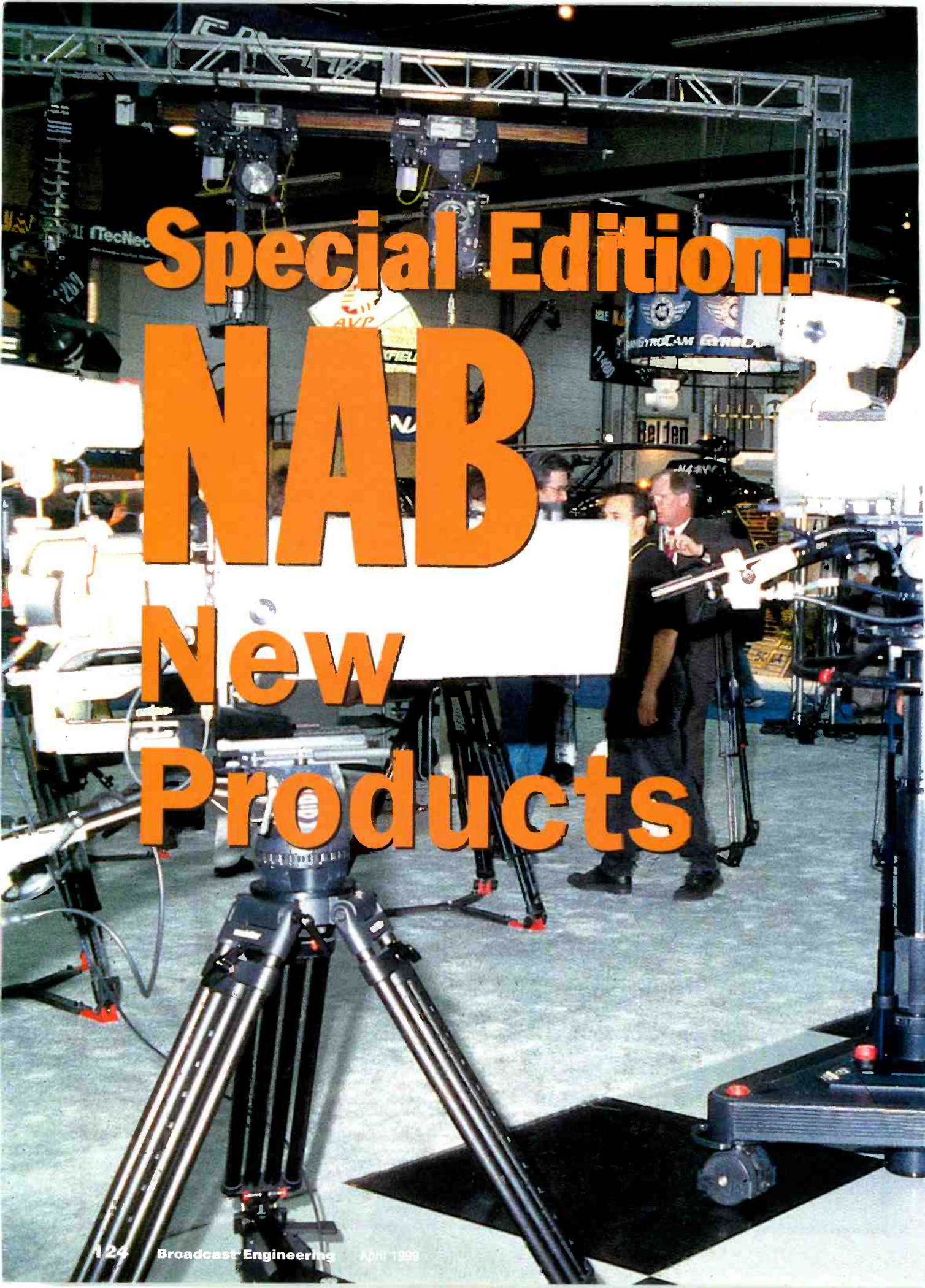
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when added to an ECHOlab superswitcher, unit offers single port control of Pinnacle DVExtreme, Lighting and Deko, Hewlett-Packard video servers, Sierra video routers, tape decks and other devices; can be customized with accompanying software.

781-273-1512; fax: 781-273-3275; www.echolab.com

Booth: L13219 **Circle (382) on Free Info Card**

Special Edition

Nonlinear editor
Editing Technologies Cut/Time

allows broadcasters to record LINE and ISO feeds, to begin editing as it is recording and to begin playing the AIR version even before the editing process is completed; various synchronizing functions and the ability to roll in from an external VTR are also provided.

818-840-1101; fax: 818-556-3973; www.etcedit.com

Booth: L25139 Circle (383) on Free Info Card

Digital transition transmitter
EMCEE Broadcast Products TTU250HD

solid state and compact transmitter features a Harris CD-1a Exciter/8VSB moulator; has a self-contained air-cooled system, broadband amps and built-in protective circuitry; unit is upgradable to 1000Ws in solid state model and up to 2500W with one Tetrode tube final amp.

800-233-6193; 717-443-9575; fax: 717-443-9257; www.emceebrd.com

Booth: L18102 Circle (384) on Free Info Card

Video and audio converter
Ensemble Designs Avenue System

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

530-478-1830; fax: 530-478-1832; www.ensembledesigns.com

Booth: S3744 Circle (385) on Free Info Card

Multichannel audio converter
Euphonix Multi-channel Audio converter

provides as many as 28 high quality 96kHz/24-bit capable signal paths per unit, series provides interfaces between any combination of analog, MADI or AES/EBY audio formats; features include on-demand SRC per stereo pair, transcode bit rate reduction and autodetection of external sync; for use in machine room interconnection applications or as stand-alone high resolution audio snake.

818-766-1666; fax: 818-766-3401; www.euphonix.com

Booth: L12483 Circle (386) on Free Info Card

Reclocking Electrical to Fiber Conversion DAs
Evertz Microsystems 7705EO-HD

HD 7705OE-HD provides conversion from optical signals sent over fiber to two outputs reclocked of 1.5Gb/s serial video via coax.

905-335-3700; fax: 905-335-3573; www.evertz.com

Booth: L21332 Circle (387) on Free Info Card

True-diversity VHF system
EVI Audio R100 Diversity Wireless Microphone System

features the company's patented Secure-Phase true-diversity circuitry, which uses the signal from both antennas at all times to increase signal strength, minimize dropouts and increase range; offers a choice of hand-held, body-pack, lavalier, headset and guitar wireless systems to meet any need.

616-695-6831; fax: 616-695-1304;

Booth: L24228 (in Telex booth)
Circle (388) on Free Info Card

Some people wake up and go to work. You wake up and you're still at work.

In video, living with your work takes on new meaning. At Quantegy, we're dedicated to the manufacturing of professional media, so we share the very same passion that you do for your craft. From our precision mechanisms to our patented formulations, we examine every detail of the manufacturing process to deliver consistent, unmatched performance. Yes, we're probably both a bit obsessed with our product.

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Circle (58) on Free Info Card

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In conventional systems, every frame synchronizer needs a physical link to its tracking audio delay unit.

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RollTrack™ is exclusive to our IQ Modular™ system. It's a connection-free automatic tracking delay that sorts out the sync process automatically without the mess and configuring problems of external cabling.

Just one wire links all boxes in the network to our RollCall™ remote control system. So now you can place audio and video modules as far apart as you choose.

SIMPLY MORE INTELLIGENT

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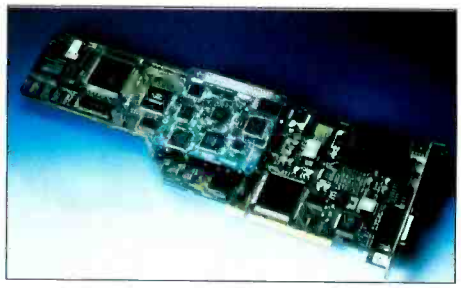
So uncomplicated. But then this is just one of the many intelligent ways that our unique IQ Modular™ system unravels the complex demands of the digital era.

Roll Call™ Controllable IQ MODULAR by SNELL & WILCOX

For more Information on the IQ MODULAR System contact:
Tel: (408) 260 1000, Fax: (408) 260 2800, e-mail: info@snellusa.com website: www.snellwilcox.com
Circle (59) on Free Info Card

Special Edition



Window NT on-air presentation system
Florical Systems AirBoss BT

a Windows NT, frame-accurate TV presentation system.

352-372-8326; fax: 352-375-0859; www.florical.com

Booth: L13302 **Circle (390) on Free Info Card**

DV editing system
Fast Multimedia US DV Master Pro

features two digital ports, switchable for two external devices and an internal port for video I/O; DV device control via link (FireWire); I/O box for analog devices; one video input S-VHS/Hi8 (Y/C) or VHS (includes composite adapter and one audio input and one output in CD-quality, 16-bit, 44.1kHz stereo.

800-249-FAST; 425-354-2002; fax: 425-354-2005; www.fastmultimedia.com

Booth: S7832
Circle (389) on Free Info Card

Multichannel digital fiber optic transmitter
Force Comlux

offers optical terminals to 3.1Gb/s; a line of video, audio and data codecs and network building blocks; now DWDM capable allowing transmission (per fiber) of up to 512 NTSC, 256 PAL, 768 MPEG-2 or 128 D1/D5 SDI at an aggregate rate approaching 50Gb/s.

800-732-5252; 540-382-0462; fax: 540-381-0392; www.forceinc.com

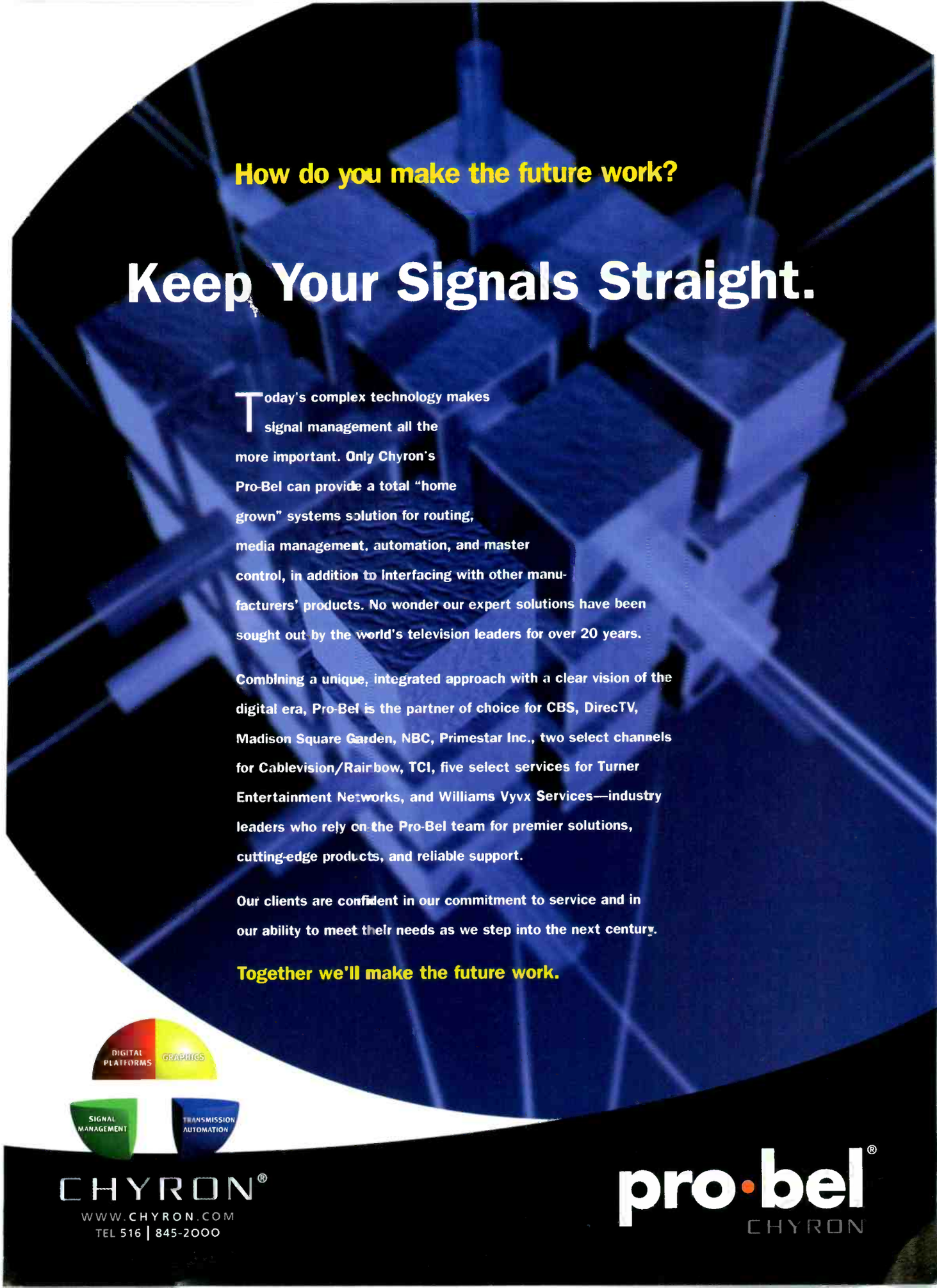
Booth: S4541
Circle (391) on Free Info Card

Brick batteries
Frezzi Energy Systems FSP-100

brick battery provides 7Ah, 14.4V with 100WH, giving the user more than 50 percent more run time than standard bricks; FSP-100 is also available with Frezzi's Energy Gage FSP-100EG.

800-345-1030; 973-427-1160; fax: 973-427-0934; www.frezzi.com

Booth: L17439
Circle (392) on Free Info Card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Today's complex technology makes signal management all the more important. Only Chyron's Pro-Bel can provide a total "home grown" systems solution for routing, media management, automation, and master control, in addition to interfacing with other manufacturers' products. No wonder our expert solutions have been sought out by the world's television leaders for over 20 years.
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Special Edition

ENG production lenses
Fujinon HA15X8BEVM

HD lens designed for ENG production with digital servo controls; provides operators with greater flexibility over the control of zoom, focus and iris functions; Digital Quick Zoom function lets the operator rapidly zoom-in to check focus with the push of a button, and then return automatically to the preset shot; Cruise Zoom function allows the operator to fix the zoom at a predetermined speed by pressing the cruise button while zooming.

800-553-6611; 973-633-5600; fax: 973-633-5216; www.fujinon.co.jp

Booth: L21135 Circle (393) on Free Info Card

Digital audio hard-disk recoder
360 Systems TCR/4

synchronous digital audio hard disk recorder designed to outperform DAT in production applications; provides random-access audio in a four-channel format for enhanced compatibility with VTRs; features 24-bit audio quality, high-density removable disks, massive internal hard-disk storage, complete timecode implementation and VTR emulation.

818-991-0360; fax: 818-991-1360; www.360systems.com

Booth: L11272 Circle (351) on Free Info Card

Digital audio cable
Gepco International 552604GFC

the latest addition to the company's popular 5526GFC digital audio multipair series; specifically designed for transmission of 110(AES/EBU digital audio; features 26-gauge conductors that are insulated with a precision, low-loss dielectric and shielded by 100 percent foil Mylar (with drain wire); integrates a nonconductive polyethylene rod that is twisted together with the insulated conductors; construction provides structural support and maintains the characteristic 110Ω impedance of the pairs.

800-966-0069; 312-733-9555; fax: 847-795-8770; www.gepco.com

Booth: L16460 Circle (395) on Free Info Card

Network control and monitoring
Drake Automation Network Control & Monitoring

Designed for MPEG distribution systems. Provides transport stream and off-air monitoring and alarm systems, as well as countrywide network monitoring and alarms for digital terrestrial and satellite systems.

973-631-6200; fax: 973-631-6206; www.drake-automation.com

Booth: L18118 Circle (379) on Free Info Card

Suite Mixer
Graham-Patten Systems D/ESAM 8000

eight-bus surround sound-capable digital edit suite mixer in a new range of rackmount digital audio terminal equipment.

800-422-6662; 530-273-8412; fax: 530-273-7458; www.gpsys.com

Booth: L12805 Circle (397) on Free Info Card

601 measuring devices
Hamlet Video Monitor Scope and DIGI Scope 601E

601E variants benefit from the modular, expandable 10-bit processing of the more technical 601 units, with a reduced function set more suited to nontechnical operations.

0500 625 525 (UK); +44(0)1494 793763; fax: +44(0)1494 791283; www.hamlet.co.uk

Booth: L24245 (in James Grunder booth)
Circle (398) on Free Info Card

PSIP solution for ATSC broadcasting
Harris Guideplus PSIP Manager

offers broadcasters a solution to gather, manage and disseminate PSIP data, including local system time, program guide and rating information, extended program descriptions and virtual channel information; allows broadcasters to manually edit data and make local program entries.

513-459-3400; fax: 513-459-3890; www.harris.com/communications

Booth: L16710 Circle (399) on Free Info Card

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Circle (61) on Free Info Card

Special Edition

Multiformat digital audio recorder
HHB Communications Genex GX8500

multiformat recorder equipped to record in linear and nonlinear modes, designed for multichannel recording and mastering applications where quality sound is required; records in AES/EBU, SPDIF, SDIF 2 and DSD (Direct Stream Digital) formats; compatible with the new Super Audio CD standard; optional internal A/D, D/A converters enable recording up to 24-bit/96kHz.

310-319-1111; fax: 310-319-1311; www.hhb.co.uk

Booth: L13994 **Circle (400) on Free Info Card**

EMF Industrial Compliance Meter
Holaday Industries HI-3804

The HI-3804 is a low-cost EMF detection and measurement solution for applications in the 10-42 MHz ISM frequency bands. Features include on-board data logging and review, electric and magnetic field strength measurements, linear, squared and power density units display, and a dynamic range of 0.05-50mW/cm2.

877-HOLADAY; 612-934-4920; fax: 612-934-3604; www.holadayinc.com

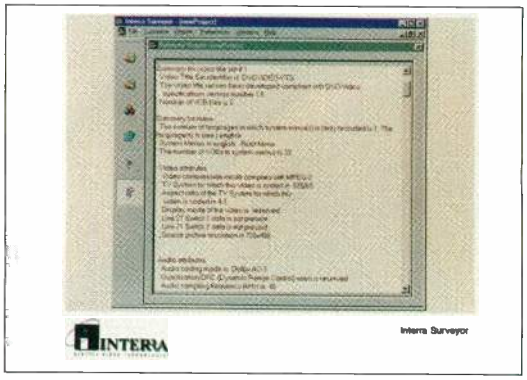
Booth: L13980 **Circle (401) on Free Info Card**

Digital video routing switcher
Hotronic AS800

provides switching capability for serial digital video I/O; includes adjustment-free operation and user-friendly display; fully compatible with SMPTE259M standard; operational up to 540Mb/s; optional RS-485 dedicated output channel remote controls allow operators to gain routing control of an output channel from another location.

408-378-3883; fax: 408-378-3888; www.hotronics.com

Booth: L23638 **Circle (402) on Free Info Card**



Video analysis software
Interra Digital Video Technology Surveyor

provides a selection of tests that can be performed on a variety of DVD data types throughout the DVD production process; program available to detect errors in early production stages; includes standard set of factory-defined tests applicable to specific DVD elements, such as video manager, titles and title sets, multiplexed video objects and elementary video and audio streams.

408-573-1400; fax: 408-573-1430; www.interrainc.com

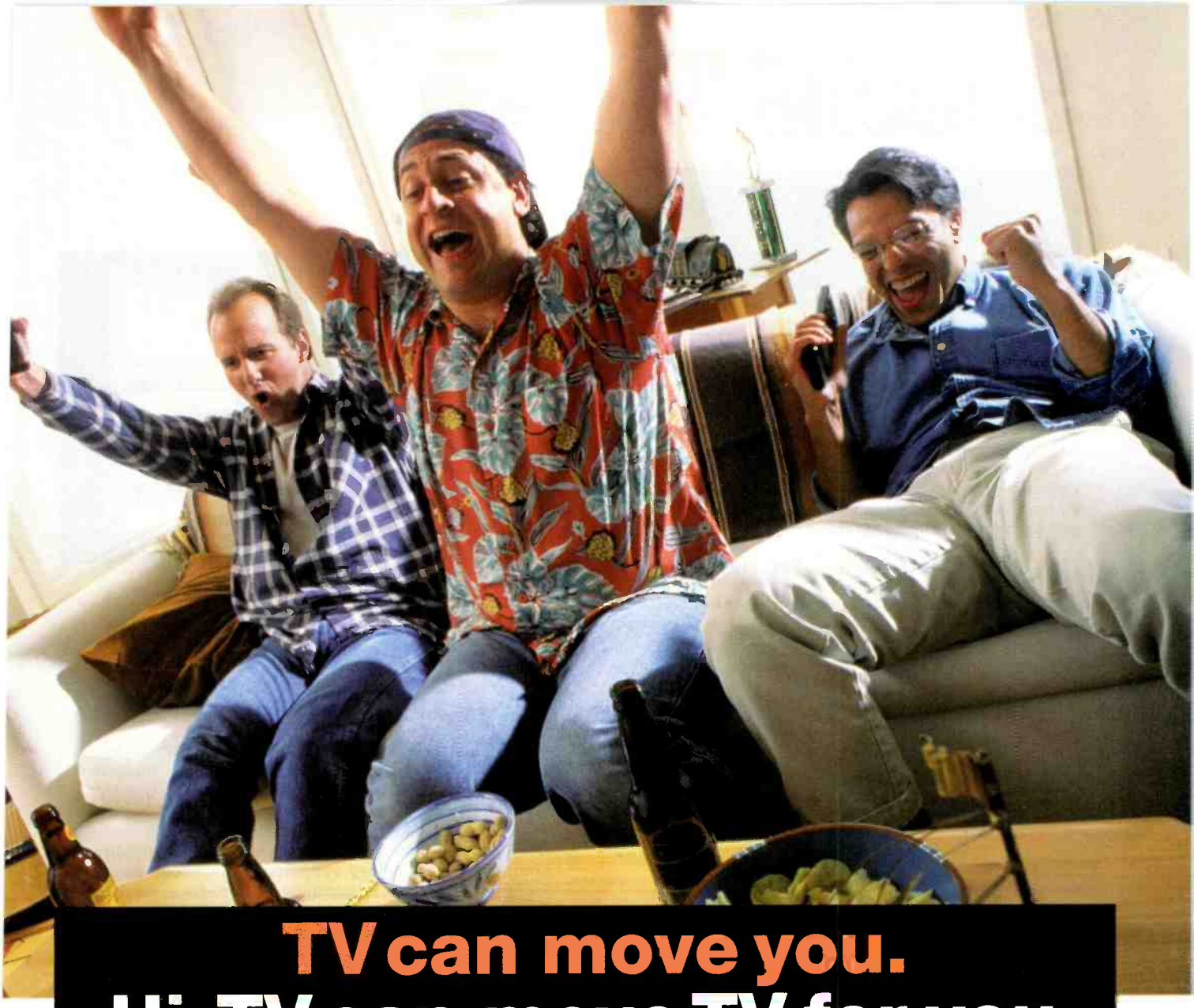
Booth: M13118 **Circle (403) on Free Info Card**

Solid state translator
Itelco DTV Solid State Translators

a 50W VHF solid state translator; part of a family of translators that extends to 10kW in UHF DTV; designed for rebroadcast applications that will bring DTV to remote communities.

303-464-8000; fax: 303-464-8770; www.itelco-usa.com

Booth: L13346 **Circle (404) on Free Info Card**



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Special Edition

Input display and resizing unit
James Grunder & Assoc. Feral QS-440

multiple input display and resizing device; can accept up to four video inputs and combine them into one video output; each input is independently scalable, allowing for resizing vertically and horizontally; offers composite and Y/C I/O, automatically transcoding between the two formats; accepts genlock inputs; fully controllable via RS-232.

800-331-2019; 913-492-4666; fax: 913-895-7496; www.grunder.com

Booth: L24245 Circle (405) on Free Info Card

VHF/UHF transmitters
LeBlanc Broadcast Larcan-TTC MX series

a series of VHF/UHF solid-state, air-cooled transmitters; output power from 1W to 100W; rack mountable units range from 3RU to 10RU.

905-844-1242; fax: 905-844-8837; www.leblanc-group.com

Booth: L18844 Circle (406) on Free Info Card

HD frame sync
Leitch HDTV Glue Video Frame Synchronizer

a DigiBus processing module capable of retiming an I/O signal to a local station clock, allowing clean processing of all synchronized signals; supports 1080i and 720p standards; interoperates with other DigiBus features; cleanly handles hot switch on input.

800-231-9673; 757-548-2300; fax: 757-548-4088; www.leitch.com

Booth: L22257 Circle (407) on Free Info Card

MPEG-2 server
Leitch ASC VR400 MPEG-2 Server

an MPEG-2 broadcast server that incorporates high-bandwidth centralized Fibre Channel storage, integrated software RAID technology, and advanced multiformat codec technology; provides bidirectional video channels for recording and playback, eliminating the need to configure dedicated encoders and decoders; advanced multiformat compression technology supports simultaneous recording, storage and playback (including back-to-back playback) of MPEG-2 4:2:2 profile at main level (up to 50Mb/s) and MPEG-2 4:2:0 main profile at main level (up to 15Mb/s) compression formats.

800-231-9673; 757-548-2300; fax: 757-548-4088; www.leitch.com

Booth: L22257 Circle (408) on Free Info Card

Commercial insertion system
Channelmatic-LIMT LVS 300

an ad insertion system that provides all the requisite functions and infrastructure for local ad insertion; advertising spots are encoded into MPEG-2 format via a fully integrated MPEG-2 file encoder system and are archived and stored on the Channelmatic-LIMT VCS 300; offers single channel-integrity and is redundant capable; provides 200 minutes of server capacity and more than 48 hours scalable; image quality is in 8Mb/s.

619-596-8968; fax: 619-596-8969; www.cml.com

Booth: L16307 Circle (366) on Free Info Card

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Silicon Graphics® workstations and servers are already HDTV compliant. Whether you decide on 480P, 720P, 1080i, or simply stick with standard resolution, we have you covered. Silicon Graphics workstation-based solutions are at the heart of today's live broadcast graphics for news, sports and special events. Many of our customers are already editing HDTV content. Let our Origin™ video computing platform solve your media streaming needs, from thousands of MPEG streams to DVCPRO™ and uncompressed HDTV. No other open platform has as many media management and distribution applications. To find out more about Silicon Graphics broadcast, cable, and satellite solutions, check out our Web site at www.sgi.com/broadcast.

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Circle (49) on Free Info Card

Special Edition

HD video patchbays
ADC Telecommunications CJ301N/4012N

mid-sized straight-through jacks for independent ground applications, such as tie-line panels; connectors mount on standard 0.5000 midsized centers and have a rated bandwidth of up to 2.4GHz for analog, serial digital and HD video applications.

800-366-3292; 800-726-4266; fax: 612-946-3237; www.adc.com

Booth: L21149 Circle (352) on Free Info Card

Testing software
Adherent Stream Monitor Plus

software extension for Stream Station II and Stream Player II; provides a set of real-time tools for development, production and transmission; consists of ETR 290 first-, second- and third-priority conformance measurements; features continuous display of ETR 290 error violations and transient errors, multiplex occupancy and dynamic bar charts/timelines and other displays and diagnostics.

+44 1223 200700; fax: +44 1223 200701; www.adherent.com

Booth: L12609 (in Sencore booth)
Circle (353) on Free Info Card

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With today's technology, we communicate via e-mail, digital cellular telephone, and fax machine. But not since the advent of color television nearly fifty years ago, has there been such a buzz in the television industry. Some say it's the natural progression of things; some say the world of communications will never again be the same. One thing is for certain: digital television will change the way we view the world.

As the new millennium approaches with the transition to digital technology on every broadcaster's schedule, you want to work with the RF experts. With our vast experience in the design, installation, and support of digital transmission equipment, ADC Broadcast Systems is poised to create innovative solutions to meet your station's specific DTV needs. We offer a complete line of DTV transmission products including 100 kW average power IOT transmitters, air-cooled Diacrode and solid state transmitters, and 8VSB Modulators. We have engineered these products with one thing in mind: to make your conversion to DTV as smooth as possible.

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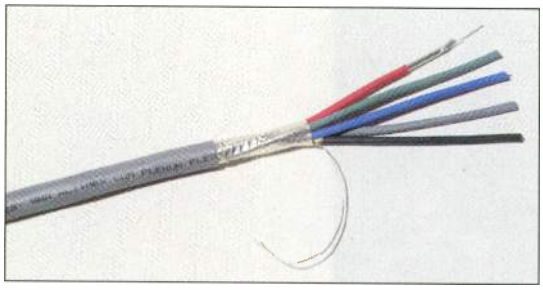
Special Edition



Multimedia Cable
Altinex CB5200PL Series

offers seven coaxes, five twisted pairs and 3-20AWG singles bundled together.

800-ALTINEX; 714-990-2300; fax: 714-990-3303; www.altinex.com

Booth: S8566 **Circle (354) on Free Info Card**

Digital audio mixing system
AMEK US Operations DMS

digital mixing console with operational efficiency from audio format to bus structure to user-interface; can be reset to handle formats from mono to 5.1; features a proprietary, 32-bit floating-point parallel processing system.

888-286-9358; 615-360-0488; fax: 615-360-0273; www.amek.com

Booth: L12589 **Circle (355) on Free Info Card**

Multiformat post-production console
AMS NEVE Libra Post

dedicated panel provides monitoring and matrix processing inserts for up to eight-channel surround; console also features a shared automation system with Digital Film Console and automated joystick panning; includes optional multimachine control and integrated hard disk recording/editing.

+44-1282-457011; fax: +44-128241-7282;

Booth: L22337 **Circle (356) on Free Info Card**

High-performance coaxial line
Andrew WIDEline transmission line

a high-performance solution for multiplexing broadcast application, incorporates a unique bellows section into each inner conductor that compensates for differential expansion between inner and outer conductors

800-DIAL-4-RF; 708-349-3300; fax: 708-349-5444; www.andrew.com

Booth: L22937 **Circle (357) on Free Info Card**

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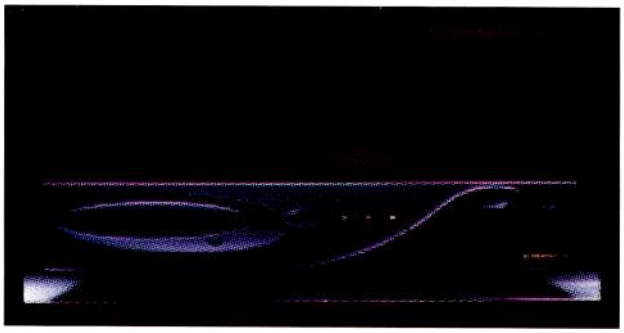
Web Site: http://www.tctus.com

Circle (53) on Free Info Card

THE CHOICE OF POWER

Special Edition



Digital Nonlinear Video Editing System
Applied Magic ScreenPlay

ScreenPlay is a turnkey, nonlinear video editing system with quality video, real-time performance and a user-friendly interface; allows users to create and edit videos from digital or analog camcorders using a TV, video or computer monitor for display.

888-624-4255; 760-931-6417; fax: 760-931-6440; www.applied-magic.com

Booth: S7266 **Circle (358) on Free Info Card**

Digital test signal generator
Asaca/ShibaSoku TG15C6

designed for use as a reference signal source for test applications; soon to be available for telecine applications with a 24-frame structure; includes more than 30 types of output test patterns installed; features mode switching, bounce and scroll functions.

800-423-6347; 310-672-6765; fax: 310-672-3665; www.shibasoku.co.jp

Booth: L23442 **Circle (359) on Free Info Card**

Combined line/frame synchronizer proc-amp
Axon Digital Design BV FLS-200

can be used as a stand-alone line synchronizer or autophaser frame synchronizer; it will have a remote-controllable digital video processing amp where total gain, luminance gain, chrominance gain, black level and saturation will be the main adjustment features.

+31(0)13511 6666; fax: +31(0)13511 4151; www.axon.nl

Booth: L11522 **Circle (360) on Free Info Card**

Display Processor
BARCO Uno Pro

enhanced version of the UNO display processor; provides the ability to display both 480p material and 480i material on one high-resolution display; provides true broadcast features, such as pulse cross, blue-only, under-monitor display and tally functions.

1-800-992-5016; 770-590-3600; fax: 770-590-3610; www.barco.com

Booth: S3344 **Circle (361) on Free Info Card**

Audio snake cable
Belden Wire & Cable Brillance Audio Snake Cable

The Brilliance audio snake cable with enhanced NEC ratings features the 1408R Series CMR-rated audio snakes (UL 1666). For installations that require penetrating multiple floors, this riser-rated cable is economical, eliminating the need for metal raceways, fireproof shafts and firestops.

800-BELDEN1; 765-983-5200; fax: 765-983-5294; www.belden.com

Booth: L22974 **Circle (362) on Free Info Card**

Modular card frame
Benchmark Media Systems System 2000

a modular card frame designed to house up to three digital conversion modules; a heavy-gauge, RF tight, 1RU chassis equipped with card guides and Phoenix connectors.; a passive motherboard provides interconnect between converter modules and the interchangable I/O connector modules.

800-262-4675; 315-437-6300; fax: 315-437-8119; www.benchmarkmedia.com

Booth: L21270 **Circle (363) on Free Info Card**

Multichannel video server w/ RAID protection
DVS Digital Video Systems ProntoServer Video Server 480P

multichannel video server with RAID protection for uncompressed D-1/D-5 operation in digital post and HD 4:1-compressed operation in HD broadcast applications.

818-846-9444; fax: 818-846-7444; www.digitalvideosystems.com

Booth: S2844 **Circle (381) on Free Info Card**

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Engineered to be ahead of its time, our video jack *already meets the SMPTE 292M specification.* Our new HD Series delivers consistent characteristics across the bandwidth, offering you the reliability you need now...and the required performance for tomorrow.

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www.pinnaclesys.com

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Special Edition

Production console
Calrec Audio C2

designed for medium-sized production facilities and vehicles where space limited; a redesigned compact console with dedicated mix-minus output per channel, conventional and VCA grouping, per channel metering of input and mix-minus output, six AUX buses and dedicated surround-sound facilities.

+44 142 284 2159; fax: +44 142 284 5244;

Booth: L11485 **Circle (365) on Free Info Card**

10-bit uncompressed DDR
Drastic Technologies VVW 5000 Production workstation

a 10-bit uncompressed DDR that is ideal for high-quality production applications; features open architecture and robust file translation capabilities.

416-255-5636; fax: 416-636-8780; www.drastictech.com

Booth: S1561 **Circle (380) on Free Info Card**

Automation/media management and multichannel works
Chyron Meridian

acts as a cost-effective, yet comprehensive, solution for smaller TV stations integrating station automation and video servers into their operations for the first time; main components of the Meridian system include hardware automation controller for single-channel control; schedule editing applications for on- and off-line user workstations, VTR interface for multi-VTR control, server interface application, including material acquisition, database management and traffic system interface application.

516-845-3871; fax: 516-845-3888; www.chyron.com

Booth: L24801 **Circle (367) on Free Info Card**

Digital intercom system

Clear-Com Intercom Systems ICS-2110

feature nine talk/listen keys, five-character LED diplays and keypad for dialing and station programming.

510-496-6666; fax: 510-496-6699; www.clearcom.com

Booth: L25062 **Circle (369) on Free Info Card**

Digital broadcast receiver
Comstream IntelliCast2000

The IntelliCast2000 digital broadcast receiver features flexible transmission of digital video, audio or data. It features operation in BPSK or QPSK modulation, with sequential, Viterbi, or concatenated Viterbi and Reed-Solomon forward error correction coding to provide compatibility with Comstream's industry standard IntelliCast401VR, IntelliCast801 and IntelliCast 101 receiver.

619-458-1800; fax: 619-657-5404; www.comstream.com

Booth: S5665 **Circle (370) on Free Info Card**

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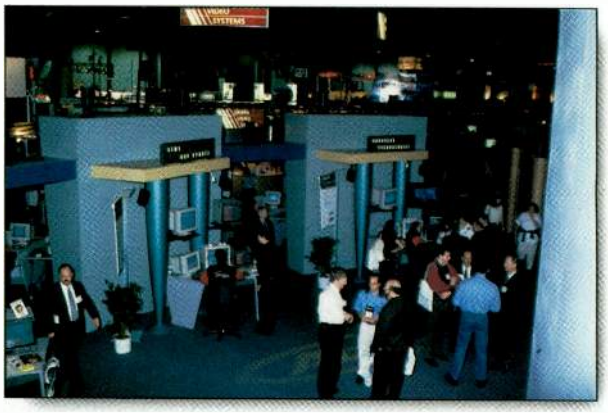

DTV transmitter
Continental Electronics LDMOS

a solid-state transmitter that uses less power than older tube transmitters; efficient digital modulators requires less power than PWM or PDM transmitters

800-733-5011; 214-381-7161; fax: 214-381-3250; www.contelec.com

Booth: L18830 Circle (371) on Free Info Card

Content rating assignment program
CPC-Computer Prompting & Captioning V-Chip Software

allows broadcasters and program producers to assign content rating to each second of a program, which reflects program content at that time; allows more programs to be viewed by larger audiences, because only carefully selected scenes are blocked out by V-chip instead of the entire program.

800-977-6678; 301-738-8487; fax: 301-738-8488; www.cpcweb.com

Booth: L24454 Circle (372) on Free Info Card

Nonlinear editing system for TV/Video
Digital Processing Systems Gravity

Designed by editors for use in a live production environment; feature set includes multicamera support, dedicated custom hardware audio and video control panels, customizable user interface, guaranteed playback through automated time-line scanning, full system recovery in the event of power or system failure — up to the last edit.

800-775-3314; 606-371-5533; fax: 606-371-3729; www.dps.com

Booth: L22278 Circle (373) on Free Info Card

Digital Broadcasting

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How do you make your TV broadcast sound better to viewers in a world of barking dogs, rumbling clothes dryers and other background noises, not to mention those excessively loud commercials? Quite a challenge. The solution? For analog broadcasting: OPTIMOD audio processing. And now the same is true for digital transmission.

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** See our Web Site for Bob Orban's DTV processing recommendations*

Circle (68) on Free Info Card

Special Edition

Digital multichannel encoder
Dolby Laboratories DP569

The DP569 supports encoded bit rates from 56- to 640Kb/s and channel configurations from mono to 5.1-channel surround sound. It lets broadcasters use time code to trigger configuration changes automatically for smooth program transitions. Disk-authoring facilities can use timecode to encode separate program segments accurately and create single encoded soundtrack files. Other features include fault-monitoring circuits that warn of system failure, bypass connections for hot-standby operation in broadcast installations, and remote control from Windows95/NT-equipped devices.

800-33-DOLBY; 415-558-0200; fax: 415-863-1373; www.dolby.com

Booth: L21328, S7438 **Circle (377) on Free Info Card**

Noise reducer
Digital Vision ANRII

combined with a quality BRICKwall filter; comes in 4:2:2, 4x4, 8:4:4 and HD-formats

888-914-5200; 310-914-5200; fax: 310-914-0011; www.digitalvision.se

Booth: L12111 **Circle (374) on Free Info Card**

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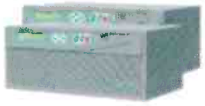

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Special Edition

VTR/DDR/slow motion controller
DNF Industries ST400

component of DNF's Clip Management Systems for use with video servers; features enhanced 15-line display to easily identify stored clips and six-channel support for complex clip playout capabilities; designed to expand the capabilities of DDR and video servers; allows production switchers to load and play video clips, complex graphics and animation on a video server.

818-252-0198; fax: 818-252-0199; www.dnfcontrols.com

Booth: L24085 **Circle (376) on Free Info Card**

Broadcast automation system
Doremi Labs BAS-1

a turnkey package featuring Doremi v1mx2 DVRs; ETERE TV software is a fully-developed Windows 95/NT product that is designed to control DVRs, VTRs, cart machines, video routers, logo generators, master control and disk servers through final transmission

323-874-3411; fax: 323-874-3401; www.doremilabs.com

Booth: L11232 **Circle (378) on Free Info Card**

Multiple playlists on one display
Louth Automation Air Monitor

monitors multiple playlists on one easy-to-read display.

650-843-3665; fax: 650-843-3666; www.louth.com

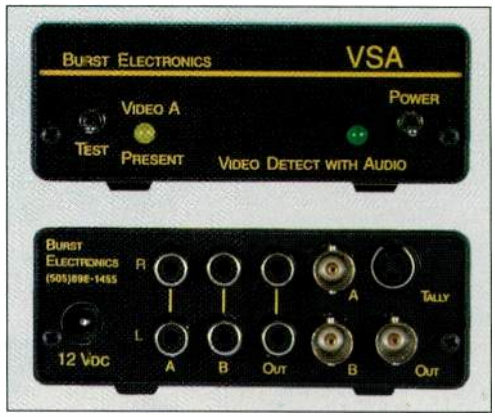
Booth: L11226 **Circle (411) on Free Info Card**

ATSC-compliant transmitter
Technosystem S.P.A. DTV Transmitter

available in configurations compliant to DTV requirements per ATSC A53 document; solid state is VHF and UHF band; high-power terode or IOT line can be upgraded with 8VSB digital modulator; features Reed-Solomon encoder, Trellis encoder, 8VSB digital filtering and serial or parallel digital data input.

+39 06 225871; fax: +39 06 2282355;

Booth: L12446 **Circle (455) on Free Info Card**

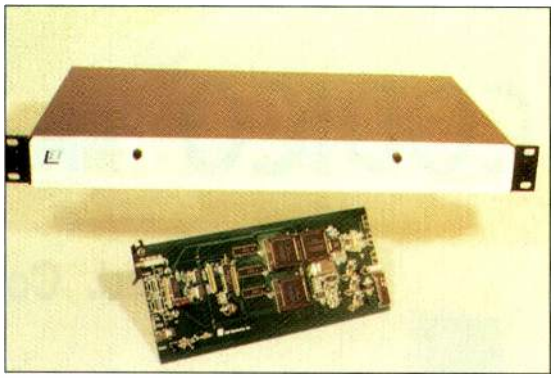


Video loss detection switch
Burst Electronics VSA

detects the quality of video signal but allows user to control the audio signal; if video is lost or of poor quality, the VSA is switched to secondary video and audio sources simultaneously.

505-898-1455; fax: 505-898-0159; www.burstelectronics.com

Booth: L21463 **Circle (364) on Free Info Card**



Digital sync generator
Link Electronics SPG-812

designed to provide accurate analog and digital timing reference signals; consists of a 1RU chassis and power supply with six slots to accommodate various modules; slots are dedicated as dual analog/digital audio reference tone generator and master genlock module; each output module is available for 525/60 NTSC or 625/50 PAL operation; there are three outputs per module and each module has its own independent infinite timing adjustments; dual tone generator is available to provide silent, 0dB,-10dB and -20dB levels.

800-776-4411; 573-334-4433; fax: 573-334-9255;
www.linkelectronics.com

Booth: L21267 **Circle (409) on Free Info Card**

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Circle (56) on Free Info Card

Special Edition

Tuneable body pack transmitter
Sennheiser Electronic SK3063

minitature transmitter that provides 50mW of output power; 16 selectable frequencies in a 24MHz micro range operate within the UHF macro range of 450- to 960MHz; the B50 battery pack powers wireless mic for four hours using two AA batteries.

860-434-9190; fax: 860-434-9022; www.sennheiserusa.com

Booth: L24825 **Circle (442) on Free Info Card**

Video disk recording system
Sierra Design Labs HD 1.5 Plus

a video disk recording system that allows you to record in standard 601 or uncompressed DTV/HDTV video; using four of Sierra's Quickframe video disk recorders with a new Sierra HD processor, you can record up to 120 minutes of uncompressed HDTV video - or used separately, each Quickframe unit delivers standard D-1/ITU-R BT601-4 video; in HDTV mode, the HD 1.5Plus is a full-specification DTV recorder featuring record and playback of SMPTE 274M/292M 1920x1080 interlaced signals (1080i) with the ability to switch to SMPTE 296M 1280x720 progressive scan video (720p); the HD 1.5Plus is available in HD capacities starting in 10-minute increments (four times 15 minutes of SDTV) and requires only 16 rack units of space with optional eight-channel audio.

702-831-7837; fax: 702-831-5710; www.sdlabs.com

Booth: S3338 **Circle (443) on Free Info Card**

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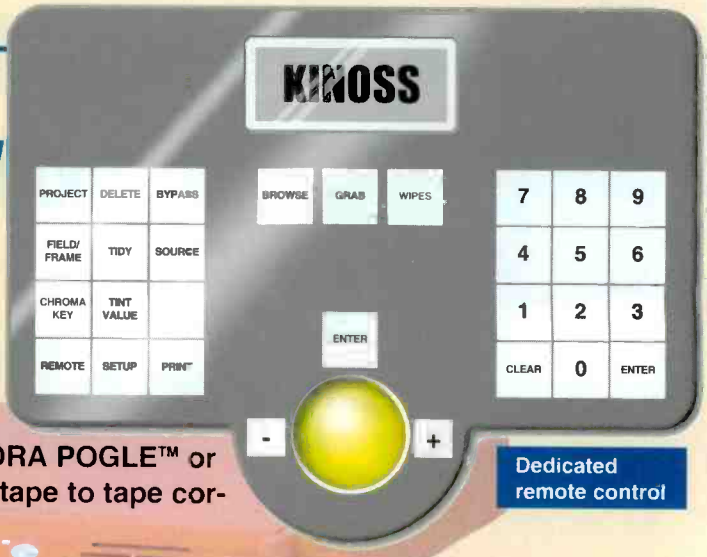

Dedicated remote control

For film colorists, who use high grade telecine controller as DA VINCI RENAISSANCE™, PANDORA POGLE™ or DIGITAL VISION™ of paramount importance, for tape to tape correction.

Kinoss is designed to allow comparisons *on a color video monitor*, the only tool which can reproduce the true colors (not a computer monitor). Kinoss can display 999 stored pictures.

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- GPI, front panel or remote control
- RS 232/422/485 (option)
- Digital serial output (or Pal)
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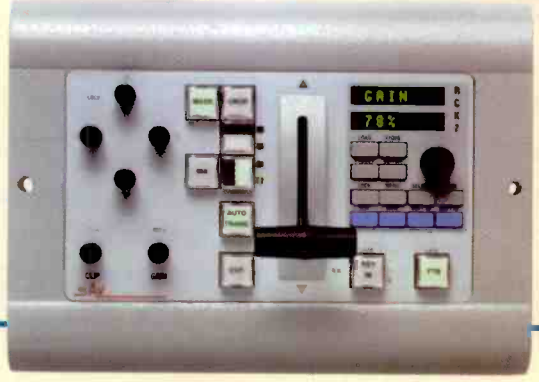
- LGA-100DK Digital unit (built in keyer)
- LGA-100P Pal or NTSC unit (built in keyer)

Digital linear mixer-keyer MKR-100



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DTV/HD recorder
Sierra Design Labs HD270

able to record and play standard uncompressed 8- or 10-bit 4:2:2 video and then, with a simple software switch, record and play a 1080i HD signal when used in conjunction with the Sony HDCAM HD SDTI processor card set; the HD270 offers the same capabilities of the Quickframe, making it an ideal video disk recorder for HD edit, telecine, duplicating, still/clip store and server for broadcast and playout applications.

702-831-7837; fax: 702-831-5710; www.sdlabs.com

Booth: S3338 **Circle (444) on Free Info Card**

Midsized routing switchers
Sierra Video Systems Shasta Series

available in three basic frame sizes for video and audio; 64x64 video in 7RUs or audio in 3RUs, 96x96 video in 11RUs or audio in 4RUs, and 128x128 video in 14RUs or audio in 5RUs.

916-478-1000; fax: 916-478-1105; www.sierravideo.com

Booth: L15960 **Circle (445) on Free Info Card**

Data injection integrator
SkyStream DBN-35

a data injection integrator that allows broadcasters to insert IP data into the null packets of an incoming MPEG-2 transport stream; capability enables broadcasters to deliver data at greater than 10 times the speed of current telephone connections; unit accepts MPEG video inputs from any number of MPEG encoders, multiplexers and modulators using a DVB-ASI or SMPTE-310m input and output interface. Data is injected into the stream via 10/100Base T Ethernet.

650-390-8800; fax: 650-390-8990; www.skystream.com

Booth: S5122 **Circle (446) on Free Info Card**

Special Edition

Picture-unsteadiness correction unit
Snell & Wilcox Shakeout, Picture Fixer

Shakeout is specifically designed for OB and studio applications. Picture Fixer features real-time detection of impairments and estimation of quality levels, real-time restoration with control of level of correction by the user, and interactive restoration tools for badly damaged materials - down to pixel level.

+44(0)1730 821188; fax: +44(0)1730 821199; www.snellwilcox.com

Booth: L23745 Circle (447) on Free Info Card

Multiphase decoder with noise reduction
Snell & Wilcox Golden Gate

capable of choosing pixel by pixel, which will provide optimum decoding quality.

+44(0)1730 821188; fax: +44(0)1730 821199; www.snellwilcox.com

Booth: L23745 Circle (448) on Free Info Card

Compact editing recorder/player
Sony Electronics DNW-A28 Betacam SX

features frame-accurate editing on Betacam SX tape and Betacam SP playback capabilities; can be used as a primary or backup field recorder, desktop editor or in a traditional rack system; based on MPEG-2 4:2:2 P@ML compression technology; suited for ENG applications; features preread editing and sequential recording functions; provides 525/625 operation, variable playback and Good Shot Marker Support.

800-635-SONY; 408-432-1600; www.sony.com/professional

Booth: L16730, 0D 410, S 2775
Circle (449) on Free Info Card

HD processors
Sony Electronics HKPF series

series includes the HKPF-1125 525-HD upconverter board, HK-E270 HDCAM encoder board and the HKPF-D270 HDCAM decoder board; HKPF-1125 is a single-board solution with high-cost/performance ratio to bring existing analog and digital SDTV sources to the HD digital domain; accepts input in conventional NTSC composite analog, 4fsc NTSC composite and 525 component SDI format; also provides three HD serial digital output in 1125-line interlaced HD standards (either 1035 or 1080 active line format); HKPF-E270 is designed to convert HDSDI signal (conforming to the SMPTE292M/BTA S-004b) to SDTI signal; HKPF-D270 is designed to convert SDTI to HD SDI signal (conforming to SMPTE292M/BTA S-004B); HKPF-E270 and HKPF-D270 boards upgrade digital signals to pass through HD signals.

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Booth: L16730, 0D 410, S 2775
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- **Ultimate** - UHF solid state, broadband amplification utilizing LDMOS technology.
- **Comark Advantage** - High power, digital UHF IOT with networking, advanced diagnostics and control technology to position you for the new millennium.
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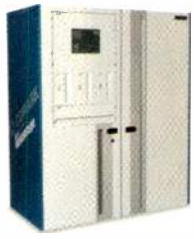

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Special Edition

12-bit digital Betacam camcorders

Sony Electronics DVW-790WS, DVW-709WS and DVW-707

three 12-bit digital Betacam camcorders offer improved features and functionality for quality production of SD images; camcorders are targeted for high-end production, ENG, sports and feature news markets; DVW 790WS is a 4:3/16:9 switchable digital camcorder and the DVW-709WS is a 4:3/16:9 switchable digital camcorder.

800-635-SONY; 408-432-1600; www.sony.com/professional

Booth: L16730, 0D 410, S 2775
Circle (451) on Free Info Card

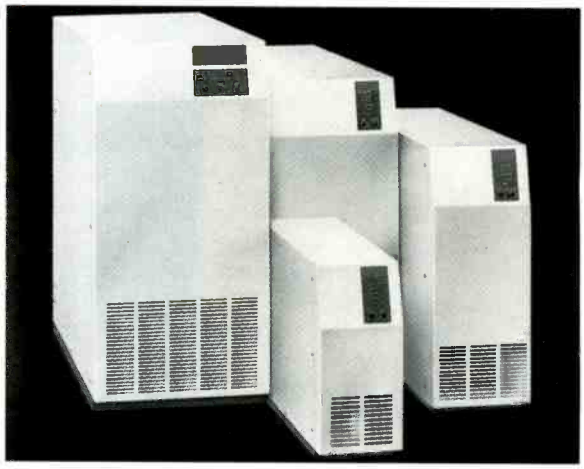
Videotape library system

Odetics Broadcast TCS90-PRO

videotape library can be configured to hold up to 344 videotapes.

714-774-2200; fax: 714-780-7594; www.odetics.com/broadcast/

Booth: L21120 **Circle (423) on Free Info Card**



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Booth: L24855 **Circle (452) on Free Info Card**

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offers improved user interface for importing any 2D format image, two video inputs for support of multiple virtual sets and full DVE effects, greater control over video elements including perspective, complete control over video mapping, support for simultaneous presentation of multiple video walls and remote control features.

877-955-2230; 212-463-9902; fax: 212-463-9931

Booth: S1750 **Circle (440) on Free Info Card**

DAT recorder

TASCAM DA-40 Digital Audio Tape Recorder

offers a broad range of controls, sampling rates and analog and digital I/Os; unit can interface with existing audio systems of any complexity; new features include trim controls for analog, LXR outputs, character pack recording and playback, two memory locate points, variable AUTO ID time setting from one-half to three seconds in half-second increments, auto END ID recording, variable REC Mute time from two to seven seconds in one-second intervals, and programmable repeat times.

323-726-0303; fax: 323-727-7635; www.tascam.com

Booth: L22383 **Circle (454) on Free Info Card**

Portable microwave link

RF Technology UCL Series

range of analog-/digital-ready, portable microwave links for ENG; available in any frequency band from 1.2GHz to 26GHz; transmitter and receiver feature direct dial of RF frequency in 100KHz steps; analog modulation is FM, digital modulation schemes include COFDM, QPSK, 16QAM and FSK; features quick replacement baseband modulation cards.

800-762-4369; 203-866-4283; fax: 203-853-3513; www.rftechnology.com

Booth: L25153 **Circle (439) on Free Info Card**

Master control system

Tektronix Grass Valley M2100

features Squeezeback Crop and Framestore Keyer; Squeezeback Crop provides transitioned removal of foreground lines and is configurable as part of Squeezeback system; Framestore keyer offers internal nonvolatile storage of pages of video and key signals and storage of station ID logos.

800-547-8949; fax: 503-627-7275; www.tektronix.com/VND

Booth: L22914, S 424, S7172 **Circle (456) on Free Info Card**

Digital phosphor oscilloscopes

Tektronix TDS 3000

phosphor oscilloscope displays the video content of signals, such as an analog oscilloscope and video module; provides a line-select capability for easy viewing of vertical interval test signals; provides amplitude, time and distribution of amplitude over time; includes triggering for SD signal formats; displays, stores and analyzes complex signals in real time.

800-426-2200; 503-627-7111; fax: 503-627-5593; www.tek.com

Booth: L22914, S 424, S7172 **Circle (457) on Free Info Card**

Special Edition

Automated video measurement set with SDTI

Tektronix VM700T with SDTI option

offers an optional analysis of the serial digital transport interface; designed for electronic design engineers and manufacturers of professional video equipment involved in the development, debugging and testing of products with SDTI interfaces; SDTI option verifies product's SDTI physical layer to SMPTE 305M specification.

800-426-2200; 503-627-7111; fax: 503-627-5593; www.tek.com

Booth: L22914, S 424, S7172
Circle (458) on Free Info Card

S-Video router module

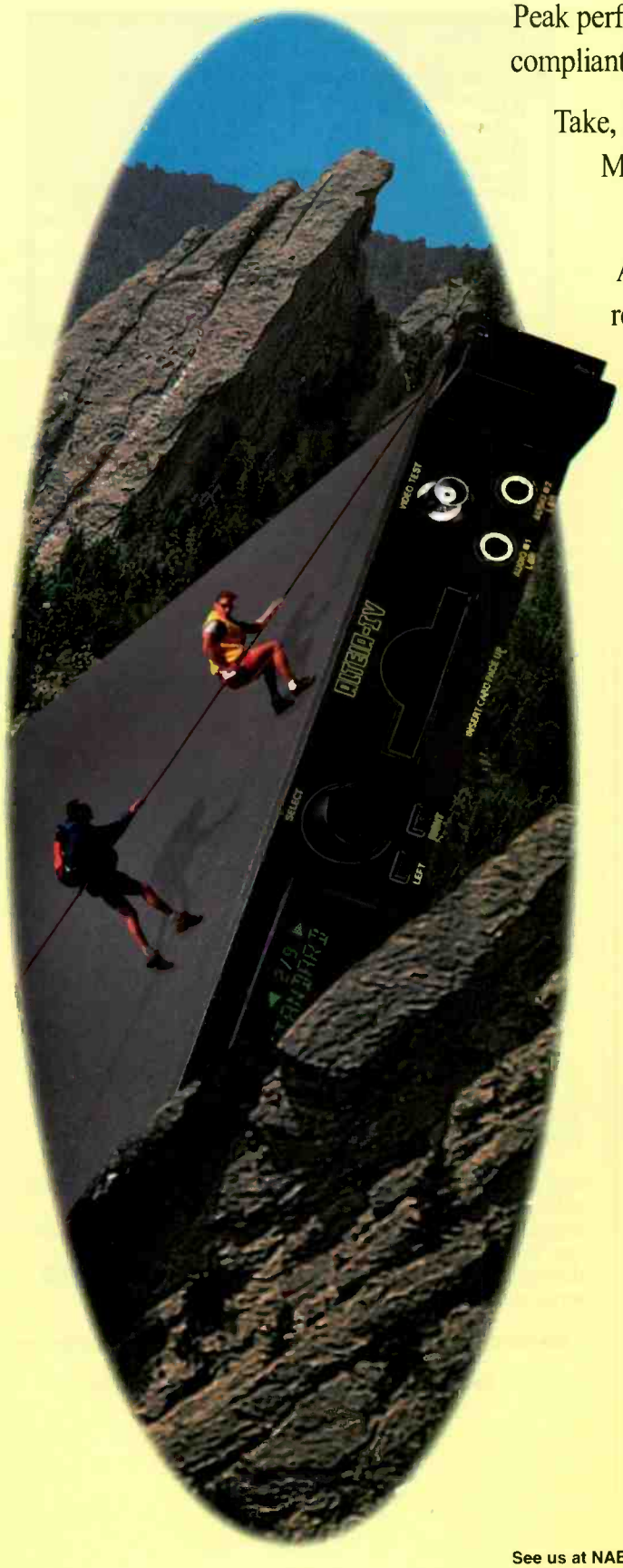
Telect Versaframe S-Video Module

8x8 Y/C switcher module that routes signals without signal degradation, providing users flexibility and signal quality for audio/video systems; docks in Telect's configurable VersaFrame signal management system; features S-Video-ready I/Os; handles multiple levels and multiple system addressing for more control flexibility; can be integrated with other system component with eight levels of breakaway.

800-551-4567; 509-926-6000; fax: 509-926-8915; www.avsm.com

Booth: L24477
Circle (459) on Free Info Card

When you move up to 4:2:2 compliant digital, do it with someone you trust.



Peak performance is what the new Alteia Series of DVB 4:2:2 compliant digital broadcast receivers and decoders is all about.

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As with the entire Alteia Series, you get sophisticated remote control and monitoring capabilities and a front panel interface that lets you setup and access the receiver's features without navigating a maze of menus. You also get standard features like Genlock for synchronized outputs, VBI capability, front-panel test ports and a real-time BER meter. Not to mention Standard's unsurpassed reputation for quality and reliability. And all in a package just one rack-unit high.

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Circle (82) on Free Info Card

Special Edition

Multiservice encoder
THOMCAST Communications MSE 5000

performs HD and SD encoding; supports 13 ATSC input formats from 1080p to 480i using the same hardware; Thomson compression chipset provides high compression quality in HD and SD video applications

201-569-1650; fax: 201-569-1511; thomsonbroad.com

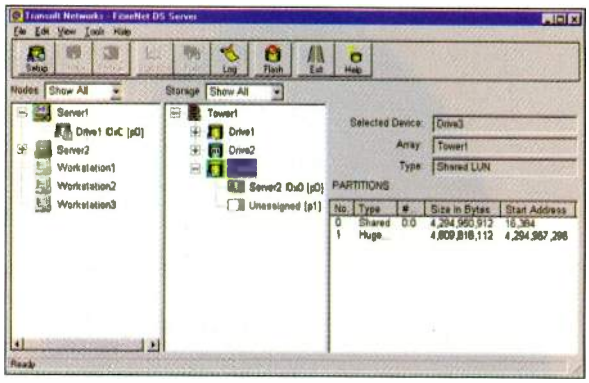
Booth: L18818 Circle (460) on Free Info Card

ATM network interface
Tiernan Communications TATM6000

An ATM network interface supporting one duplex MPEG-2 transport stream.

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

Booth: S4771, OD 230 Circle (461) on Free Info Card



Storage access system
Transoft Technology FibreNet DS

presents the concept of "shared data," and allows heterogeneous or homogeneous hosts to concurrently access file systems; FibreNet DS is the available for high-speed digital data transfer where Mac, UNIX, and NT systems access shared data in audio, video, animation, imaging, data warehousing and other storage intensive production environments.

800-949-6463; 805-897-3355; fax: 805-897-3355; www.transoftnetworks.com

Booth: S9152 Circle (462) on Free Info Card

Video patch panel
Trompeter Electronics MP20W monitor plug

companion product to the Trompeter J214W serial digital video jack; plugs into jack to sample signal without degrading or interrupting the normal through signal path; can be used with most other WECO standard normal through jacks, including the Trompeter J14W and J24W series patch jacks.

800-982-2629; 818-707-2020; fax: 818-706-1040; www.trompeter.com

Booth: L18516 Circle (463) on Free Info Card

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Mark Brooks
Vice President of Engineering
East Coast
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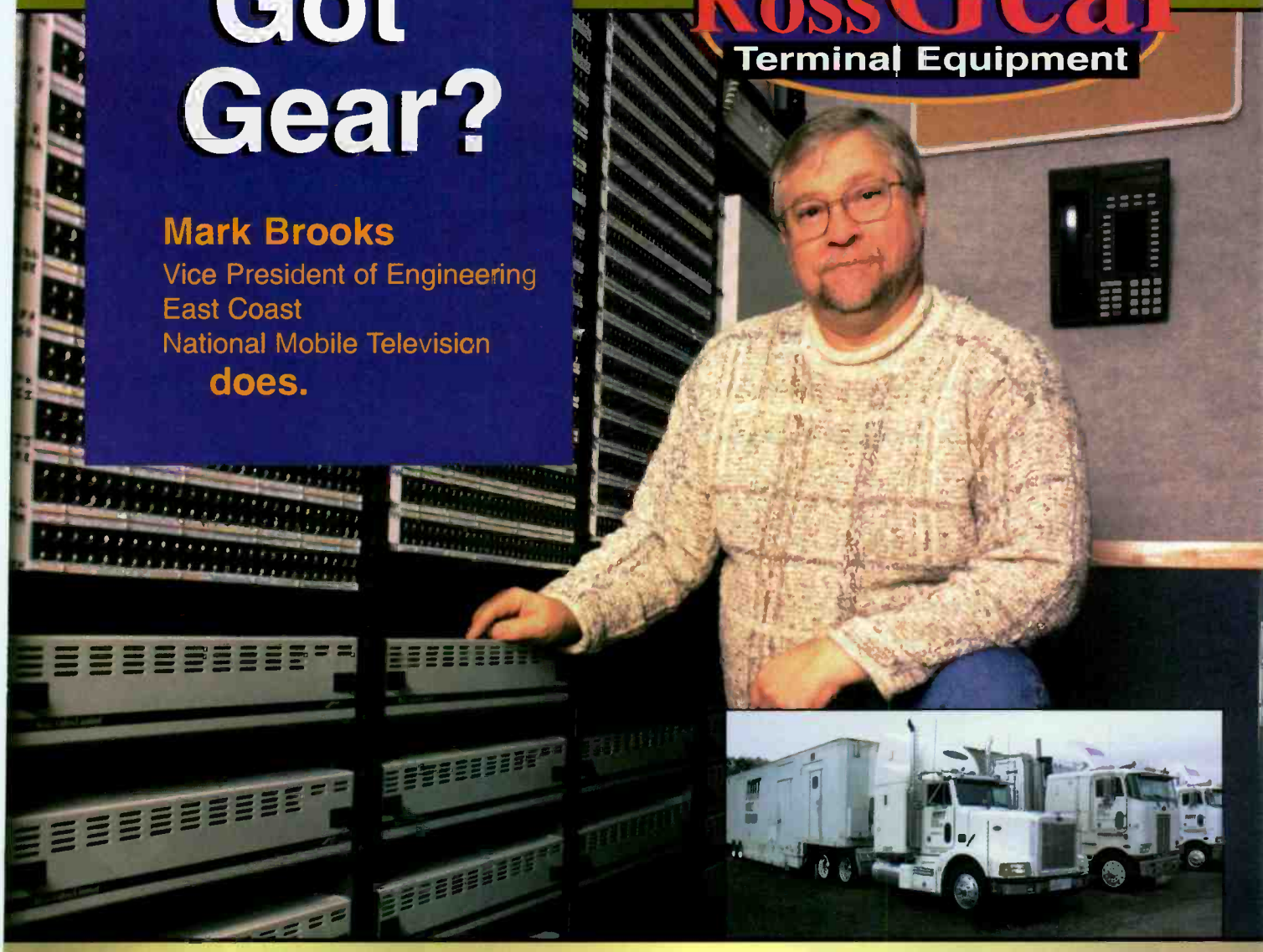
RossGear
Terminal Equipment



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Vice President of Engineering - East Coast
National Mobile Television

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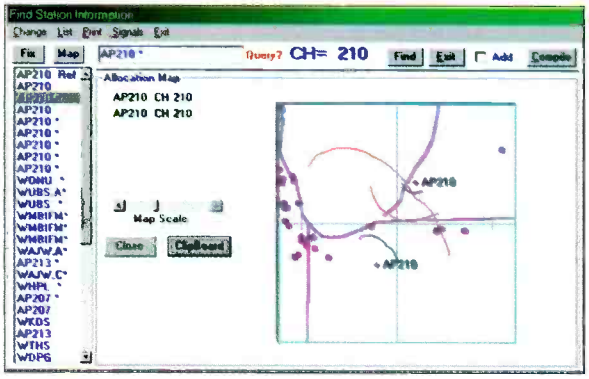
Circle (84) on Free Info Card

Special Edition



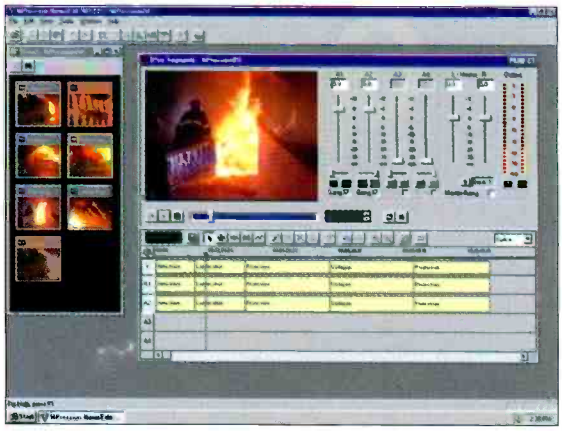
Contour-to-contour program

V-SOFT Communications FMCONT for Windows

Windows version of V-Soft's contour-to-contour program; newest version goes above and beyond previous capabilities; produces bitmap graphics for use in documents and reports; directional antenna pattern editing is also included in the program.

800-743-3084; 319-266-8402; fax: 319-266-9212; www.v-soft.com

Booth: L12481 **Circle (464) on Free Info Card**



Nonlinear editor

Vibrint Technologies NewsEdit

a nonlinear editor with the functionality and speed as deck-to-deck editing, including insert editing; features timeline-based interface, splice, overwrite, replace, fit-to-fill edits, voice-over recording and thumbnail-based gallery for storyboarding; works with MPEG2 4:2:2 or 4:2:0 video and 16-bit stereo PCM audio.

781-275-4088; fax: 781-275-5070; www.vibrint.com

Booth: L13126 **Circle (465) on Free Info Card**

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Special Edition

DV image sequencer
Viewgraphics Viewstore 6000

a multiresolution DV image sequencer that now offers new HD serial I/O capability, and increased storage capacity.

650-903-4900; fax: 650-969-6388; www.viewgraphics.com

Booth: S4341 Circle (466) on Free Info Card

Digital on-air/production console
Wheatstone D-600

a digital on-air production console available in mainframe sizes up to 40 positions; inputs feature four-band EQ, dynamics processing, ducking and eight character source displays, four stereo buses provide both digital and analog outputs; switches, faders and displays are addressable via serial interface.

252-638-7000; fax: 252-637-1285; www.wheatstone.com

Booth: L12171 Circle (467) on Free Info Card

Dual parallel to serial converter
YEM (Yamashita Eng Mfg) SPC-292M

supports the 1035i, 1080i and 720P formats; input and output capabilities include two sets of (1) serial in and (1) parallel out; processing is built around either 8- and 10-bit parallel paths; an LCD display gives the operator an instant status for all converter attributes.

310-544-9343; fax: 310-544-9363; www.yem.com

Booth: L13230 Circle (468) on Free Info Card

Digital broadcast console
Studer (AKG) OnAir-2000

channel-related touch screens used for configuration; analog/digital I/Os in 6-, 12-, 18- or 24-input sections (six faders per section) with XLR connections for up to 48 inputs; total recall of all parameters, administration lockout capabilities.

408-542-8880; fax: 408-752-9699; www.studer.ch

Booth: L18107 Circle (453) on Free Info Card

HD virtual studio
Orad Hi-Tec Systems CyberSet HD

Orad's first-ever HD virtual studio; supports 1080i and 720p HD formats.

+972-9-45020; fax: +972-9-7676861; www.orad.co.il

Booth: S2832 Circle (425) on Free Info Card

HDTV downconverter
YEM (Yamashita Eng Mfg) HSC-525S

the converter is able to input either an HDTV Digital Serial Signal (HDTV SDI - BTA S-004A) or HDTV Analog Signal (Y/Pb/Pr). The converted signals can be output as: NTSC Digital Serial Signals (D1 or D2 SMPTE 259M - 2 outputs), NTSC Analog Component Signals (Y/R-Y/B-Y or GBR) and NTSC Composite Signals (2 outputs). Other HSC-525S converter attributes are: vertical frequency of HDTV, 59.94Hz/60Hz; number of active scan lines, 1035 lines/ 1080 lines; horizontal phase: +/- 8 steps (output mode/edge crop); selection of output modes, squeeze, letter box or edge crop; and an internal enhancer for horizontal/vertical image that can be used to emphasize the outline of the converted images.

310-544-9343; fax: 310-544-9363; www.yem.com

Booth: L13230 Circle (469) on Free Info Card

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www.fiberoptions.com

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Special Edition

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Magni Systems SDM series

integrates serial digital 601 monitoring with video and audio signal processing; series monitors key video parameters, including gamut, EDH and jitter, and display measurement on any picture monitor.

800-237-5964; 503-615-1900; fax: 503-615-1999; www.magnisystems.com

Booth: L22267 **Circle (412) on Free Info Card**

Audio routing switcher
MATCO MA-204B

self-contained playback automation system with an internal 22x3 routing switcher, dedicated programming, keypad, front panel and Microsoft Windows PC program for remote control.

800-348-1843; 408-353-2670; fax: 408-353-8781

Booth: L24839 **Circle (413) on Free Info Card**

Real-time, nonlinear editing engine
Matrox DigiSuite DTV

combines Matrox DigiSuite real-time nonlinear editing engine with support for DTV standards, including DV25, DV50, MPEG-2, IEEE-1394 and SDTI.

800-361-4903; 514-685-2630; fax: 514-685-2853; www.matrox.com/video

Booth: S4032 **Circle (414) on Free Info Card**

Data and audio fiber optic multiplexer
Multidyne Electronics FMX-120

supports up to 12 full duplex data channels of RS-232C at up to 38.4Kb; carries a seven year warranty.

800-4TV-TEST; 516-671-7278; fax: 516-671-3362; www.multidyne.com

Booth: L22465 **Circle (416) on Free Info Card**

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Similar to DSR-20 with Addition of RS-422A; Can be Used as Source Machine in RS-422A Edit Systems; iLink Interface; Control S Interface; Analog Composite and Y/C Input; Analog Composite, Y/C and Analog Component (Y/R-Y/B-Y) Output; RCA Audio In/ XLR Audio Output; Reference Video Input; Auto Repeat/Power On Record/Playback; Consumer DV Playback; Dubbing w/Time Code

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DSR-1 Docking DVCAM Recorder Docked w/ DXC-D30 2/3" Three CCD Color Camera via 76 Pin Connector; Camera Section: 850 Lines Resolution, 63 dB S/N, 0.5 lux Min. Illum.; Status Info from DSR-1 Superimposed in VF of DXC-D30; Playback Capability without an Adaptor; Freeze Mix Function; Compact & Lightweight (16lb 1oz) in Operation; Low Power Consumption—24.8 W

Includes: DXC-D30H Camera Head, DXF-701 1.5" Viewfinder, VCT-U14 Tripod Plate, External microphone, DSR-1 Docking Recorder and Unified Handle

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Sony DSR-1 Docking DVCAM Recorder

ROSCOR PRICE

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DSR-300 1/2" Three CCD/ DVCAM Camcorder

Fully Digital—From Camera to Tape; 62 dB S/N; Minimum Illumination 0.5 Lux; Exceptional Professional Features (Previously only Found on DXC-D30!): TrueEyeTM, DynaLatitude™, DCC+, Black Stretch and Compress, EZ Mode, TLCS, Hyper-gain and Skin Detail

System Includes: Camcorder, 1.5" Viewfinder, Tripod Plate, Canon YH18x67KRSB 18x Lens and Soft Case

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DSR-80 Edit Recorder. Optional SDI

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Triax Camera Control System for DXC-D30

Sony CCU-TX7
Camera Control Unit

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Rotary (70°) Triax Connector; 76 Pin & 50 Pin Interfaces; Viewfinder Box Cursor Indication

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Full Control Functions as a Remote Camera Control Panel for CCU-TX7; Scene File System (up to 16); Links in Control of Iris and Master Black; Color Matching Capability; Liquid Crystal Display on control Panel; Can be Used as Standalone Camera Controller Directly Connected to DXC-D30

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Sony COU-TX7
Basic Camera Control Unit

Can be Attached to the Front Panel of the CCU-TX7; Controls Basic Camera Operations; Perfect for Limited Space Applications

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This Triax Control System Can Also Be Used With Sony DXC-637 Cameras

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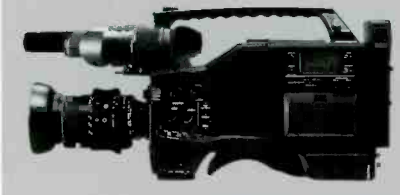

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...UNDER $16,500

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...UNDER $15,500

PVW-2600 Edit Source/Player

...UNDER $11,000

PVW-D30 2/3" Three CCD Camcorder. Includes DXC-D30H Camera, PVV-3 Docking Recorder and Integrated Handle

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with Canon 18x Lens and LC-423TH Shipping Case

...UNDER $20,000

with Fuji 19x Lens and LC-423TH Shipping Case

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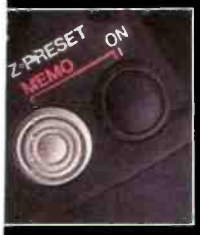

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Pixel Power, recognized the world over for its Collage family of products, with its business partner, Majortech, are pleased to announce a new generation of high definition graphics systems. Pixel Power and Majortech have explored issues plaguing the broadcast and post-production industry and mapped a safe route that ushers in an era of superior performance, reliability and exceptional

Clarity

See Clarity in booth L11235 at NAB99

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Clarity's operating software boasts a wide array of features in a character generator designed for live-to-air use. An integrated still store and a paint system with animation and effects capability round out the list of standard features. Available options include an interface to newsroom and station automation, as well as offline text entry and picture-browsing software.

Clarity's powerful graphics tools and a simple user interface offer easy exploration of its creative capabilities. Designed with the future in mind it allows users to keep one step ahead of the ever-changing demands of the fast-paced broadcast and post-production environments. Clarity guides the way toward DTV and HDTV by providing a definitive solution to your HD graphics needs.

Manufactured by

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Cambridge, UK
www.pixelpower.com
011 44 1223 721 000

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www.majortech.com
(905) 890-6338

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949-725-2500; fax: 949-725-22545; www.ndsworld.com

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

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Newsroom Solutions NewsTicker

a browser-based, user-interface that seamlessly allows display of up to eight graphic elements and in any combination of topics, including weather forecasts, sports, financials, lottery and headlines; program gathers data by connecting to dedicated server and newsroom computer system, can be run from one or all PCs in the newsroom with network access.

704-377-1496; fax: 704-377-6336

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Scientific-Atlanta Inc PowerVu Plus MDR

can simultaneously receive and decrypt up to 16 digital channels, allowing programmers to deliver a digital multiplex easily down a cable system to any OpenCable set-top; wide range of data rates allows operator to efficiently use either a full or partial transponder; provides cable operator with a cost-effective solution for 63 or 256 QAM distribution.

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Pinnacle Systems DC1000

dual-stream MPEG-2 nonlinear editing system; provides prosumer environment to digital editing; allows user to capture, edit, effect and output content in MPEG-2 format.

650-526-1600; fax: 650-526-1601; www.pinnaclesys.com

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Pinnacle Systems Deko 2000

provides the same Deko interface and compositional power as FXDeko; performs 2D text and character manipulations; features creative font enhancement, instant background creation, Macro Language and Editor and variety of file import/export formats.

650-526-1600; fax: 650-526-1601; www.pinnaclesys.com

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Virtual set

Radamec Broadcast Systems Virtual Scenario

expanded to support camera position data from the RP2VR remote control VR pedestal; the 2D Virtual Scenario System can now accept 3D camera movements, including X, Y position and camera height above a predetermined range.

908-518-0685; fax: 908-518-0687; www.radamec.com

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Plasma display unit

Pioneer New Media Technologies PDP-V501X

a space-saving panel that offers users the benefits of plasma's emissive display capabilities, provides bright and even colors, better contrast ratios, clearer, crisper pictures and 160° viewing angle; ideal for precise image quality and detail; features true XGA (1280x768) images and a 16:9 aspect ratio.

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High-definition character generator

Pixel Power Ltd. Clarity

a HD character generator with integrated stills store and painting facilities; capable of producing output in 720p, 1080i, and supports 1080p; based around dedicated multiprocessor video hardware and designed to allow a high degree of scalability; supports high-end feature set of the Collage system, including Cool Moves and Smart Moves animation libraries, unlimited real-time layers, 2D and 3D cel animation capabilities and full-featured video painting and keyer.

+44(0)1223-721000; fax: +44(0)1223-721111; www.pixelpower.co.uk

Booth: L11235 **Circle (429) on Free Info Card**

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Pixel Power Ltd. Graphite

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Digital encoders
Prager Associates Serial D1 encoders/ decoders

convert from serial D-1 to analog composite, Y-C (S-Video) and component; decoders convert analog composite, Y-C and component (Y Cr Cb) to serial digital D-1.

310-474-8139; fax: 310-474-8159;

Booth: L15148 **Circle (434) on Free Info Card**

Digital video generator
ProTeleVision Technologies Digital Video Generator, PT 5230

configured around a basic unit to which additional generator outputs can be added, making up to six different SDI signals available simultaneously; can provide all of the signals needed for fault finding and checking of an entire digital video chain.

800-421-0888; 201-529-2188; fax: 201-529-2109; www.ptv.dk

Booth: L21632 **Circle (435) on Free Info Card**

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QTV WINCUE NET

scripting and show management program for video magazines, variety shows, corporate meetings and local news programs; Windows networkable and scalable from one to 1000 users; show database with dozens of field types, including back time, hit time, link time, SOT and customizable layout by system group and user.

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Integrated news/sports production system
Quantel Inspiration

handles all aspects of news/sports operation in a fully integrated system; centered around the Clipbox video server; integrates the AP Electronic News Production System with journalist PC video browsing and editing capabilities (supplied by OmniBus Systems); provides complete automated control of loading; OmniBus Columbus automation system provides playout and asset management.

800-218-0051; 203-656-3100; fax: 203-656-3459; www.quantel.com

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DTV server
Abekas 6000 Multiflex DTV Server

features DVCPRO compression with user-selectable bit rates of either 25Mb/s or 50Mb/s and can be configured with up to eight digital video I/O channels, each with associated four-track digital audio; offers up to 40 hours of RAID-3 disk storage; local storage can be increased to over 160 hours with optional disk expansions; offers VTR-style hardware control panel for full system operation.

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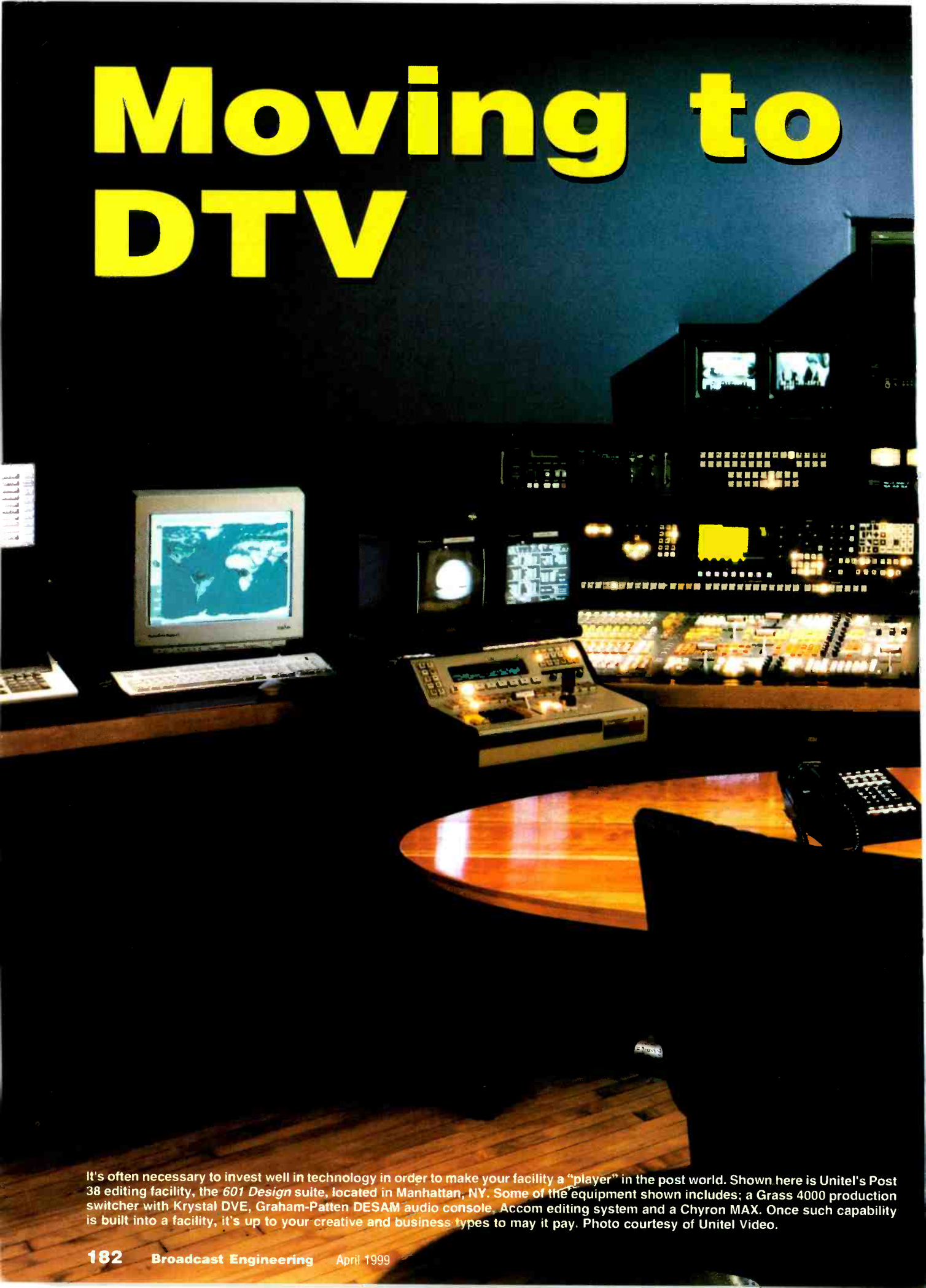
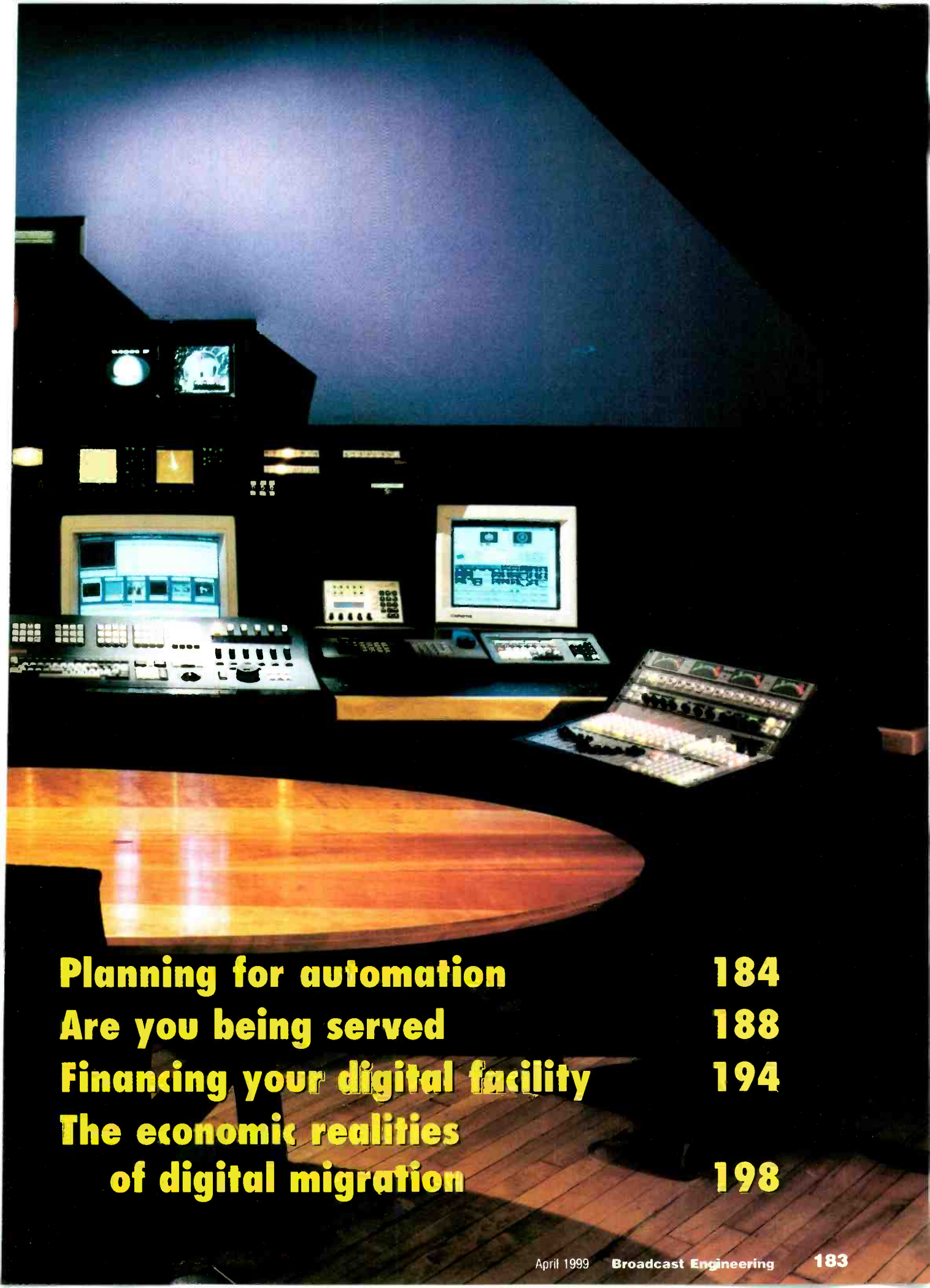
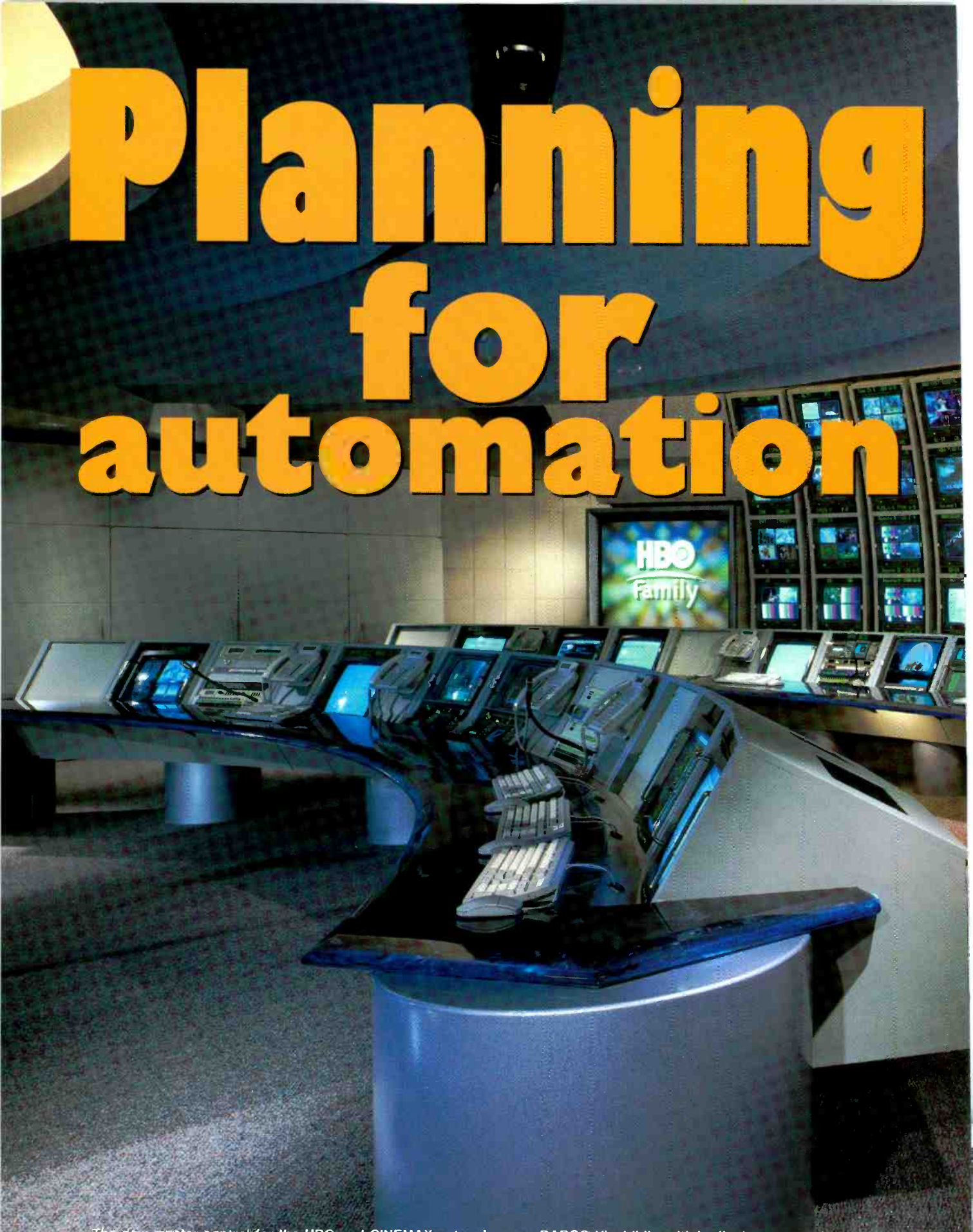
Moving to DTV



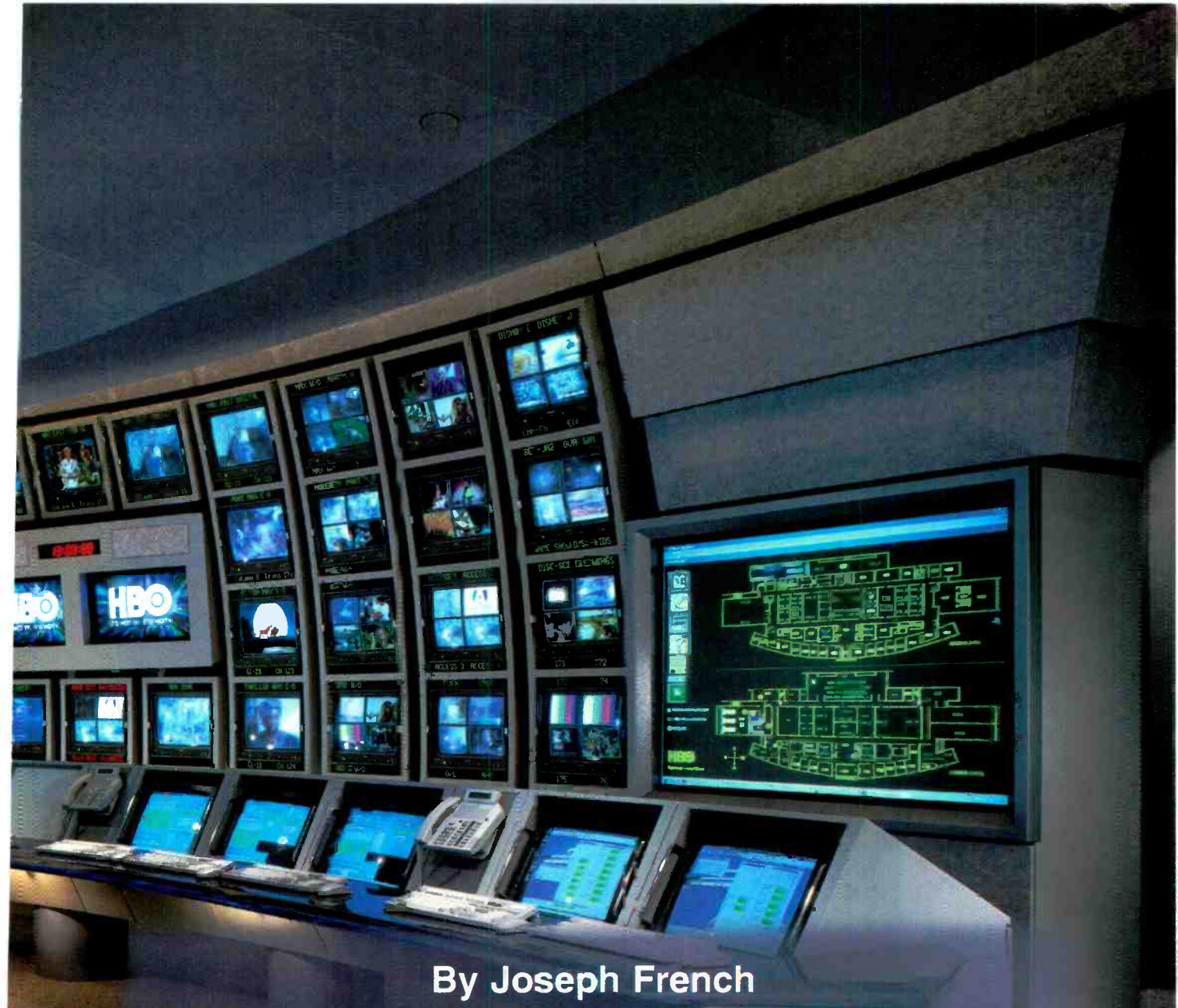
It's often necessary to invest well in technology in order to make your facility a "player" in the post world. Shown here is Unitel's Post 38 editing facility, the *601 Design* suite, located in Manhattan, NY. Some of the equipment shown includes; a Grass 4000 production switcher with Krystal DVE, Graham-Patten DESAM audio console, Accom editing system and a Chyron MAX. Once such capability is built into a facility, it's up to your creative and business types to may it pay. Photo courtesy of Unitel Video.



Planning for automation



The new master control for the HBO and CINEMAX networks uses BARCO Vivaldi-II multiple displays to monitor more than 100 networks. The automated system oversees both analog and digital formats, including CCIR-601 serial digital video with two levels of AES audio, analog video, RGB and HD signals. HBO launched its HDTV service in March, with 45 percent of its programming transmitted in 1080i. Photo by Robert Wolsch, courtesy of BARCO.



By Joseph French

Designing your on-air automation system for the future requires planning for digital and multichannel operations. Decisions made now can limit expansion possibilities in the future and can ultimately lead to inefficient operations. Careful planning can reduce staffing requirements and result in a higher-quality broadcast signal.

How do you make the automation decision? It's one of the most important decisions for any station. The right one will mean a competitive operation; the wrong one will result in money spent without any real savings. Ironically, the decision should not be based solely on technology. Your decision should be based on a series of questions that address not only the details of the latest technical advances, but also which company best fits into your future plans.

The following 12 points and the discussion that follows are designed to help you look

Planning for automation

beyond that interesting demo and address the key issues of choosing a long-term automation solution.

A complete solution within your operation

It is always important to remember that your automation system is not an island within your overall operation. Automation executes the on-air playout, but its integration with traffic, billing, scheduling and transmission is critical. Choosing a solution with an integrated approach (from a technology and support basis) will be the key to an efficient operation.

Standard interfaces are available that allow batch process to integrate the business applications and on-air applications to operate in an integrated environment. However, future systems need to go past the batch process and into the interactive process. Changes made after a schedule is passed into automation need to occur in sales or traffic. Those changes need to be passed into the automation environment electronically, not with sheets of paper. Material information, such as timing and availability, needs to be accessible to scheduling and traffic interactively so that accurate schedules can be composed the first time, not iteratively by the automation products. Choosing an automation system that is linked to the station's business systems is critical for a solution that will grow as your environment grows.

Industry standards

Technology has advanced to a level where standards are essential for product development and the technology base from which it runs. By choosing a product that is based on timely technology, your station is taking less of a risk of ending up with a solution that is not expandable or supportable.

Adaptability for operators

Operational variances between stations are vast. Your environment is not the same as the environment down the road. An automation system that is not adaptable to your operation can be costly. You cannot afford to completely alter your operation to fit the way the automation system wants to operate.

Choosing a system that has the ability to adjust to your operational flow will limit the training time and be better received within your operation.

Ease of use

While some automation companies have held on to line editors as the effective way to communicate to the operator, others have chosen GUI devices to expedite some of the operations. Your decision in this area is really based more on personal choice than on a right or wrong decision. Operators should work with several interfaces before deciding which one best fits their operational environment. Often your first impression does not match your final decision. Ask the automation suppliers why they have chosen their particular method of user interfacing and then see if their approach matches your concerns.

When planning for automation, ensure all current operations within master control are addressed. Not all operations will be needed once automation is implemented. Pictured above is master control at KMGH-TV, Channel 7, Denver.

Distributed control

Again, your automation solution is not an island. Can your system be controlled remotely? Can your system allow workstations throughout your facility to be used by other affected departments?

Centralization of operations allows efficiencies of staffing. Multiple stations' operations that are not located in the same facility can be controlled from alternative locations. There are great benefits in having workstations from your automation system located throughout your operation. Traffic, billing, sales and scheduling can benefit from being able to monitor and work with the automation software, sharing information in a fast and accurate fashion.

Solution building

Automation systems that offer partial, one-step-at-a-time solutions will provide your operation a systematic and orderly transition to a fully automated facility. Replacing a cart system with a video server solution that builds towards a full facility automation package is a cost-effective way to grow towards a fully automated environment.

Video server management

Video servers have changed the way broadcasters operate. Unfortunately, some solutions create more jobs instead of reducing the work requirements. Careful evaluation of a video server solution is required when moving towards a tapeless environment.

Video server applications must take into consideration many aspects. Can it take a playlist directly from traffic? Can it purge and add material automatically? Can it interact with an archive system intelligently? Does it work off a common database of information that is shared by other aspects of the automation environment and is available to the rest of the broadcast operation? Without this type of functionality, your video server can create more work and cause tremendous inefficiencies.

Complete suite of preparation tools

Automation is about executing the on-air playout, but this execution is incom-

plete without all the material being properly prepared in advance. When material arrives at your facility, how does the automation system record it, time it, and prepare it for playout? Does the preparation process make the information available to all departments? How does the automation system take advantage of the information during the playout?

Single database of information

When you evaluate your current environment, you might be surprised at the number of separate, nonconnected databases. All this information, if not relational, must be translated and shipped to the appropriate applications. Moving to one common database is more than just a good idea, it is essential. All departments want to share material information, and your automation system must have designs in this direction.

Ability to pool equipment in a multichannel environment

More and more stations are going to have several channels operate out of the same facility. Equipment pools reduce the need for incremental capital equipment costs. Sharing VTRs, character generators and video servers simply saves money.

Analog today and digital tomorrow

Today, your plans probably include keeping an analog channel on air. But in the future, you plan to launch a digital channel in a multichannel environment. Does your automation system have the ability to control multiple channels, do regional breakaways, and address the complex operations of a digital environment? You can't wait until you move to digital to make a decision – it will be too late. You need to start today with an automation system that can grow into this multichannel digital environment. Training your staff today will make the transition to digital easier.

Digital transmission

Digital transmission requires a close link between the transmission control and the automation control. In the origination of an analog signal, once the material leaves the master control, it is then sent to the transmitter. However, in a digital broadcast, once the signal leaves the master control, it is then sent to a separate area — the digital transmission area. Here the signal is sent through encoders and multiplexers. It is in this process that the material is matched to its appropriate transmission parameters (resolutions, bit rates, data, electronic program information, channel identifiers, ratings, etc.). This information is held in the database of the automation layer (driven by traffic). Last-minute changes in digital must not only be coordinated between the origination of the signal but also with the transmission parameters. Sending out a commercial with a competitor's data field could prove to be disastrous. Linking your automation environment with the transmission environment, all being driven by traffic, is a complex model that once addressed, will save operational costs.

The big picture

As stated at the beginning of this article, automation systems are not just about technology. Thus far, we have examined basic technology and operational issues, but in the big picture, there still remain the issues of service and support.

First, because your automation system will be the central component in integrating and controlling a variety of products within your station, you will need to examine the level at which the automation supplier has partnered with the equipment suppliers that you use. Your current choices will range from automation suppliers who provide software and little else, all the way to suppliers who not only supply the software, but also represent, install and support the equipment that the software will be automating. Obviously, the software-only solution will present a short-term cost advantage. Given the complexity that many operations will face in the future, there will be many long-term advantages offered by the automation companies with established relationships with the equipment suppliers.

In fact, one of the common complaints from broadcasters over the years has been their difficulty in getting suppliers to take responsibility for problems that arise when equipment from different manufacturers does not function properly when working together. From your point of view, the last thing you want during down time is to have to act as the referee between the automation company and the provider of the equipment. Ideally, you want to make one call and let that solve the problem. This responsibility can really only fall onto the automation company. When a character generator does not work or a video server is skipping a clip, your station will see that within the automation software application. It is natural that when those catastrophes occur, your operators or engineers will want to work with one provider, the automation supplier, to troubleshoot the problems fast and without conflict. When issues arise you will need an automation supplier that accepts the responsibility for your whole operation.

Support as described above is easy to talk about but hard to consistently supply. This one issue is the key to your station's long-term success. Regardless of the automation supplier you decide on, you will have support needs, and those needs will go beyond the installation and training periods.

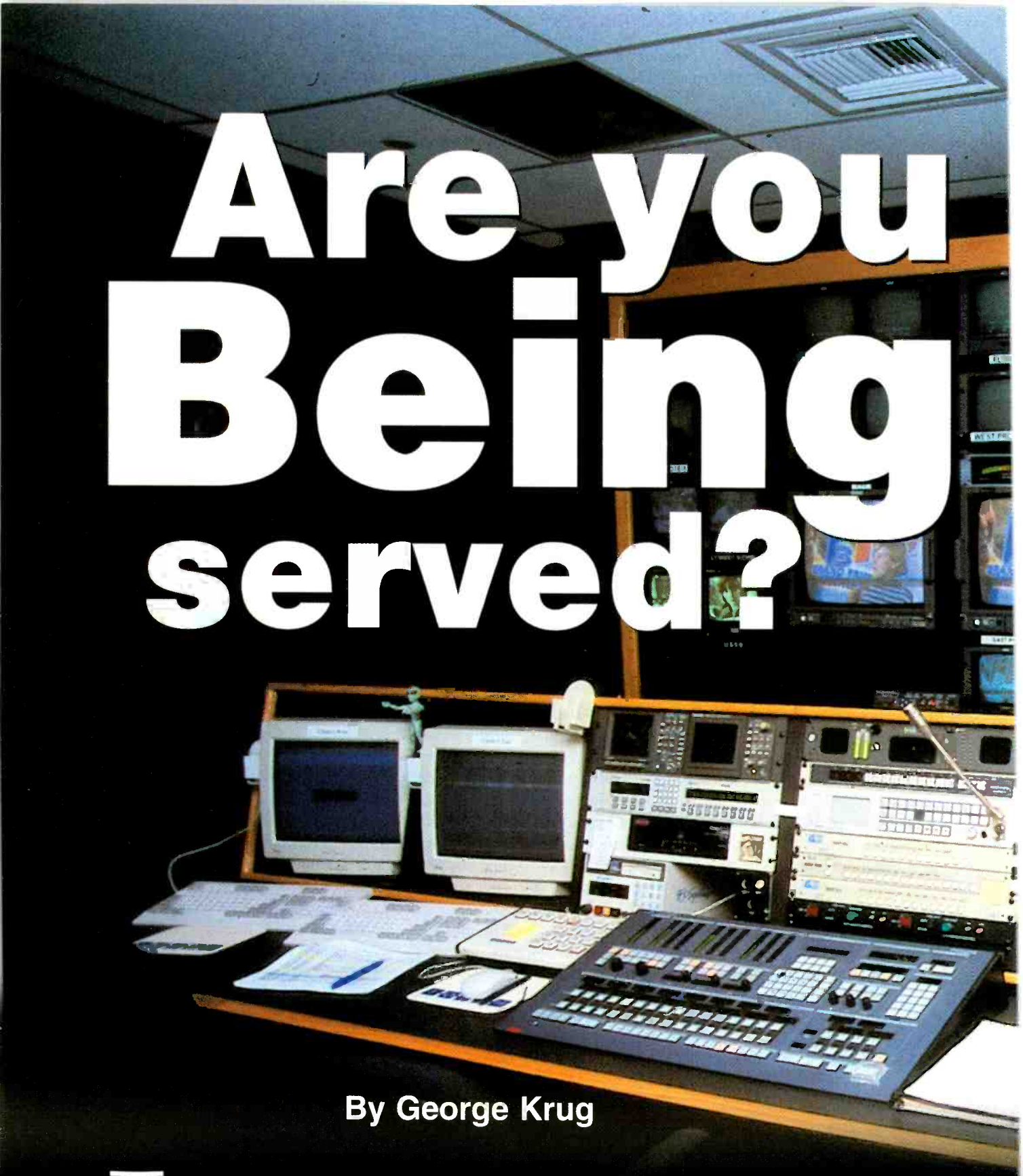
Research your automation company in this area. How much have they invested in support? How many people are dedicated to 24/7 support? Do they support the whole operation or just part of it? Do they have a reference base to point you towards?

The other area of support that deserves exploration is that of feature enhancements. All products demo well; only after those products are in use at your facility that you will identify the need for unique feature growth. While your automation company will not become your custom development company, it should have a history of feature enhancements that are part of an overall release strategy and/or be able to provide engineers to do separately funded custom development work.

Designing a station's automation system has become more complex than it was several years ago. In the past, people could be used to bridge the gap between traffic and on-air operations. But the complexity of digital transmission as well as the crushing need to reduce operational costs has forced broadcasters into considering automation systems. Careful station planning can reduce costs. Automation systems that are tightly linked to traffic reduce costs through efficient operations and sharing of information. ■

Joseph French is director of Columbine JDS' Engineering Products Group, Denver.

Are you Being served?



By George Krug

Just as it "morphed" the world of post production, the video disk is changing the world of master control operations. For years trade shows have featured demos of the "master control of the future" where video servers were used to cache spots, first from a standard video cart machine, and more recently from cart machines that hold data cartridges instead of video cassettes.

Lifetime's digital master control room includes traditional equipment such as VTRs, as well as quite a few computer monitors and keyboards. Photo by George Dumper.

Are you being served

Ingest stations at Lifetime are used to turn tape-based spots and programs into disk-based files.

Such an environment for on-air spot playback intrigued Lifetime Television. A year ago, when the network began preparing to launch the Lifetime Movie Network, we examined our aging cart-machine, our analog facility, and our digital options. The launch of the Movie Network would allow Lifetime to climb back up on the leading edge.

The system is now online and working. The research process and experience gave us an accurate picture of where the state of this art really is. Many lessons were learned, chief among them that this was more than a transition from tape-based playout to disk-based playout; this was a transition from the broadcast world to the computer world, and a different world it is.

Lifetime learned just how robust and fully developed the software used to run our cart machine was, especially in contrast to the software used to run our new disk-based system. While decisions on a disk-based system will be, or have been, based on the quality of the compressed images, the bit rates used, compatibility with existing infrastructure and other factors, the biggest gaps are in the software, and those gaps are the topic of this discussion.

Lifetime's cart machines were replaced with video servers and disk arrays including these HP MediaStream servers.

The checklist compiled here can be used to test systems you may be considering, or perhaps have already purchased. Lifetime's experience afforded us the chance to learn a few things the hard way, and we were reminded of why "leading edge" can also be "bleeding edge." In many cases we presumed that certain functionality's would be built-in (as they were in our cart machine), only to find that they would be available "in the next release." Welcome to the world of computing.

Basic architecture

Our configuration is simple: commercial and promotional spots are encoded or "ingested" onto a main server with a relatively large (20-hour) capacity. Ingest is done using the automation system's inventory management software, which provides for semi-automated video encoding and entry of data about the video into the automation database. When a playlist calls for a spot, a backup copy is transferred via data network to one of two buffers, which in our case are smaller servers. At air time, both copies of the spot are played from decoders on the two servers. Automation keeps both sources synchronized, and will switch the backup to air if the prima-

One claimed benefit of automation is that more (typically channels) can be controlled with less (typically people). Note the simple, straightforward layout of this control room at Lifetime Television. Such a design can allow one person to handle ingest, archiving and on-air operations if needed. Typically these tasks are divided between several studios, which provide other types of efficiencies.

ry source should fail.

While our main server has a working capacity of roughly 2500 spots, the data tape archive holds our entire active spot library which can be five times that number. During ingest, the user initiates a "send to archive," and a copy of that file is created there. Inactive spots are autopurged, by automation, from the main server to make room for newer and more active spots. When an inactive spot later appears on a playlist, copies are restored from archive back to disk for air. This is a simple and elegant solution that allows one spot library to be used across several channels of playout — efficiency and flexibility we would never have expected from our old cart machine.

Performance problems stem largely from the fact that our "system" is really several systems connected by several software applications running on several operating systems. Much of the communication between systems is indirect — commands and messages may be relayed from one device or system to another. While automation vendors all purport to be developing "integrated solutions," much of what's deliverable is a patchwork of hardware and software that's been adapted from the VCR- and videotape-based world to disk-based operations.

Archive transfers are handled strictly between the main server and archive device by software, an application often called *middleware*.

Inventory management

Having touched on some of the issues at hand, let's start with spot inventory management. In our model, automation talks directly to the main server. However, archive transfers are handled strictly between the main server and archive device by software, an application often called *middleware*.

Requests to archive a spot or restore to disk are stacked in a queue, and are generally handled "first-come, first-served." That may work fine from day to day, but what about the inevitable last-minute changes and additions? If the spot you need has been inactive, and must first be restored, you'll be in business if it's the only request. But what if it's not; say, just after you've generated 30 or 40 restore requests by linking the next day's playlist? Unless your system provides an override capability, or allows the user to change the priority of the requests, you'll need to find another way of restoring that spot.

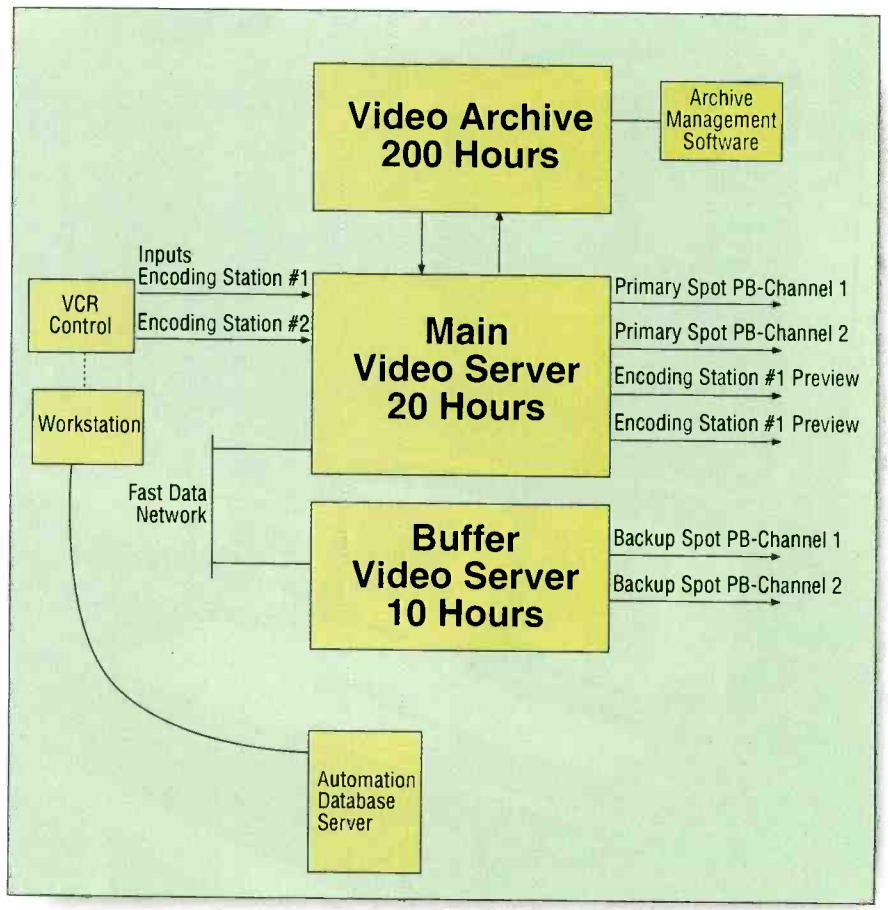
Short of having that control, what about monitoring the process? Will your system allow you to see what retrievals are in progress? Is there an

Are you being served

alarm of any kind to tell you if a send or restore has failed? Depending on the system and vendor, the inventory management software (and the user) may or may not receive such feedback. Only now is software emerging that provides for a direct interactive connection between the automation and the archive.

Outside master control, an operator is busy ingesting newly arrived commercials. After ingest, he quality-checks each spot, sends a copy to archive and saves the data to the database. Inevitably, he will come across a house number that's already in use. The mechanism for flagging this duplicate ID can be crucial. Is he given the opportunity to override the old ID with the new spot? If so, will all copies of the old spot be overwritten, including the archive and buffer copies? An old spot on an archive with an ID that's been reused is an error waiting to happen.

Be aware, too, that when the user sends to archive, that copy may not be made for some time after. Find out ahead of time what happens when multiple purge, and send commands are issued for the same spot. Knowing in advance what your system's behavior will be will enable you to properly adapt your procedures and build in safeguards to prevent old spots from lingering and therefore airing.



Basic block diagram of the server system includes the main video server as well as the buffer server and archive.

Lifetime's ingest stations include ready access to a variety of tape formats, making it quick and easy for operators to transfer tapes to files.

Speaking of purging, there are two instances where spots will be purged: When the spot has reached the end of it's flight; When the server and buffers need to purge inactive spots to make room for active ones. In the first instance, all copies of the spot and the data about it must be removed from the system. In the second instance, the data and archive copy must be kept, and copies are removed as needed from each server or buffer. Before assuming that your system can distinguish between the two, test. Find out what prevents the user from deleting a spot that's on a playlist, or even one that's playing? How does the system determine what spots are active versus inactive? Will your system check for an archive copy before auto-purging the on-line copy? Re-ingesting the same spot multiple times is frustrating and inefficient.

In our system, our refrigerator-sized archive replaced an entire videocassette storage room. However, though these devices boast terabytes of capacity, like the hard drive on your desktop

PC, they will never be quite big enough. Make sure you know your upgrade path before you buy. Your cart machine probably gave you a running count of the number of empty bins: Will your archive device tell you how much room is left? You may find that such monitoring is limited, or nonexistent. At best, it may be like your wristwatch: It won't tell you the time; you've got to look at it.

Keep in mind that you may be dealing now with upwards of three databases: The traffic system, automation system, and archive may each keep their own list of active spots. Make sure you've got tools available to keep those lists reconciled.

Know your system's needs

Having cleared the inventory management hurdle, how will those spots get from archive to the playout devices? A limitation of our system is that spots can only be restored from archive to the main server. Those spots can then, in turn, be restored to the buffers from the main. Playlists running on the buffers are therefore limited to spots restored to the main given no direct access to the archive. While this is a limitation that our vendor (and presumably others) is working to overcome, it's an issue to be sensitive to when designing your system.

We've also questioned our decision to use one disk to backup another. At the research phase of our project, discussion about backups centered on disk drive, decoder card, and other gross failures. Based on those scenarios, we determined that an additional server would provide the security we needed. In practice we find that a subtle software glitch is far more likely to affect spot playout than a hardware failure. Indeed, such glitches frequently afflict both disk sources simultaneously, at times negating the effectiveness of the backup server. Fortunately, and in keeping with our belt-and-suspenders approach, we use a daily compilation reel (on videotape) to backup our servers, and have thus been able to minimize the breakage caused by such subtle failures.

Prior to the upgrade, the information stored in this archive system require d a 400-square-foot archive room.

Lastly, there is the specter of what our director of engineering calls "inevitable and relentless upgrades". This is, as noted, the computer world, and nowhere else is obsolescence more built-in. As you plan your facility, make sure your design provides for installation and testing of new software, hardware, and peripherals. If one (or more) of your potential suppliers has new software/firmware/hardware versions pending, consider whether you'd be better off delaying your installation until the new version is released. Such installations can be painful, as anyone who has ever upgraded their PC's hardware or software can attest.

In the computer world, change is rapid and continuous.

Not every test mentioned here will be applicable to systems that you may be considering, and there will be issues specific to your system that are not included here. A one-size-fits-all testing strategy might be:

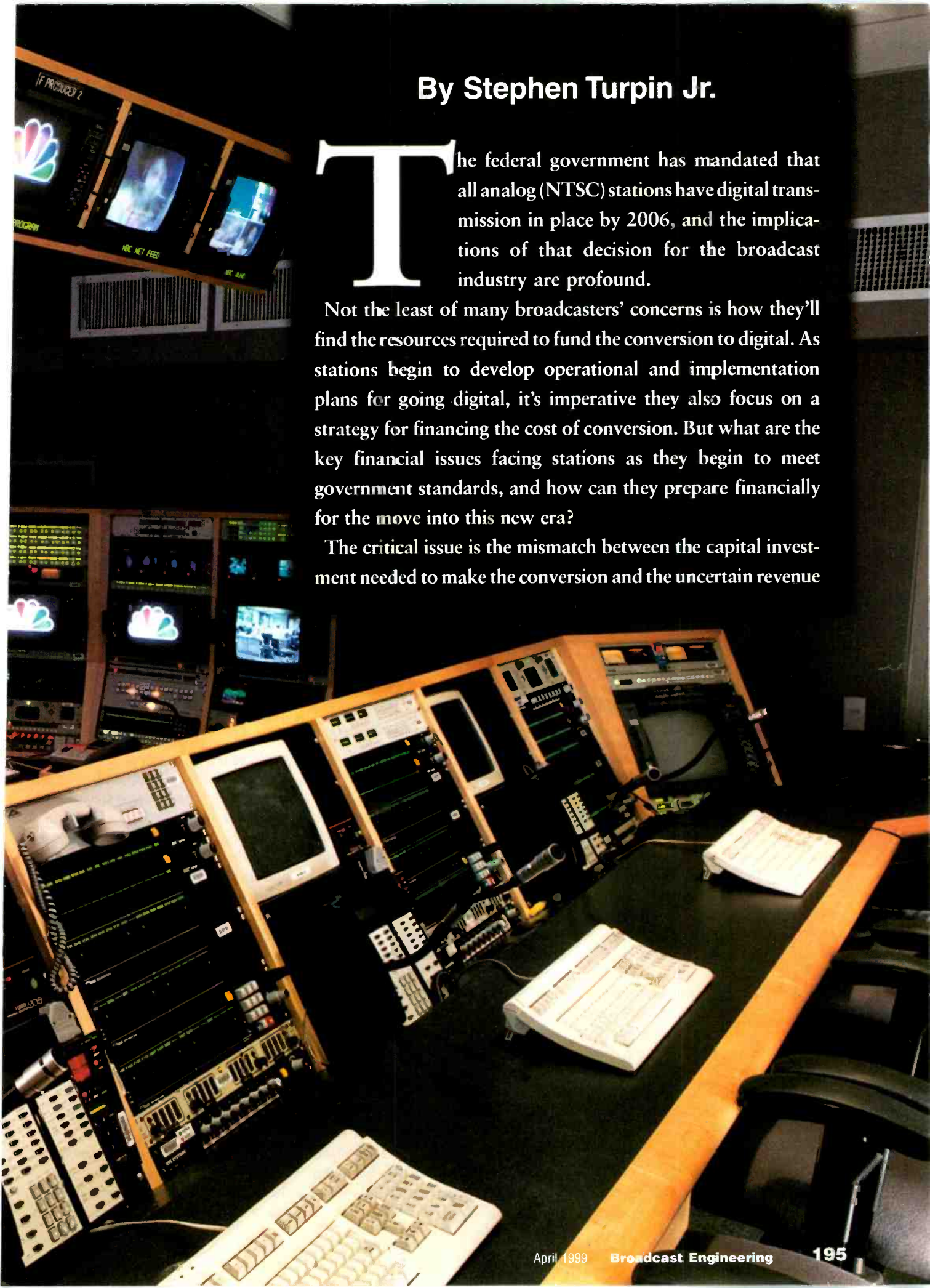
- Analyze the "nuts and bolts" of the work flow of your facility, station, or network. Be excruciatingly detailed. Summarize the functions and effects of your existing processes and procedures. Ask yourself: What functionality do I presume the new system will have?
- Summarize the enhancements you expect or need the system to bring to your operation. During your evaluation, make sure those features are there and working.
- Determine what new wrinkles the new system will bring with it. Pay particular attention to maintenance, upkeep, and upgrade issues. Sure, a headclog may be a thing of the past, but then again you rarely needed to "reboot" your VCR.

It wasn't all pretty, but Lifetime has made its transition, and we never seriously looked back. In fact, our experiences migrating to this new, disk-based environment compare favorably to a transition we made 10 years ago when we installed a then-new and unproven video cart machine. In the computer world, change is rapid and continuous. While we have certainly wondered, given the issues above, whether we should have waited for some of these systems to mature, the same advice applies here as it does to making your personal computer buying decision: Buy the most you can afford, and buy it when you need it. Then test, test, test. Your best defense in this brave new world is to be able to identify the bumps in the road, and make the appropriate accommodations in order that you may avoid them. ■

George Krug is director of technical operations for Lifetime Television, Astoria, NY.

Financing your digital facility

NBC News Washington DC control room illustrates how today's digital technology can provide increased operational control and flexibility along with improved image quality. While such benefits don't always come cheap, it does pay long-term dividends to a facility. (Photo courtesy Communications Engineering Inc.)



By Stephen Turpin Jr.

The federal government has mandated that all analog (NTSC) stations have digital transmission in place by 2006, and the implications of that decision for the broadcast industry are profound.

Not the least of many broadcasters' concerns is how they'll find the resources required to fund the conversion to digital. As stations begin to develop operational and implementation plans for going digital, it's imperative they also focus on a strategy for financing the cost of conversion. But what are the key financial issues facing stations as they begin to meet government standards, and how can they prepare financially for the move into this new era?

The critical issue is the mismatch between the capital investment needed to make the conversion and the uncertain revenue

streams from this new technology. The potential profit from this unique medium, as well as the timing of such revenue, is still unclear. Additionally, the current consumer base for DTV is limited, and even though it should grow over the next few years, the rate of growth is unknown.

Although there are many unanswered questions about entering the digital era, there are ways to plan that will help make financing the cost of conversion achievable for both small and large stations.

Most news broadcasts can be handled by a small console. This NBC news Washington audio control room shows how network demands require a more extensive setup. In this case, an SSL 8000 GB is integrated with a wide variety of support technology and multichannel mixes to handle any assignment. (Photo courtesy Communications Engineering Inc.)

Equip yourself

Let's take a brief look at the equipment needed to upgrade to digital transmission and some of the issues related to each.

In order to transmit a digital signal, a station needs a new antenna, transmitter and master control, in addition to other related equipment. As has been widely discussed, the antenna installation is a complicated issue because of tower capacity.

The current tower could be wind-load restricted and thus force the station to deal with a number of possible options, all of which have varying degrees of cost. The station might have to significantly reinforce a tower, erect a new tower, or even rent space on another tower. In any case, the impact of these options on cash flow must be reviewed.

Although the installation of a new transmitter is less complicated than the antenna, it's important for stations to determine the level of power they want for their digital transmitters. Some stations might prefer to acquire a low-power, lower-cost transmitter to promulgate the digital signal within a smaller contour until there is proven consumer demand in their market. On the other hand, stations might choose a full-power transmitter so that there will be no need for additional funding later on to upgrade equipment because of growing consumer demand or because the station needs to phase-in local digital programming.

Another cost-related issue is the additional operating expense associated with the conversion. During the changeover to digital, a station will be operating on two different frequencies, and as a result will incur additional utility, maintenance and insurance expenses resulting in lower cash flow. Because these costs will be unmatched by an increase in revenues for an unknown period of time, they must be taken into account when the conversion plan is being formulated.

So how much?

The NAB has estimated the minimum cost to transmit a digital signal is approximately $750,000 to $1 million and suggests if there is a need to add a tower the cost could range between $3 million and $5 million. This would allow a station to pass through the network digital signal but would not include the equipment cost for local program production and origination. The NAB also estimates the maximum cost of going digital, which would include digital program production, supplemental equipment (i.e., 10 digital studio cameras instead of two), a new tower, and other "deluxe" costs, could total more than $10 million.

Many industry experts believe $10 million is a high total, and most stations won't need to spend anywhere close to that amount on equipment to be in FCC timetable compliance. One widely held view is that many stations will be able to meet market demand at a cost of $1 million to $5 million, depending upon their tower situation, if they elect to delay original programming.

Consider the "gap"

From a strictly financial standpoint, the goal is to minimize the "gap" in cash flow created by the mismatch between the conversion capital investment and the undetermined revenue streams that the technology has the potential to create. In simpler terms, what's the best way to pay for going digital now in order to be better prepared to reap its benefits later?

The level of current DTV penetration is low. There is limited HDTV programming, and the cost of purchasing a DTV set is relatively high. However, not that long ago networks were in the same predicament when introducing color to TV and look what happened. One can only assume that the same scenario will take place with DTV.

With the amount of HDTV programming increasing, and consumer awareness and appreciation developing, it is anticipated that the price of DTV sets will drop as a result of volume. Under the traditional broadcast model, some revenue increase could result from the attraction of a wider audience.

However, new revenue opportunities are being explored that utilize SDTV/multichannel options for narrowcasting, which has the potential to attract new advertisers. Herein lies the excitement of the technology — creation of new revenue opportunities for both large and small markets.

All of these elements are evidence that there is no generic step-by-step process that every station can follow as it develops a financial conversion plan to go

Today's graphic suites, like this one at NBC News Washington, often operate like small production islands. However, best efficiencies come from interconnecting them to the rest of the facility with 601 interfaces so all areas can take advantage of the staff's creativity. A key advantage in building with 601 now, is the longer life and future options it brings to both user and facility. (Photo courtesy Communications Engineering Inc.)

digital. Because the specific conditions of individual stations differ, each one must evaluate its own specific needs and situation before implementing a financial strategy. How station A converts to digital will differ from B, even if both stations are the same size and in the same region.

How can you afford this?

There are several financing options for making the switch to digital that broadcasters should be aware of as they develop their plans to fund the costs of conversion. They include:

- Utilizing free cash flow.
- Refinancing the station.
- Leasing or financing the equipment.

Looking at these options, the first one is ideal for stations that have the free cash flow to pay for the equipment outright. However, for many stations this is not practical and ties up significant amounts of working capital that could be used to research and promote the new technology that has revenue-generating potential. The opportunity costs of this financing option could be considerable.

The second option, refinancing the station, could be done through senior loan financing which involves using the whole company as collateral. This is an option for those stations that have, or can obtain, extra borrowing capacity.

Financing or leasing the equipment with the option to purchase are attractive alternatives for all stations, no matter the size. With leasing, 100 percent of the capital cost is generally provided. Monthly payments can be lower since the leasing company can structure the lease to take advantage of accelerated depreciation. Because of acquisitions, stations often can not take immediate advantage of additional depreciation. (For more information on the options afforded by leasing, see "Ten benefits of leasing,")

Using any combination of the three funding options could also be effective. For example, a station might choose to purchase a new master controller with cash, but because it doesn't want to further deplete its cash flow, decide to borrow capital to pay for the transmitter. The same station may not benefit from owning a tower, so it leases one.

Consult knowledgeable capital sources

It's important to reiterate that every station has different needs. And although there are a myriad of ways for any station — no matter its size — to fund the cost of going digital, it's imperative that each station determines its full range of financial options prior to making any decisions.

Ideally, the station should seek out a financial service organization that has experience in the industry and knowledge of all financing options, not just lending. Such a company should have strong experience in broadcast financing, and the ability to provide flexible options that will allow a station to be comfortable with its financial position.

In the past, stations could move forward with upgrades and changes without considerable outside assistance. In going digital there is an "economic gap" that not only needs to be bridged but also requires soliciting advice from professionals.

Digital television is here and it's not going to be cheap. However, with the right planning and the right advice, financing the cost of conversion can be achieved by the smallest and largest broadcasters. ■

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Ten benefits of leasing

Purchasing power: Lease financing allows the lessee to acquire more and/or higher-end equipment.

Balance sheet management: Certain types of leases help the lessee better manage the balance sheet and improve their overall financial picture by conserving operating capital and freeing up working capital and bank credit lines.

100 percent financing: With leasing, there is no down payment. The term of the lease can be matched to the useful life of the equipment.

Asset management: A lease provides the use of equipment for a specific period of time at fixed payments. It assumes and manages the risks of equipment ownership.

Service additions: Many lessees choose to structure their leases to include repairs and maintenance, if needed.

Tax treatment: Leasing offers the option of deducting 100 percent of the lease payment as a business expense.

Upgraded technology: Leasing provides companies with the ability to keep pace with technology. The lessee can upgrade or add equipment to meet ever-changing needs.

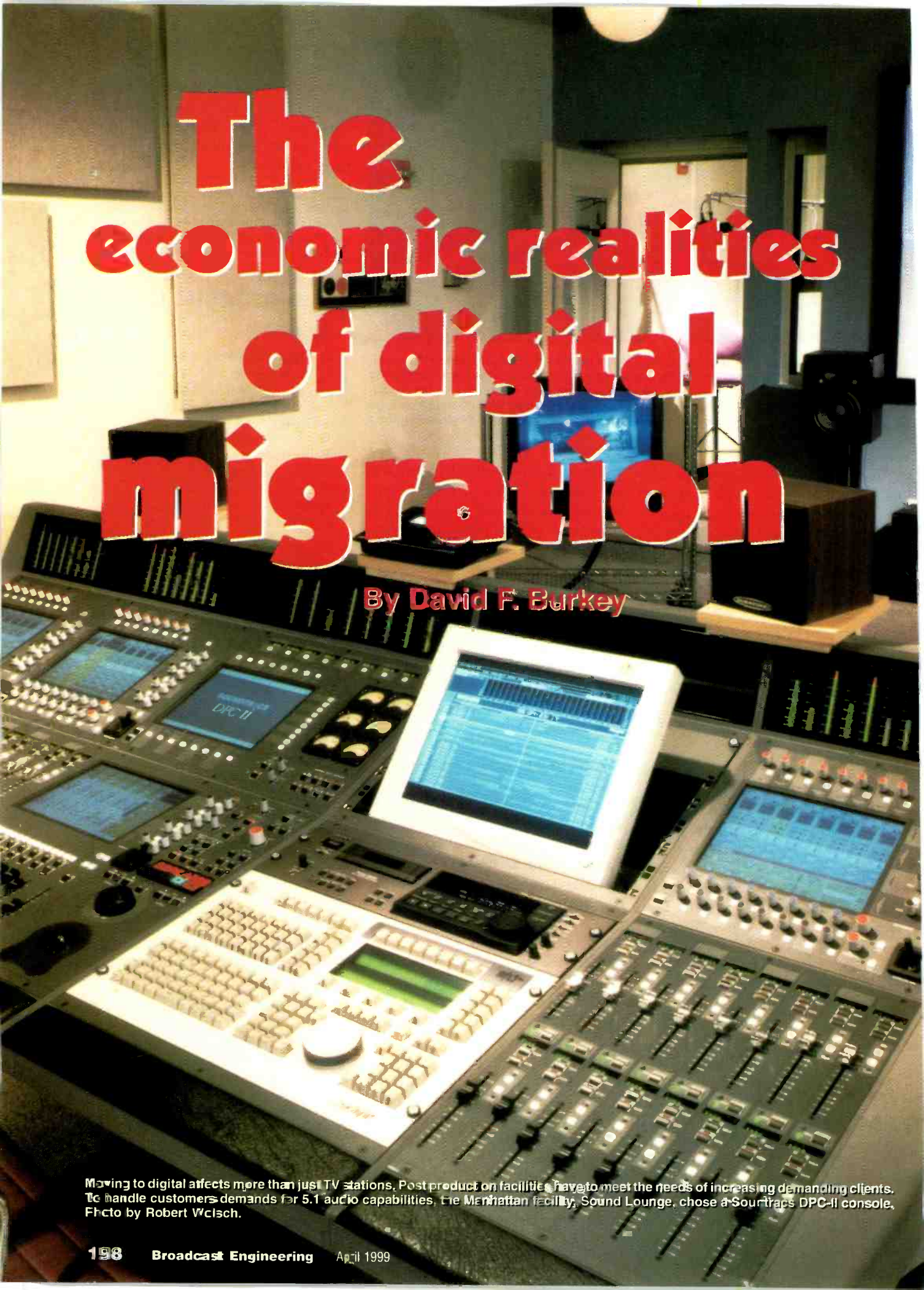
Specialized assistance: Lessors are specialists in equipment leasing and financing, and understand capital equipment markets.

Flexibility: There are a variety of leasing products available, allowing the lessee to customize a program to address needs and requirements - cash flow, budget, transaction structure, etc.

Proven equipment-financing option: Over 30 percent of all capital equipment in the U.S. is acquired through leasing. In fact, eight out of 10 companies lease their equipment

The economic realities of digital migration

By David F. Burkey



Moving to digital affects more than just TV stations. Post production facilities have to meet the needs of increasing demanding clients. To handle customers demands for 5.1 audio capabilities, the Manhattan facility, Sound Lounge, chose a Sourtracs DPC-II console. Photo by Robert Welsch.

With the introduction of digital technology, over-the-air broadcasters' share of the media consumer market has begun to decline. DTV broadcasting promises to change this tide but only if stations examine the hidden costs and benefits of this exciting new technology.

Broadcasters must react quickly to the changing communications landscape to place their digital investments in proper perspective. As the new millennium appears on the horizon, the broadcast industry faces challenges from technologies that provide consumers near limitless choices and convenience. Viewing the digital transition as only a mandated requirement could have dire results.

We have seen several watershed events in the history of consumer media. The Broadcast Age emerged at the beginning of the 20th century with radio and later TV. During the last 50 years, the number of TV sets has climbed to around 1.4 billion units worldwide. The introduction of VCRs, Surround Sound systems and cable have transformed the way we watch. Analog broadcast equipment has undergone little change, and programming is still viewed on the same dated cathode-ray tube technology that introduced it.

Now, the world stands on the verge of a new era that will bring revolutionary changes to all aspects of life, especially to the media consumer: The Internet Era.

The digital Internet monster

Worldwide Internet use is expected to grow by more than 40 percent over the next five years, reaching more than 425 million people by 2003. More than a million new users log on to the Internet each week. The Internet has reached 50 million users in four years, substantially faster than radio, television, and the PC. The realization of this forecast, coupled with the speed of acceptance, will make the Internet the most important communication phenomenon in history.

Because of its pervasive acceptance, growth in Internet traffic represents an essential driver to future demand for goods and services. The latest projections indicate that U.S. business trade on the Internet will expand from $43 billion in 1998 to $1.3 trillion in 2003. At this pace, on-line business will exceed 9 percent of the total U.S. business activity in 2003.

In turn, revenues from Internet advertising will continue this explosive pace. Current estimates call for Internet ad activity to double each year until 2000. This equates to about $6 billion, up substantially from $550 million in 1997. The Internet offers advertisers unparalleled closeness to the point-of-sale transaction as well as lower costs, increasing the value of on-line advertising.

Because of the Internet, the days of consumers waiting for the local news with its sports and weather reports are diminishing. When emerging streaming technologies are factored in, wired consumers can see events in real time. These advancements in information delivery represent a tremendous change for today's broadcasting paradigm.

Not everybody agrees the Internet is a positive driver. In a recent editorial, Clayton Christensen, a Harvard Business School professor, called the Internet a "disruptive technology." He first used this term to describe how new products or services appear in a market, thrive and eventually displace an entrenched provider. Another way to view the Internet is as a "technological discontinuity," where new technology provides a market entrance event that displaces an established, dominant provider. In this case, broadcasting.

The Internet is the "poster child" for this phenomenon. In a short time, the Internet has grown to the point where it is challenging the traditional ways of conducting business. How broadcasters define

economic realities

their technology platforms in the Internet Age will determine their success and longevity in the digital world.

With the introduction of digital television, virtually anyone can have the ability to convert programming into bits and bytes. All the shows you want to watch will start out as bits, making the TV and computer technologically compatible. With the adoption of software and Internet standards, digital television will blend entertainment with Internet interactivity. In fact, nearly half of all Internet users are between 12 and 34 years old, making interactivity a preferred feature. To meet expectations of its most prevalent users, the TV interface must evolve to include voice-activated and smart-learning features.

The realities of digital broadcasting

In the near future, broadcasters must develop a business model for digital technology that fits their market dynamics. Digital television represents much more than the ability produce beautiful pictures, providing broadcasters a 19.39Mb/s pipeline in a bandwidth-constrained world. Marketing opportunities offered by this technology will be limited only by the imagination.

By fully utilizing digital technology, broadcasters will have the tools to compete in the Internet Age and define their role in the converging communications universe. This universe is composed of digital networks that offer greater real-time data and video access. Broadcasters will compete with companies that supply e-mail, Web and other interactive services.

The era of the traditional broadcaster dominating TV is quickly fading to black. Advancements in streaming audio and video make worldwide broadcasting a reality, a reality without licenses, borders or content control. And advertisers are taking notice. For them, the Internet provides nearly absolute user tracking, giving them a powerful way to reach target customers with minimal cost outlay.

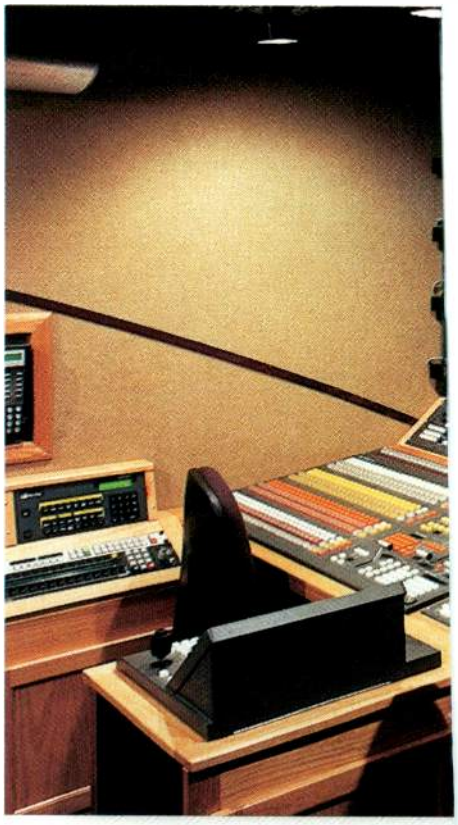
The business paradigm for analog broadcasters is significantly different from the digital world: Events move faster. The digital world is governed by Moore's Law, which says the cost of computing power drops 30 percent every 12 months while processing power doubles every 18 months. To put this in perspective, the singing greeting card available in any department store for $6 presents more computer power than existed in the world before 1950. A home video camera has more processing power than an IBM 360, the device that began mainframe computing. Broadcasters who delay migration into the digital world will see their long-term viability drop as viewers seek entertainment elsewhere, taking ad revenues with them.

Still there is resistance. According to a recent survey, nearly 81 percent of all chief engineers who responded felt their stations were not ready for DTV, and only 5 percent said they have made a digital transmitter purchase. These engineers also believe that the best selling feature for digital television is high-definition television, followed by multicasting. Only 8 percent of the respondents felt that data services were the best DTV selling feature. Based on other information, it appears that around 90 percent of broadcasters are still NTSC analog and have not taken the first steps into the digital world. Is the economic investment the reason for the delay?

While no exact dollar figure has been set, some experts have projected that digital transition will cost between $5 million and $12 million per station. Other projections indicate that U.S. broadcasters will invest more than $4 billion on digital conversion. On average, this will equate to between $3 million to $4 million per station. While it is difficult to quantify the impact new technology will have on the cost structure during the next five to six years, it is clear the digital transition represents a major investment for the broadcast industry.

A lesson in broadcasting economics

Every station exists to maximize customer and shareholder value. Markets provide investment opportunities for businesses such as broadcasting. By identifying and capitalizing on these opportunities, broadcasters can create value for their viewers and investors. A broadcaster must vigilantly search for new opportunities by exploring and developing new markets and technologies. As market dynamics evolve, broadcasters must continuously reinvigorate their



ability to maximize value to remain competitive. In the Internet Era, this search takes on a much greater role as new competitors challenge the traditional broadcasting business model.

Financial metrics used by general managers and CFOs to evaluate a broadcast investment are net present value (NPV) and internal rate of return (IRR). Expenditures occur as new equipment is purchased, and cash inflows occur as the equipment helps to generate new revenues. The NPV represents what these cash outlays and inflows are worth today, when compared with the required rate of return. The required rate of return is the return that the station must earn in order to satisfy its investors. The internal rate of return (IRR) is the expected rate of return that equates to a NPV of zero. If the broadcast project has a NPV greater than zero, then it adds value to the station, and the chief engineer receives the approval to make a purchase - in most cases.

Several things must be kept in mind when reviewing investment opportunities. First, sooner is always better. A broadcast project that generates cash inflows sooner will yield a better NPV and IRR performance, if all other factors remain constant. A CFO does not appreciate equipment investments that take a long time for cash inflows to occur.

State of the art control room in the National Digital Television's Center's Hollywood based all digital production truck. Photo by Bud Shannon.

Second, the expected cash flows are just that: expected. Nobody can forecast what will happen during the next several years, much less the next 10 years. Who, in 1995, could have predicted that Internet ad revenue would be $3 billion in 1999? In the digital era, opportunities develop, mature and disappear at a much quicker pace, adding additional ambiguity to investment evaluation.

Costs

Hidden costs associated with the digital transition appear to be minimal. Once the digital system is operational, early indications show that the power used by the transmitter is the only substantial addition to the operating expense budget. That can vary considerably depending on transmitter type and channel - from $500 to $22,000 per month.

Compared with analog equipment, digital equipment will also provide operating cost benefits. First, digital products are usually easier to operate, enabling existing staff to handle the workload more efficiently. Second, digital equipment tends to be more reliable. Some products have built-in intelligence that is capable of alerting technicians prior to imminent failure, increasing uptime. Finally, if something does go wrong, digital technology offers sophisticated self-diagnostic features and modular repair schemes that can expedite repairs while reducing maintenance expenditures.

Embracing the change

The digital model changes the world for the equipment manufactures as well. It is up to equipment manufacturers to assist with the transition from analog to digital. To be successful, manufacturers need a strategy that offers broadcasters cost-effective ways to manage the transition, ensuring a satisfactory financial return. Manufacturers must offer programs that allow broadcasters to extend implementation costs over several years. Pay-as-you-grow schemes could provide broadcasters with the flexibility to install lower power equipment now and have a financially attractive future upgrade path to higher power equipment. Equipment leasing also could provide another method to defray up-front investment.

This also affords broadcasters the ability to develop alternative services such as data casting. These programs also provide economic incentives for being an early technology adopter.

Broadcasters could reallocate funding from studio equipment to datacasting equipment to enter the data world while simultaneously broadcasting a digital signal. For example, the broadcaster could postpone the studio investment until HD programming becomes widely available. Most people find upconverted pictures acceptable. The broadcaster could use studio funding to purchase a data router, fiber connection and a statistical multiplexer.

What can broadcasters do with the pipeline to earn an acceptable return? First, the broadcaster has access to a new audience: people in their workplaces. A recent Internet study showed that 40 percent of all the Web users gain access from work. Broadcasters, in conjunction with their Web site, could develop new marketing and advertising opportunities.

When combined with streaming technology, any business' network manager could be a new market for broadcasters. In most cases it is cheaper to install a PC converter and build distribution schemes to alleviate network congestion than it is to change network topologies or install network switching.

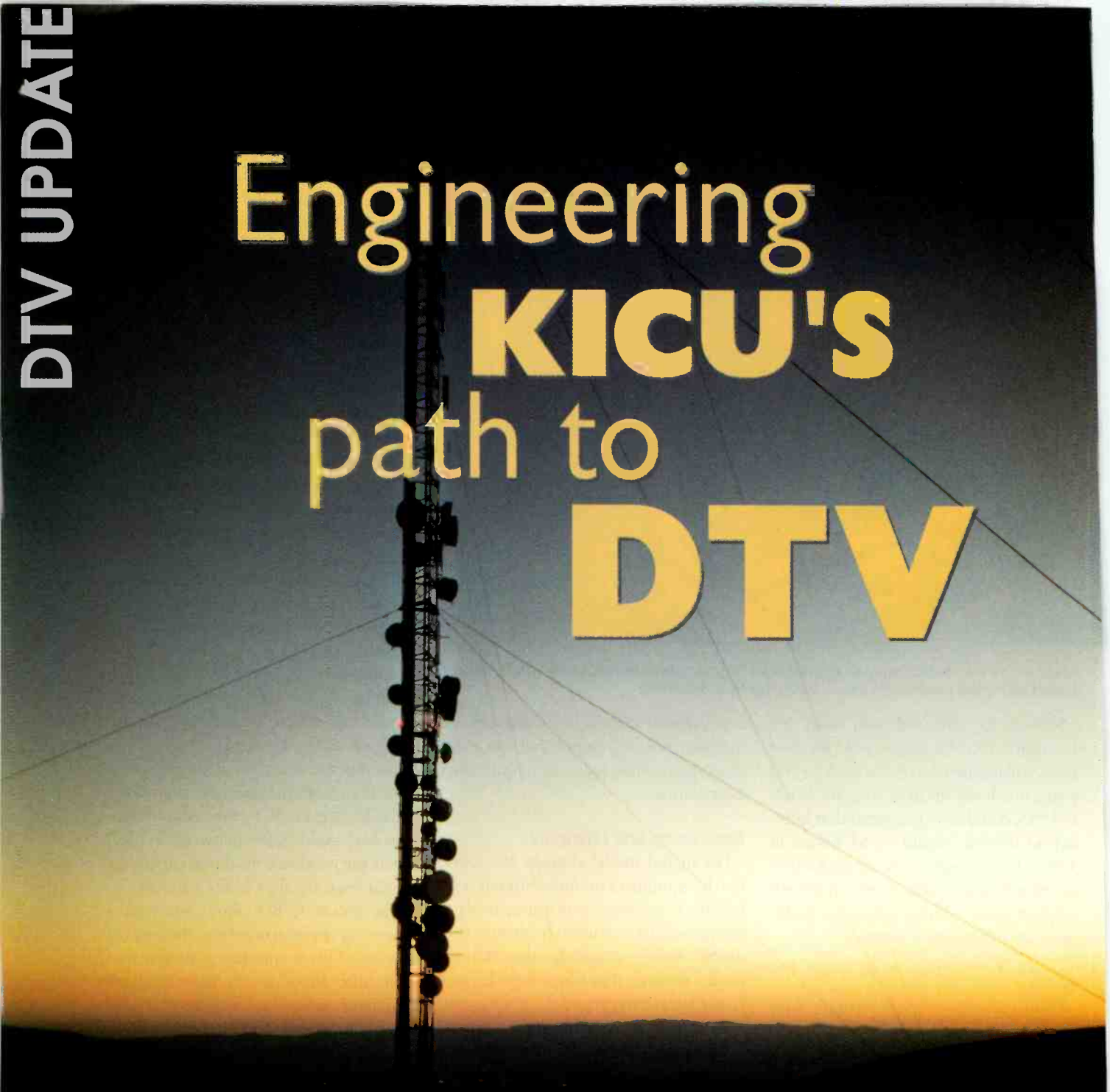
With the 3G wireless technology, which promises 2Mb/s data rates, the broadcaster has a new business model for Internet access. Data traffic tends to be more intense from the network to the user than from the user to the network. Broadcasters could transmit data-intensive back-haul traffic (network to user) while the wireless connection carries the signal from the user to the network.

The recent CeBIT show has seen a flurry of activity around handheld or net devices. This is another platform that will offer broadcasters new markets. The next wave of net devices will have the ability to surf the Internet, making those media consumers prime targets for broadcasters' new streaming media. Laptops are being introduced that incorporate full telecommunications phone-enabling mobile Internet access.

The Internet Era will bring many challenges and opportunities for broadcasters. Broadcasters can embrace the technology now and begin to develop new, innovative products or postpone the transition until later. With the explosive growth of the Internet and the new media opportunities it world bring, the cost of delaying until tomorrow will be greater than the investment required today. ■

David F. Burkey is president and CEO of Continental Electronics.

Engineering KICU's path to DTV



By Jim Boston and David Lingenfelter

Now that digital television has been rolled out in most of the major markets, many broadcasters facing their day of DTV reckoning must start doing their homework to ensure a successful launch. KICU, an independent station in San Jose, CA, decided last year that it would be a DTV player sooner, rather than later. KICU is part of the fifth largest

KICU's transmitter site at Monument Peak, CA. The test H and CP antennas were located at 245ft, with the NTSC antenna at 562ft.

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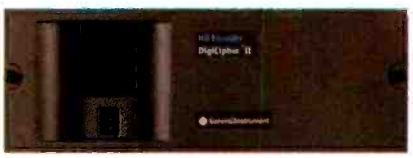

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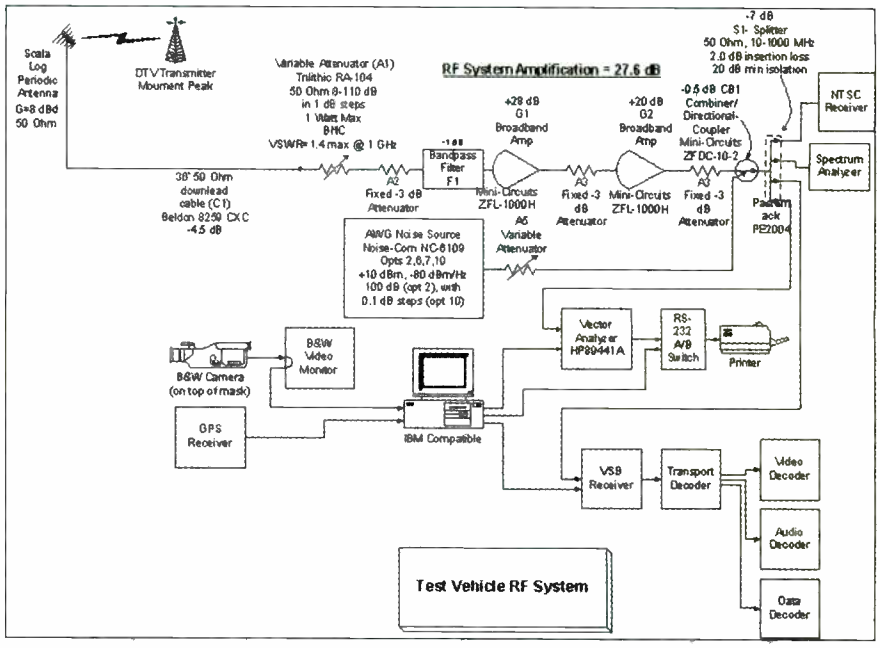
market, but it also straddles the 121st market. KICU is independent, in the fullest sense, in that it is one of the few remaining stations that is not part of group ownership and that it is actually locally owned. From an engineering perspective, this presents opportunities, along with a fair amount of risk. A group-owned station can generally look to its corporate engineering entity for a lot of the answers to the DTV puzzle. KICU was faced with engineering its DTV transition all by itself. The station's chief engineer, David Lingenfelter, and vice president of operations, Bill Beeman, have led this engineering pathfinding. Although both have extensive NTSC baseband and RF experience, a steep DTV learning curve had to be negotiated.

A number of questions would have to be answered before the exact path to DTV could be charted. The assigned channel (52), and the power to replicate the existing NTSC channel (36) was spelled out in the FCC's Sixth Report and Order. This meant that effective radiated power (ERP) was established, or so it would seem. Although Horizontal (H) vs. Circular Polarization (CP) propagation, and reception characteristics had been tested before by the Model Station Group (MSG), the station's staff wondered if the earlier testing, which showed no benefit in using CP, was applicable to KICU's market.



The test vehicle RF system was built by assistant chief engineer, Chuck Pracna. The bandpass filter (in line with the Scala antenna) was used to prevent the NTSC stations on channels 48 and 54 from overloading the analyzers front end. This filter was bypassed when making NTSC measurements on channel 36.

KICU's coverage area is a region of extremely diverse topology. It includes many mountain ranges, with accompanying valleys, large expanses of water and three major metropolitan areas that have expanded to form one megalopolis known as "The Bay Area." This mix of natural and man-made obstacles produces many reflections and casts many shadows for broadcast signals. This situation has caused much degradation of NTSC coverage. As has been widely publicized with the advent of digital television, gradual degradation of the signal should not occur in the digital domain. The baseband, modulated, and transmitted digital signal should be decoded perfectly by a receiver right up to the point where noise, reflections and other factors swamp the error correction system's ability to recover the data, the well known "cliff effect." From testing it has

Transmitter site with the Harris 200W Ultra 1 on the left and rack-mounted Philips encoding equipment just to the right. Philips engineer Ben Sorensen configuring the Philips encoder/multiplexer.

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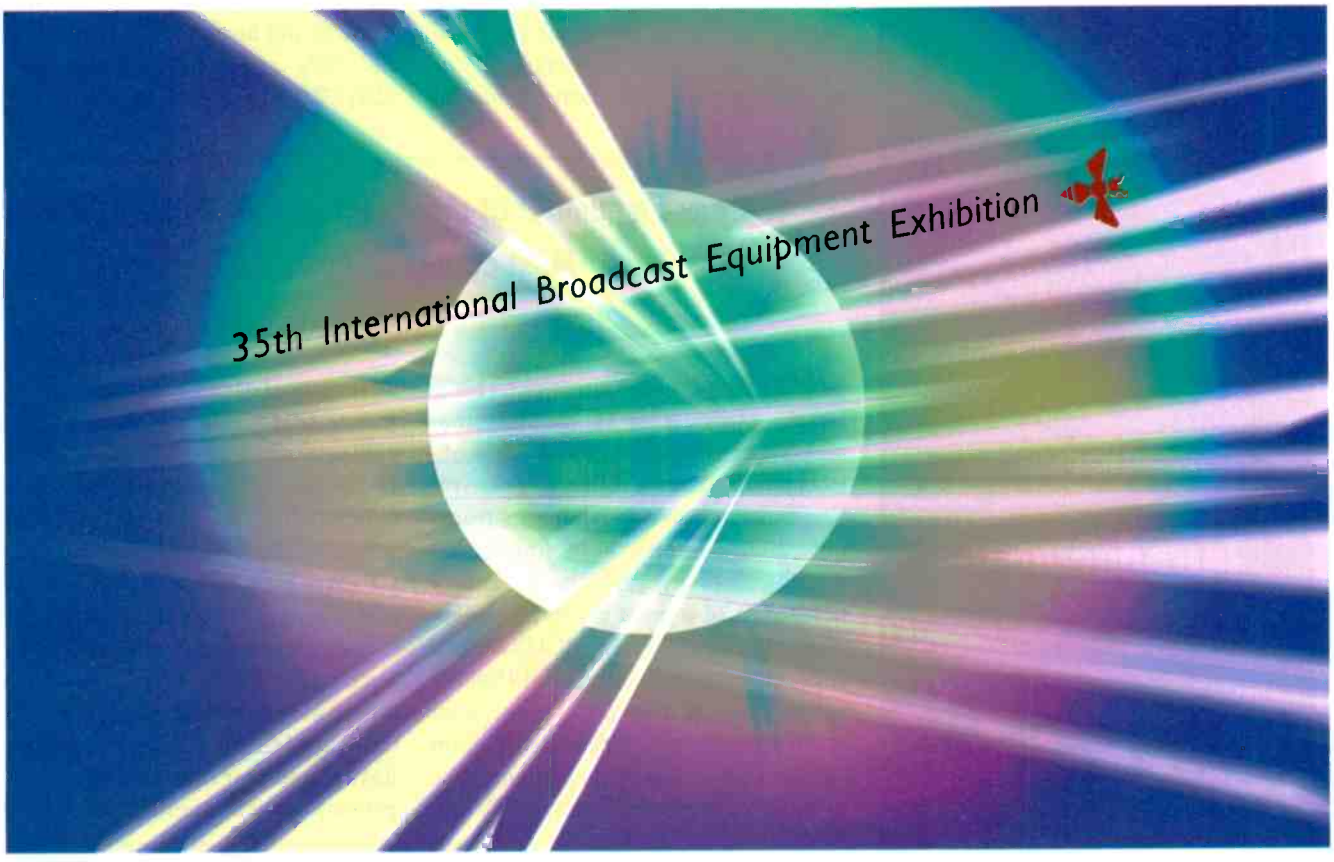

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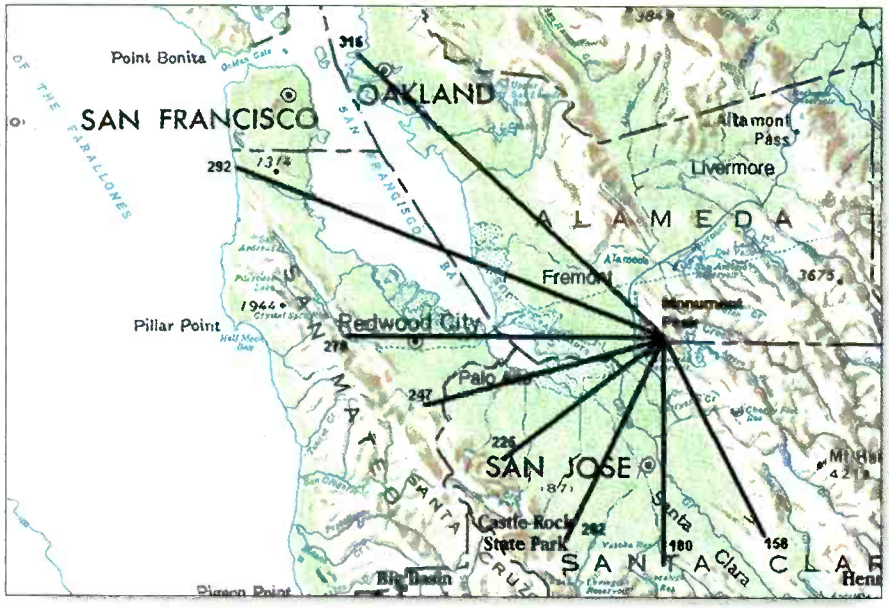
KICU

been determined that error-free DTV reception can plummet to an almost one in two chance for errors with less than a 0.6dB change in S/N.

Signal reflection, or multipath problems, while annoying in NTSC have been rumored to be lethal to ATSC signals. CP propagation has been employed by some broadcasters since the late 70s to minimize ghosting. This is largely attributable to the fact that reflections off buildings and other objects tend to have a different polarization sense relative to what was transmitted. It has also been found that signal components in the H and V fields fade to a great extent, independently of each other. In KICU's experience, H seems to fade or be diffracted off its axis to a greater degree over water than does V. Indeed, diffraction off the H axis has been evident since television's inception. Early CATV systems often mounted receive antennas in vertical orientations rather than horizontal for the strongest receive signal. Horizontally polarized E fields sometimes appear to be diffracted by obstacles along the path and end up with vertical orientation.

There are a number of disadvantages with using CP. Most center on cost. Although true circular polarization is difficult to achieve it also means doubling radiated power, with nearly equal vertical and horizontal E fields. Channel 52's assigned radiated power (251kW), along with the desire to use a fat vertical pattern, low-gain antenna means that CP would need three RF cabinets (one for backup) using IOT or Diacrode technology instead of two cabinets if H polarization was implemented. The power requirements for CP (over 500kW ERP) would preclude any thought of using a Solid State transmitter. A three-cabinet transmitter translates into increased up-front costs, along with increased monthly costs, mainly for power. Some experts have stated that they believe only a 25 percent vertical component might be

There are a number of disadvantages with using CP. Most center on cost.



Map shows the eight radials tested. All denote the compass heading from Monument Peak. The 76 test sites on these radials ranged from 2 to 37 miles from the transmitter site. Measurements along the radials stopped when that radial reached water or a mountain ridge.

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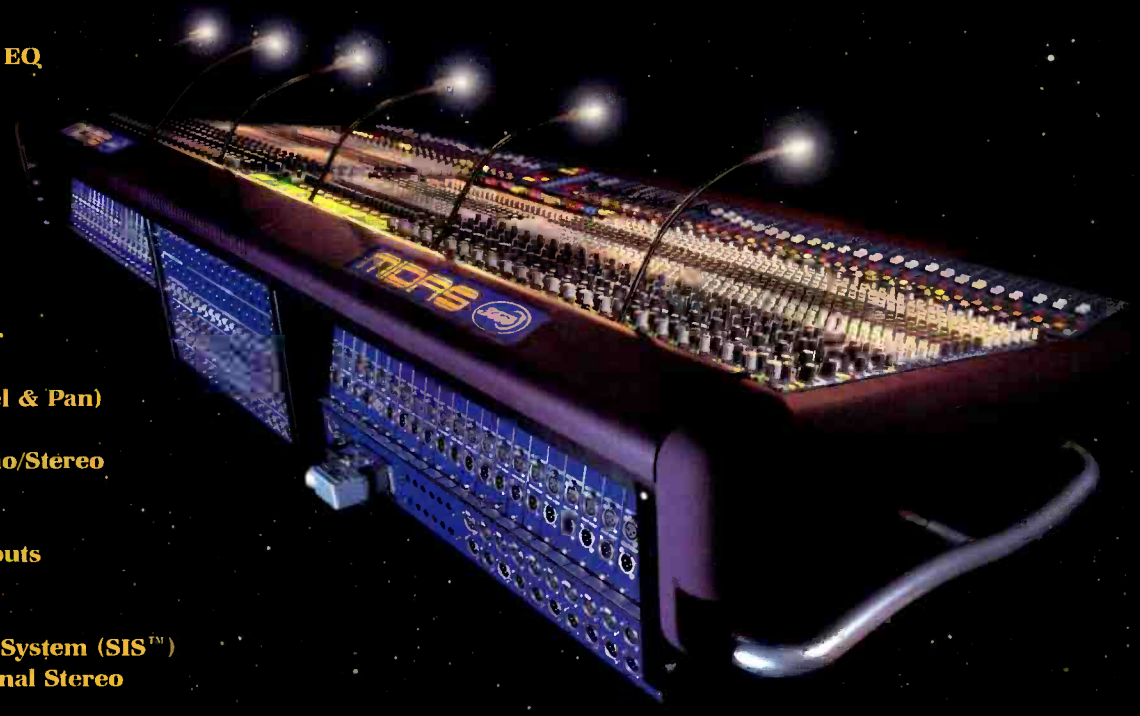

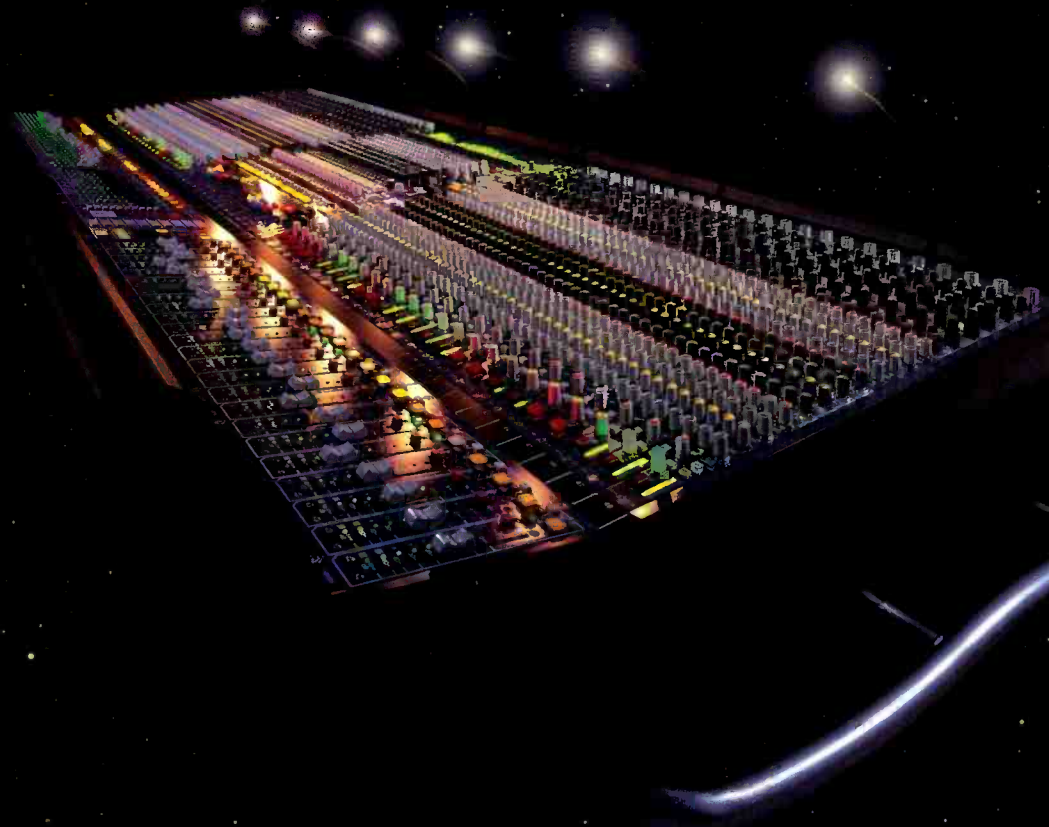

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necessary. This would obviously lower the power required. Robert J. Plonka, principal engineer for Harris, has said noteworthy diversity improvement can be obtained without doubling the power. A very general rule of thumb for the difference between NTSC and assigned DTV power levels is due to the S/N ratio differences between the two at just acceptable reception. NTSC is generally considered unusable when S/N drops to 28dB. DTV becomes absolutely unusable at a much lower S/N value, which is around 15dB.

After doing a spreadsheet analysis of transmitter capital cost, operating costs, power levels, antenna gains and polarization, it was determined that CP would need to clearly show an advantage over H to justify the increased cost of ownership of the larger transmitters.

It became clear that because CP would impact ERP and antenna selection, which in turn would affect transmitter technology selection, KICU's engineering staff would perform it's own DTV testing to gather information. In order to avoid "reinventing the wheel," the tests were based on the protocol developed by MSG. MSG is an association of equipment vendors and broadcasters that have rallied around a "model station," WHD, to iron out interoperability and testing of DTV. Besides WHD, testing has also been done at WRAL in Raleigh and WGN (using WYCC's final amp) in Chicago under MSG guidance.

	KICU-TV	KICU-DT
Type	NTSC	DTV
Channel	Ch. 36	Ch. 52
Center Frequency	605MHz	701MHz
ERP	4000kW	1.6kW
Ht. AMSL	3012ft	2695ft

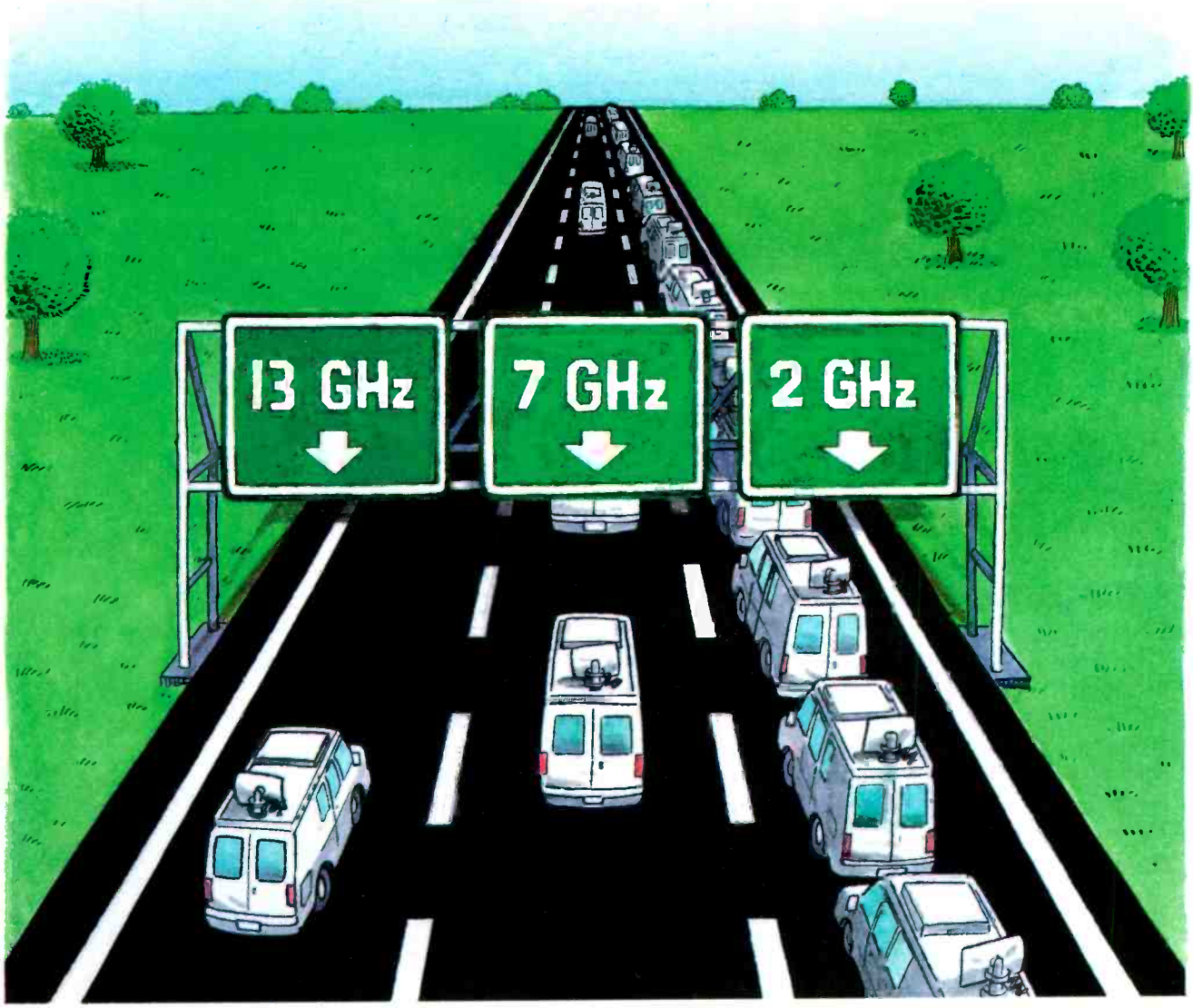
Table comparing key NTSC and DTV parameters. Note the difference in testing power levels between NTSC (4MW and DTV 1.6kW).

The plan

The station's engineering staff set out to design, document, construct, test and place into operation a low-power DTV transmission system for the purpose of conducting tests that would provide answers that can be applied to the design of full power DTV channel 52. The goal of the project was to produce a solid engineering recommendation as to whether KICU-DT should employ horizontal or some form of circular (elliptical) polarization. The fallout from that decision would allow staff members to select a transmitter configuration, transmitter technology and a set of antennas for DTV operation.

After studying the previous tests, a plan was made that would remove as many variables as possible and, hopefully, make the results clear enough that a decision could be made with some confidence. It was decided that an H antenna and a CP antenna would be installed at the same location on the tower with a remotely controlled coax switch selecting which antenna was being fed. The coax switch would be interlocked to the test transmitter, removing drive during switch motion. This would allow easy and safe selection of which antenna was active while the field measurements were being taken. The transmit antennas, built by Antenna Concepts, were such that the H gain of the H and CP antennas was the same. At this point, antenna height, gain and patterns were as close to being the same as practical

ENG Congestion Ahead



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Measurements were taken at 81 sites along eight radials. The farthest measurement point was 37 miles from the transmitter.

KICU

thus removing these factors from consideration.

Due to the low power of the available transmitter, the H and CP transmit antennas were mounted on a single pipe which was in turn mounted on a 2000-pound-rated rotator. The top of the antenna-mounting pipe fitted into a strut-supported bearing. It was then possible to align the transmit antennas with the radial being measured in the field. Essentially, the rotator created an omni-transmit antenna as far as the measurement van was concerned. This removed the azimuth antenna pattern variable from the equation. A control system was designed so that staff members could change antenna-aiming azimuth, control the coax switch and also turn the transmitter on with a keypad on a two-way radio. This allowed the testing to be conducted without having a person at the transmitter site all day, and, in many cases, late into the night and on weekends.

Our testing was done with a horizontal receive antenna because that is what consumers have available.

Our testing was done with a horizontal receive antenna because that is what consumers have available. The measurement van receive antenna was itself on a rotator so that vertical polarity measurements could also be taken as needed for multipath study. At each test site we also performed signal strength and S/N measurements on our Ch. 36 NTSC signal. This was done for two reasons. The first was to compare the DTV signal to the NTSC signal. The second reason was because of the familiarity most of us have with NTSC reception characteristics. The NTSC signal made it easy to confirm several site parameters, such as multipath and signal strength. Our DTV effective radiated power (ERP) for the test was only 1600W (average), while our NTSC ERP is 4MW. Because of the low DTV power a few unique engineering solutions were developed, which we will see shortly.

A generator was installed in the van so the equipment could be warmed up in the morning, calibrated and let run all day. At the end of the day the equipment and generator were shut down. Air conditioning kept the equipment rack temperature reasonably constant so equipment drift was eliminated.

We conducted this study from the viewpoint of getting an answer to CP versus H for KICU. The engineering studies done previously by WHD, and WRAL had already thoroughly documented 8VSB propagation and receive characteristics.

Strategy and objectives

To accomplish the above mission we used as much borrowed equipment as possible in exchange for vendor access to information obtained and the lessons learned.

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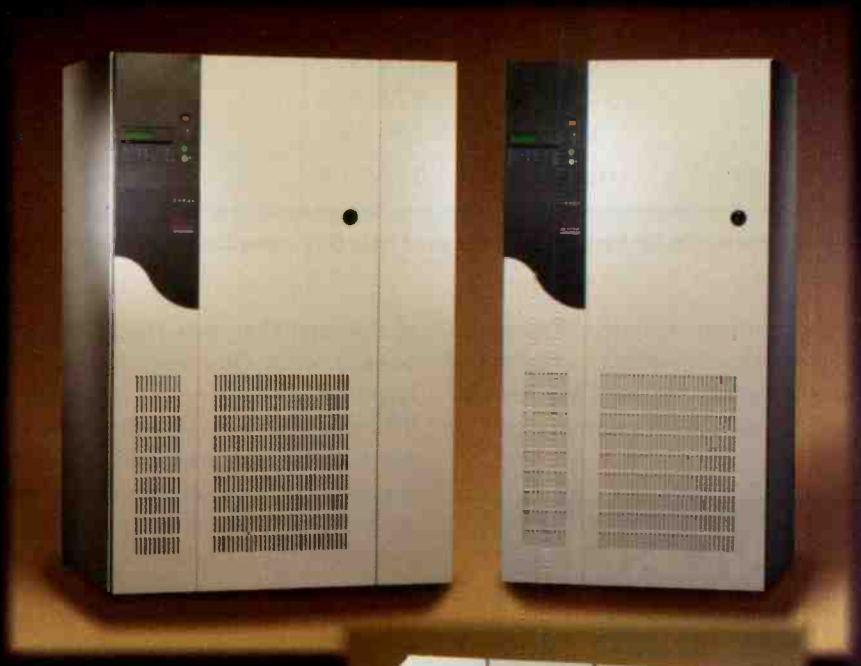

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• Harris loaned a 200W (average power) Ultra 1 solid state transmitter.

• Leitch loaned an ASC audio/video server to act as a source at the transmitter.

• Phillips provided a DVS3112/2 MPEG-2 encoder, and a TokenMux transport stream multiplexer.

• Hewlett-Packard provided an HP89441A vector signal analyzer.

• Tektronix provided an RFA300 VSB test monitor.

• Antenna Concepts Inc. provided the antennas

• Zenith provided an ATSC demodulator/decoder and technical advice.

The HP89441A was used to perform a number of the RF measurements. To perform these measurements an IBASIC program written by Zenith for the VSA was used. This unit measured channel passband characteristics, DTV and NTSC channel power, and the truck's RF amplifier gain, and noise floor.

Zenith loaned the latest iteration of what is commonly called "the blue racks," a prototypical DTV demodulation measurement system. Zenith also provided the considerable expertise of Gary Sgrignoli. Sgrignoli has been involved with Zenith's development of the 8VSB modulation scheme since it's inception. His tutoring and guidance on the intricacies of the testing procedure ensured we would be able to accomplish our objectives.

One of the unique aspects of the test is that we applied for and received what is probably the only STA in history for a steerable transmit antenna. Antenna Concepts of Diamond Springs, CA provided panel antennas that were stacked on top of each other. One was a horizontally-polarized emitter, the other a CP. The antennas were designed with the same horizontal gain of 11dB. This was done using a single panel antenna for the H antenna and two CP panels for the CP antenna. The vertical beamwidth is therefore narrower for the CP antenna, 12° vs. 24° for the H antenna. The total CP antenna gain was 14dB.

NTSC CCIR Grade Impairment rating	# of test sites	Satisfactory DTV sites	Med DTV margin (H/CP) (dB)	DTV Tap Energy (H/CP) (dB)
1	7	4/4	25.0/21.7	-12.8/-11.9
2	5	5/3	31.7/27.9	-12.0/-12.4
3	35	34/32	32.2/30.9	-17.3/-17.3
4	30	30/30	37.0/33.9	-17.3/-17.9
5	3	3/3	32.7/34.8	-17.8/-16.4
	80	**76/72**	**33.1/31.8**	**-17.2/-17.2**

Summary results. The bottom line is that CP transmission does not help DTV reception when an H receive antenna is used.

Frank Foge engineered a steering and control system for the antennas. A 1 5/8-inch coax switch directed the RF coming up the tower to either the H or CP antenna. This switch could be controlled from either the base of the tower or via RF control from the test vehicle or at the studio. A camera pointed at the top of transmitter cabinet allowed confirmation of antenna azimuth and coaxial switch position via a TSL back to the studios. Mark Cunningham, president of Antenna Concepts, and his crew mounted the complete antenna(s)/steering system at the 245-foot level of our 600-foot tower in the middle of October. The testing commenced Nov. 2, 1998.

Chuck Pracna, the station's assistant chief engineer, oversaw the transformation of an ENG van into a DTV test vehicle. The truck was built to the MSG test vehicle specifications which

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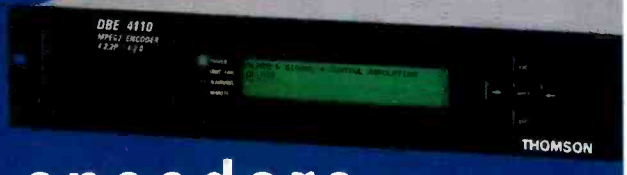

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A 30-foot pneumatic mast with a pan/tilt head, Scala yagi antenna, rotator, compass and B&W camera was used at each measurement point. The camera image provided a picture of what the receive antenna "saw" as it looked toward the transmitter site.

were developed for the initial field tests at WHD for the Model Station Project. Information gathered at each test site allowed the calculation of DTV signal strength and FCC site margin, along with the confirmation that 8VSB signal would always fail when the S/N of the channel dropped to 15dB. We also recorded tap energy using the Zenith demod ("Son of Blue Rack"). Tap energy is an indication of multipath. These measurements were done with both the H, and CP transmit configurations. Since there is a long history of NTSC measurements, we made field strength and CCIR view-ability checks on our Ch. 36 NTSC signal also. The picture on a NTSC receiver will often give hints as to reception problems at a site that are easier to discern to anyone who is new to DTV testing. But it should be stressed that in a very short time we began to be able to detect the symptoms of reception problems by looking only at the DTV measurements. The July issue will explain how to make these measurements and how to interpret them in detail.

General DTV test findings and observations

- Eighty sites were tested over a three-week period during November of 1998. Both DTV (1.6kW ERP) and NTSC (4MW) were evaluated and measured. It should be noted that our DTV test station is 22dB below our authorized ERP of 251kW.
- We found three sites where neither the DTV nor the NTSC signals were useable. In all but one instance, terrain caused low signal levels.
- We found only one site where NTSC was OK but DTV didn't work. This site was two miles out on the 180° radial. We had line of site to the NTSC transmit antenna, but the DTV transmit antenna was below a ridge (the DTV antenna was 317 feet below NTSC antenna). This, combined with the low transmit ERP, caused the signal to fall below the threshold. We found five sites where NTSC was OK but DTV C polarization didn't work. One of these sites is where DTV-H didn't work either (again, two miles out on the 180° radial).

We found only one site where NTSC was OK but DTV didn't work.

- We found four sites where DTV-H was OK but NTSC was unwatchable due to extreme ghosting, and/or noise.
- One site had noisy NTSC reception while DTV was OK.
- Ghosting on NTSC was evident at 17 sites, while DTV was OK. Sites with strong and multiple NTSC ghosts didn't always translate into high tap energy values. In many instances, a few pronounced ghosts would not produce enough total coefficient summation to cause poor tap energy readings, but a few high value coefficients seemed to

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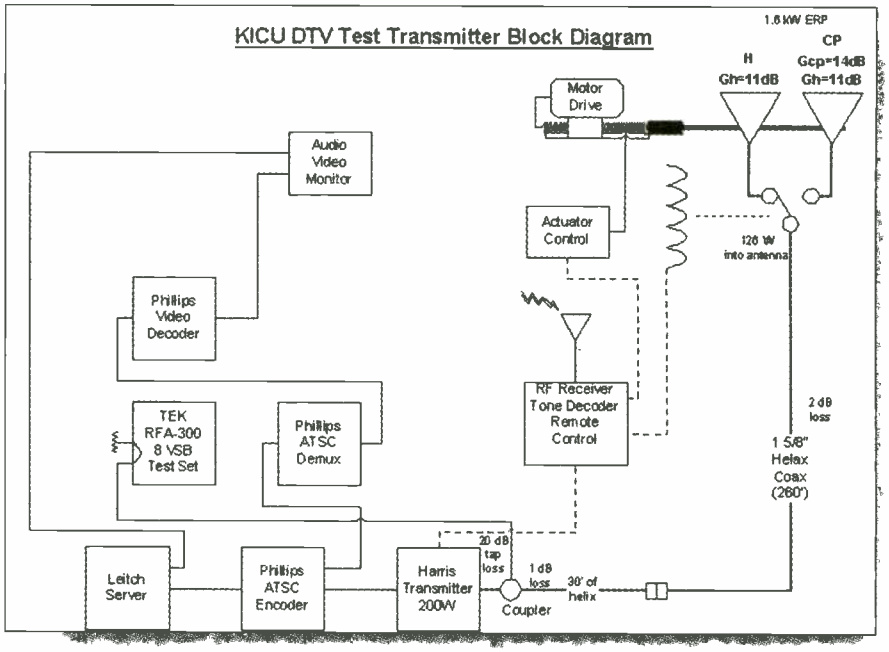
track what was seen on NTSC. In 11 instances, tap energy for H was lower (less multipath) than CP and in one instance they were equal. In only five of the 17 instances were the values more than 1dB apart. Also, propagation effects, such as multipath, are not identical at Ch. 36 and Ch. 52 due to the 96MHz frequency separation.

CP does not seem to help DTV outdoor reception when using H-receive antennas, even in high multipath environments.



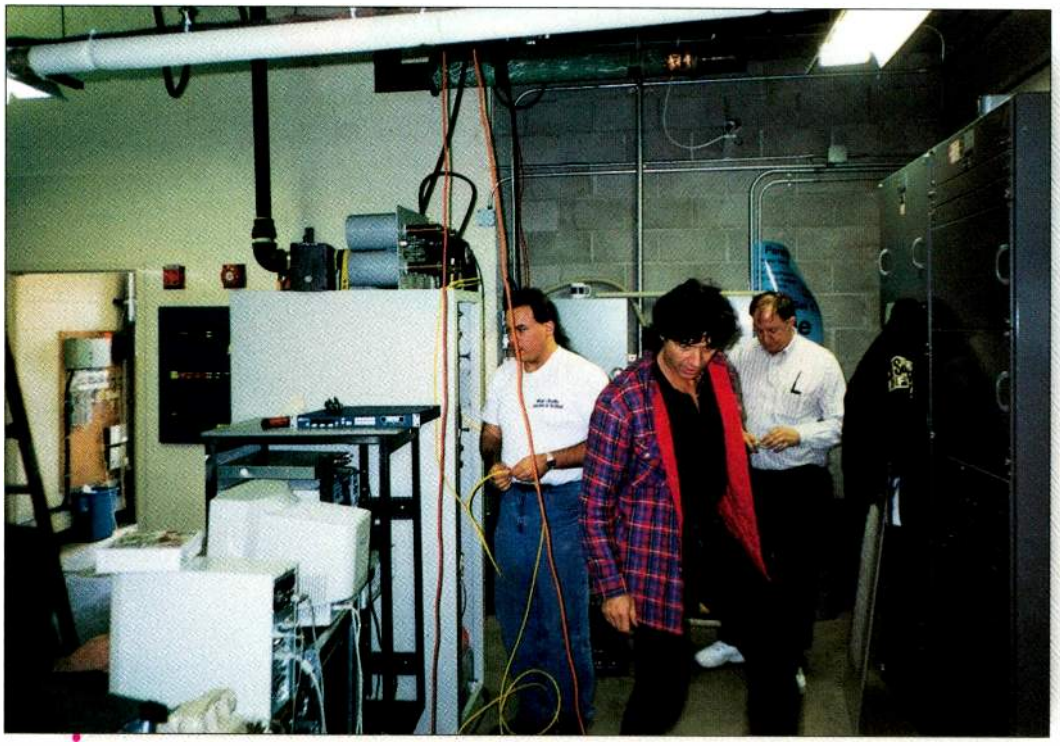
KICU DTV test transmitter block diagram. Key elements were the remotely (H and CP) antennas. This allowed the field test crews to switch between H and CP polarization at each test point.

• At one site we witnessed both NTSC and DTV fades, but there was a ridge line approximately 3/4 miles away that was even in elevation with the test site.

• In two instances at sites close in (large antenna depression angles), NTSC had strong ghosting, while the DTV signals faded. Again we attribute this to the fact that the DTV antenna was 317 feet below the NTSC antenna.

• At two sites near Sutro tower, which is the site for most of San Francisco's VHF/UHF transmitters (292°, 36 & 37 miles), the NTSC signal had high intermod, which was most likely due to receiver direct pickup of NTSC, while the DTV signal was OK.

• At nearly all the sites, the horizontally polarized DTV transmit antenna has a slightly higher site margin than the circular polarized signal. This was due to received field strength generally being slightly hotter for horizontal. This might be attributed to the gains of the H and CP antenna being slightly different. Additionally, because the overall gain of the CP antenna was twice that of H (because of a fixed TPO out of the transmitter), the ERP's for H will be the same for both but the vertical patterns for the H components in both the H and CP antenna were different.



James Mueller, Chuck Pracna and David Lingenfelter install the transmitter and support equipment. Because the station did not have a digital STL, the ATSC encoder, multiplexer and SDI video source were installed at the transmitter site.

Summary of results

After all this work, what did we learn?

Conclusion: CP does not seem to help DTV outdoor reception when using H-receive antennas, even in high

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multipath environments.

It will most likely be necessary in many cases in the future for DTV stations to conduct these outdoor and, probably as important, indoor tests. The TV manufacturers are very concerned about reception testing. If a customer buys one of these expensive sets, and then takes it home to find that he lives in an area where some, or even all, DTV stations can't be decoded because of reception problems, that DTV set will be coming back to the store where he bought it. This expensive A stock DTV receiver will now become a discounted B stock item. Some manufacturers are concerned enough about this to take preemptive action. Panasonic is instructing its dealers to sacrifice a low-end DTV receiver as a test receiver. When a customer buys a set, the dealer sends along with a technician to evaluate reception before the customer's set is taken out of the box.

Sony Electronics is taking a more quantifiable approach. They plan to equip their dealers with a test box that performs a couple of the tests called for by MSG. This box not only measures signal strength of a selected channel, providing an AGC value, but it also has the ability to add noise through a control knob until an LED indicates that errors are occurring. The amount of noise added is displayed on a LCD. This reading gives you a relative indication of the amount of headroom or margin for a given DTV station, at a given location. We tested this box and found it useful.

Digital television does not mean that your analog skills will go away.

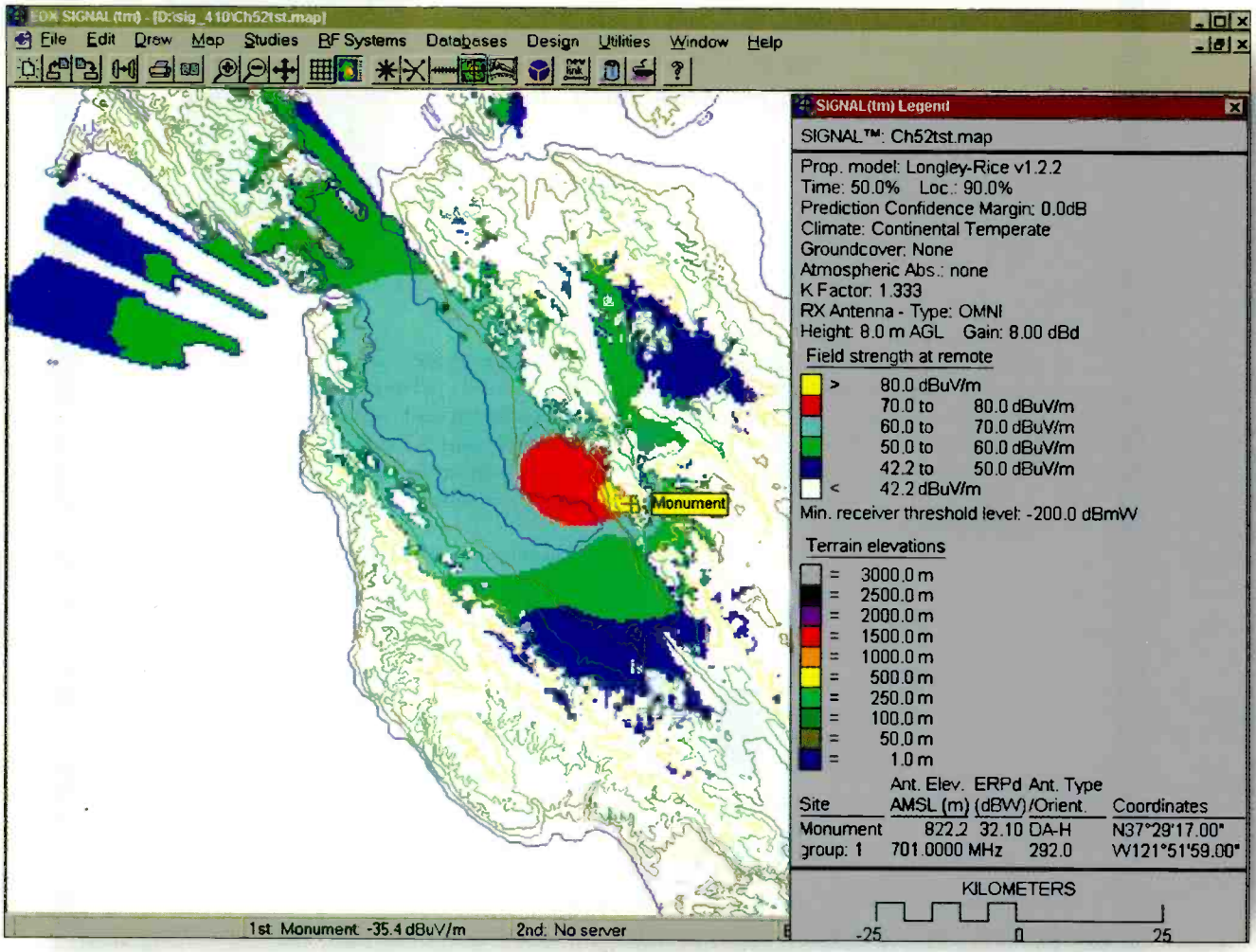
Conclusions

CP versus H

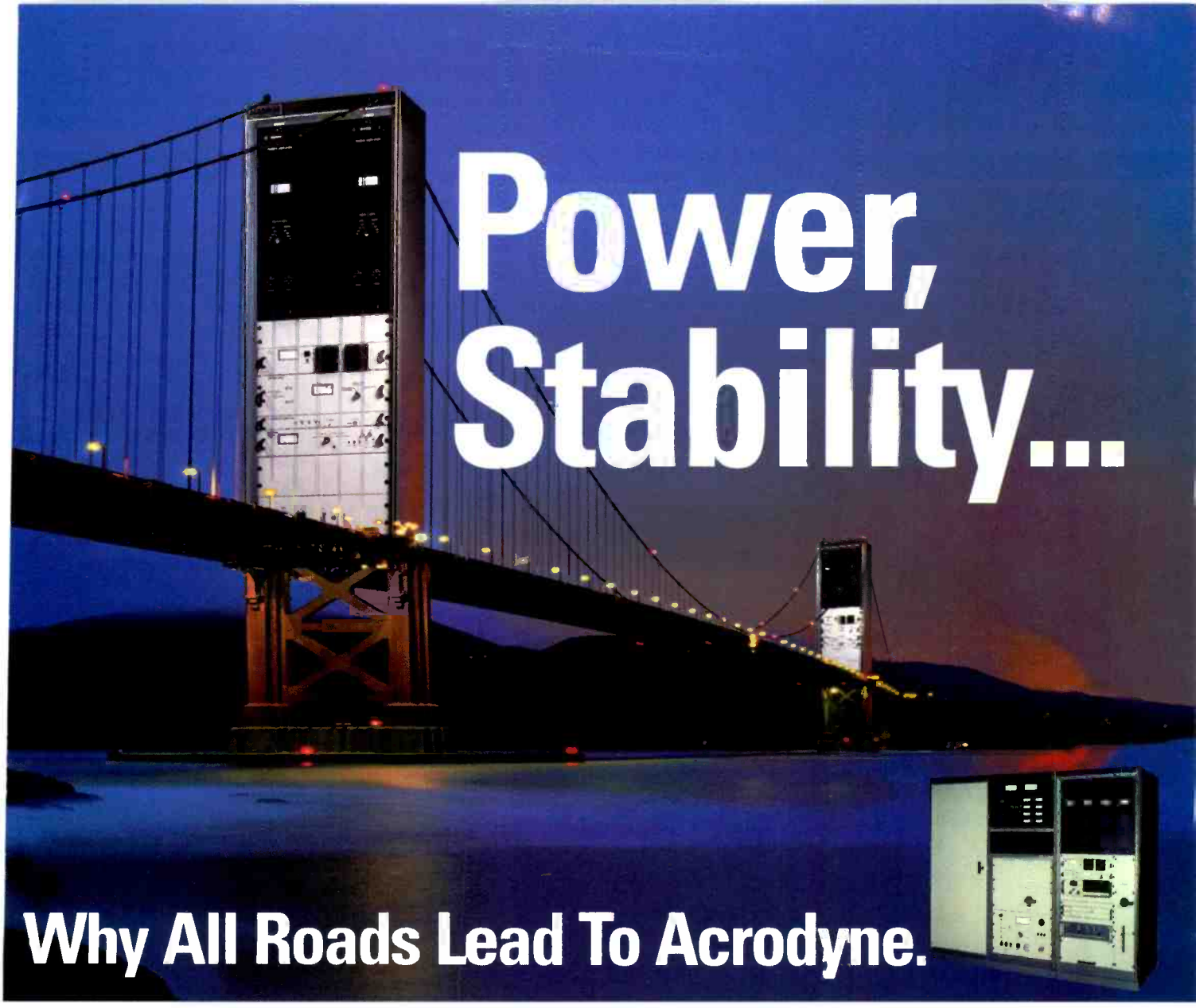
The main reason for our tests were to see if CP would help minimize the effect of multipath with the topology of our market. Tap energy and field strength measurements indicated that CP has no benefit, and in some cases actually performed worse than H for outdoor DTV reception. No indoor tests were performed.

Analog skills remain important

Digital television does not mean that your analog skills will go away. You must stay cognizant of the fact that processing does not end at your ATSC transmitter's encoder. A lot of what



Plot of EDX-Engineering propagation modeling program. This radial predicts a fair amount of coverage toward San Francisco with only 1.6kW ERP. Actual recorded field strength along this radial closely correlates with that predicted coverage. Signal strength was 59.1dBmV/m with H transmit and 57.4 dBmV/m with the CP antenna.



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makes ATSC so robust is the high-powered VSB signal processing that takes place in the consumer's receiver, be it an out-and-out television or just a set-top box.

Once again, it is being driven home to us that just as analog audio and video will be around, your analog skills need to stay intact also. Noise used to be the limiting factor as to how far out your signal could be viewed. With ATSC, it is not only noise, but also transmit linearity. As nonlinearity gets worse, your out-of-band performance gets worse (remember the FCC channel mask) and your in-band signal to noise gets worse. Passband amplitude distortion and group delay affect S/N.

Although transmitter manufacturers are trying to out-compete each other when it comes to S/N out of their boxes, Zenith claims that 27dB is sufficient. Some manufacturers claim values well into the 30s. One has to wonder if this is necessary or just desirable. At 33dB the 8VSB noise threshold is 15.1dB. At 27dB it is 15.25dB, which is a worst case scenario if all the noise is uncorrelated. To keep this value as high as possible, the analog specs remain important. Also, S/N relates directly to EVM. This is the value often reported as an indication of 8VSB's health. Again, manufacturer's specs have values between two percent to five percent. You will see those out of the transmitter but not at most receive sites. Values approaching 15 percent are seen as you approach the cliff. Linearity is extremely important. The coverage area will shrink as the system becomes nonlinear. That's the bad news.

The good news is that the 8VSB system appears to be very robust.

Height is important

The good news is that the 8VSB system appears to be very robust, and the picture quality, even at standard-definition, appears very good. We found comparable NTSC and DTV service availability even though the KICU NTSC is 16 channels below KICU-DT and NTSC is radiated at 34dB higher than our DTV test transmitter. It would appear that having the transmit antennas at high elevations is much more important than power.

A complete discussion of DTV receive parameters will be presented in the July issue of *Broadcast Engineering* magazine. Readers with specific questions on this article or DTV testing can send them to Jim Boston c/o brad_dick@intertec.com. Selected questions may be included in the July feature article. ■

Jim Boston is engineer and David Lingenfelter is chief engineer of KICU-TV, San Jose, CA

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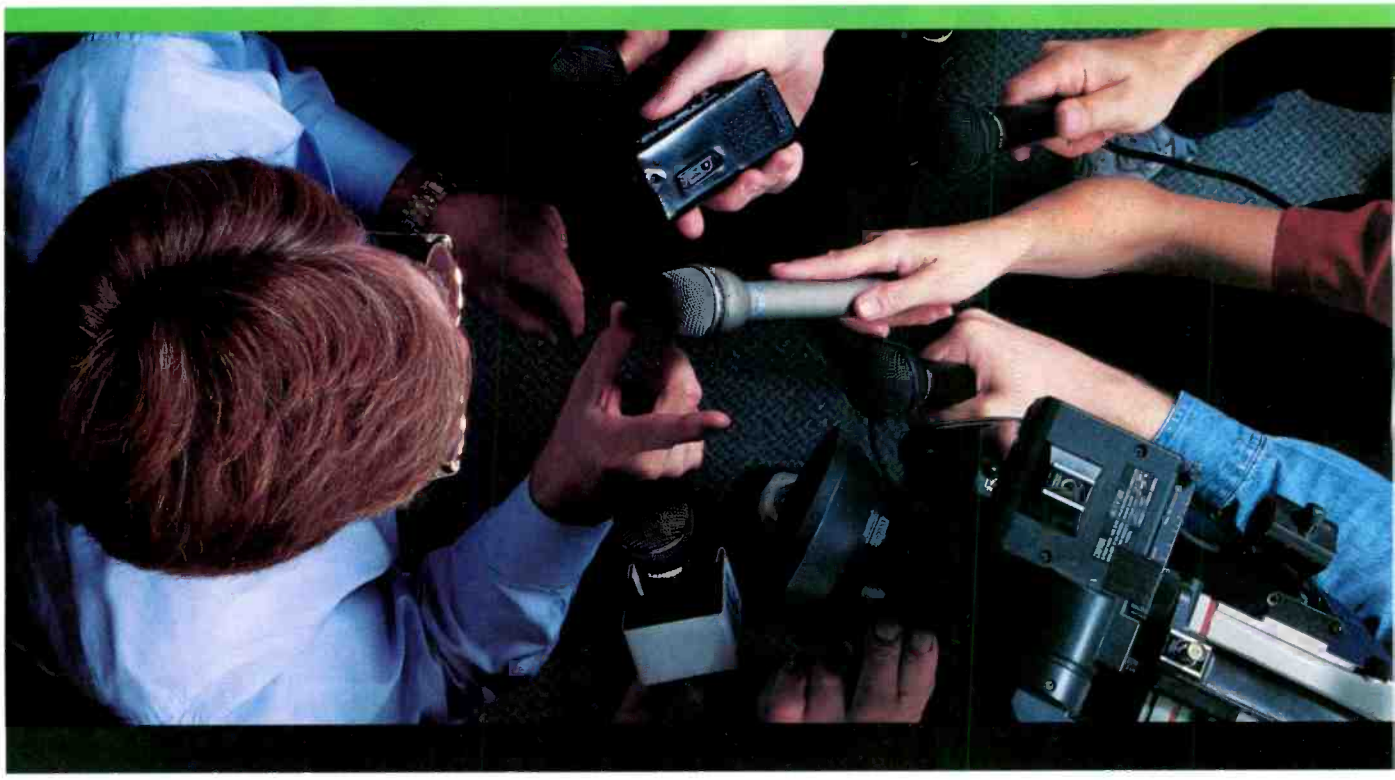

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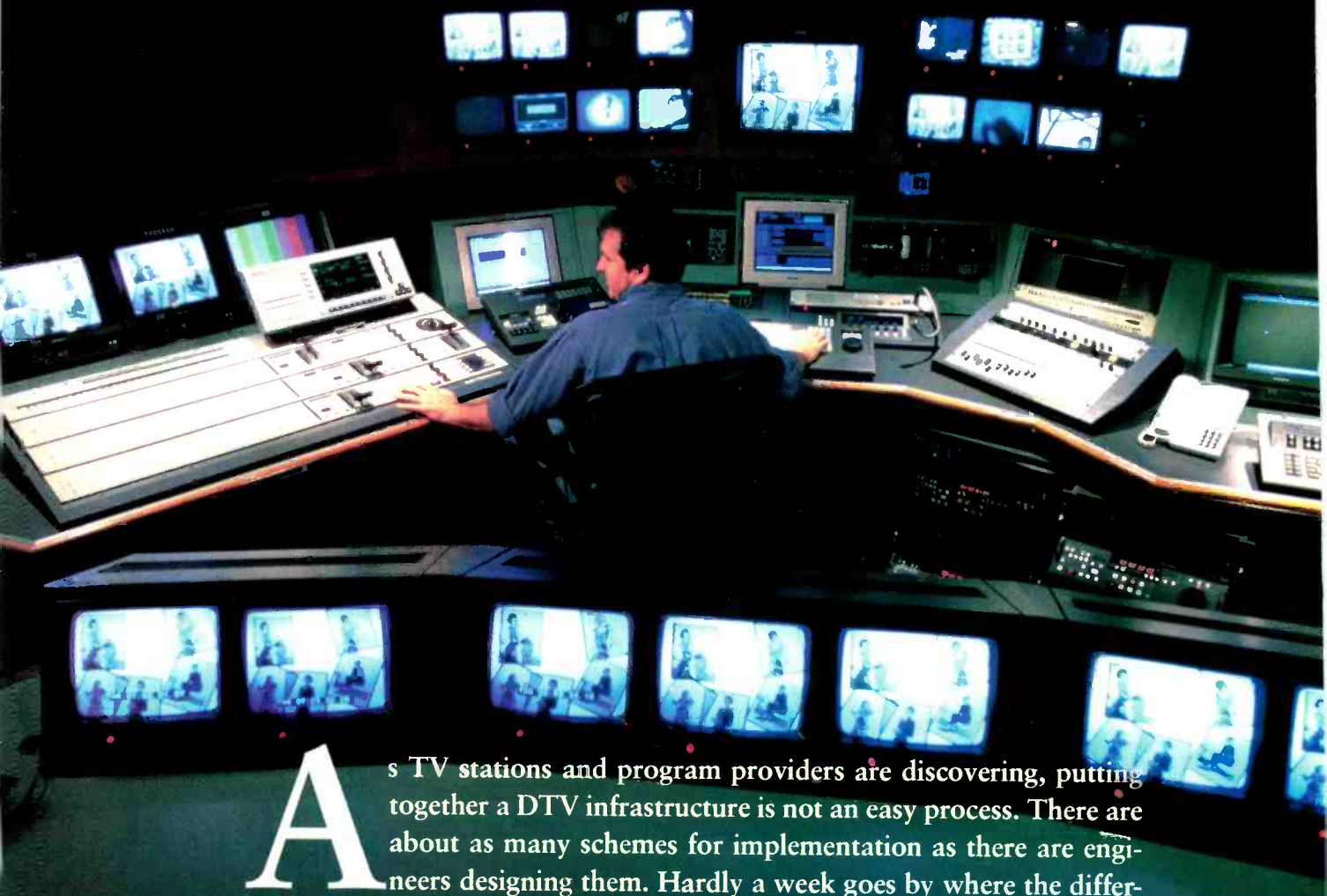
The ATSC Top-Down Report:

A blueprint for building digital facilities

by Kenneth Hunold



As TV stations and program providers are discovering, putting together a DTV infrastructure is not an easy process. There are about as many schemes for implementation as there are engineers designing them. Hardly a week goes by where the differences among the ways similar DTV concepts are brought to market are

Photo courtesy of Betelgeuse Productions

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ATSC

highlighted. Sometimes, it may be as simple as the wrong gender or pin-out of a connector, but often there are huge discrepancies in how different pieces of the DTV puzzle are put together.

Although the list of available equipment is small, it is growing. As broadcasters try to build their technical plants, there is no single model to follow. There are an extraordinary number of choices that stations and group engineers must make when designing these systems. As they are finding out, not all the pieces needed for every type of system exist, nor are all the necessary standards in place. To make matters worse, a mixture of implementation scenarios may be needed, depending on the needs, wants and desires of each department within a station or group.

Online editor Ed Givnish uses the Sony DVS-720 for client post production, while working in Edit Room 1. (Photo courtesy of Betelgeuse Productions)

In order to aid the transition to digital broadcasting, as well as to purposely find the gaps in the transition that need to be filled, the Implementation Subcommittee of the ATSC (Advanced Television System Committee) started a process to lay out all of the systems that might exist at a typical station. This inventory of systems would identify and highlight the standards that already exist for equipment interfaces. In addition, by noting places where standards either do not exist or conflict, these areas would be identified for future standardization and technological development.

This report was released on Oct. 30, 1998, is officially designated ATSC Document IS-095, and is available on the ATSC website at www.atsc.org. The committee presented the report at the recent SMPTE Conference in Pasadena, CA, and it was published in the December 1998 issue of the SMPTE Journal. For a complete copy of the 80-page ATSC report, visit www.atsc.org/Cover_Top-Down.html.

Included in the report are system maps, including a general diagram that includes a number of possible ways to design a DTV facility. It is not intended, expected or even desirable for any station to build the system shown on the main map, as it has been designed to indicate and address as many system topologies as possible. The system map was developed in a way that would not show one preferred implementation. Stations would rather, it is hoped, take the sections of the map that are appropriate for the station's needs, and implement just those sections, using the main map as a general guide. When possible, preferred — or strawman — implementations were offered by the different committee subgroups. Because the top-level map identifies all of the possible functions and their associated interconnections, it can be a bit confusing.

While the committee members were working on this top level map, it was discovered that smaller maps could be made for the timing, control and monitoring systems (forming levels or "planes") to the overall map. As each layer was examined, it led to the concept of the entire map being a "top-down" look at the overall system. Thus the meetings became known as the "top-down" meeting, and the name stuck.

The "signal plane" was divided into different sections for individual examination and discussions. These sections were:

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In the complete report, the objectives and scope of each group is defined and the method used for evaluating the issues is described.

Video routing and formats take up a major part of the report (excluding the functional block diagrams, attachments and appendices.) This section notes that the many formats listed in ATSC Table 3 complicate the design of the DTV facility. (It should be noted that the FCC in its Report and Order did not adopt ATSC Table 3, and that broadcasters are free to use any video format they choose, so that the marketplace may decide. It should also be noted that most of the broadcasters and equipment manufacturers are attempting to confine their offerings, at least for now, to the formats that are in Table 3 — or very close to them — in hopes of avoiding market confusion.

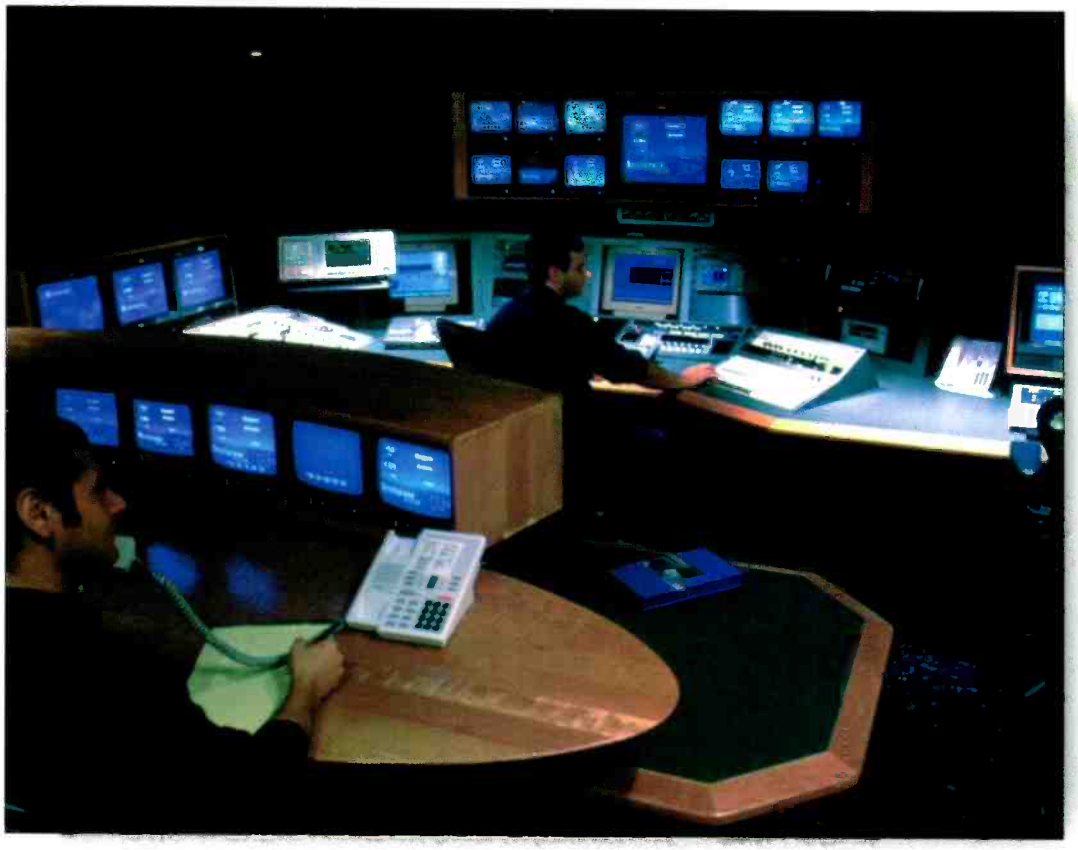
The report states that the DTV program facility's capability must include all NTSC program operations as a minimum. In situations where a station merely passes a previously encoded program to its DTV transmitter (pass-through operation) the station must still perform the additional step of inserting PSIP data (Program and System Information Protocol) as specified in ATSC document A/65. Among many other things, this data addresses how the DTV channels are tuned and accessed. Over 30 TV station operations were identified, including local and network programs and commercials, tape playback, audio and graphics.

Because working with so many formats is complicated, the concept of a "plant native format" was introduced. A plant native format must be chosen, and all originating sources and local storage devices are configured to use that format. Possible choices for a plant native format were:

- Analog NTSC (SMPTE 170M).
- Standard 525-line video, either 4:3 or 16:9 carried in SMPTE 259M.
- 1080i or 720p using SMPTE 292M
- 480p using SMPTE 293, either 4:3 or 16:9.
- Intermediate compressed formats.

The actual choice of the native format was not included as part of the report, but such a system provides the on-air flexibility needed that also supports the necessary business objectives of the station. The report recognized that in the near term there may be two native formats, one being the legacy format of the station and the other being the preferred format for future operations. Programming in any other video format must be converted to the plant native format for processing.

The idea of a smart format converter was suggested. While some existing format converters do have the ability to determine the format of the input signal, it was suggested that the search could be aided with format identification codes. These format identification codes could be embedded in the data bitstream and used by these smart format converters.



Careful coordination of client needs with technology capacity requires a balance of capital. Online editors John Servidio (left) and Jeff Wurtz are shown working in Betelgeuse's Edit Room 7. (Photo courtesy of Betelgeuse Productions)

Audio was given special consideration, and indeed this is an area where many stations are encountering their greatest problems. The native format concept was thought not to apply to audio. Also, a distinction needs to be made between the number of audio channels and the plant audio format. The number of channels is the physical number of channels that the plant is wired to carry (e.g., mono, stereo, four-channel, etc.) This is often part of the description of the number of audio levels of routing. The audio format can differ from the number of audio channels because matrixing techniques and digital coding techniques (such as

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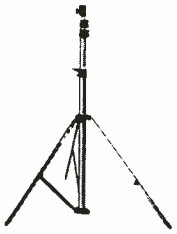

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matrix surround and AC-3 coding) can allow four or more channel formats to be carried through facilities with fewer physical channels.

The audio group assumed there was a digital audio infrastructure that would allow the plant to carry multichannel signals, if provided. If a high-level (i.e., multichannel) signal is received, and the plant infrastructure can support it, then the signal can be transported and transmitted as such. If the plant infrastructure can only transport a lower-channel format, then the incoming signal must be mixed down to the house signal format, and can only be transmitted in this downmixed format.

Encoding and multiplexing

The group recognized that compression was at the heart of the transition to digital broadcasting. Whether you are compressing an HD image or multiple SD images for broadcast, compressing and multiplexing this data with other data types will be a major operation in the DTV plant. It was noted that many different video formats could be carried on SMPTE-standardized links, including SMPTE 259, 292 and 305. SMPTE 292, in particular, is a candidate for handling either uncompressed, compressed or packetized data of all rates and types. Efforts to standardize these procedures are ongoing.

Station I/O

The group focused on the implementation of network feeds and other contribution links, both to and from the station. The group also dealt with the link between the studio and the transmitter for both the DTV and NTSC signals.

It was noted that the latency, or delay, of compressed video systems can be substantial, and that a method of communicating with remote crews (similar to the BTSC pro channel) must be developed. Otherwise, a separate return path for audio communication must be provided, similar to today's practice with satellite links.

Data services

Broadcasters have been delivering data to their markets for many years as a vertical blanking interval (VBI) sig-

Standards and interfaces

Systems live and die by the interfaces between their parts. These interfaces must be standardized if manufacturers are expected to deliver equipment for the DTV system. The six ATSC "top-down" report appendices contain about 30 pages of interface inventories for the various parts of the DTV system. Some of these interfaces are already standardized, others are not. A partial list of the existing standards that are applicable to DTV systems are listed below.

SMPTE Standards and Recommended Practices

125M	Component Video Signal 4:2:2 — Bit-Parallel Digital Interface
259M	10-Bit 4:2:2 Component and 4fsc Composite Digital Signals — Serial Digital Interface
274M	1920 by 1080 Scanning and Interface
292M	Bit Serial Digital Interface for HDTV Systems
296M	1280x720 Scanning, Analog and Digital Representation and Analog Interface
310M	Synchronous Serial Interface for MPEG-2 Digital Transport Stream
RP-187	Centering, Aspect Ratio and Blanking of Video Images

ATSC Standards

A/52	Digital Audio Compression (AC-3) Standard
A/53	Digital Television Standard
A/54	Guide to the Use of the Digital Television Standard
A/57	Program/Episode/Version Identification
A/65	Program and System Information Protocol for Terrestrial Broadcast and Cable

MPEG Standards

ISO/IEC IS 13818-1	MPEG-2 Systems
ISO/IEC IS 13818-2	MPEG-2 Video

DVB Standards

DVB-0101	Asynchronous Serial Interface for MPEG-2 Digital Transport Stream

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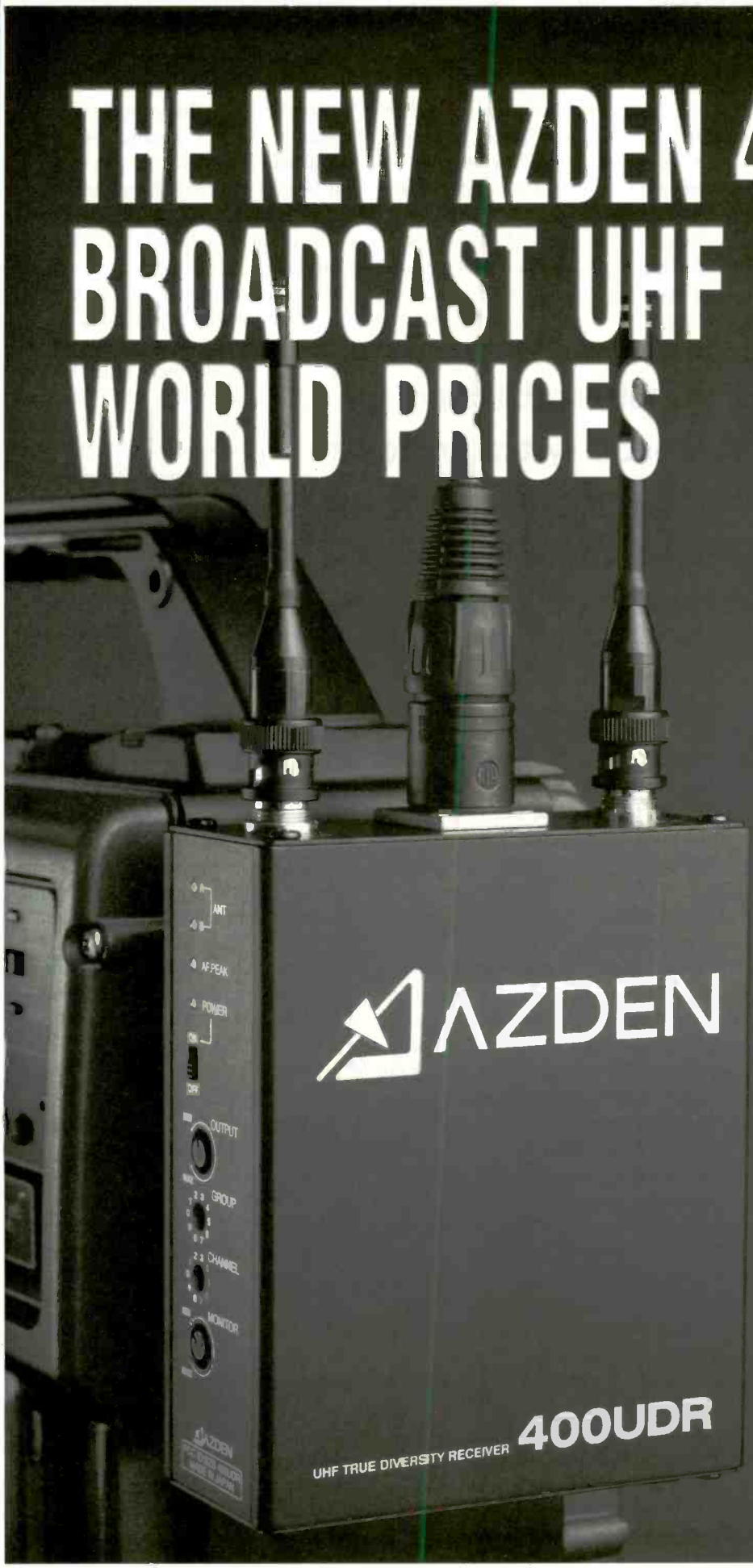

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ATSC

nal. However, VBI data is a case of transmitting digital data through an analog NTSC system. Today's new DTV system is largely a digital distribution system that can deliver a wider range of services to its market. The data group considered four types of data that were part of the final broadcast signal. These were broken down to:

- **Picture user data:** This data is inserted into the datastream by the video encoder. It includes the existing closed caption data.
- **Program related data:** This could be additional program data or advertising data.
- **Non-program related data:** This is subscription (or "opportunistic") data, and could include Internet distribution, paging, etc.
- **System data:** PSIP data, program guides, conditional access (scrambling) etc.

There are many areas where further clarification of standards work is required. They include:

- Carrying EIA-708 data over SMPTE 259, SMPTE 292, and AES-3 links.
- Carrying data from the data source to the video encoder over RS 232, RS 422, Ethernet, etc.
- Delivering data from the network to the local station.
- Interfaces to and from the management and control planes.

Redistribution signals

The obvious destination for all of this data, including picture, sound and other types that the DTV station will generate, is the DTV transmitter. This delivers the data directly to the home consumer by terrestrial transmission. Upon further investigation it was (re)discovered that there are potentially many other destinations for this data, and a variety of formats that this data must be delivered in. These include:

- Cable head-ends — normal broadcast feeds.
- Satellite uplinks — syndicated program feeds to other stations.
- Microwave systems — possible translator feeds.
- Independent feeds to cable — alternate news or programming channels.
- Telecommunications systems — common carriers at various data rates.
- Dedicated fiber.

Questions were raised as to whether all of the modulation schemes for these services were documented in current standards, and where would the interface be between the station and any common carrier. The group found that existing standards will probably suffice for these needs, but that certain details of existing standards need to be clarified to resolve future questions.

If the full capabilities of the ATSC audio system are to be utilized, the correct metadata from the session must be delivered to the home receiver.

Audio plane

As mentioned previously, proper implementation of multichannel audio in the DTV station is going to be a major headache. As also mentioned previously, the Audio Group, in discussions with the Video Group, decided that the native format approach suggested in the video format report was not applicable to audio. Once multiple program channels are mixed down to fewer channels there is no inverse process available to restore the original program channels. (This is not the same the matrixed surround sound process, where a center dialog and a surround effects channel are matrixed into a stereo pair. Such a system can recover, to a certain extent, the original four channels.)

A great deal of emphasis was given to the audio metadata parameters. In order to properly implement and gain the most useful advantage of the ATSC audio system, metadata authoring should be seriously examined. In fact, the report assumed that the metadata would have its own routing layer or level. The ideal place to create this metadata is in the post-production stage. If the full capabilities of the ATSC audio system are to be utilized, the correct metadata from the session must be delivered to the home receiver.

The group concluded that DTV stations would have to carry six audio channels, plus metadata, as a minimum. It was also recognized that most stations would most likely not be expanding their physical audio distribution systems. It therefore recommended that a contribution-quality coding scheme be developed to use the existing distribution infrastructure for ATSC audio, and that this system explicitly provide a path for the audio metadata.

Using the existing AC-3 system for the distribution of multichannel audio (and metadata) in the plant was not recommended because of the limited number of decode-encode cycles that the format was designed to tolerate. AC-3 coded audio may, however, be useful as an interim solution until multichannel audio plants with sufficient capacity are more prevalent. Other multichannel distribution formats may be (and are) being developed to address the needs and/or limitations of the ATSC audio delivery format as a distribution format.

Control plane

It was noted by the group that the data and control aspects of DTV appear to have been forgotten in the rush to DTV, perhaps replacing audio as the forgotten child of TV broadcasting. The group recognized that the acquisition and presentation of DTV material will be handled similarly to current practices. The details of controlling the new equipment, primarily in the presentation area must be worked out, but that this will probably occur over time. It is the area that follows the traditional master control switcher, and extending into the RF system, where new methods of control must be developed. The group agreed that the object

model is the preferred model to use for developing a control system, and noted that SMPTE is working to develop the specifications and standards for this model.

Timing plane

The Timing Group explored an area that could fundamentally change the way facilities are synchronized, both digital and analog. The group stated that it is impractical to operate a facility at 59.94- and 60Hz simultaneously, and expects that all broadcast facilities will operate at 59.94Hz. While not taking a position, they described future modifications to the drop-frame timecode algorithm to resolve the difference between timecode and real (clock) time. These changes include dropping an additional two frames once a day, and adjusting the reference subcarrier by about 0.8Hz.

The group noted that SMPTE is revising its recommended practice RP-154 and will release it as a SMPTE standard document. This revised reference will be analog NTSC blackburst with VITC (Vertical Interval Time Code). It will include a five-frame count for "deriving or synchronizing signals with a five-frame periodicity with respect to 59.54Hz." This could be a reference to synchronizing AES digital audio to an NTSC blackburst signal. Due to the noninteger relationship between the AES frame rate and the 59.94Hz NTSC frame rate, digital audio and video frame rates coincide only every five frames.

The group noted that it is now practical to use the Global Positioning System (GPS) as an accurate time reference. The raw GPS data, although intentionally dithered for military security reasons, can be processed to provide an extremely accurate source of time and frequency data. It strongly suggested that all facilities should lock to the GPS. This would include stations, networks, syndicators, and other program producers.

Monitor plane

Monitoring the DTV signal will continue to be an important process. It has been written in these pages before that going digital is not an excuse to be sloppy or less vigilant in system design, monitoring, and operation. Conven-

ATSC

tional audio, video and RF monitoring will remain. However, additional test equipment may be needed as operations shift to the digital domain.

Over 100 monitoring points were listed where signals could be monitored and/or inserted for test and measurement. While this may seem like a lot, existing NTSC stations most likely have a similar number of signal monitoring points today. The point is that testing and measurement should not be viewed as unnecessary in the DTV facility. Do not give up your ability to test and monitor your facility while you are on the air. Prudent NTSC design requires it, and future DTV station design should, as well.

MPEG analysis will be needed, as well as AC-3 analysis. 8VSB modulation analysis must be performed at many points in the transmission chain. 8-VSB modulation accuracy is crucial because poor modulation quality directly affects the coverage area of the station. Modulation errors act like noise in the DTV receiver. Unlike analog NTSC (and remembering the digital cliff), poor modulation quality doesn't make the picture look bad, poor modulation quality reduces the number of televisions that can receive the station.

Do not give up your ability to test and monitor your facility while you are on the air.

The 1.5Gb/s uncompressed HDTV signal will also need to be monitored, both as a baseband video signal and as a digital interconnection strategy.

The ATSC report on the findings of the "top down" meetings contains a wealth of knowledge and experience about what exists on the DTV technological landscape, as well as what still needs to be developed. It is not a blueprint for any one DTV station, but lays the foundation that individual stations can use when building their facility. To summarize all of their work into a single article trivializes their effort and the hours that have been invested in its generation. Station engineers are encouraged to download the entire report (80+ pages, plus diagrams) from the ATSC website at www.atsc.org. At that website you will find other standards and tutorials, documenting and detailing the ATSC system. Please read and re-read them carefully to gain the insights of the creators. Forward the portions of the documents that you do not yet understand to the departments in your facility who do (or will) understand them. It will be well worth the effort for all involved. ■

Kenneth Hunold is project engineer of audio/video systems at the ABC Engineering Laboratory, New York.

Speak English like it tastes good

BY KARE ANDERSON

Dusk settled over the vineyards in Napa Valley one fall evening. I gazed through the window at a thin stream of bittersweet chocolate sauce that a waiter was laddling high over a raspberry-colored cake inside the big stone restaurant operated by the Culinary Institute of America. I knew it was bittersweet chocolate because the rich smell was drifting through the French doors onto the patio where we were drinking a fine cabernet.

Get the picture? Here's the point: As adults, we tend to lose our picture-making way of speaking. We forget to tell the story that tells the story. We've gradually forgotten how to speak English like it tastes good, even when we desperately want people to remember what we are saying. Our conversations often begin with sweeping generalizations. We further numb people when talking about work as our sentences tend to become longer and full of jargon so that even colleagues won't remember what we said.

Unlike most children under the age of 12, adults offer qualifiers and/or chronology before we finally get to the delicious details that are most involving, credible and evocative. By then, even well-intentioned listeners have gone on several mental vacations. Think of the speeches, advertisements and conversations you most remember. Didn't the words evoke some visual experience? The specific detail proves the general conclusion. It's also more credible and memorable. Avoid gray generalities. Speak in technicolor. Say less better. Make your most important truths (those who matter most to you, your job, product, program, cause or idea) well-told. Ironically, because you are so close to these topics, you are most likely to speak generally about them than about a recent, negative incident you've experienced. Use words from the real world. Which was easier to remember the first time you heard these company names: Intel or Apple?

Whoever most vividly characterizes a situation or person usually determines how others see it, discuss it and decide on it. If your description is more interesting than another's, even if that person has more money, smarts or power to push his message, others are more likely to recall and repeat yours. Use these four techniques to get people to remember what you say:

1. Imagine the brain is like a wall with clothes hooks on it. For the brain to catch and retain a detail, that detail must hang on one of the memory-inducing hooks that is already in the brain. The biggest hooks are the three universal and core life experiences: family, hometown or the town where one has lived or is living, and past or current kind of work.

2. Motion makes memories. Whenever people are moving or see movement they remember more and are more emotional about what they remember. Get customers in motion with you in a positive experience and they will be more fervent, vivid and believing fans, more likely to evoke their bragging rights and likely to share their experience with others. That's why we literally move to offer samples, getting them to reach out so they feel the experience more deeply.

However, movement is a two-edged sword. It is never neutral. If a listener experiences something negative where motion is involved, that person will also remember the experience longer and more intensely. We hold on sooner, longer and more strongly to the negative incidents of life than the positive.

3. Speak first of the person's most current, pressing interest. Just as those in the market for new cars are most likely to hear car ads on the radio, all people listen sooner when you first speak about what is most on their mind at that moment. Sadly, in fewer than five percent of interactions where we want something from someone else do we first speak about what matters most to them. We are more likely to speak about our interests first.

4. Speak in vivid, specific details that have a high emotional value for the listener.

The good news? If you practice speaking first about your listener's interests than about what you share in common, and only then about how that commonality relates to your interests, amazingly powerful changes occur in how the other person relates to you. That person listens sooner and longer, remembers more and assumes you have a higher IQ than if you first spoke about your interests. ■

Kare Anderson is a speaker and author.

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Applied Technology

Quantel's Cachebox

BY BOB PANK

The Cachebox is aimed primarily at the traditional video server application areas; transmission, distribution and commercial insertion. When combined with Clipbox, it creates a range of video servers that cater to many applications.

Cachebox is a modular system that can grow from modest to very large and offers one of the highest storage capacities available today. Its engineering is based on many of the principles of Clipbox, including simultaneous true random access, which allows contention-free instant access for all users to any material, but in a smaller package.

For those working in transmission, distribution or commercial insertion, video compression is well accepted. Cachebox is a DV-native server with the signals recorded onto the store in DV form. It can be switched between DVCPRO 25 (25Mb/s with 4:1:1 sampling) and DVCPRO 50 (50Mb/s with 4:2:2 sampling).

Inputs and outputs

The basic Cachebox has four identical ports. Each is half duplex, capable of instant switching between record and play, and can operate with uncompressed 601 and DVCPRO compressed video – at real time and four times real time. The interface is intelligent and can automatically switch between SDI (for uncompressed) and SDTI (for DVCPRO). Since storage is in DVCPRO, coders and decoders are included and used as necessary. This arrangement allows flexibility in operation plus the possibility to freely switch or rearrange the server system to respond to new requirements. Full use of the sever is always guaranteed, so delays such as waiting for a record port while all that's available is a play-only channel, do not occur.

While all ports share the same store, there is no interaction between them. This allows each to have its own remote control and to be assigned applications that are completely independent of all other ports. For example one could be recording new material, another used for reviewing and two others on transmission supplying two separate TV channels. Because the remote control protocol is almost identical to that already used by Clipbox, all major automation companies are familiar with it and will be able to quickly provide control applications.

A bonus of disk storage, and the associated move away from real-time-only recorders, has been the ability to make wide use of networking. While the requirement for real time video connections remains, it is the ability to deliver and accept material faster or slower than real-time that allows networking to be used, effectively adding a second layer of connection. Cachebox can connect with Quantel's Clipnet, which uses Gigabit Ethernet, TCP/IP and NFS, to create an open video and audio network connecting between Quantel systems, as well as third party equipment.

When combined with Clipbox, Quantel's Cachebox is can be used in commercial insertion system, transmission and distribution applications

Because of the excess bandwidth available within Cachebox's store, it is able to transfer material over Clipnet as a background task while serving its SDI/SDTI ports. Clipnet is format independent so for Cachebox, uncompressed video or DVCPRO can be transferred . While the time taken for any transfer depends on other activity on the network, the speed is such that much faster than real-time transfers may be achieved – especially with compressed video. The extra connectivity provided can derive more value from Cachebox by dedicating the SDI/SDTI ports to direct 4x real-time transfers or to tasks demanding real-time operation, such as transmission, while loading new material via Clipnet.

Storage

To be able to operate at or near transmission requires very reliable operation. As with other Quantel video stores, Cachebox's store uses RAID-3 protection to allow operation to continue at full specification in the event of a disk failure. The missing data is rebuilt when a new replacement is fitted.

The basic store can hold three to six hours of DVCPRO video with both the video and audio held on the same disk system. The store uses Dylan technology but is physically much smaller and is mounted within the 6RU mainframe itself. It uses six 3½ inch, 18GB SCSI drives, five for signal data and the sixth for parity.

For those seeking greater storage, this is provided by an external RAID storage unit offering space for 25 hours of DVCPRO 25. In this case the number of SDI/SDTI ports may be doubled to eight and there is no internal six-hour store. Yet larger capacity can be added as storage units can be cascaded to provide 50, 75 or 100 hours for DVCPRO 25 and half that time for DVCPRO 50.

Bandwidth

Cachebox is designed to offer contention-free operation. Its simultaneous true random access allows every port to access

any stored material, regardless of all other activities on the server. This works because there is bandwidth to continuously support all ports at the same time, as well as running with Clipnet, even while the store is making random accesses.

The internal store provides ample bandwidth to support more than seven DVCPRO 25 channels. It simultaneously runs three real-time I/Os, a x4 input and Clipnet, so it can handle the most demanding situations. The DVCPRO 50 can support three I/Os, a x2 input and Clipnet. Using the larger store provides yet more bandwidth to extend contention-free operation to configurations with twice the I/O capablility. The eight SDI/SDTI ports require up to 11 channels bandwidth for 25Mb/s DV (7 + 1x4) or nine at 50Mb/s (7 + 1x2) plus, in both cases, additional bandwidth to run Clipnet.

Applications

Broadcasters have now become familiar with the advantages of lower running costs and greater reliability associated with servers. Using Cachebox adds more flexibility to operations and enables moving further away from tape. When used for transmission, it can immediately respond to changes in a running order – even while it is already playing. This makes room for flexibility to alter transmission at very short notice – as may be necessary during live programming or simply to accommodate last moment selling of commercial space. The four times-speed input, along with Clipnet, reduces ports used for loading and increases efficiency. One can be enough to support three real-time outputs.

For broadcasters, commercials are the major source of income, but, if lost or unaired, they are gone. Like an empty airline seat, the revenue is not recoverable, so the commercial insertion system (CIS) must be reliable. Many current CIS configurations use servers to supplement cart machines, but Cachebox can offer an almost totally disk-based operation. One six-hour box is used on-air while a second (with the larger 25- to 100-hour capacity) provides instant-access bulk storage and on-air backup for one or more smaller servers. The whole is controlled by an automation system that orders the loading of spots into the bulk server (maybe still from tape) and copies them to the six-hour cache prior to air. It finally runs the spot out of the 24- and six-hour boxes at once. If there is an error the router is switched to the better feed.

Using Cachebox in conjunction with Clipbox provides a number of useful configurations. As an economical method to expand beyond Clipbox's 14 ports, Cachebox offers more ports that could be used for operations such as transmission. At the same time, the introduction of a second server provides 100 percent back-up, because either could fail while output continues.

Cachebox directly addresses the needs of transmission and has been designed with the benefit of server experience in that area. Its bandwidth and access capabilities ensure reliable performance at all times, no matter what the loading. The SDI/SDTI video interfaces, together with high-speed open networking which can be widely applied via Clipnet, allow the user to make connections to a variety of equipment, some at many times real-time. For applications such as news and commercial insertion, the offer of up to 100 hours of storage provides ample space for daily and weekly online operations, simplifying management and providing more flexibility. ■

For more information on Quantel's Cachebox, circle (300) on the Free Info Card.

Bob Pank is a technical communications manager for Quantel Ltd., Newbury, England.

Applied Technology

SkyStream's Integrator

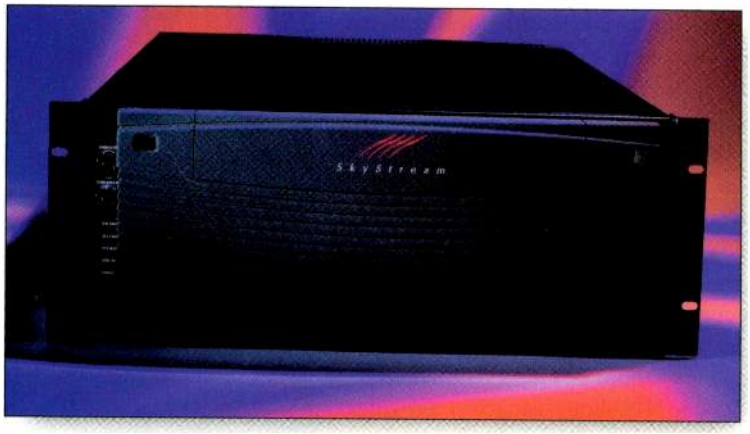
BY CLINT CHAO

With the era of DTV already upon us, terrestrial broadcasters are looking for the best ways to set up shop in the new digital world. While the public is still digesting the benefits that DTV promises, broadcasters are faced with determining the best approach to launching the four services of DTV: HDTV, SDTV, Dolby AC-3 audio and data broadcasting.

Key decisions must be made in order to determine how to best use the nearly 20Mb/s of bandwidth that each station has available for digital programming.

For example, a broadcaster needs to decide what combination of HD and SD programs to transmit, as well as determine a viable business model that allows him to recoup his investment in DTV. While an MPEG-2 encoded HDTV program can consume up to 15Mb/s of bandwidth, SDTV programs containing comparable quality to today's programs can be encoded at 3- to 5Mb/s. Once a video channel lineup is determined, the remaining bandwidth can be used for transmission of revenue-generating data services. These new datacasting applications provide broadcasters the promise of new revenue streams, and an entry into the red-hot Internet market. Before this can be done, however, broadcasters must determine the appropriate amount of bandwidth to allocate for data applications versus video programming. A cohesive DTV architecture can demonstrate the best that DTV has to offer: the highest quality digital programming mixed with the ability to access large amounts of data information at speeds previously unachievable.

SkyStream Corp., a Silicon Valley-based supplier of broadcast networking products, has created a new DTV product category, called Integrators, that allows terrestrial broadcasters to meet the challenge of dividing up the DTV spectrum in the right manner. An Integrator is a product that allows broadcasters to blend disparate media sources together at a point in the DTV media center architecture. Using an Integrator, broadcasters are enabled to intuitively allocate bandwidth for video and data services as required to meet their specific business models.



The Integrator series enables broadcasters to intuitively allocate bandwidth for video and data services as required to meet their specific business models

The need for a new category

With DTV, broadcasters will have true flexibility to offer a variety of video and data services to meet the needs of their particular audience. With bandwidth being so precious, the wrong combination of video and data programs can lead to lost revenue opportunities (either ads or subscribers) if the audience responds in a way different than predicted by the broadcaster. By placing a SkyStream Integrator at the output of a DTV video encoder or multiplexer, a broadcaster can analyze the entire bitstream, then properly determine the amount of available bandwidth left to add data services. Data that is injected into the stream can come from a variety of sources, depending on the application.

With the broad number of data broadcasting applications available in DTV, data can come directly or indirectly from the Internet or from a data server that has cached the IP data from an enterprise network or intranet. Coupled with video content, these multiple sources of media can most easily be managed when there is a true point of integration where all content can be blended together. Broadcasters will also need to inject program schedule information and conditional-access tables for tiered subscriber services.

SkyStream's Integrator products can even opportunistically insert data into the MPEG videostreams using a patented technique called Null Packet Optimization (NPO), which allows broadcasters to reclaim up to 10 percent of the consumed bandwidth occupied by null packets created by the MPEG encoding and multiplexing process. Null packets exist in every MPEG-2 stream, because it is inherent to the MPEG encoding and multiplexing process to occasionally stuff a series of zeros into the digital videostream to maintain a predetermined bandwidth. Digital video programming, in the form of MPEG-2 transport streams, contains anywhere between 2 percent and 10 percent null packets. Even the world's most efficient MPEG-2 statistical multiplexers create a minimum of 2 percent null packets in an encoded videostream, which, in the case of DTV, could generate a significant amount of reusable bandwidth. This bandwidth is the ideal space to test new data services, because it doesn't interfere with the video program allocation. Once a data service becomes viable, broadcasters can allocate additional bandwidth for that service.

By capturing and exploiting null packets, broadcasters can create new business models for the delivery of data in space that is otherwise unusable. For example, a data service can consume as little as 9.6Kb/s, which means that broadcasters can create new revenue streams with even the smallest amount of opportunistic bandwidth available in an MPEG bitstream. The following are examples of types of data applications that broadcasters can deliver:

- On-screen program guides.
- Data classifieds.
- Interactive advertising.
- Cached e-commerce websites.
- Turbo Internet services.
- Local community service information.
- Special event notices.
- Financial stock data.
- Local weather.
- Train and bus schedules.
- Coupons.
- Electronic publishing.
- Sports scores.

SkyStream's NPO allows a broadcaster to generate revenue without needing to consume additional bandwidth. In the space where a broadcaster traditionally consumes bandwidth for video only, he can also inject data that would typically consume additional bandwidth. For a 19.4Mb/s DTV spectrum, assuming the entire bandwidth is consumed with MPEG video, the minimum number of null packets would be about 380Kb/s, which is enough bandwidth to deliver a number of revenue-generating data services.

Post-multiplexer architecture

While most data broadcast products require operators to allocate bandwidth, an Integrator product that is able to reclaim null packets sits at the output of the video multiplexer to reclaim lost bandwidth. By analyzing the entire MPEG transport stream, the Integrator is able to determine the exact number of null packets in every stream, remove them, and replace them with IP data that is pulled from any number of data sources. This architecture also makes an Integrator the ideal injection point for Program and System Information Protocol (PSIP) tables, which control the scheduling of video and data program broadcasts. A conditional-access interface will allow broadcasters to scramble any video or data channel for subscriber-based program applications.

The time to specify an Integrator product into the DTV architecture is at the time of the initial DTV launch. Even if the broadcaster is not ready to initiate data services at initial deployment, he can prepare his architecture to launch data services at any point in the future. Data services that start off needing only small amounts of bandwidth could use the opportunistic space with NPO, and as the service or channel builds momentum, can begin to use additional bandwidth as needed. The key is for the broadcaster to use great flexibility to manage his bandwidth, and establish the most cohesive architecture to deliver rich multimedia content at the very outset of his DTV deployment. Products such as SkyStream's Integrator can help make the terrestrial broadcaster's transition to the digital world smooth, and even prosperous. ■

For more information on SkyStream's Integrator series, circle 301 on the Free Info Card.

Clint Chao is the vice president of marketing for SkyStream Corp., Mountain View, CA.

Business highlights from broadcast and production

BY SANDRA FERGUSON, EDITORIAL ASSISTANT

BUSINESS

Intergraph Computer Systems announced that it is shipping Intel's 500MHz Pentium III processor in its line of TDZ 2000 ViZual Workstations.

Leitch made the following announcements: Leitch and Hoboken, NJ-based Systems Group announced that 12 additional ASC VR300 video server systems will be integrated into the Ethnic-American Broadcasting Company's (EABC) new all-digital Fort Lee, NJ, broadcast facility. This purchase is in addition to EABC's original order of 25. WTNH-TV, the Hartford/New Haven ABC affiliate, recently installed RF Technology's ACL series digital fixed microwave link using a Leitch DigiBus MPEG-2 compression system. Williams Communications installed eight Leitch ASC VR300 video servers in its ChoiceSeat interactive, in-stadium sports entertainment network.

Canon announced the following lens purchases: CNN specified the purchase of 50 J21ax7.8B telephoto zoom lenses for its field unit. Green HD Productions purchased two 18x7.8 HD lenses.

LeBLANC recently announced the following: DTV-Utah announced that it awarded a $3 million contract to LeBLANC Broadcast to construct its DTV facility. DTV-Utah is a joint venture of eight broadcasters in Salt Lake City. Sylvan Tower Co. LLC awarded LeBLANC a $7 million contract for a DTV and radio transmission facility in Portland, OR.

McGraw-Hill KMGH-TV was the first station in the state of Colorado to air HD programming. The broadcast used a HD turnkey system purchased from Panasonic System Solutions Company.

Skywalker Sound, a division of Lucas Digital Ltd. LLC, upgraded its film dubbing facilities with the installation of an AMS Neve DFC console (see photo above) in its Mix Stage G.

Plus 8 added the following Fujinon HD lenses to its video equipment arsenal: one 66x (HA66x9.5BESM) lens, four 10x (HA10x5.2BEVM) lenses and five 20x (HA20x7.5BEVM) lenses.

Acrodyne made the following announcements: The company received the first of several expected orders for TV transmitters from Sinclair Broadcast Group. The order is for two Diacrode-powered transmitters rated at 60kW and 120kW. American Christian Television Services Inc. placed an order for a 40kW Au4OD Diacrode transmitter to be installed in May at WTLW-TV 44 in Lima, OH. Christian Faith Broadcasters Inc. placed in order for a 50kW Au50D Diacrode transmitter for WLLA-TV 64 in Kalamazoo, MI.

Disney i.d.e.a.s. recently showcased the installation of a Studer D950S digital mixing console in its Audio A mixing theater.

Harris recently announced the following: Hearst-Argyle Television Inc. purchased 25 Harris FlexiCoder high-definition encoding systems. Harris will provide a Sigma UHF TV transmitter to Turner Broadcasting's WTBS-TV in Atlanta.

Omneon Video Networks recently announced a broad range of products in keeping with the company's goal of delivering digital video networking solutions. The company, located in Campbell, CA, released the Omneon Video Area Network which uses a set of open industry standards and is compatible with local and wide area networks. Omneon's products will provide a core infrastructure.

Itelco received an order from public TV station KRWG-TV (New Mexico State University) in Las Cruces, NM, for five of its translator systems.

NFL Films' post production installed Solid State Logic's Advant digital film mixing console.

Dielectric Communications recently made the following announcements: The company signed an agreement with Paramount Stations Group to supply the transmitting equipment for the DTV conversion of six of Paramount's facilities. Dielectric has been awarded a contract covering DTV/NTSC antenna equipment, transmission line and RF equipment for Baltimore's WBAL-11, WJZ-13 and WMAR-2. Dielectric recently completed work on the newest addition to its Raymond, ME, facility.

Times Square Studios chose Sony to provide digital equipment and complete system integration for a new standard-definition 480i digital component production facility, which is planned as the future home of ABC's *Good Morning America*.

Tiernan Communication announced it will provide HD and SD encoders to enable McGraw-Hill Broadcasting Group's three ABC affiliates in the top 30 markets to meet their on-air target for delivery of 720p HD services in 1999.

ESPN used Accom's Abekas video post-production equipment to create digital effects during its recent Winter X Games coverage.

Cohen Brown Management Group selected Digital Systems Technology Inc. to implement a storage/networking solution.

The WB 100+ Station Group selected Vela Research's Argus AFF MPEG-2 encoder for use in encoding spots that are distributed to its cable-delivered stations nationwide.

Paxson Communication Corp. announced that Gentner is its choice to provide additional remote facilities management (RFM) equipment for the continued expansion and upgrade of the PAX TV network.


JORDAN

Nexus ASA Group and its subsidiaries, NewsMaker Systems Inc. and Nexus-Informatics GMbH, announced a reciprocal, worldwide marketing agreement with Chyron. Under the agreement, both companies will market integrated Nexus OpenMedia/StarDrive and Chyron Duet systems.

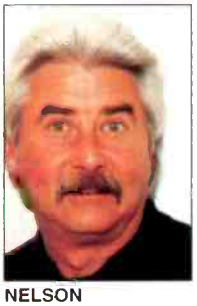
PEOPLE

Leitch announced that Tom Jordon, vice president of regional sales, will serve on the SMPTE Executive Committee as conference vice president.

Harris recently introduced Dale Mowry as vice president of its TV Systems business unit.


TANIELIAN

Fujinon announced the following appointments: Kelly Nelson now serves as southeast regional sales manager. Alan Tanielian is the company's regional sales manager for its broadcast and communications division.


NELSON

ENCORE Hollywood announced the appointment of Joshua Touber as the new managing director of the facility.

Turner Studios recently selected Trevor Mincher as engineering manager of technical operations.

Euphonix announced the appointment of Richard McKernan to recorder sales manager. ■

VIDEO and PRO AUDIO

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QUICK DIAL 74

SONY

DSR-200A
3-CCD Digital (DVCAM) Camcorder

ombining a compact and lightweight body with the superior picture quality of DSP (Digital ignal Processing) and the DVCAM format, the DSR-200A is the ideal acquisition tool for ideo journalists, event and wedding videographers, stringers and production houses. 500 nes of horizontal resolution, 48kHz or 32kHz digital audio, three hour record time, and mini- ium illumination of 3 lux is only the beginning. Other features include 16:9/4:3 capability, teady Shot, high resolution 1-inch viewfinder, time code operation, time/date superimposi- on and an IEEE-1394 interface for direct digital output. Offers full automatic as well as anual control of focus, iris, gain, white balance and shutter speed.

Variable servo 10X optical power zoom lens goes from 5.9 to 59mm in 1.7 to 24 seconds. The manual zoom rocker is continu- ously variable right up to where the digital 20X zoom kicks in. Sony's Super Steady Shot reduces high frequency camera shake without compromising image quality. SteadyShot uses horizontal and vertical motion sensors that allow it to work accurately while zooming, moving (even shooting from a car), and shooting in low light conditions.
Has digital effects including audio and video fade, overlap and Slow Shutter.
Automatic and manual focus, iris, shutter, gain and white bal- ance. Iris is adjustable in 12 levels from F1.6 to F11, shutter from 1/4 to 1/10,000 of a second in 12 steps, Gain from -3dB to +18dB in 8 steps.
Zebra Pattern indicator, built-in ND filter.
Custom Preset function lets you preset, store and recall custom settings for color intensity, white balance (bluish or reddish), sharpness and brightness.
Stores Photo, Date/Time, Shutter Speed, Iris, Gain and F-stop for easy recall. So if you have to re-shoot, you know your original settings for every scene and frame.

- Records Drop/Non-Drop Frame time code. Time code can be read either as RC time code or as SMPTE time code.
- Has a large 1-inch B&W viewfinder with 550 lines of resolution for easy focusing even in low contrast lighting situations. Separate information sub panel displays time code, battery time, tape remaining and other camcorder functions without cluttering up the viewfinder.
- Records 16-bit/48kHz audio on one stereo track or 12-bit/32kHz with two pairs of stereo tracks (L1/R 1, L2/R2), so you can add stereo music or narration.
- One-point stereo electret condenser mic for clear stereo separation. Directivity can be selected from 0°, 90° & 120°.
- Automatic & manual (20-step) audio level record controls. Monitor audio with headphones or from the LCD panel which has an active VU meter.
- XLR input connectors for mics and audio equipment.

DSR-200A Field Package:
- DSR-200A Camcorder • NPA-1000/B Battery Case Adapter
- 3 NP-F930/B 7.2v 4000 mAH Batteries
- AC-V900/B AC Adapter, Triple Battery Charger
- VCT-U14 Tripod Adapter • LC-2000CP System Case

DSR-20 DVCAM Player/Recorder

The DSR-20 is a versatile DVCAM VCR with a very compact chassis and a variety of convenient functions for recording, playback and simple editing. It features auto repeat playback, power-on recording/playback, multiple machine control interfaces, AC/DC capability and i.LInk (IEEE1394) input and output. And of course, it offers the stunning image and sound quality inherent to the DVCAM format.

DVCAM Quality
- Utilizing the DVCAM format, the DSR-V10 provides the record- ing/playback quality and reliability required for professional use. It can also play back consumer DV format tapes without any spe- cial adapter.
- Provides two selectable audio modes; a two channel mode with 48 kHz/16-bit recording and a four channel mode with 32 kHz/12-bit recording.
- Dual-size cassette mechanism accepts both mini size (up to 40 minutes) and standard size DVCAM tapes (up to 184 minutes) without an adapter.

Editing Capability
- Equipped with Control L interface, the DSR-20 can perform sim- ple time code-based editing when connected to another DSR-20 or other similarly equipped VCRs/cameras like the DSR-30, DSR- 2C0A or DSR-PD1. When using the FXE-120 or ES-3 EditStation System, the DSR-20 can serve as a feeder player.
- Has DV (IEEE1394) input and output. When connected to other DV equipped machines, the DSR-20 offers digital dubbing of video, audio and data, without any deterioration of image and sound quality. In addition, in the "Digital dubbing including TC copy" mode, full information of video, audio and time code of the original tape can be copied to another tape. Especially useful when making working copies of the original.

Record/Playback Functions
- Automatic repeat function for repeated playback. After reaching either the end of the tape, the first blank portion or the first index point, the DSR-20 automatically rewinds the tape then starts playing back the segment again.
- Power-on recording/playback capability for unattended automatic VCR operation. When connected to an external timer and the VCR's TIMER switch is set to REC, the DSR-20 starts recording as soon as power is turned on. Likewise, when the TIMER is set to REPEAT, the VCR goes into Auto Repeat mode and starts play- ing back the moment power is turned on.
- In addition to Control L, the DSR-20 also incorporates a Control S and RS-232 interface for remote control operation. Basic VCR functions can be controlled from a PC via RS-232, while Control S allows control via the optional DSRM-10 Remote Control. In addition, with the Control S input/output connector, two or more (up to 50) DSR-20's can be daisy-chained and controlled from one DSRM-10 Remote Control.
- External sync input enables synchronized playback with other VCRs. Especially important in A/B roll configurations.

Conveniences
- The DSR-20 be powered by AC or DC. Ideal for mobile applica- tions, the DSR-20 can be connected to a 12V power supply like a car battery or battery belt & powered via the 4-pin XLR DC input.
- Can perform searches for Index Points, which are recorded on the tape as "in-point" marks everytime a recording starts. The DSR-20 can also search for photo data recorded on a DVCAM cassette by the DSR-PD100/200A/300, or where the recording date has been changed.
- Supplied with the RMT-DS20 Wireless Remote for control of basic VCR functions. And again, when two or more VCRs are connected via Control S, they can be simultaneously controlled from one wireless remote by simply sending one command to the master deck.

PVM-14N5U/14N6U & 20N5U/20N6U
13-inch and 19-inch Presentation Monitors

With high quality performance and flexibility, Sony's presentation monitors are ideal for any envi- ronment. They use Sony's legendary Trinitron CRT and Beam Current Feedback Circuit for high resolution of 500 lines as well as stable color reproduction. They also accept worldwide video signals, have a built- in speaker and are rack mountable. The PVM-14N5U/20N5U are designed for simple picture viewing, the PVM-14N6U and 20N6U add RGB input and switchable aspect ratio.
They Feature:
- 500 lines of horizontal resolution
- They handle NTSC, NTSC 4.43, PAL, and SECAM.

- Picture (chrome, phase, contrast, bright- ness) and setup adjustments (volume, aspect ratio) are displayed as easy-to- read on screen menus.
- Closed captioning is available with the optional BKM-104 Caption Vision Board.

PVM-14N6U/20N5U Only:
- (Last Input Switch) - Contact closure remote control allows you to wire a remote to an existing system so that the monitor's input can be remotely con- trolled to switch between the last previ- ously selected input and the current input.
- 4:3/ 16:9 switchable aspect ratio

PVM-14M2U/14M4U & 20M2U/20M4U
13-inch and 19-inch Production Monitors

Sony's best production monitors ever, the PVM-M Series provide stunning picture quality, ease of use and a range of optional functions. They are identical except that the "M4" models incorporate Sony's state-of-the-art **HR Trinitron** CRT display technol- ogy and have SMPTE C phosphours instead of P22.
- HR Trinitron CRT enables the PVM-14M4U and 20M4U to display an incredible 800 lines of horizontal resolution. The PVM-14M2U and 20M2U offer 600 lines of resolution. M4 models also use SMPTE C phosphours for the most critical evaluation of any color subject.
- Dark tint for a higher contrast ratio (black to white) and crisper, sharper looking edges.
- Each has two composite, S-Video and component input (R-Y/B-Y, analog RGB).For more accurate color reproduc- tion, the component level can be adjusted according to the input system. Optional BKM-101C (video) and BKM-102 (audio) for SMPTE 259M serial digital input.
- Beam Current Feadback Circuit
- 4:3/16:9 switchable aspect ratio.
- True multi-system monitors they handle four color system signals: NTSC, NTSC 4.43, PAL, and SECAM.
- External sync input and outputcan be set so that it will automatically switch according to the input selected.
- Switchable color temp: 6500K (broadcast), 9300K (pleasing picture), User preset.(3200K to 10000K).
- Blue gun, underscan and H/V delay capability
- On-screen menus for monitor adjustment/operation.
- Parallel remote control and Tally via 20-pin connector.

QUICK DIAL 74

SONY

UVW-100B 3-CCD Betacam SP Camcorder

More affordable than ever, the UVW-100B offers 700 lines of horizontal resolution, 60dB S/N ratio, 26-pin VTR interface, compact design and ease of operation– making it ideal for field shooting applications.
- 1/2-inch Power HAD CCDs attain sensitivity of F11 at 2000 lux (4 lux low light), 700 lines of resolution & 60dB S/N ratio.
- Gain-up can be preset in 1dB steps from 1dB to 18dB.
- Auto Iris detects the lighting conditions and adjusts for the proper exposure.
- Clear Scan records computer monitors without horizontal bands across the screen. Shutter speed can be set from 60.4 to 200.3 Hz in 183 steps. Also has a variable high speed shutter from 1/100 to 1/2000 of a second.
- SMPTE LTC time code and UB generator/reader. Rec Run/ Free Run, Preset/Regen are easily set. For multi-camera operation, genlock to an external time code is provided.
- Genlock input and built-in color bar generator.
- 26-pin VTR interface for feeding component, composite and S-Video signals to another VTR for simultaneous recording. Sart/stop are controlled and external VTR status such as Rec and Tally are shown in the viewfinder.
- 8-digit LCD display indicates time data, warning indications and video status. Battery status audio level are also shown in a bar graph meter.

- Diecast alu- minum, 1.5- inch DXF-601 viewfinder is rugged yet comfortable while providing 600 lines of resolution.
- Large diameter eye cup reduces eye strain and sim- plifies focusing. Diopter adjust- ments (-3 to 0) compensates for differences in eye sight.
- Zebra level indicators, safety zone and center marker gener- ator. Shows tape remaining and audio levels.
- With Anton/Bauer Digital Batteries remaining battery power is displayed on the LCD panel and through the viewfinder.
- Weighs 15lb. with viewfinder, battery, tape and lens. Shoulder pad is adjustable, so you maintain optimum bal- ance when using different lenses and batteries.

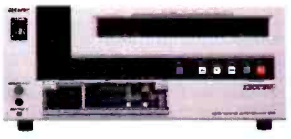
DXC-637 3-Chip Color Video Camera

- PVW-637 - Perfect camcorder operation with the PVV-3
- Compact size, lightweight and low power consumption
- High density three 2/3-inch IT Hyper HAD sensors
- 800 TV lines of horizontal resolution
- HAD sensor structure
- 2 dimensional optic low pass filter
- Clear scan function for shooting computer dis- plays • Hyper Gain mode
- EZ mode and EZ Focus functions enable cam- eramen to get ready for shooting swiftly
- Dual Pixel Readout technology
- Can be coupled directly with the DSR-1/PVV-3 for high quality component acquisition or with the EVV-9000 for handy operation
- Can be combined with the recorders from Panasonic or JVC
- Can be connected with com- puter equipment via CA- 325A/325B camera adapter.

DXC-637 with Fujinon 16:1 zoom lens, tripod plate and hard case **$7495**
Also available in Betacam or DV-CAM packages, call for prices.

UVW-1600/UVW-1800
Betacam SP Editing Player • Betacam SP Editing Recorder

The UVW-1600 and UVW-1800 are the other half of the UVW series. They offer the superiority of Betacam SP with sophisticated editing features. They feature an RS-422 9-pin interface, built-in TBCs and Time Code operation. Inputs/outputs include component, composite and S-Video.
All the features of the UVW-1200/1400A *PLUS*—
- Optional BVR-50 allows remote TBC adjustment.
- RS-422 interface for editing system expansion.
- Two types of component output, via three BNC connectors or a Betacam 12-pin dub connector.
- Frame accurate editing is assured, thanks to sophisticated servo control and built-in time code operation. In the insert mode of the UVW-1800, video, audio Ch-1/2 and time code can be inserted indepen- dently or in any combination.



PVW-2600/PVW-2650/PVW-2800
BETACAM SP PRO SERIES

Whenever versatility and no compromise performance is needed, there is only one choice. Legendary reliability and comprehensive support for its many users has established the PVW series as the standard in broadcast and post production .The PVW Series includes the PVW-2600 Player, PVW-2650 Player with Dynamic Tracking and the PVW-2800 Editing Recorder. They feature built-in TBCs, LTC/VITC time code operation and RS-422 seri- al interface. They also offer composite, S-Video and component video inputs and outputs. Most important they are built for heavy, every day duty.
- Built-in TBC's and digital dropout compensation assure con- sistent picture performance. Remote TBC adjustment can be done using the optional BVR-50 TBC Remote Control.
- The PVW-2600, PVW-2650 and PVW-2800 (generates as well) read VITC/ LTC time code as well as User Bits. Ext/Int time code, Regen/Preset, or Rec-Run/ Free-Run selections
- Built-in character generator displays time code or CTL data.
- Set-up menu for presetting many functional parameters.
- Two longitudinal audio channels with Dolby C- type NR.
- Recognizable monochrome pictures at up to 24X normal speed in forward and reverse. Color at speeds up to 10X
- Two types of component connection; three BNC connectors or a Betacam 12-pin dub connector. They have composite and S-Video signals as well.

PVW-2650 Only
- Dynamic Tracking (DT) playback from -1 to +3 times normal speed.

PVW-2800 Only
- Built-in comprehensive editing facilities.
- Dynamic Motion Control with memory provides slow motion editing capability.

800 SERIES UHF WIRELESS MICROPHONE SYSTEMS

Consisting of 5 handheld and bodypack transmitters and 6 different receivers, Sony's UHF is recognized as the out- standing wireless mic system for professional applications. Operating in the 800 MHz band range, they are barely affect- ed by external noise and interference. They incorporate a PLL (Phase Locked Loop) synthesized control system that makes it easy to choose from up to **282** operating frequen- cies, and with the use of Sony's pre-programmed channel plan, it is simple to choose the correct operating frequencies for simultaneous multi-channel operation. Additional fea- tures, like space diversity reception, LCD indicators, reliable and sophisticated circuit technology ensure low noise, wide dynamic range, and extremely stable signal transmission and reception. Ideal for broadcasting stations, film production facilities, and ENG work.

SEVEN DAY CUSTOMER SATISFACTION GUARANTEE

Circle (108) on Free Info Card

Panasonic

QUICK DIAL 74

WJ-MX50
Digital A/V Mixer

- Four input switcher and any two sources can be routed to the program busses. • Two-channel digital frame synchronization permits special effects in each A/B bus.
- Combination of 7 basic patterns and other effects creates 287 wipe patterns. • External edit control input for RS-232 or RS-422 serial controls. Also has GPI input.
- Wipe boundary effects: soft/border (bold, eight background colors available). • Digital effects:strobe, still, mosaic, negative/ positive, paint, B&W, strobe, trail, and AV synchro.
- Real-Time compression - entire source image is compressed inside a wipe pattern.
- Fade-in and fade-out video, audio, titles individually or synchronously faded. • Down stream keyer with selectable sources from character generator or external camera.
- "Scene Grabber" moves a pattern while upholding the initially trimmed-in picture integrity.
- Eight separate memories enable instant recall of frequently used effects. • 8 preset effects including: Mosaic Mix, Position Stream, Corkscrew, Bounce, Flip, Shutter, Vibrate, and Satellite. • Audio mixing capability of 5 sources with 5 audio level adjustments.

FUJINON
ENG LENSES

While ENG camera technology evolves faster and faster, delivering ever higher performance in ever small bodies, it has been increasingly difficult for lens manufacturers to improve quality while keeping size and weight to a minimum until recently. With Aspheric Technology (Ar2) Fujinon has succeeded in manufacturing superior quality lenses that are both smaller and lighter than lenses of conventional spherical design. From the widest angle to the highest telephoto, Fujinon's broadcast hand-held style lenses offer unparalleled features and performance. In fact, they are so advanced and so optically superb they will reshape your thinking about how well a lens can perform.

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

A15X8EVM Standard Zoom Lens
A versatile performer in a compact package, offers AT2, inner focus, Quick Zoom and the "V-Grip".

A20X8EVM
Standard /Telephoto Zoom Lens
Combines additional focal length with AT2, inner focus, Quick Zoom and the "V-Grip".

A36X14.5ERD
Super Telephoto Zoom Lens
The longest focal length hand-held style lens to offer AT2 and inner focus.

GLIDECAM INDUSTRIES

V-16 AND V-20
Camera Stabilization Systems

The V-16 and V-20 allow you to walk, run, go up and down stairs, shoot from moving vehicles and travel over uneven terrain without any camera instability or shake. The V-16 stabilizes cameras weighing from 10 to 20 pounds and the V-20 from 15 to 26 pounds. They are both perfect for shooting the type of ultra-smooth tracking shots that take your audience's and client's breath away – instantly adding high production value to every scene. Whether you are shooting commercials, industrials, documentaries, music videos, news, or full length motion pictures, the Glidecam "V" series will take you where few others have traveled.

QUICK DIAL 74

sachtler

Tripods & Fluid Heads
DV Systems—Digital Support for Every Budget

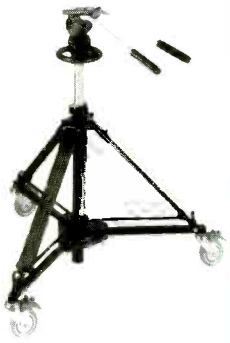
Today's compact digital cameras require light, fast and highly versatile camera support systems. Starting from the DV2 all the way up to the DV12, Sachtler has a solution tailored for just about every conceivable digital camera package available today. All feature Sachtler's patented counterbalance system and Touch and Go wedge plates. And all except the DV2 feature sliding camera platform to ease in the balancing of your camera.

DV2 System
- The smallest head of the Sachtler's line.
- Sachtler Touch and Go quick release with automatic camera lock and safety lever/drop protection
- One step of dynamic counterbalance
- Frictionless leak proof fluid damping with one levels of drag
- Vibrationless vertical /horizontal brakes
- Built in bubble for horizontal leveling
- Single Stage 75mm tripod DA 75 Long
- Lightweight floor spreader SP 75

This system (0210) consists of:
Fluid Head (DV-2), Long Tripod (DA 75), floor spreader (SP 75)

DV4 System
- Sliding balance plate
- Touch and Go quick release with automatic camera lock and safety lever/drop protection
- One step of dynamic counterbalance
- Frictionless leak proof fluid damping with one levels of drag
- Vibrationless vertical /horizontal brakes
- Built in bubble for horizontal leveling
- Single stage 75mm long tripod DA 75
- Lightweight floor spreader SP 75

DV4 System (0410) consists of:
Fluid Head (DV-4), Long Tripod (DA 75), floor spreader (SP 75)



DV6 System
Same as the DV4 PLUS —
- Five step of dynamic counterbalance
- Five step of vertical and horizional drag

DV6 System (0610) consists of:
Fluid Head (DV-6), Long Tripod (DA 75), floor spreader (SP 75)

DV8 System
Same as DV6 PLUS —
- Greater load capactiy

DV8 System (0810) consists of:
Fluid Head (DV-8), Long Tripod (DA 75), floor spreader (SP 75)

DV12 *Same as DV8 PLUS —* • Great Load Capacity • Fits 100mm tripods

Vinten
PRO-130 SYSTEMS

The Pro-130 tripod systems are perfect for today's on the move ENG cameramen. Lightweight, these systems have been specifically designed to provide a wider balance range to suit the latest DV, DVCPRO, OVCAM camcorder and camera/recorder combinations. All systems come complete with the PH-130 fluid pan & tilt head, choice of single or 2-stage ENG tripod, floor spreader and soft carrying case for easy transportation.
The PH-130 pan & tilt head incorporates Vinten's continuously variable LF drag system to provide smooth movement and easy transition into whip pan, together with a factory set balancing mechanism. Both the single-stage and two-stage legs are toggle clamp tripods are made from strong, durable aluminum with excellent height range capabilities.

VISION 8 AND 11 Lightweight Heads For the Future

Superbly engineered and designed for use in professional broadcast, educational and corporate productions, the Vision 8 and Vision 11 simultaneously provide the ultimate in lightweight support with exceptional robustness— even in the toughest shooting conditions.

Vision 8 Pan & Tilt Head
The incredibly lightweight Vision 8 provides smooth shots, whip pan action and quick set-up while supporting up to 23 lbs. Add the single-stage carbon fiber tripod and you have the lightest combination possible for that all important event— without sacrificing the reliability and robustness that you require.
- Simple external adjustment for perfect balance over the full 180° of tilt
- Infinitely variable drag with proven LF technology
- Calibrated drag knobs
- Flick on/flick off Pan and Tilt brakes
- Single rotation counterbalance
- Leveling bubble standard
- Standard 100mm leveling ball • Lightweight, only 5.9 lbs.

Vision 11 Pan & Tilt Head
Slightly heavier the Vision 11 offers additional capacity (up to 29 lbs.) plus it has illuminated controls to allow fast camera balancing and leveling even in poor lighting. Combine with a two-stage carbon fiber or aluminum tripod and you have a package with the biggest height adjustment yet the smallest to carry. Ideal for all ENG assignments
- Simple external adjustment for perfect balance over the full 180° of tilt
- Infinitely variable drag with proven LF technology
- Back-lit and calibrated drag knobs
- Flick on/flick off Pan and Tilt brakes
- Digital counterbalance readout
- Illuminated leveling bubble • Standard 100mm leveling ball
- High load to weight ratio • Lightweight — only 6.2 lbs.

anton bauer

DIGITAL PRO PACS
The ultimate professional video battery and recommended for all applications. The premium heavy duty Digital Pro Pac cell is designed to deliver long life and high performance even under high current loads and adverse conditions. It's size and weight creates perfect shoulder balance with all camcorders.
- **DIGITAL PRO PAC 14 LOGIC SERIES NICAD BATTERY**
  14.4v 60 Watt Hours. 5 1/8 lbs. Run time: 2 hours @ 27 watts, 3 hrs @ 18 watts
- **DIGITAL PRO PAC 13 LOGIC SERIES NICAD BATTERY**
  13.2v 55 Watt Hours. 4 3/4 lbs. Run time: 2 hours @ 25 watts, 3 hours @ 17 watts

DIGITAL TRIMPAC
Extremely small and light weight, the Digital Trimpac still has more effective energy than two NP style slide-in batteries. High voltage design and Logic Series technology eliminate the problems that cripple conventional 12 volt slide-in type batteries. The professional choice for applications drawing less than 24 watts.
- **DIGITAL TRIMPAC 14 LOGIC SERIES NICAD BATTERY**
  14.4 v 43 Watt Hours. 2 3/4 lbs.
  Run time: 2 hours @ 20 watts, 3 hours @ 13 watts

QUAD 2702/2401
Four-Position Power/Chargers

The lightest and slimmest full featured four position chargers ever, they can fast charge four Gold Mount batteries and can be expanded to charge up to eight. They also offer power from any AC main in a package the size of a notebook computer and weighing a mere four lbs! The 40 watt 2401 can charge ProPacs in two hours and TrimPacs in one. Add the Diagnostic/ Discharge module and the QUAD 2401 becomes an all purpose power and test system. The 70 watt QUAD 2702 has the module and is the ultimate professional power system.

HyTRON 50 Battery
Weighing a mere 31oz (880 grams) and packing 50 Watt-hours of energy - enough to operate a typical ENG camcorder for two hours, the HyTRON 50 is the most advanced lightweight battery in the industry.
- Made possible by recent advancements in a cell technology originally designed for the mobile computing industry, it incorporates nickel metal hydride cells that provide the highest energy density of any rechargeable cylindrical cell available. High performance is further assured through the integration of Anton/Bauer InterActive digital technology.
- Equipped with an on-board "fuel computer" which monitors energy input and output as well as critical operating characteristics and conditions. This data is communicated to the InterActive charger to ensure safety and optimize reliability.
- In addition, remaining battery capacity information is available by means of an LCD display on each battery and in the view-finder of the most popular broadcast & professional camcorders.
- Special low voltage limiter prevents potentially damaging overdischarge

Specifications: 14.4 V, 50 WH (Watt Hours)
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PROFESSIONAL VIDEO TAPES

QUICK DIAL 71

fuji

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PG-30	2.39	PG-60	2.59	PG-120	2.79

Broadcast Grade VHS Box

BGR-30	3.29	BGR-60	3.99	BGR-120	4.49

H471S S-VHS Double Coated

ST-30	6.79	ST-60	7.49	ST-120	7.69

M221 Hi 8 Double Coated

Metal Particles		Metal Evaporated	
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P660HMP	6.29	E660HME	10.29
P6120HMP	8.29	E6120HME	13.59

M321SP Metal Betacam (Box)

05S	17.95	10S	18.49	20S	19.95
30S	22.95	60L	31.95	90L	49.95

DP121 DVC PRO

12M (Med.)	7.49	23M	8.79	33M	10.99
63M	19.99	64L (Lg.)	21.99		
94L	31.99	123L	39.99		

maxell

Hi8 Metal Particle (XRM)

P6-120 XRM	6.99

Broadcast Quality Hi8 Metal Particle

P6-30 HM BQ	5.39	P6-60 HM BQ	6.09
P6-120 HM BQ			7.99

P/I PLUS VHS

T-30 Plus	1.79	T-60 Plus	1.99	T-90 Plus	2.09
T-120 Plus		2.19	T-160 Plus		2.69

HGX-PLUS VHS (Box)

HGXT-60 Plus	2.69	HGXT-120 Plus	2.99
HGXT-160 Plus			3.99

BQ Broadcast Quality VHS (Box)

T-30 BQ	4.29	T-60 BQ	3.99	T-120 BQ	5.99

BQ Professional S-VHS (In Box)

ST-31 BQ	6.79	ST-62 BQ	6.99
ST-126 BQ	8.49	ST-182 BQ	13.99

Betacam SP

B5MSP	10.99	B10MSP	11.99	B20MSP	12.99
B30MSP	14.49	B60MLSP	21.99	B90MLSP	31.99

Panasonic

Mini DV Tape

AY DVM-30	6.49	AY DVM-30 (10 Pack)	ea. 5.99
AY DVM-60	8.49	AY DVM-60 (10 Pack)	ea. 7.99
AY-DVM80			16.99

DVCPRO

AJ-P12M (Medium)	6.99	AJ-P23M	9.99
AJ-P33M	11.19	AJ-P66M	19.49
AJ-P64L (Large)	20.99	AJ-P94L	30.99
AJ-P126L			44.99

SONY

Hi-8 Professional Metal Video Cassettes

P6-30 HMPX	4.59	P6-30 HMEX	7.99
P6-60 HMPX	6.69	P6-60 HMEX	10.99
P6-120HMPX	8.99	P6-120HMEX	14.99

PR Series Professional Grade VHS

T-30PR	2.39	T-60PR	2.59	T-120PR	2.79

PM Series Premier Grade Professional VHS

T-60PM	3.99

BA Series Premier Hi-Grade Broadcast VHS (In Box)

T-30BA	3.79	T-60BA	4.19	T-120BA	4.99

MQ Master Quality S-VHS (In Box)

MQST-30	7.49	MQST-60	7.79	MQST-120	7.99

BRS 3/4" U-matic Broadcast Standard (In Box)

KCS-10 BRS (mini)	8.69	KCS-20 BRS (mini)	9.49
KCA-10 BRS	8.59	KCA-20 BRS	9.09
KCA-30 BRS	10.19	KCA-60 BRS	13.99

XBR 3/4" U-matic Broadcast Master (In Box)

KCS-10 XBR (mini)	9.29	KCS-20 XBR (mini)	10.69
KCA-10 XBR	9.69	KCA-20 XBR	11.19
KCA-30 XBR	12.59	KCA-60 XBR	16.49

KSP 3/4" U-matic SP Broadcast (In Box)

KSP-S10 (mini)	9.99	KSP-S20 (mini)	11.59
KSP-10	10.49	KSP-20	11.99
KSP-30	13.49	KSP-60	17.69

BCT Metal Betacam SP Broadcast Master (In Box)

BCT-5M (small)	12.29	BCT-10M (small)	13.29
BCT-20M (small)	13.99	BCT-30M (small)	14.99
BCT-30M (small) (50 Pack)			ea. 13.99
BCT-30ML	21.49	BCT-60ML	23.49
BCT-90ML			34.99

Mini DV Tape

DVM-30EXM w/Chip	15.99	DVM-60EXM w/Chip	17.99
DVM-30EX "No Chip"	12.99	DVM-60EX "No Chip"	14.99
DVM-30PR "No Chip"	9.99	DVM-60PR "No Chip"	10.49

Full Size DV Tape with Memory Chip

DV-120MEM	25.89	DV-180MEM	29.99

POV Series Professional DVCAM Tape

PDVM-12ME (Mini)	19.50	PDVM-22ME (Mini)	19.99
PDVM-32ME (Mini)	16.99	PDVM-40ME (Mini)	18.99
PDV-94ME (Standard)	33.99	PDV-124ME (Standard)	38.99
PDV-184ME (Standard)	44.95	PDVN-64N	24.95
PDVN-124N	32.95	PDVN-184N	39.95

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PHOTO - VIDEO - PRO AUDIO

QUICK DIAL 731

NewTek

Calibar 3-Oz. Pocket-Sized Test Generator

he size of a ball point pen and running on a single battery, Calibar is an NTSC test signal generator that packs a rack lount's worth of test equipment into a battery operated instrument. Calibar is the fastest, easiest and most portable way ver to calibrate video equipment. No patch bay racks. Just one cable. So besides giving you fast accurate readings in ie studio, it's perfect for off-site events or trouble-shooting in the field.

$349

Designed for studio and field operation, it produces 24 test pattern functions at the touch of a button. 10-bit precision digital-to-analog conversion assures highly accurate signals. Calibar's combination of low cost, portability and full-featured operation makes it ideal for broadcast engineers, television production facilities and video post houses.

- Tuck Calibar in your pocket and you're ready to go. Touch the button to generate SMPTE color bars, touch it again to calibrate convergence and so on.
- With the supplied AC adapter, it also functions as a black burst generator.

CHYRON PC-CODI & PC Scribe

Text and Graphics Generator and Video Titling Software

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

PC-CODI Hardware:

- Fully-antialiased displays • Display and non-display buffers
- Less than 10 nanosecond effective pixel resolution
- 16.7 million color selections • Fast, realtime operations
- Character, Logo and PCX Image transparency
- Variable edges: border, drop shadow and offset
- Full position and justify control of character and row
- User definable intercharacter spacing (squeeze & expand)
- Multiple roll/crawl speeds • Automatic character kerning
- User definable tab/template fields
- Shaded backgrounds of variable sizes and transparency
- Software controlled video timing
- User definable read effects playback; wipes, pushes, fades
- NTSC or PAL sync generator with genlock
- Board addressability for multi-channel applications
- Auto display sequencing • Local message/page memory
- Preview output with safe-title/cursor/menu overlay
- Composite and S-video input with auto-genlock select

PC-Scribe Software:

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

PC-CODI and PC-Scribe Bundle.....2995.00

TRUEVISION/Avid

TARGA 1000/MCXpress NT

Professional Video Production Workstation

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

TARGA 1000 Features:

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

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

MCXpress Features:

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

TARGA 1000/MCXpress Turnkey Systems:

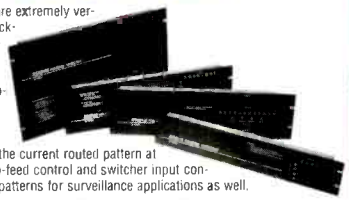
- 300-watt, 6-Bay Full Tower ATX Chassis
- Pentium ATX Motherboard with 512K Cache
- Pentium II- 300 MHz Processor
- Matrox Millenium II AGP 4MB WRAM Display Card
- 64MB 10ns 168-Pin (DIMM) S-DRAM
- Quantum Fireball 6.4GB IDE System Drive
- Seagate Barracuda External 9.1GB SCSI-3 Ultra Wide Capture Drive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

With TARGA 1000.....$5995.00
With TARGA 1000 Pro (component input/output).....$6495.00

KNOX VIDEO

RS4x4/8x8/16x16/16x8/12x2

Video/Audio Matrix Routing Switchers



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

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

LEADER

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

5860C WAVEFORM MONITOR

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

5850C VECTORSCOPE

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

5100 4-Channel Component / Composite WAVEFORM

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

5100D Digital Waveform/Vectorscope

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

5870 Waveform/Vectorscope w/SCH and Line Select

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

5872A Combination Waveform/Vectorscope

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

5864A Waveform Monitor

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

5854 Vectorscope

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

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

CORPORATE ACCOUNTS WELCOME

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MPEG encoders

BY KENNETH HUNOLD

Like it or not, the age of DTV broadcasting is upon us, and it is real. Many volunteer stations are already on the air, and a large portion of the remaining stations will be on the air at the end of 1999. This is the year when critical decisions must be made regarding major purchases for digital television.

One of the cornerstones of digital broadcasting is reducing the amount of data that is transmitted in order to fit within the constraints of the transmission medium. For U.S. terrestrial broadcasters this means a 6MHz-wide channel in either the VHF or UHF band. This data reduction is often referred to as "compression" and selecting a "compression encoder" is just one of those major purchases that was mentioned earlier. Some engineers bridle at the mention of compression, saying that they don't want any compression in their system. However, with digital broadcasting, compression is not optional, it is required.

The ATSC has selected the MPEG-2 compression system for broadcasting. MPEG compression encoders, as they are commonly called, are expensive, and this is partially by design. When the digital delivery system was developed, it was decided to reduce the cost of the decoder so it could be inexpensively incorporated into the millions of receivers, set-top boxes and other appliances that would eventually be sold to the public.

In order for the design of the decoder to be simple, the complexity must be shifted to the encode side of the process. It was felt that a single, complex encoder could serve many inexpensive decoders. This one-to-many distribution approach is the essence of broadcasting.

MPEG encoders are being used in applications other than "emission," or broadcast, scenarios. The 19Mb/s emission data rate was deemed inappropriate for pre- or post-production use. As a result, many networks and program providers have rethought their distribution systems and now deliver a higher data rate, high quality feed for their stations to use. In addition to the higher data rate, the sampling structure is increased to 4:2:2. This requires more data, but provides a signal that can withstand further manipulation by the stations in post production while still maintaining higher image quality.

No one can publish a complete, foolproof guide to selecting an MPEG compression system, but here are a few topics to consider. Compression effectiveness is very program content related. Scenes with a lot of motion often need more bits to faithfully represent them than slower, static scenes. MPEG exploits the redundancy between adjacent pictures or frames to increase the effectiveness of the rate reduction.

Noise reduction

Noise is the enemy of MPEG compression systems. Without external help, an MPEG compression system may use up all of its "bit budget" trying to code the noise in the picture. This is a wasteful use of the available bits and does not really improve the picture quality. Some encoders will apply noise reduction techniques to the incoming video to try to reduce the unwanted noise without affecting the wanted noise (the video signal itself).

Statistical multiplexing

If you are sending multiple programs through a single channel, it is theoretically possible to use a technique called statistical multiplexing to borrow bits from a less active program for use on another program that has a temporary need for more data. This has been discussed for quite a while, and these features are now becoming available in some products.

I/O formats

The compression encoder must be flexible enough to deal with the different interface formats of program material that will be used in the facility. If the signal being fed to the encoder is an analog NTSC signal, a high-quality NTSC decoder will be necessary to give the compression encoder the best quality signal components to work with, free of as many NTSC artifacts as possible. If the signal has already been converted, or is being originated as a digital signal, then the proper SMPTE interface must be provided. This includes SD and HD digital signals. Likewise, the proper output interface must also be provided to feed the rest of the transmission chain. Popular choices to feed the satellite or 8VSB modulator include SMPTE 310M and DVB-ASI, as well as other proprietary serial and parallel data formats. Check to be sure that the preferred, or necessary, formats are available.

Audio, too

Don't forget audio. Make sure there are proper interfaces for your audio signals. Analog and digital interfaces could be required, although a transition to a digital audio infrastructure is probably inevitable. Some MPEG encoders include a two-channel audio encoder as part of the package, but require external encoders if 5.1-channel audio is desired. Make sure the proper interface format for your facility is supported (XLR or BNC).

Audio-to-video synchronization, or lip sync, is very important, and might even vary among different decoders. The encoder should time stamp the audio and video packets so that the decoder can properly assemble and reorder the packets for display.

Evaluating the quality of an MPEG encoder/decoder system is a procedure that would take volumes to discuss. Prepare a mix of typical scenes and program material, as well as "killer" material (fast sports, fancy effects, etc.) then sit back and watch. Try to look at a few different manufacturers' equipment, and record the results on tape for further study after the demonstrations are over. If you have network or group engineering staffs, ask them for their opinions. This is a large purchase, and you should give it the attention it deserves.

MPEG encoder manufacturers

MPEG encoding is becoming an increasingly important part of a digital facility. Whether it's DVD encoding for authoring systems or ATSC encoding for transmission, knowing the players is the first step to finding the correct solution. To help readers know who makes encoding equipment, the following table is provided. It is based on information provided to us from our 1999 Buyers Guide survey, which took place late last year. Look to the June NAB review issue for the latest updates in MPEG encoding technology.

COMPANY	WEB	TEL.	TOLL FREE	FAX	RS Number
ADC Telecommunications Inc	www.adc.com	800-726-4266	800-366-3292	612-946-3237	Circle (305)
BARCO	www.barco.com	770-590-3600	800-992-5016	770-590-3610	Circle (306)
Computer Modules, Inc.	www.compumodules.com	408-496-1881		408-496-1886	Circle (307)
CPC/Computer Prompting & Captioning Co	www.cpcweb.com	301-738-8487	800-977-6678	301-738-8488	Circle (308)
Digital Transport Systems	www.dtsys.com	619-675-1410		619-675-1412	Circle (309)
Digital Vision Inc	www.digitalvision.se	310-914-5200	888-914-5200	310-914-0011	Circle (310)
Divicom	www.divi.com	408-490-6700	877-348-4266	408-490-6999	Circle (311)
ECI Telecom	www.ecitele.com	+972-3-9266336		+972-3-9287155	Circle (312)
General Instrument Corp	www.gi.com	619-455-1500	888-800-8346	619-404-2443	Circle (313)
Harris Corporation Broadcast Systems Division	www.harris.com/communications	513-459-3400		513-459-3890	Circle (314)
Heuris	www.heuris.com	314-534-1514	800-923-9232	314-534-4351	Circle (315)
InnovaCom	www.innovacom-mpeg2.com	408-727-2447		408-727-6625	Circle (316)
James Grunder & Associates Inc	www.grunder.com	913-492-4666	800-331-2019	913-895-7496	Circle (317)
Leitch Incorporated	www.leitch.com	757-548-2300	800-231-9673	757-548-4088	Circle (318)
LEL Computer Systems	www.lelcs.com	561-347-2242		561-347-6276	Circle (319)
LNR Communications Inc	www.lnr.com	516-273-7111	888-LNR-7858	516-761-5454	Circle (320)
Lucent Technologies	www.lucent.com	407-662-7254		908-582-3662	Circle (321)
Macrovision Corp	www.macrovision.com	408-743-8600	800-622-7686	408-743-8622	Circle (322)
Microwave Radio Communications	www.cm-mrc.com	978-250-1110	800-490-5700	978-256-6225	Circle (323)
Minerva Systems Inc	www.minervasys.com	650-940-1383	800-806-9594	650-940-1450	Circle (324)
NDS Americas Inc	www.ndsworld.com	949-725-2500		949-725-22545	Circle (325)
NEC America Inc Broadcast Equipment Department	www.nec.com/products/ccd/	972-751-7246	888-383-4DTV	972-751-7245	Circle (326)
Optibase Inc	www.optibase.com	408-260-6760	800-451-5101	408-244-0545	Circle (327)
Optivision Inc	www.optivision.com	650-855-0200	800-562-8934	650-855-0222	Circle (328)
Orad Hi Tec Systems	www.orad.co.il	+972-9-45020		+972-9-7676861	Circle (329)
Philips Digital Video Systems	www.broadcast.philips.com	801-977-1611	800-962-4287	801-972-0837	Circle (330)
Preferred Video Products	www.pvpburbank.com	818-562-6544	800-556-6544	818-562-3342	Circle (331)
Scientific-Atlanta	www.sciatl.com	770-903-6057		770-903-6464	Circle (332)
Snell & Wilcox	www.snellwilcox.com	+44(0)1730 821188		+44(0)1730 821199	Circle (333)
Tadiran Scopus	www.scopus.co.il	+972 3 557 6200		+972 3 557 6249	Circle (334)
Tektronix Inc Video & Network Division	www.tektronix.com/VND	800-547-8949		503-627-7275	Circle (335)
Telestream		530-470-1300			Circle (336)
Thomson Broadcast	thomsonbroad.com	201-569-1650		201-569-1511	Circle (336)
Tiernan Communications	www.tiernan.com	619-587-0252	800-323-0252	619-587-0257	Circle (337)
TV/Com International	www.tvcom.com	619-618-3500		619-618-3650	Circle (338)
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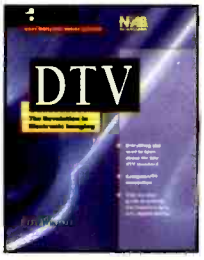

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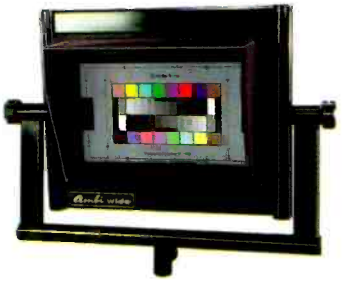

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TV MAINTENANCE ENGINEER WHSH-TV, USA Broadcasting has an immediate opening for a maintenance engineer experienced with transmitter and studio equipment. Responsibilities will include all aspects of television installation, repair to component level, and maintenance. Immediate opportunity to be involved with UHF digital transmission. Good computer and communication skills required. SBE certification preferred. Please send resume and cover letter by fax to WHSH-TV 978-562-1166 or mail to WHSH-TV, 71 Parmenter Rd, Hudson, Massachusetts 01749.

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The RF Engineer reports to the Assistant Engineering Manager, RF. This position supports the maintenance and repair of all equipment pertaining to signal compression and transmission. Must have a minimum of 3 years' RF engineering maintenance experience with satellite transmission provider or TV transmission facility. Knowledge of video, audio, and RF signal parameters and quality control standards required, including maintenance of satellite uplink systems. Component-level repair and knowledge of test equipment required. PC literacy also required, as well as experience with digital compression systems (Scientific Atlanta Power Vu preferred). Knowledge of Phillips/BTS master control/routing and Louth Automation systems a plus. **This is not an Operations position.** Weekend and/or shift work may be required. Spanish and/or Portuguese a plus.

Please send your resume to: **Strategix Human Resources, 6505 Blue Lagoon Drive, Miami, FL 33126, or fax to: (305) 507-1583 by April 20, 1999.**

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Job requires 5+ years' professional exp in the design, operation, testing and maintenance of large scale digital video and audio production and broadcast facilities. Job duties focus on the design of floor plans, equipment rack and patch bay elevations; and signal flow diagrams. Must be computer savvy, have in-depth knowledge of MS Windows and Excel, and have a strong electronics background. AutoCAD, LAN/WAN, ATSC, MPEG-2, AC-3 and video server experience a plus.

Project Managers

Job Code: BEM-DO-7704233

Job duties focus on the management of resources to execute fully-integrated broadcast systems. Must complete projects on time and within budget using your 5+ years' exp in project management in broadcast/production systems.

Please forward your resume, indicating job code, to: Sony Electronics Inc., 3300 Zanker Road, MD #SJ2C2, San Jose, CA 95134-1901. Fax 408/955-5166 or e-mail sj_jobs@mail.sel.sony.com. EOE/M/F/D/V

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

CHIEF ENGINEER- WAND-TV the ABC in Decatur, Illinois has an opening for a Chief Engineer. Job functions include: Inspect, direct and/or perform testing, maintenance and repair of studio and remote broadcasting equipment. Establish, enforce and follow procedures for operation and maintenance of studio, remote control and microwave transmission equipment. Maintain FCC compliance for the facility. Prepare and maintain annual engineering operational expense budgets and capital project budgets. The successful candidate will also have the following: FCC Radiotelephone General Class and/or and SBE Certification preferred. Strong RF background. Experience with digital video systems and DTV integration a plus. Strong computer networking skills a must. Managerial/supervisory experience. Demonstrated ability to handle multiple tasks, supervise staff, delegate and/or perform specific assignments and work under pressure. Minimum 5 years of television broadcast engineering experience and a Bachelor's Degree in a related field or equivalent combination of education and experience. Send Resume and Cover Letter to WAND-TV, Attn: President/General Manager, 904 Southside Drive, Decatur, IL 62521 EOE.

Technical Systems Designers

Are you technically savvy? A self starter? Experienced with one or more of the following: AV, sound, acoustics, broadcast, theater, or telecommunications systems? WJHW, a leading consulting and design firm, has career opportunities available in Dallas and San Antonio. Positions require teamwork, flexibility and a sense of humor. Please fax resume and cover letter to: (972) 934-3720; Attn: HR.

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CHIEF ENGINEER: FOX 61, a Tribune Broadcasting Station, has immediate opening for a Chief Engineer. Seeking resourceful progressive technology leader to take our analog plant into the future world of digital. Must have leadership skills as well as a strong technical background and thorough knowledge of broadcast equipment including RF transmission system. Degree in Engineering required. Candidate should have 5 to 10 years television broadcast electronics experience with minimum of 3 years supervisory experience. Please forward resume, salary history & cover letter to: Human Resources, WTIC Television, One Corporate Center, Hartford, CT 06103 or fax to: 860-560-3066.

BROADCAST ENGINEER Position in TV and FM master control operations, satellite feeds and transmitter monitoring. Resume to WNYE-TV/FM, 112 Tillary Street, Brooklyn, NY 11201. Tel: (718) 250-5800. Fax: (718) 855-8863. EOE.

Junior Video Engineer:

Must have knowledge of PC, Mac and Unix platforms, their applications and networking. Fluent with AutoCAD and systems documentation. Must be familiar with the use and operation of Broadcast test and measurement equipment. Experience with Video, Broadcast & Film integration projects helpful. Must have experience with basic video Post Production techniques and procedures. Work with an Astronomy Visualization Production Facility and Planetarium in New York City. Fax resume to (609) 716-8254 or email rumsky@aol.com. **Will interview at NAB.**

Senior & Junior Systems Administrator:

Responsible for maintaining a 7 pipe Onyx2 used in real-time simulation. Knowledge of Unix Systems administration and distributed file systems in the service of an Astronomy Visualization Production Facility and Planetarium located in New York City. Interest in Astronomy, CGI or Scientific Visualization a plus. Fax resume to (609) 716-8254 or email rumsky@aol.com. **Will interview at NAB.**

FEDERAL COMMUNICATIONS COMMISSION USA

The Mass Media Bureau, Audio Services Division of the Federal Communications Commission is accepting applications for an Electronics Engineer, GS-855-11/12/13/14 ($44,034 to $89,142, depending on experience). The position involves reviewing AM and FM broadcast applications for compliance with the Commission's technical rules. Broadcast Communications experience preferred. Qualified applicants must have excellent technical writing and communication skills. The selected candidate will conduct complex engineering studies and prepare documents addressing deficiencies, disputes between parties, and appeals and requests for waiver of the Commission's technical rules. This is a Term appointment. For Vacancy Announcement information call Ed De La Hunt at (202) 418-2726, email: edelahun@fcc.gov. Information also available at FCC website: www.fcc.gov/jobs/. THE FEDERAL COMMUNICATIONS COMMISSION IS AN EQUAL OPPORTUNITY EMPLOYER.

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EXPERIENCED TV ENGINEERS Willing to train and operate a satellite truck. Must love to travel and have a clean driving record. Relocate to northeast Ohio. Fax resumes to 330-542-1020

BROADCAST MAINTENANCE TECHNICIAN - Freedom Communications top-40 station has an opening for an experienced **Broadcast Maintenance Technician.** Candidate should have two years formal technical electronic education and three years experience in a broadcast environment. Must be able to work a flexible schedule. Requirements include - install, repair and maintain various broadcast and computer equipment. Including Beta cameras, recorders automation equipment, studio equipment and related computer based broadcast products. Please fax (616-388-8228) or send resume and cover letter to Margie Candela, Human Resource Coordinator, WWMT-TV, 590 W. Maple St., Kalamazoo, MI 49008. EOE

MAINTENANCE ENGINEER: ABC 30 KDNL-TV St. Louis has an immediate opening for a Maintenance Engineer. Applicants should have experience in studio and RF systems. Experience with Odetics, DVCPro and digital systems desirable. Must be able to work with vendors and organize multiple projects. Send resume to: Personnel Administrator, KDNL TV 30, 1215 Cole Street, St. Louis, MO 63106. Resumes can be faxed to 314-259-5504. Pre-employment drug screening required. EOE. No Phone calls please. Minorities are encouraged to apply.

VIDEOTAPE/STUDIO ENGINEER (99-17): K-EYE TV 42 has an immediate opening for a Videotape/Studio Engineer. Must have 5 years experience and excellent diagnostic/troubleshooting skills. K-EYE TV/Granite Broadcasting is an Equal Opportunity Employer. No phone calls, please. Send resume to: Art Smith, Chief Engineer, 10700 Metric Blvd., Austin, TX 78758. Fax: 512-837-6753. Email: artsmith@keye.com.

BROADCAST MAINTENANCE TECHNICIAN: Requires self starter having experience with Beta, VPR-3, PC's and other studio equipment maintenance. Experience with microwave, satellite, VHF & UHF transmitters, CADD ability and FCC General Class License preferred. Contract Charles Hofer, Manager of Engineering Maintenance, WTNH-TV, 8 Elm Street, New Haven, CT 06510. No phone calls please. EOE.

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alrec Audio Ltd.	3	4	142-284-2159
hyron	75, 131		516-845-2000
olumbine Systems	181	88	303-237-4000
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omtek	60	54	800-496-3464
oollux	227	104	800-ACDC-LUX
PI/Eimac Division	24	15	415-594-4000
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PS	63	33	606-371-5533
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LeBlanc Broadcast	231	107	
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Montreux '99	59	31	
NDS	65	34	
Network Electronics	168	85	800-877-TAPE
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NVision Inc.	100-101	41	530-265-1000
NVision Inc	239	111	530-265-1000
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Panasonic Broadcast	4 - 5		800-528-8601
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S.A.V.	155 - 156		
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Snell & Wilcox	128 - 129	59	408-260-1000
Sony Electronics	15-17		800-635-SONY
Sony Electronics	56 - 57		800-635-SONY
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Standard Communications	165	82	310-532-5300
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StorageTek	67	26	800-STO-RTEK
SunUp Design Systems	83	37	408-437-4500
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EOM

DTV advice is missing the mark

BY PAUL MCGOLDRICK

It's always difficult to believe that NAB is upon us yet again; another year of broadcasting fun and developments will be shown off in that most elegant of cities in Nevada— if you happen to have a penchant for the ridiculous. Although I have been tempted to explore the continuing greed of the NAB organization in overdeveloping this property, they did back down on some of the custom varnish on this year's overly expensive marketing monstrosity and, in the process, butchering numerous Hollywood and TV programs in an extraordinarily cavalier manner.

No, the time for NAB reminds me that it is a year since the networks declared their intentions regarding DTV transmission standards. Those first-stated positions have basically remained unchanged through the year, though we have felt some higher standard compromises being suggested as possible by some.

We are not in an industry that is encouraging a switch to digital television at any real speed.

The first stations are now on the air and the public should be more aware of what is happening. After all, it is for them, isn't it? When you think about it there are only six more working months until the remainder of the Top 30 markets must have digital television on the air.

The media is always a good indicator of general public knowledge. We all know that what's published is always true, and if it did happen to be incorrect there would be so much reaction from those who know better that the publication would correct its statements. Well, surprise. As always, that's not happening.

Even in many electronics trade journals, it is as if the writers finally expose their true level of understanding in the last paragraph. Everything goes well in the pieces as the writers obviously use the material fed to them by their sources. Then the really wacky statement comes, making you realize that the writer is not thinking of high-definition television as being a special case of digital television at all; that it is all high-definition television and that it is all that good. In one electronics journal the editor-in-chief wrote an editorial that clearly showed he had no understanding of digital television, let alone high-definition. Time should, no doubt, cure all these mixed-up thinkers, but that doesn't help the confused buyer.

When you add the awful lack of information emanating from sales associates in the larger electronics chains, we are not in an industry that is encouraging a switch to digital television at any real speed. I would suspect that a large proportion of these associates would even be unable to offer a cogent explanation of digital audio systems and the differences between the various Dolby labels, and between Dolby and THX. This misinformation is going to hurt development of equipment. And, the production of unique programming at the higher DTV standards will be financially encumbered.

The *Consumer Reports* straw

The final straw came with the March 1999 report from the Consumers Union in its *Consumer Reports* magazine. I suppose the initial grimace came with the fact that it was including its first tests of high-definition sets, but referring to a couple of 16:9 monitors with external digital decoders – neither of which even had an AC-3 decoder.

Here are some gems for the "Oh, Golly" files from *Consumer Reports*: "Allowing delivery ... of CD-quality sound and pictures." "We had to use a special high-definition image player to create HDTV signals in our labs, because only one local station was broadcasting in digital during our test period." "But only HDTV broadcasts are formatted to fit that wide screen." "It's still safe – and sensible – to buy a conventional model...you can always enjoy the cleaner picture and superior sound offered by digital TV (though not its high-definition incarnation) by pairing your regular set with a digital decoder." "If you're buying a satellite setup, ask the provider if the dish can handle HDTV signals. Make sure the set is a true HDTV model; it should have a 16:9 aspect ratio and the ability to display images in both the 1080i and 720p HD formats." "A regular TV antenna will do, but it must be able to pull in a signal of sufficient strength for the set. If it can't you'll get a blank screen." "While the 35mm film used in most movies is high in visual definition, expensive new processing is needed to reformat a film for its HDTV debut."

I don't think that the technical folks at Consumers Union came from the wastelands yesterday. These little misunderstandings compound an overall scenario that must be hellishly confusing to the consumer. I'm sure it's not our individual faults that complete and correct DTV information is not getting to the public, but it's certainly time to do something about it. How would it be if the stations that are already on the air with DTV get sales associates of these major stores to education sessions? Then give qualified associates large pins to wear that will show them apart from their colleagues. "ABC, CBS, Fox, NBC and PBS Have Trained Me on Digital TV!" ■

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

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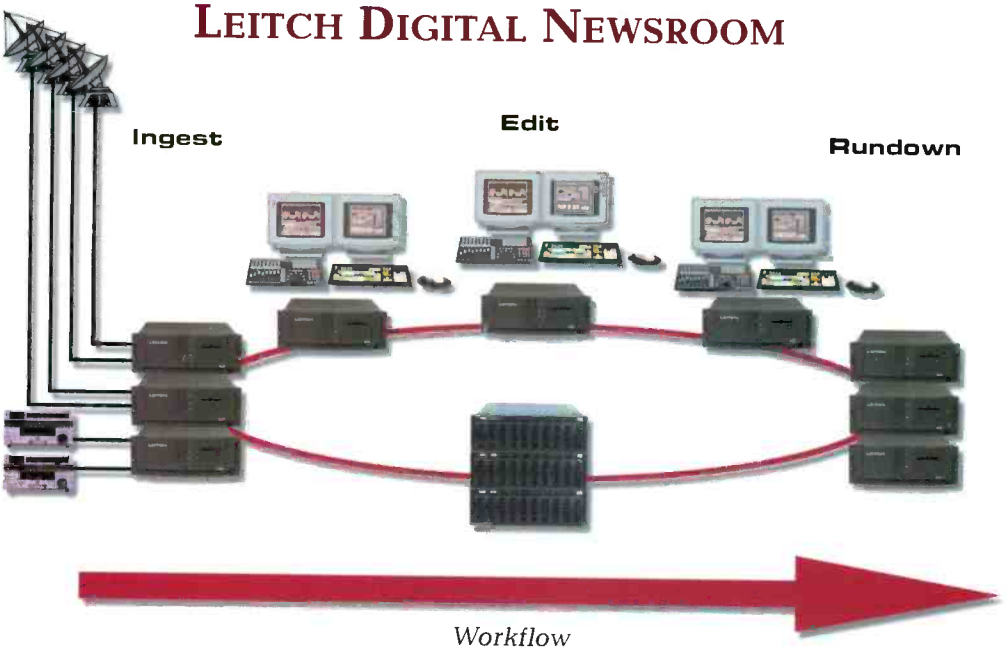

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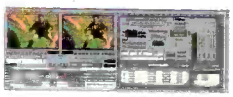

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